U.S. NAVY PACIFIC MISSILE RANGE FACILITY AND NASA KŌKE'E PARK GEOPHYSICAL OBSERVATORY REAL ESTATE

FINAL ENVIRONMENTAL IMPACT STATEMENT

August 2026

VOLUME 5

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Appendix J

Scoping Summary Report and Draft EIS Comment Summary Report

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Scoping Summary Report

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SCOPING SUMMARY REPORT

Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate

Environmental Impact Statement

FINAL

August 2024
Revised April 2025

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Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement
Scoping Summary Report
Final

This report summarizes public involvement and stakeholder outreach activities for the scoping period for the United States (U.S) Department of the Navy (Navy) and National Aeronautics and Space Administration (NASA) *Pacific Missile Range Facility (PMRF) and Kōkeʻe Park Geophysical Observatory (KPGO) Real Estate Environmental Impact Statement (EIS)*. The scoping period ran from May 8, 2024, to June 17, 2024.

The purpose of public involvement and outreach during the scoping phase was to notify the public, elected officials, government agencies, nongovernmental organizations, Native Hawaiian Organizations, and other stakeholders about the Navy's and NASA's intent to prepare an EIS in accordance with the National Environmental Policy Act (NEPA) and Hawaiʻi Revised Statutes (HRS) Chapter 343 (commonly known as the "Hawaiʻi Environmental Policy Act [HEPA]"). As part of scoping, the Navy and NASA solicited comments on the proposed real estate action including proposed alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, any information the public would like to see addressed in the EIS, and the project's potential to affect historic properties pursuant to Section 106 of the National Historic Preservation Act (NHPA) and HRS Section 6E-42.

The Navy and NASA recognize the importance of public engagement and have made significant efforts to encourage public participation during the scoping process, exceeding those required by NEPA and HEPA to ensure the broadest effort to notify, inform, and engage the public in this EIS scoping process.

Additional outreach efforts include the following:

- A 40-day comment period, 10 days more than the minimum 30-day period;
- Multiple, consecutive newspaper and social media advertisements;
- Offer to hold advanced stakeholder briefings;
- Personalized notification letters; and
- A pre-Notice of Intent (NOI) and EIS Preparation Notice Flyer posted on the PMRF and NASA websites.

Summary of Activities

A. PUBLIC NOTIFICATION

The Navy and NASA prepared materials to notify the public of the intent to prepare an EIS and provide project information and public involvement opportunities.

Federal Register Notice and The Environmental Notice

A NOI to prepare an EIS was published in the *Federal Register* on May 9, 2024, and the EIS Preparation Notice (EISPN) was published in State of Hawaiʻi, Office of Planning and Sustainable Development's Environmental Review Program semi-monthly publication, *The Environmental Notice*, on May 8, 2024. The *Federal Register* notice is found in Attachment A to this Scoping Summary Report, and *The Environmental Notice* publication is found in Attachment B.

Newspaper Advertisements

Display advertisements were placed in four local and regional newspapers in Hawai'i. The advertisements were published beginning May 8, 2024, to coincide with publication of the EISPN in *The Environmental Notice*. The advertisements were published for three consecutive days, including on Sunday if the publication schedule allowed.

Table 1 shows the newspapers and corresponding publication dates for each advertisement. The newspaper advertisements are found in Attachment C.

Table 1: Newspaper Publications for the Notice of Intent and Environmental Impact Statement Preparation Notice

Newspaper	Newspaper Coverage	Publication Frequency	Publication Dates
The Honolulu-Star Advertiser	Hawaiian Islands	Daily; except Saturday	Wednesday, May 8, 2024 Thursday, May 9, 2024 Friday, May 10, 2024 Sunday, June 2, 2024 Monday, June 3, 2024 Tuesday, June 4, 2024
The Garden Island	Kaua'i	Daily; except Sunday	Wednesday, May 8, 2024 Thursday, May 9, 2024 Friday, May 10, 2024 Saturday, June 1, 2024 Monday, June 3, 2024 Tuesday, June 4, 2024 Including online events calendar
MidWeek Kaua'i	Kaua'i	Wednesdays	Wednesday, May 15, 2024 Wednesday, May 22, 2024 Wednesday, May 29, 2024 Wednesday, June 5, 2024 Including online events calendar
Ka Wai Ola News	Hawaiian Islands	Monthly	Saturday, June 1, 2024

Stakeholder Notification Letters

Notification letters were mailed on May 8, 2024, via first-class mail, to 174 stakeholders comprising elected officials (local, state, federal), government agencies (local, state, federal), environmental organizations and other non-governmental organizations (local, regional, national, government programs), Native Hawaiian Organizations and cultural centers, and participants in the Cultural Impact Assessment. Stakeholders were offered a briefing upon request and provided a point of contact should they have questions. A copy of the stakeholder letter is found in Attachment D.

Postcard Mailer

Notification postcards were mailed on May 8, 2024, via first-class mail, to 96 stakeholders, including the following: agencies and environmental organizations; Native Hawaiian Organizations; schools, colleges, and universities; small business associations, economic development/tourism organizations, and recreational and real estate interests; fishing and diving interests; community planning groups and civic organizations; boating, yacht clubs, and marinas; libraries; and other interested individuals and groups. A copy of the postcard is found in Attachment E.

Mailing List

A mailing list for the stakeholder letter and postcard was developed from the project Strategic Communications Plan, Hawaii-California Training and Testing EIS/Overseas EIS (OEIS) project mailing list, and Navy and NASA stakeholder lists for Kauaʻi. The list was updated to add individuals who requested to be added to the mailing list. The complete mailing list is provided in Attachment F.

News Release and Media Distribution

A news release was distributed May 8, 2024, by the Public Affairs Officers (PAOs) for Commander, Navy Region Hawaii, PMRF, and NASA to local, regional, and national media. The news release provided a description of the Proposed Action, its purpose and need, resources to be analyzed in the EIS, project website address, public commenting information, information about the scoping meetings, and information about consultation under Section 106 of the NHPA. Additionally, information about the scoping process for the EIS to include information on the public meetings and how to submit public comments was also provided in the news release. The news release also provided contact information for media questions. The news release is found in Attachment G.

Social Media Posts

Social media posts began on May 8, 2024, and continued through the end of the public comment period on June 17, 2024. Commander, Navy Region Hawaii and PMRF posted to their social media accounts, including the Navy Region Hawaii Facebook and X pages and PMRF Facebook page. NASA posted to their social media accounts, including KPGO and Space Geodesy Project (SGP) page. Social media was used to raise awareness of the NOI and EISPN, public meetings, and public comment period. Social media posts are found in Attachment H.

Flyer

A flyer was created to notify community members about the NOI and EISPN, public meetings, and comment period. PMRF distributed the flyer to their community contacts via email and in-person events and meetings. A copy of the flyer is found in Attachment I.

B. PUBLIC SCOPING INFORMATION

Project Website

A website has been established by the Navy and NASA to provide the public with project information. The website will remain active throughout the EIS process. The website serves as a repository of information and includes notices, maps, the public scoping meeting presentation, posters and fact sheets, and other project information. Other highlights of the website include educating the public on the environmental planning process, PMRF conservation and community activities, information center for frequently asked questions (FAQs), and means for the public to reach out to the EIS team. The public was able to submit comments via the website using the online comment form and subscribe to receive future notifications.

The project website for the Navy and NASA is https://www.pmrf-kpgo-eis.com/ and the address was included in all public notifications. Fact sheets and link to the project website can be found at NASA's SGP website https://space-geodesy.nasa.gov/. The project website included information about the public meetings and was updated after the close of the public scoping period. The website was made available to the public on May 8, 2024, and announced on both the Navy's PMRF and NASA's SGP websites.

Selected screen captures of the website are found in Attachment J.

Fact Sheet Booklet

A 12-page fact sheet booklet was prepared that included details about the following: the Proposed Action and alternatives; its purpose and need; the NEPA, HEPA, and Section 106 processes; public involvement opportunities; environmental stewardship activities; and information about PMRF and KPGO. The fact sheet booklet can be found in Attachment K. The fact sheet booklet was posted on the project website and provided at the public meetings.

Stakeholder Briefings

Monthly meetings with the Navy, NASA, and Department of Land and Natural Resources (DLNR) - Land Division started on May 28, 2024, and continue to occur on the last Tuesday of every month. Neither the Navy nor NASA received any other request for briefings. Briefings included information about the Proposed Action and alternatives; its purpose and need; the NEPA, HEPA, and Section 106 processes; resources affected; public involvement opportunities; environmental stewardship activities; and about PMRF and KPGO.

C. PUBLIC MEETINGS

The Navy and NASA initiated a public scoping period to receive comments on the scope of the EIS. Members of the public were encouraged to participate in the environmental planning process by providing input on the proposed real estate action including proposed alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, any information the public would like to see addressed in the EIS, and the project's potential to affect historic properties pursuant to Section 106 of the NHPA and HRS Section 6E-42.

Public scoping meetings were held June 4–6, 2024, at three locations on Kauaʻi. The scoping meetings also served as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the NHPA and HRS Section 6E-42. All meetings were held from 5 to 8 p.m. Hawaiʻi Standard Time (HST). Table 2 provides the meeting dates, locations, and agenda as advertised.

Table 2 Public Meeting Dates and Locations

Date	Location	Time and Agenda
Tuesday, June 4, 2024	Kauaʻi Veterans Center 3215 Kauaʻi Veterans Memorial Hwy, Līhuʻe	**Meeting Times:** 5 to 8 p.m. HST **Agenda:** • **5 to 8 p.m.** Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment. • **6 to 6:30 p.m.** Project presentation by Navy and NASA.
Wednesday, June 5, 2024	Kekaha Neighborhood Center 8130 Elepaio Rd., Kekaha	
Thursday, June 6, 2024	Sheraton Kauaʻi Coconut Beach Resort 650 Aleka Loop, Kapaʻa	

Meeting Format

The public meetings were open house style with the project presentation moderated by a facilitator. The meetings opened with protocol led by a Hawaiian cultural practitioner. Information stations were organized by topic and arranged around the room enabling the public to meet project team members and ask questions. Members of the public were encouraged to visit the comment station to provide

written comments and/or oral comments to a court reporter. Oral comments were audio recorded in accordance with HEPA requirements. The 3-hour open house session included a project presentation by Navy and NASA leadership and project team members. The presentation covered the project's purpose and need, description of the Proposed Action and proposed alternatives, overview of the NEPA/HEPA environmental review process, public involvement opportunities, and information about PMRF and KPGO including environmental and cultural stewardship. After the presentation, attendees were invited to return to the poster stations to continue conversations with project team members and provide comments. An American Sign Language interpreter was available remotely via Zoom, and Hawaiian interpreters (and other languages) were available upon request. The open house meeting also included a children's activity station with coloring books and other activities to allow the parents to focus on the project information.

The station topics are listed below. Each station was staffed by subject matter experts.

- Welcome/Sign-In Table
- Why We Are Here Tonight
- About PMRF and About KPGO
- Project Map
- Proposed Action and Alternatives
- Environmental Resources to be Studied in the EIS
- Conservation and Community/Care of the Land
- NEPA/HEPA/Community Involvement
- Comments Table/Written Comments
- Comments Table/Oral Comments

A copy of the posters and other handouts produced for the public meetings are found in Attachment L and Attachment M. A copy of the presentation slides is found in Attachment N. Additionally, this information is available to the public under the "Documents" tab (Informational Materials Section) on the website, https://www.pmrf-kpgo-eis.com/.

D. SUMMARY OF PUBLIC SCOPING COMMENTS

This section is intended to summarize the comments identified during the EIS scoping phase; it is not meant to identify all comments or respond to comments. A formal scoping comment response section will be included in the Draft EIS.

The public scoping period ran from May 8, 2024, to June 17, 2024. Eighty-four comment letters were received. Twenty-nine comments were submitted using the project website's online comment form, 28 via email, 2 from postal mail, 11 in writing at the public meetings, and 14 orally to the court reporter at the public meetings.

Each comment was reviewed and categorized into specific resource areas or topics. One comment may have comments on multiple resource areas or topics. All comments were compiled, logged, and distributed to the EIS project team and appropriate subject matter experts. The EIS project team discussed the impact, significance, and relevance of the comments to the preparation of the Draft EIS. All comments submitted during the public scoping period will become part of the public record and will be considered during the development in the Draft EIS.

Table 3 includes a summary of scoping comments in order to provide a brief overview of the issues and concerns expressed during this EIS scoping phase.

Table 3 Summary of Scoping Comments

Resource Area/Topic	Issue/Concern
Proposed Action and Alternatives	• The Proposed Action does not include Navy activities on fee simple land. Impacts in the EIS should include impacts from Navy activities on fee simple lands. • Concerns about military presence and training around the Hawaiian Islands, which commenters consider sensitive environments. • Concerns about impacts from Navy activities at PMRF and from agricultural activities to the local environment and public health. • Request for military training to be conducted away from the Hawaiian Islands, which commenters consider sacred lands. • Concerns about increasing development and infrastructure and associated impacts. • Request the EIS include how ongoing missile system tests on fee simple lands impacts the environment. • Request for a figure that shows the individual leases and easements. • Request for additional details regarding military readiness at PMRF and additional details about the Proposed Action including details about KPGO surveillance and tracking. • The Project has no benefit to the community. • Concerns about the impacts training with explosives has on land and the marine environment around Hawai‘i. • Increased detail regarding the No Action alternative including a request for robust description of restoration following the end of the lease, and concern about infrastructure that could be abandoned in place under the terms of the current leases. • The two action alternatives are similar and additional alternatives should be considered to include: ▪ a more distinctive action alternative ▪ a modified Proposed Action ▪ a shorter-term lease ▪ restoration of the Mānā plains to wetlands and cultural practice areas ▪ removal of agriculture ▪ expansion of the Kawai‘ele Bird Sanctuary ▪ reduce Navy reliance on non-renewable energy ▪ replace big agricultural lessees with small local farmers • Concern about linking the analysis of Navy and NASA Proposed Actions. • Develop alternatives that take into account other foreseeable and needed projects on the Mānā plains and surrounding areas; e.g., West Kaua‘i Energy Project, infrastructure for Department of Hawaiian Homelands use, water diversions to support instream flows, groundwater use restrictions and needs, siting and construction of a new landfill, repair roadways to Kōke‘e, the ongoing need for pollution control improvements to the Mānā ditch system, and Kaua‘i’s acute need for affordable housing. • Identify Best Management Practices and better define the activities that occur on the leased and easement lands. • Integrate applicable nature-based project elements into the Project design. • Dune restoration could be incorporated into the Project. • Consider new technological developments associated with the Project.

Resource Area/Topic	Issue/Concern
	• As part of the new agreements, request Navy and NASA provide additional community resources including services and infrastructure. • Recommend NASA transfer its technologic infrastructure at KPGO to Space Force and phase out NASA's presence on Kaua'i. • Explain facilities on Ni'ihau and their relationship to the Proposed Action. • Support for the military's presence and activities. • Support for NASA's presence and activities. • Support for the Navy and NASA land stewardship. • Support of the No Action Alternative. • Support for Alternative 2.
Air Quality and Greenhouse Gases	• Provide thorough air quality data at PMRF, documentation and reporting of any incidents that have impacted air quality, and emissions data from all activities at PMRF. • Consider electric buses for use by the Navy at PMRF and other renewable energy technologies for improved base sustainability.
Biological Resources	• Request for Navy and NASA to provide natural resource data for leased and easement lands. • Concern about impacts to coastal lands and wetlands. • Concern about endangered species, including marine species. • Effects of noise, light pollution, and chemical byproducts to biological resources. • Concern of ecosystem-scale effects from military activities. • Concern about impacts from invasive species. • Concern about impacts to avian species at Kōke'e. • Consider lowland forest restoration to remediate soil and capture carbon dioxide. • Recommend early consultation with the Division of Forestry and Wildlife and U.S. Fish and Wildlife Service. • Preserve and restore natural terrestrial and marine environments.
Cultural Practices/Archaeological and Historic Properties/NHPA Section 106 Process/HRS 6E Process	• Concern about Native Hawaiian's cultural attachment to the land and stress that their lands were wrongly taken. • Consider how effects of permanent loss of state land through fee simple retention given the unique historic context of the area. • Discuss mental and emotional health impacts, sense of loss and injustice, in addition to impacts to other resources, and identify mitigation. • Establish regular communication with Native Hawaiian communities and explore other state-owned lands that could be repurposed for community use. • Request for Navy and NASA to provide information on cultural resources and cultural practices. • Request to engage in early consultation under Section 106 of the NHPA. • The Hawai'i Revised Statutes, HRS Chapter 6E process should inform the environmental review process, and incorporate any mitigation identified from the HRS 6E process. • Request for the Navy to consult with Native Hawaiian Organizations, homestead communities, and Native Hawaiian Ni'ihau beneficiaries. • Concern about impacts to culturally sensitive sites. • Concern about access for cultural practices and gathering rights at PMRF. • Discuss whether dune restoration would protect cultural sites. • Concern about impacts to culturally sensitive plants and animals. • Ensure a Cultural Impact Assessment is prepared for the Project and include a list of who was consulted. • EIS should incorporate a Ka Pa'akai analysis.

Resource Area/Topic	Issue/Concern
	• EIS should consider the cultural landscape. • Concern about impacts to cultural practices from water diversion to the wetland.
Cumulative Effects	• Include a description of environmental conditions prior to military use.
EIS Process	• Concern about different interests and obligations of the federal government (Navy and NASA) and the State of Hawaii (DLNR) regarding decisions about public trust lands. • Concern about the state's responsibility as the trustee of these public lands in the public trust to malama ʻāina. • Revise Purpose and Need to reflect the state's duty to enforce the Navy and NASA's terms of the lease consistent with principles of malama ʻāina. • Public meetings should provide an opportunity for the public to interact with each other. • Request an independent body prepare the EIS. • Not enough advertising was conducted for scoping.
Hazardous Materials and Waste	• Concern about the presence of hazardous materials and waste in the land, water, and air from activities at PMRF. • Concern about Navy clean-up after testing activities at PMRF. • Concerns about certain contaminants. • Concern about fuel storage tank conditions at PMRF. • Request removal of fuel storage tanks at PMRF. • Request for third party testing of sites for hazardous materials. • Concerns about PFAS at PMRF. • Concerns about solid waste management.
Land Use and Access	• Concern about ongoing effects from the presence of the military on Kauaʻi. • EIS should include history of land title and land use, including initial negotiation and approval of leases and easements. • EIS should analyze the land use zoning and permitting requirements. • Request for increased access to the beach for fishing, water sports (i.e., surfing and kayaking), walking, horseback riding, and camping from Kekaha Beach to Polihale.
Ocean ROW	• Request explanation for not including the Ocean ROW lease in the area of analysis. • Clarify how Ground Hazard Areas and Launch Hazard Areas are related to the Ocean ROW.
Other	• Concern about the Navy's actions impacting marine resources from underwater testing and training, and pollution from runoff at PMRF. • Request to demilitarize the Hawaiian Islands, returning the land to the people of Hawaiʻi with no trace of previous military activities. • Concerns about how the military is perceived to treat the Hawaiian Islands. • Concerns about the U.S. military and destruction caused to other countries. • Request for all acronyms to be defined and for the EIS to be consistent in use of diacriticals. • Request for EIS to define use of uncommon terms. • Concerns about impacts from RIMPAC activities.
Public Health and Safety	• Concern about impacts from agricultural activities on the easements. • Concern about impacts of explosive ordnance storage at PMRF. • Request for safety procedures to prevent unintentional or unauthorized detonation of ordnance be identified in the EIS. • Concern about public safety risks from Navy ordnance and hazardous material transfer on Kauaʻi. • Concern about electromagnetic radiation effects on people, wildlife, and weather.

Resource Area/Topic	Issue/Concern
	• Concerns about wildfire. • Concern about noise impacts on people.
Real Estate Agreements	• Request for a list of reports for all site inspections conducted by DLNR. • Include copies of the leases and easements.
Socioeconomics	• Concern about the low cost of the current leases and easements (only $1 for the Navy). • Support for socioeconomic benefit of the Navy and NASA to Kaua‘i. • Support for socioeconomic benefit of Alternative 2. • Concern about economic impacts of the military and associated costs. • Concern about fair market value of the new real estate agreements, and request for backpay.
Transportation	• Concern about impacts from Navy’s use of the roads.
Visual Resources	• Concern about impacts to viewsheds.
Water Resources	• Concerns about the Navy’s water use. • Discuss how current groundwater pumping at PMRF will affect the project, and if updating the practices would increase resilience. • Request for the Navy and NASA to provide information on punawai spring water sources. • Concern about impacts to water quality from Navy activities, including wells. • Concern about the Navy’s responsibility to apply for a National Pollutant Discharge Elimination System permit for outfall discharges. • Identify interconnected system of irrigation ditches. • Concerns about Red Hill and similar impacts to other water resources from Navy activities at PMRF.

Legend: DLNR = Department of Land and Natural Resources; EIS = Environmental Impact Statement; HRS = Hawaii Revised Statute; KPGO = Kōke‘e Park Geophysical Observatory; NASA = National Aeronautics and Space Administration; NHPA = National Historic Preservation Act; PFAS = Per- and polyfluoroalkyl substances; PMRF = Pacific Missile Range Facility; RIMPAC = Rim of the Pacific; ROW = right-of-way; U.S. = United States

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Attachment A

including the agenda, is available on the DHB website, *https://www.health.mil/dhb*. A copy of the agenda or any updates to the agenda for the June 4, 2024, meeting will be available on the DHB website. Any other materials presented in the meeting may also be obtained at the meeting.

Purpose of the Meeting: The DHB provides independent advice and recommendations to maximize the safety and quality of, as well as access to, health care for DoD health care beneficiaries. The purpose of the meeting is to provide progress updates on specific tasks before the DHB. In addition, the DHB will receive information briefings on current issues related to military medicine.

Agenda: The DHB anticipates receiving updates from the DHB Public Health Subcommittee's tasking on Effective Public Health Communication Strategies with DoD personnel and the DHB Trauma and Injury Subcommittee's tasking on Prolonged Theater Care. The DHB also anticipates receiving briefings about the National Center for Disaster Medicine and Public Health and the Health of the Force Report.

Meeting Accessibility: Pursuant to 5 U.S.C. 552b and 41 CFR 102–3.140 through 102–3.165, this meeting is open to the public from 12:00 p.m. to 5:30 p.m. on June 4, 2024. The meeting will be held by videoconference/teleconference. The number of participants is limited and is on a first-come basis. All members of the public who wish to participate must register by emailing their name, rank/title, and organization/company to *dha.dhb@health.mil* or by contacting Dr. Clarice Waters at (703) 275–6003 no later than Tuesday, May 28, 2024. Once registered, participant access information will be provided.

Special Accommodations: Individuals requiring special accommodations to access the public meeting should contact Dr. Clarice Waters at (703) 275–6003 at least five (5) business days prior to the meeting so that appropriate arrangements can be made.

Written Statements: Any member of the public wishing to provide comments to the DHB related to its current taskings or mission may do so at any time in accordance with section 10(a)(3) of the FACA, 41 CFR 102–3.105(j) and 102–3.140, and the procedures described in this notice. Written statements may be submitted to the DHB's Designated Federal Officer (DFO), CAPT Clausen, at *shawn.s.clausen.mil@health.mil.* Supporting documentation may also be included, to establish the appropriate historical context and to provide any necessary background information. If the written statement is not received at least five (5) business days prior to the meeting, the DFO may choose to postpone consideration of the statement until the next open meeting. The DFO will review all timely submissions with the DHB President and ensure they are provided to members of the DHB before the meeting that is subject to this notice. After reviewing the written comments, the President and the DFO may choose to invite the submitter to orally present their issue during an open portion of this meeting or at a future meeting.

Dated: May 6, 2024.

Aaron T. Siegel,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 2024–10123 Filed 5–8–24; 8:45 am]

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DEPARTMENT OF DEFENSE

Department of the Navy

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Notice of Intent To Prepare an Environmental Impact Statement for Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate

AGENCY: Department of the Navy (DON), Department of Defense (DoD), and National Aeronautics and Space Administration (NASA).

ACTION: Notice.

SUMMARY: Pursuant to the National Environmental Policy Act (NEPA) of 1969 and regulations implemented by the Council on Environmental Quality, the Department of the Navy (DON) and National Aeronautics and Space Administration (NASA), the DON and NASA announce their intent to prepare an Environmental Impact Statement (EIS) to evaluate the potential environmental effects associated with the continued long-term DoD use of 8,348 acres of State lands on Kauai, Hawaii for operational continuity and sustainment (in support of continued military training, testing, and facility operations) at the Pacific Missile Range Facility (PMRF), and the continued long-term NASA use of 23 acres of State lands on Kauaʻi, Hawaii in support of continued operations (including measurements of the Earth's rotation and local land motion) at Kōkeʻe Park Geophysical Observatory (KPGO).

DATES: The 40-day public scoping period begins on May 8, 2024, and extends to June 17, 2024. Comments must be postmarked or submitted electronically via the project website no later than 11:59 p.m. Hawaii Standard Time (HST) on June 17, 2024 for consideration in the Draft EIS.

Public scoping meetings are planned as follows:

- June 4, 2024, from 5:00–8:00 p.m. HST at Kauaʻi Veterans Center, 3215 Kauaʻi Veterans Memorial Highway, Līhuʻe
- June 5, 2024, from 5:00–8:00 p.m. HST at Kekaha Neighborhood Center, 8130 Elepaio Road, Kekaha
- June 6, 2024, from 5:00–8:00 p.m. HST at Sheraton Coconut Beach Resort, 650 Aleka Loop, Kapaʻa

The purpose of the scoping period is to provide the public with information related to the Proposed Action, its purpose and need, environmental resources to be analyzed in the EIS, the NEPA and HEPA process, consultation under NHPA, and public involvement opportunities. The DON and NASA are providing a web-based platform, as well as public scoping meetings for the public to learn about the Proposed Action and alternatives and to provide scoping comments. Comments must be postmarked or submitted electronically via the website no later than 11:59 p.m. HST on June 17, 2024 for consideration in the Draft EIS.

ADDRESSES: The DON and NASA invite all interested parties to submit scoping comments on the EIS or information regarding historic properties or Section 106 consulting party interest through the project website at *http://www.PMRF-KPGO-EIS.com* or by mail to: Naval Facilities Engineering Systems Command, Hawaii, Environmental OPHEV2, Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells, 400 Marshall Road, Building X–11, Pearl Harbor, HI 96860.

FOR FURTHER INFORMATION CONTACT:

DON: Commander, Navy Region Hawaii, Attn: Mr. Danny Hayes, Environmental Public Affairs Specialist, by telephone (808–473–0662) or email (*danny.r.bxhayes6.civ@us.navy.mil*).

NASA: Shari A. Miller, NASA; EIS Project Manager, by telephone (757–824–2327) or email (*Shari.A.Miller@nasa.gov*).

SUPPLEMENTARY INFORMATION:

As the proposed action involves State lands, the EIS will be a joint NEPA, Hawaii Environmental Policy Act (HEPA) (as governed by Hawaii Revised Statutes [HRS] chapter 343), and Hawaii Administrative Rules (HAR) section 11–200.1 (implementing HRS chapter 343) document; therefore, the public scoping processes will run concurrently and will jointly meet NEPA and HEPA

requirements. The DON and NASA are initiating a 40-day public scoping process to receive comments on the scope of the EIS including identification of potential alternatives and environmental concerns, information and analyses relevant to the Proposed Action, issues the public would like to see addressed in the EIS, and the project's potential to affect historic properties pursuant to section 106 of the National Historic Preservation Act (NHPA) of 1966. DON's action proponent for this proposal is Commander, Navy Region Hawaii.

The DON's purpose for the Proposed Action is to maintain long-term DoD use of 8,348 acres of State lands (including leaseholds and easement lands) on Kaua'i, Hawaii for operational continuity and sustainment of the military readiness mission. NASA's purpose for the Proposed Action is to maintain long-term use of 23 acres of State land on Kaua'i, Hawaii for continued operations of KPGO. The Proposed Action is needed because the existing real estate agreements are set to expire between 2027 and 2030. Preserving the long-term DoD and NASA use of these State lands is critical for military readiness, continuation of ongoing military training and testing, and maintaining data collection efforts of global significance. It also ensures the continued conservation management by the DON and NASA of natural and cultural resources on these lands.

For the Hawaii Department of Land and Natural Resources (DLNR), in addition to its role as the lessor of State lands, the proposed real estate action presents an opportunity for the agency to secure a revenue source to support its management of public lands and associated environmental and conservation programs. Fees from leases and easements are put into a State fund as required by law.

By ensuring continued DON and NASA operations on Kaua'i, the real estate action would also preserve local jobs and income for the residents of Kaua'i, financially contribute to the overall economic well-being of Kaua'i, and maintain continued conservation management of natural and cultural resources on State lands at no cost to the State of Hawaii.

The DON and NASA have identified two preliminary action alternatives to carry forward for analysis in the EIS, along with the No Action Alternative.

Alternative 1 (Succeeding Current Real Estate Agreements): The DON and NASA would apply to DLNR for new long-term real estate agreements in the same manner and for the same uses as the current leases and easements.

Alternative 2 (Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds): The DON and NASA would pursue fee simple acquisition of 700 acres (684—DON, 16—NASA) of leaseholds, and otherwise obtain use of the remaining acreage as described in Alternative 1.

Alternative 3 (No Action Alternative): The DON and NASA would not seek any real estate agreements for the State lands on Kaua'i after expiration of the leases and easements between 2027 to 2030. The current real estate agreements for 8,348 acres with the DON and 23 acres with NASA would expire. All existing infrastructure would be removed, or abandoned in place (as determined by the existing real estate agreements), from the DON and NASA leased and easement lands.

Consistent with Council on Environmental Quality regulations and HAR section 11–200.1–24(b), the scope of the analysis for the alternatives in this EIS is proportionate to the potential for environmental impacts. The following 13 resources have a potential for impacts and are analyzed in this EIS: archaeological and historic resources, cultural practices, biological resources, land use, socioeconomics, environmental justice, water resources, utilities, public health and safety, air quality and greenhouse gases, transportation, hazardous materials and wastes, and visual resources. The EIS will analyze measures that would avoid, minimize, or mitigate environmental effects. The DON and NASA will conduct coordination, consultation, and permitting activities required by the NHPA, the Endangered Species Act, the Clean Water Act, the Coastal Zone Management Act, Hawaii Revised Statues chapter 183C and HAR chapter 13–5, HAR chapter 6E, and other laws and regulations determined to be applicable to the project.

This EIS will satisfy both Federal and State of Hawaii requirements and provide the necessary analyses to allow the DON, NASA, and DLNR to consider the environmental effects of the Proposed Action and alternatives as part of their decision-making. The DON and NASA encourages Federal, State, and local agencies, and interested persons to provide comments concerning the alternatives proposed for study and environmental issues for analysis in the EIS, as well as to identify specific environmental resources the DON and NASA should consider when developing the Draft EIS. The DON and NASA will prepare the Draft EIS and will include analyses of potential effects to the resources the DON, NASA, and the commenting public have identified. All comments received during the public scoping period will be considered during EIS preparation.

Comments must be postmarked or submitted electronically by email to *info@PMRF-KPGO-EIS.com,* and/or electronically through the EIS website at *www.PMRF-KPGO-EIS.com.* Comments must be posted by 11:59 p.m. HST on June 17, 2024.

After the scoping period, the DON and NASA will develop the Draft EIS. The DON and NASA intend to release the Draft EIS in summer of 2025, the Final EIS in spring of 2026, with a Record of Decision signed in late spring of 2026.

Dated: May 6, 2024.

Emily A. Pellegrino,

Program Analyst, Directives and Regulatory Team, National Aeronautics and Space Administration.

J.E. Koningisor,

Lieutenant Commander, Judge Advocate General's Corps, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. 2024–10167 Filed 5–8–24; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

Combined Notice of Filings #1

Take notice that the Commission received the following electric rate filings:

Docket Numbers: ER23–2764–004.

Applicants: Northeastern Power & Gas, LLC.

Description: Tariff Amendment: Amendment to 12 to be effective 9/25/2023.

Filed Date: 5/3/24.

Accession Number: 20240503–5171.

Comment Date: 5 p.m. ET 5/24/24.

Docket Numbers: ER24–1420–001.

Applicants: Sierra Estrella Energy Storage LLC.

Description: Tariff Amendment: Response to Deficiency Letter to be effective 3/18/2024.

Filed Date: 5/3/24.

Accession Number: 20240503–5097.

Comment Date: 5 p.m. ET 5/24/24.

Docket Numbers: ER24–1421–001.

Applicants: Superstition Energy Storage LLC.

Description: Tariff Amendment: Superstition Energy Storage LLC submits tariff filing per 35.17(b): Response to Deficiency Letter to be effective 3/18/2024.

Filed Date: 5/3/24.

Accession Number: 20240503–5098.

Attachment B

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA 'OIHANA KUMUWAIWAI 'ĀINA

P.O. BOX 621
HONOLULU, HAWAII 96809

DAWN N.S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RYAN K.P. KANAKA'OLE
FIRST DEPUTY

DEAN D. UYENO
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

April 29, 2024

Mary Alice Evans, Acting Director
Office of Planning and Sustainable Development
c/o Environmental Review Program
235 South Beretania Street, Room 702
Honolulu, Hawai'i 96813

SUBJECT: Publication of the Environmental Impact Statement Preparation Notice (EISPN) for the Proposed Pacific Missile Range Facility and Kōke'e Park Geophysical Observatory Real Estate Project Located in Kekaha, West Kaua'i on the Island of Kaua'i, Further Identified as Tax Map Key(s): (4)1-2-001:001, 006, & 010; (4)1-2-002:001, 010-013, 015, & 024-030; (4) 1-2-016:011; (4) 1-4-001:002, 013, 014, & 999; and (4) 2-1-003:018

Dear Ms. Evans:

With this letter, the Department of Land and Natural Resources (DLNR) submits the Pacific Missile Range Facility and Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement Preparation Notice (EISPN) for publication in the next available edition of The Environmental Notice on May 8, 2024. The applicants for the action are the United States Department of the Navy (U.S. Navy) and the National Aeronautics and Space Administration (NASA).

The DLNR has coordinated with the applicants to determine the appropriate level of environmental review for the action. So as to not overlook any potentially significant impact to the natural and/or human environment, an Environmental Impact Statement will be prepared pursuant to Hawai'i Revised Statutes (HRS) §343-5(e) and Hawai'i Administrative Rules (HAR) §11-200.1-14(d)(2).

The required publication form and files have been provided electronically via the "Online Submittal Form" on the Office of Planning and Sustainable Development, Environmental Review Program website. The submittal includes a .pdf file of the EISPN and .zip file containing a shapefile of the project's location boundary. Concurrent with the electronic submittal and as required by HAR §11-200.1-5(4)(B), paper copies of the EISPN have been submitted to the nearest state library (Waimea Public Library, Kaua'i) and the Hawai'i Documents Center (Hawai'i State Library, O'ahu).

Pursuant to HAR §11-200.1-23(10)(c), publication of the EISPN in *The Environmental Notice* initiates a 30-day public comment period for parties to provide comments regarding potential effects of the proposed action. A Notice of Intent for the project will also be published in the Federal Register. The applicants are preparing a single EIS compliant with both the Hawai'i Environmental Impact Statements law (HRS Chapter 343) and the National Environmental Policy Act as allowed under HAR §11-200.1-31.

Should you have any questions, please contact Mr. Russell Tsuji, Land Division Administrator at (808) 587-0422.

Sincerely,

Dawn N.S. Chang,
Chairperson

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Wednesday, May 1, 2024 8:41:33 AM

Action Name

Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Type of Document/Determination

Environmental impact statement preparation notice (EISPN)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds
- (2) Propose any use within any land classified as a conservation district

Judicial district

Waimea, Kauaʻi

Tax Map Key(s) (TMK(s))

(4) 1-2-002:001; (4) 1-2-002:012; (4) 1-2-002:015; (4) 1-2-002:027; (4) 1-2-002:028; (4) 1-2-001:006; (4) 1-2-016:011; (4) 1-4-001:999; (4) 1-2-002:029; (4) 1-2-002:030; (4) 2-1-003:018; (4) 1-2-001:001; (4) 1-2-002:024; (4) 1-2-002:025; (4) 1-2-002:026; (4) 1-4-001:002; (4) 1-4-001:013; (4) 1-4-001:014; (4) 1-2-002:013; (4) 1-2-001:010; (4) 1-2-002:010; (4) 1-2-002:011; (4) 1-4-001:013

Action type

Applicant

Other required permits and approvals

Numerous

Discretionary consent required

Use of State land

Approving agency

Department of Land and Natural Resources, Land Division

Agency contact name

Russell Tsuji

Agency contact email (for info about the action)

dlnr.land@hawaii.gov

Email address or URL for receiving comments

info@PMRF-KPGO-EIS.com

Agency contact phone

(808) 587-0419

Agency address

1151 Punchbowl Street
Room 220
Honolulu, Hawaii 96813
United States
Map It

Public Scoping Meeting information

6/4/2024, 5-8pm 3215 Kaua‘i Veterans Memorial Highway, Līhu‘e

Accepting authority

State of Hawaii Board of Land and Natural Resources

Applicant

United States Department of the Navy

Applicant contact name

Kerry Wells

Applicant contact email

info@PMRF-KPGO-EIS.com

Applicant contact phone

(808) 473-0662

Applicant address

400 Marshall Road
Building X-11
Pearl Harbor, Hawaii 96860
United States
Map It

Is there a consultant for this action?

Yes

Consultant

Cardno GS-AECOM Pacific Joint Venture

Consultant contact name

Michele Lefebvre

Consultant contact email

info@PMRF-KPGO-EIS.com

Consultant contact phone

(808) 791-9872

Consultant address

737 Bishop Street
Suite 3050
Honolulu, Hawaii 96813
United States
Map It

Action summary

The Navy proposes to retain the use of 8,348 acres of State lands on Kauaʻi, Hawaiʻi, for operational continuity and sustainment (in support of continued military training, testing, and facility operations) at Pacific Missile Range Facility (PMRF). NASA proposes to retain the use of 23 acres of State lands on Kauaʻi, Hawaiʻi, in support of continued operations including measurements of the Earth's rotation and local land motion at Kōkeʻe Park Geophysical Observatory (KPGO).

Attached documents (signed agency letter & EA/EIS)

- 240429-ERP-Transmittal-Letter-for-PMRF-EISPN-RUSH-part-1-signed.pdf
- PMRF-and-KPGO-RE-EIS-Version-Report-EISPN-1May2024.pdf

Action location map

- PMRF-and-KPGO-Real-Estate-EIS-Location-Boundary.zip

Authorized individual

Michele Lefebvre

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE

for

PACIFIC MISSILE RANGE FACILITY AND KŌKEʻE PARK GEOPHYSICAL OBSERVATORY REAL ESTATE

KAUAʻI, HAWAIʻI

May 2024

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Project Information Summary (Abstract)

Project Name:	Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement	
Applicants (Joint Lead Agencies under NEPA):	United States Department of the Navy Naval Facilities Engineering Systems Command Environmental OPHEV2 400 Marshall Road Building X-11 Pearl Harbor, HI 96860 Contact: Kerry Wells Phone: 808-473-0662 Email:info@PMRF-KPGO-EIS.com	National Aeronautics and Space Administration Goddard Space Flight Center 34200 Fulton Street Wallops Island, VA 23337, Contact: Shari Miller Phone: 757-824-2327 Email: Shari.A.Miller@nasa.gov
Approving Agency:	Department of Land and Natural Resources, Land Division 1151 Punchbowl Street, Room 220 Honolulu, Hawaiʻi 96813 Phone: 808-587-0419 Email: dlnr.land@hawaii.gov	
Accepting Authority:	State of Hawaii Board of Land and Natural Resources	
Planning Consultant:	Cardno GS-AECOM Pacific Joint Venture Local Office: Stantec GS Inc. 737 Bishop Street, Suite 3050 Honolulu, HI 96813 Contact: Michele Lefebvre Phone: 808-791-9872 Email: info@PMRF-KPGO-EIS.com	
Location:	County of Kauaʻi, Hawaiʻi	
District:	Waimea	
Tax Map Keys:	(4) 1-2-002:001, (4) 1-2-002:012, (4) 1-2-002:015, (4) 1-2-002:027, (4) 1-2-002:028, (4) 1-2-001:006, (4) 1-2-016:011, (4) 1-4-001:999, (4) 1-2-002:029, (4) 1-2-002:030, (4) 2-1-003:018, (4) 1-2-001:001, (4) 1-2-002:024, (4) 1-2-002:025, (4) 1-2-002:026, (4) 1-4-001:002, (4) 1-4-001:013, (4) 1-4-001:014, (4) 1-2-002:013, (4) 1-2-001:010, (4) 1-2-002:010, (4) 1-2-002:011, (4) 1-4-001:013	
Land Area:	Navy lease area and easements: 8,348 acres	NASA lease area and easements: 23 acres
Recorded Fee Owner:	State of Hawaiʻi	
Existing Use:	Navy Uses: Antenna structures, ordnance storage/assembly facilities, missile tracking and surveillance facilities, water well, undeveloped land used for safety zone buffers, drainage management, roadways, and access to utilities	NASA Uses: Kōkeʻe Park Geophysical Observatory, antenna structures, data collection systems, and supportive infrastructure
State Land Use District:	Agricultural, Conservation	
Zoning:	Agricultural, Conservation, Open Space, Special Treatment – Ecological	
Flood Zone Designation:	A, AE, D, VE, X	

Proposed Action:	The Navy proposes to retain the use of 8,348 acres of State lands on Kaua'i, Hawai'i, for operational continuity and sustainment (in support of continued military training, testing, and facility operations) at Pacific Missile Range Facility (PMRF). NASA proposes to retain the use of 23 acres of State lands on Kaua'i, Hawai'i, in support of continued operations including measurements of the Earth's rotation and local land motion at Kōke'e Park Geophysical Observatory (KPGO).
HRS Chapter 343 Trigger(s):	Proposed use of state or county lands, propose any use within any land classified as a Conservation District

Project Summary:

The United States (U.S.) Department of the Navy (Navy) and the National Aeronautics and Space Administration (NASA) as applicants and joint lead agencies have prepared this Environmental Impact Statement Preparation Notice (EISPN) and a separate Notice of Intent (NOI) to Prepare an Environmental Impact Statement (EIS) in accordance with the following: the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] 4321 et seq.), as amended by the Fiscal Responsibility Act of 2023 (Public Law [P.L.] No. 118-5, div. C, tit. III, 321(b), 137 Stat. 10, 40 (amending NEPA § 107) (2023) (codified at 42 U.S.C. § 4336a); Council on Environmental Quality, Navy and NASA policies and regulations; and Hawai'i Revised Statutes (HRS) Chapter 343 and Hawai'i Administrative Rules (HAR) § 11-200.1. The Navy proposes to retain the use of 8,348 acres of State lands on Kaua'i, Hawai'i, for operational continuity and sustainment (in support of continued military training, testing, and facility operations) at the Pacific Missile Range Facility (PMRF). NASA proposes to retain the use of 23 acres of State lands on Kaua'i, Hawai'i, in support of continued operations including measurements of the Earth's rotation and local land motion at Kōke'e Park Geophysical Observatory (KPGO). The Proposed Action is needed because the existing real estate agreements for these lands are set to expire between 2027 and 2030. The Navy and NASA are considering two action alternatives and the No Action Alternative. The Draft EIS will evaluate potential environmental impacts associated with these alternatives. The following resource areas are evaluated: archaeological and historic resources, cultural practices, biological resources, land use, socioeconomics, environmental justice, water resources, utilities, public health and safety, air quality and greenhouse gases, transportation, hazardous materials and wastes, and visual resources.

Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement Preparation Notice

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Appendix B Regulatory Setting

Appendix C List of Interested Parties Contacted During Scoping

Appendix D Detailed List of Activities and Operational Elements Under Current Real Estate Agreements

Appendix E No Action Alternative: Detailed List of Activities/Operations Impacted

Abbreviations and Acronyms

ACHP	Advisory Council on Historic Preservation
AFFF	Aqueous Film Forming Foam
APE	Area of Potential Effects
ARPA	Archaeological Resources Protection Act
AT	Anti-Terrorism
BMP	Best Management Practice
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
CIA	Cultural Impact Assessment
CNRH	Commander, Navy Region Hawai‘i
CO	Carbon Monoxide
COMNAVREG	Commander, Navy Region
CRM	Cultural Resources Management
CZMA	Coastal Zone Management Act
DAR	Division of Aquatic Resources
DHHL	State of Hawai‘i Department of Hawaiian Home Lands
DLNR	Department of Land and Natural Resources
DoD	Department of Defense
DOFAW	DLNR Division of Forestry and Wildlife
DOH	Hawai‘i Department of Health
DORIS	Doppler Orbitography and Radio-positioning Integrated by Satellite
EIS	Environmental Impact Statement
EISPN	Environmental Impact Statement Preparation Notice
EO	Executive Order
ESA	Endangered Species Act
ESQD	Explosive Safety Quantity Distance
GHA	Ground Hazard Area
GHG	Greenhouse Gas
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HAR	Hawai‘i Administrative Rules
HEPA	Accepted Term for Hawai‘i Revised Statutes Chapter 343
HRS	Hawai‘i Revised Statutes
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
ITRF	International Terrestrial Reference Frame
KISC	Kaua‘i Invasive Species Committee
KPGO	Kōke‘e Park Geophysical Observatory
MBTA	Migratory Bird Treaty Act
MOA	Memorandum of Agreement
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NASA	National Aeronautics and Space Administration
Navy	Department of the Navy
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRHP	National Register of Historic Places
O_3	Ozone
OPNAVINST	Office of the Chief of Naval Operations Instruction
PA	Programmatic Agreement
P.L.	Public Law
PCB	Polychlorinated Biphenyl
PFAS	Per- and Polyfluoroalkyl Substances
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter Less than or Equal to 2.5 Microns in Diameter
PM_{10}	Particulate Matter Less than or Equal to 10 Microns in Diameter
PMRF	Pacific Missile Range Facility
RADAR	Radio Detecting and Ranging

RDT&E	Research, development, test and evaluation
REPI	Readiness and Environmental Protection Integration
SECNAVINST	Secretary of the Navy Instruction
SGP	Space Geodesy Project
SHPD	State Historic Preservation Division
SHPO	State Historic Preservation Office
SLUD	State Land Use District
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
SOS	Save Our Shearwaters
T&E	Test and Evaluation
U.S.	United States
U.S.C.	United States Code
USCB	United States Census Bureau
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VLBI	Very Long Baseline Interferometry

1 Purpose of and Need for the Proposed Action

This chapter provides the following: an introduction and overview of the project; the project location, background, purpose of and need for the Proposed Action; scope of analysis; relevant laws and regulations; and public and agency participation.

1.1 Project Introduction and Overview

The United States (U.S.) Department of the Navy (Navy) and the National Aeronautics and Space Administration (NASA) are joint lead agencies and are preparing a Draft Environmental Impact Statement (EIS) in coordination with the Hawai‘i Department of Land and Natural Resources (DLNR) (Hawai‘i Administrative Rules [HAR] § 11-200.1-23 (a)(4)). The EIS will evaluate the potential environmental consequences of the Navy’s and NASA’s proposal to retain the use of 8,348 acres and 23 acres, respectively, of State lands including leaseholds and easement lands on Kaua‘i, Hawai‘i, for operational continuity and sustainment (in support of the military’s continued and ongoing military training, testing, and facility operations) at the Pacific Missile Range Facility (PMRF), and NASA’s continued operations including measurements of the Earth’s rotation and local land motion at Kōke‘e Park Geophysical Observatory (KPGO).

The Navy’s current real estate agreements with DLNR include 684 acres of leaseholds and 7,664 acres of easement lands, for a total of 8,348 acres. These existing Navy real estate agreements with DLNR are set to expire between 2027 and 2030. The Navy’s current leases and easements are primarily used for passive encroachment buffers, as well as for mission readiness (see Section 1.2 and Appendix D), access, and utilities at the following five general locations: Main Base, Kamokalā Ridge, Mānā Water Well, Miloli‘i Ridge, and Mākaha Ridge. No ground-based training occurs on these parcels. The Navy’s 8,348 acres of leaseholds and easement lands are part of the larger PMRF installation.

NASA’s current real estate agreements with DLNR include 16 acres of leaseholds and 7 acres of easement lands, for a total of 23 acres. NASA uses the land for operations at KPGO that include collecting and coordinating geodetic data that contribute to daily measurements of the Earth’s rotation and orientation in space. NASA issued the Navy a Use Permit in 2016 for portions of KPGO to conduct radar, telemetry, and communications services in support of PMRF operations. In addition to their mission operations, the Navy and NASA also conduct environmental management and stewardship activities on these lands.

These leases and easements collectively comprise the Project Area that will be analyzed in the EIS.

Figure 1-1 depicts an overview of general locations for PMRF and KPGO (Main Base, Kamokalā Ridge, Mānā Water Well, Miloli‘i Ridge, Mākaha Ridge, and KPGO) on the Island of Kaua‘i. The Project Area includes leaseholds and easement lands within these locations; it does not include the 1,933 acres of federally owned fee simple lands.

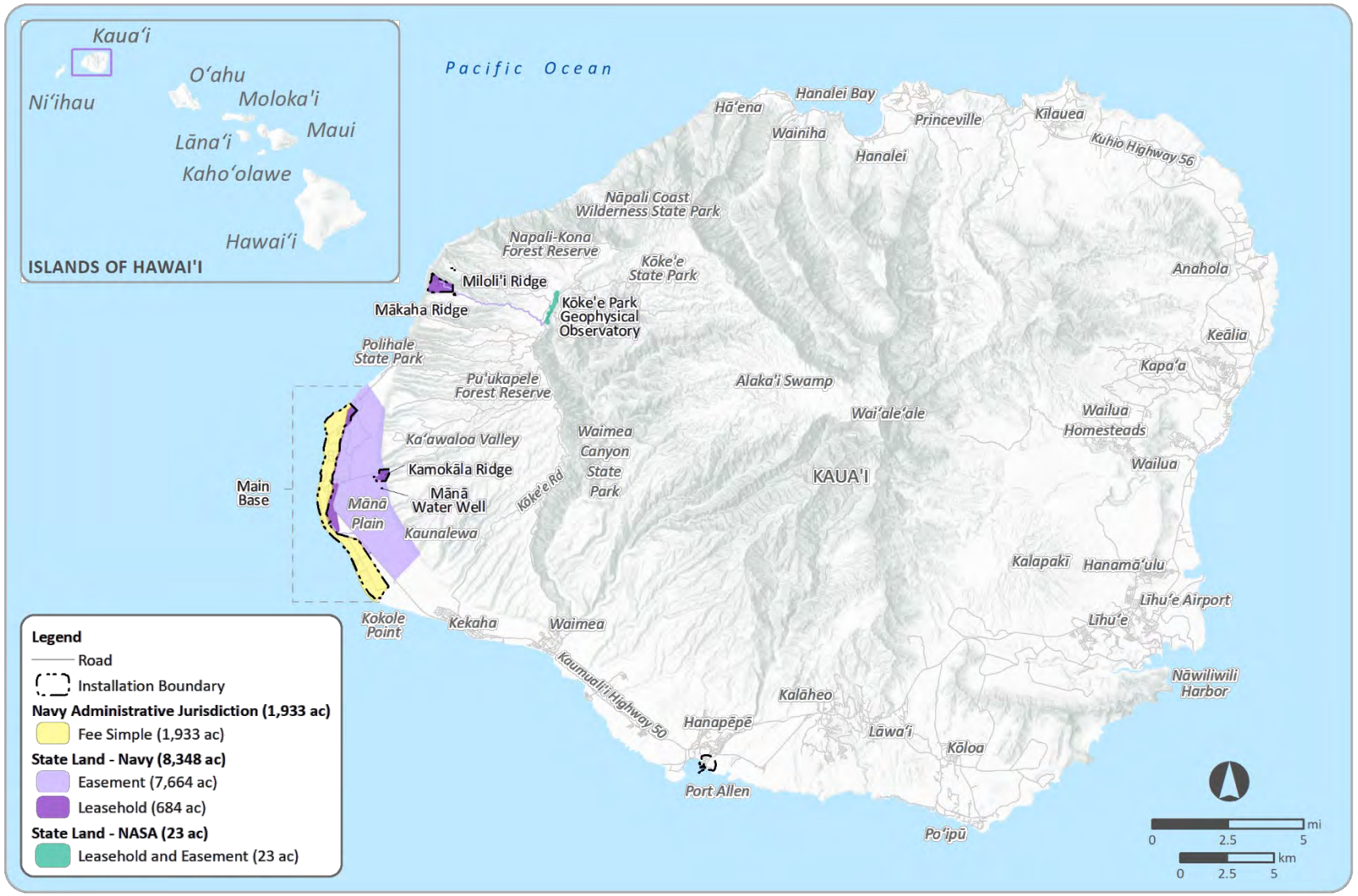

Figure 1-1 General Location

The Navy and NASA have jointly prepared this document and a separate Notice of Intent (NOI) to prepare an EIS in accordance with federal and state law including: the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] 4321–4370), as amended by the Fiscal Responsibility Act of 2023 (Public Law [P.L.] No. 118-5 , div. C, tit. III, § 321(b), 137 Stat. 10, 40 (amending NEPA § 107) (2023) (codified at 42 U.S.C. § 4336a)); the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] §§ 1500–1508); Navy and NASA regulations and policies for implementing NEPA (32 CFR § 775, 14 CFR § 1216, OPNAVINST 5090.1E, and NPR 8580.1A, 32 CFR); all applicable federal environmental laws and agency guidance listed in Appendix B; Hawai‘i Revised Statutes (HRS) Chapter 343 (the state law governing preparation of an EIS and commonly referred to as “HEPA”); and HAR § 11-200.1 (implementing HRS Chapter 343).

As requested by and in coordination with DLNR, the Navy and NASA identified that an EIS is the appropriate level of environmental review for the Proposed Action (HAR § 11-200.1-23 (a)(5)) (Lauren Yasaka e-mail message to Kerry Wells, email title: Lauren Pacific Missile Range Facility and Kōke‘e Park Geophysical Observatory Real Estate EIS, January 18, 2024). HAR § 11-200.1-14(d)(2) supports this determination, which provides “[if the] proposing agency or approving agency determines, through its judgment and experience that an EIS is likely to be required, then the proposing agency may choose to prepare, or an approving agency may authorize an applicant to prepare, an EIS in accordance with subchapter 10, beginning with preparation of an EISPN.” Additionally, due to the nature of the Proposed Action, the Navy and NASA concur with DLNR’s determination that an EIS is likely to be required. An EIS also helps ensure that input from the public and agencies is integrated into the process of assessing environmental impacts of the Proposed Action and conducting fully informed decision making.

DLNR’s mission is to “[e]nhance, protect, conserve and manage Hawai‘i’s unique and limited natural, cultural and historic resources held in public trust for current and future generations of the people of Hawai‘i nei, and its visitors, in partnership with others from the public and private sectors” (Hawai‘i DLNR, 2024). DLNR is also responsible for issuing and managing leases of State lands (agricultural, pasture, commercial, industrial, governmental, and resort leases). DLNR’s responsibilities include managing and maintaining the state’s coastal lands and waters, water resources, conservation and forestry lands, historic sites, small boat harbors, parks, and recreational facilities. DLNR also performs public safety duties (e.g., flood and rockfall prevention), maintains unencumbered public lands, and enforces the agency’s rules and regulations.

For this Proposed Action, DLNR is responsible for issuing leases and easements to the Navy and NASA. DLNR is the agency with the responsibility for approving the real estate action since the State lands are under the management of DLNR’s Land Division. DLNR is required to conduct an environmental review of this Proposed Action because the Navy and NASA are proposing the continued use of State lands (HRS § 343-5(a)(1), (2), (4)). Pursuant to HRS § 343-5(h): “[w]henever an action is subject to both the National Environmental Policy Act of 1969 (Public Law 91-190) and the requirements of this chapter, [DLNR] shall cooperate with federal agencies to the fullest extent possible to reduce duplication between federal and state requirements. Such cooperation, to the fullest extent possible, shall include joint environmental impact statements with concurrent public review and processing at both levels of government. Where federal law has environmental impact statement requirements in addition to but not in conflict with this chapter, [DLNR] and agencies shall cooperate in fulfilling these requirements so that one document shall comply with all applicable laws.” Under HAR § 11-200.1-28, DLNR, as the accepting authority for HEPA,

evaluates whether the EIS fulfills the intent of HRS Chapter 343. In addition, during review of the EIS, DLNR will consider HRS Title 12, Chapter 171 (Hawai‘i’s land lease law).

1.2 Project Area

PMRF is located approximately 100 miles from O‘ahu on the northwest coast of the Hawaiian island of Kaua‘i (refer to Figure 1-1). KPGO is located within Kōke‘e State Park on the island of Kaua‘i, at an elevation of approximately 3,600 feet above sea level near Waimea Canyon.

The Project Area overview is shown in Figure 1-2. Current real estate details for the Main Base, Kamokalā Ridge, and Mānā Water Well portions of the Project Area are shown in Figure 1-3. Mākaha, Miloli‘i Ridge, and KPGO portions of the Project Area are shown in Figure 1-4.

The Project Area consists of the following:

- Main Base: leaseholds (392 acres) and easement lands (7,267 acres), located adjacent to the fee-simple lands at the installation, used for PMRF operational support, utilities and flood control, and as safety buffers;
- Kamokalā Ridge: leaseholds (89 acres) and easement lands (355 acres) used for ordnance storage, utilities access, and tsunami evacuation;
- Mānā Water Well: leaseholds (0.29 acre) used as the primary potable water source for PMRF;
- Mākaha Ridge: leaseholds (203 acres) and easement lands (42 acres) used for missile tracking and surveillance;
- Miloli‘i Ridge: leaseholds (0.015 acre) used for radar and telemetry activities; and
- KPGO: leaseholds (16 acres) and easement lands (7 acres) used for surveillance and tracking, as well as NASA geodetic data collection and backup power generation.

1.3 Background

1.3.1 Historic Land Use at PMRF

The history of the Mānā Plain is complex, with the earliest known traditional Hawaiian archaeological site at PMRF dating to the eleventh century (NAVFAC Pacific, 2012). Appendix A provides a more detailed summary of land use history at PMRF.

Traditionally, the people of Mānā were noted as fishermen. It is likely that permanent settlements were concentrated at the inland edge of the Mānā Plain, where houses, temples, and agricultural complexes were built in the foothills at the base of the cliffs, on high ground overlooking the wetlands and coastline. Small seasonal fishing communities were scattered along the coast. The people of Mānā developed and maintained brackish water loko pu‘uone fishponds in the wetlands of the Mānā Plain. Inland of the wetlands, they grew sweet potatoes and gourds on the fertile strip of land at the foot of the pali. The coastal dunes of the Mānā Plain, particularly at Nohili, were the burial grounds of ancient Hawaiians. Several important heiau were located at Mānā. These heiau include Polihale, where rites associated with departing souls were conducted, and ‘Elekuna, which King Kalakaua and his priests visited many times in the nineteenth century.

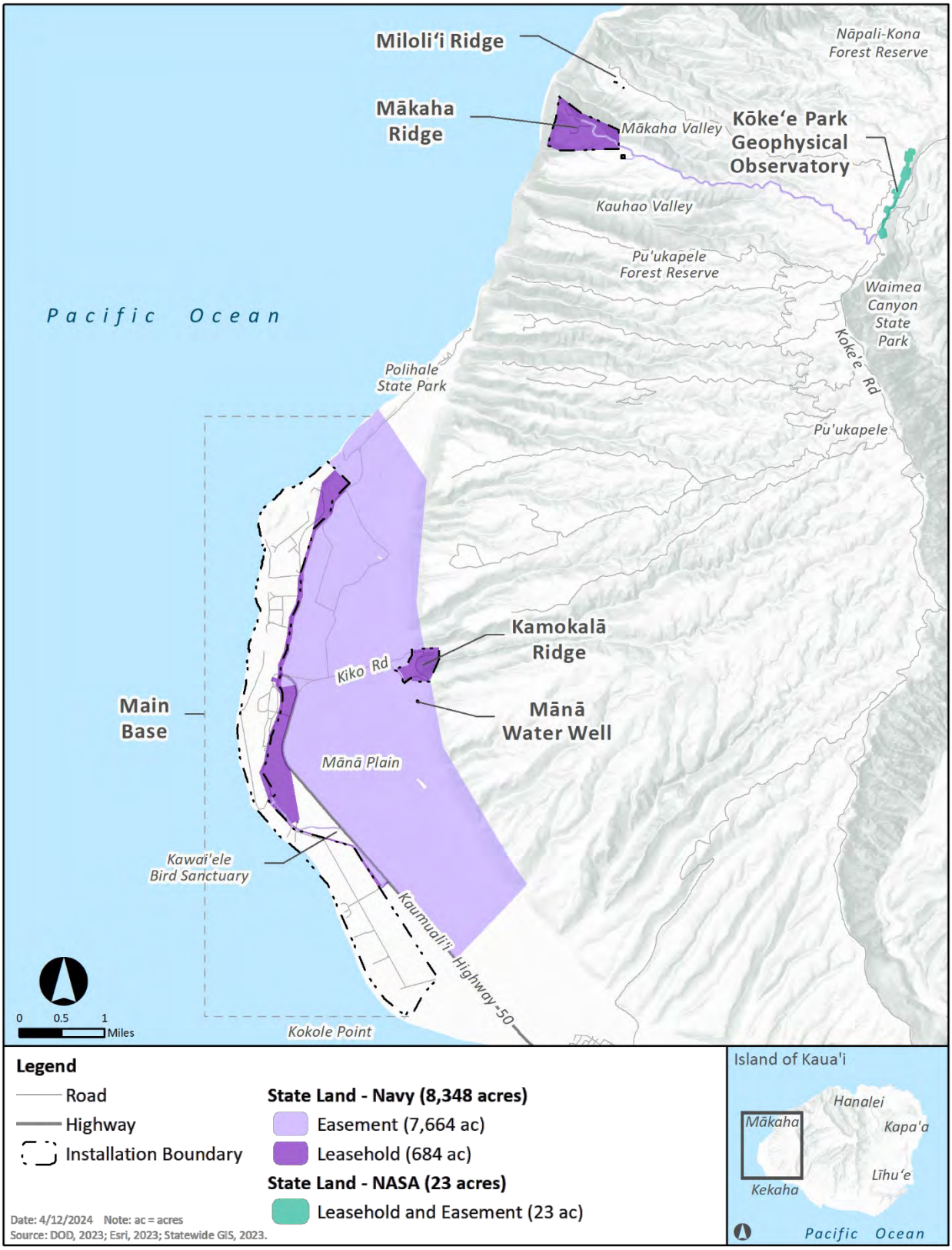

Figure 1-2 Project Area: Overview

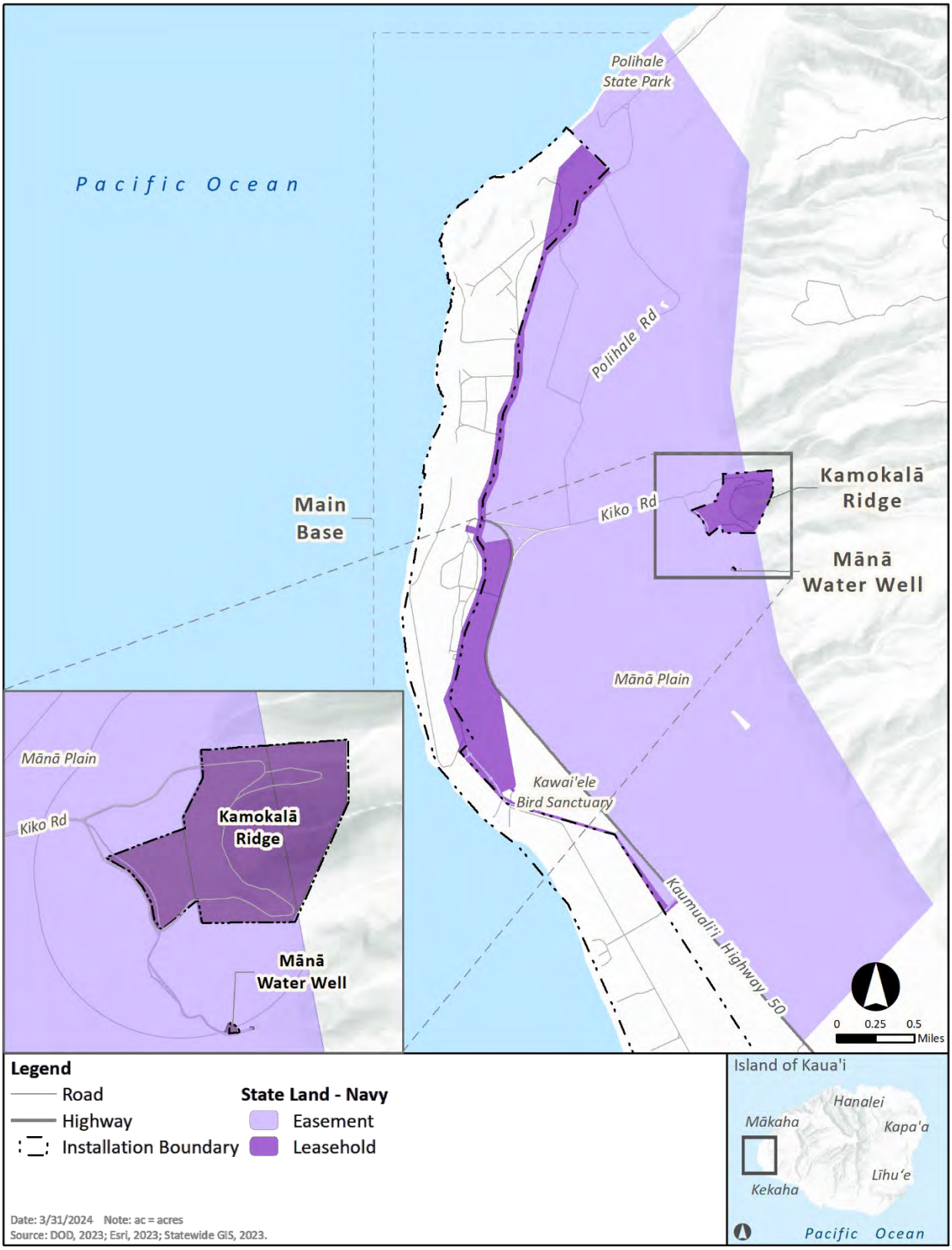

Figure 1-3 Project Area: Main Base, Kamokalā, and Mānā Water Well

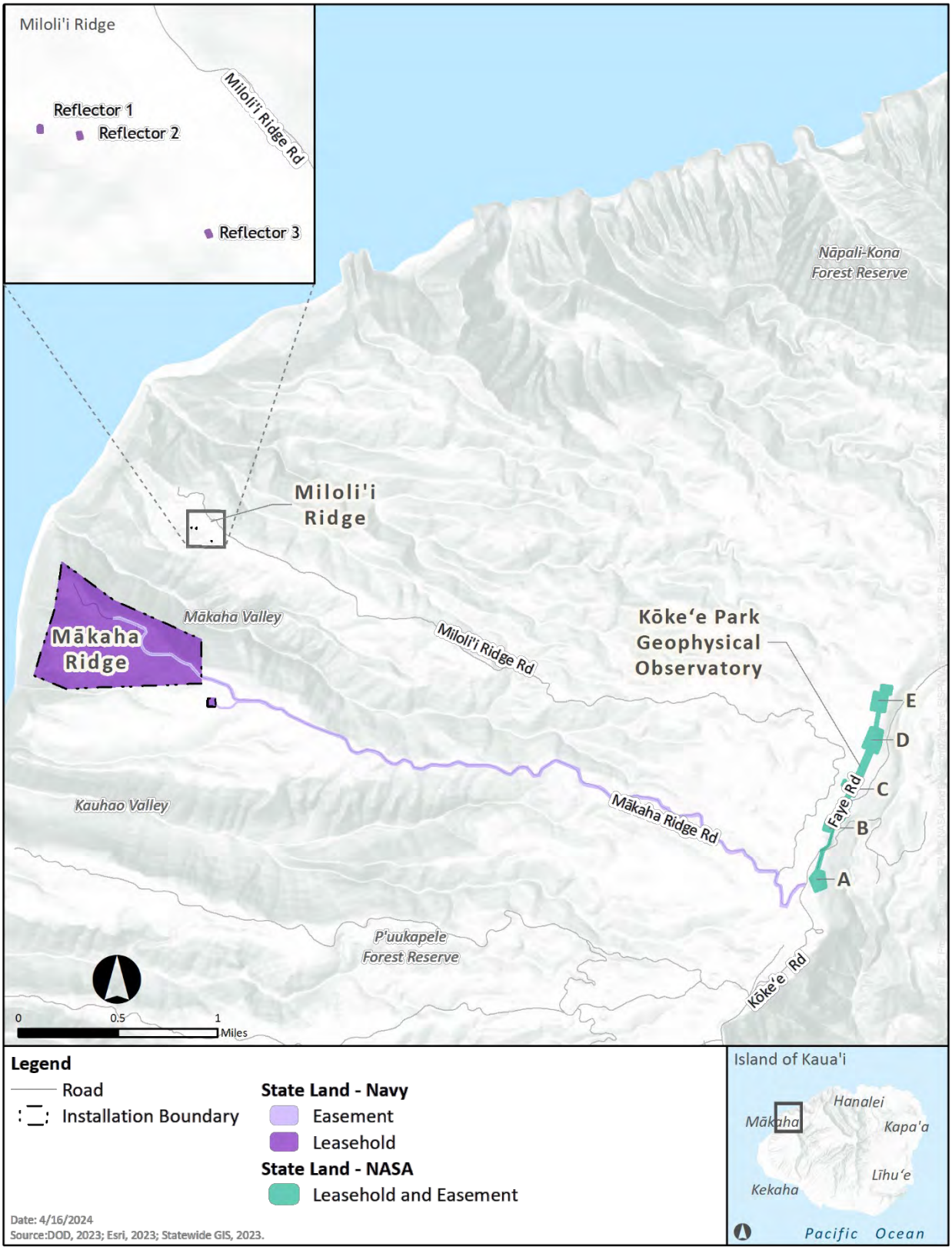

Figure 1-4 Project Area: Mākaha Ridge, Miloli'i Ridge, and KPGO

The Māhele of 1848 placed the ahupua'a of Waimea, including the Mānā Plain, into the possession of the Crown, and shortly afterwards the Crown leased these lands for commercial agriculture, such as livestock grazing, rice production, and sugarcane cultivation. As these agricultural ventures grew over the next three decades, contract laborers from China, then Japan, and finally the Philippines were brought to the area. Plantation camps were built to house the laborers. Mānā Camp eventually included a school, three stores, a company office, and a post office. Much of the wetlands were drained or filled to create more arable land for sugarcane cultivation under the Kekaha Sugar Company, Ltd., which was formed in 1898. Commercial sugarcane cultivation continued through the twentieth century.

In the 1920s, an airstrip was built by the Territory of Hawai'i. Beginning in 1940, the U.S. military acquired the airstrip and surrounding land to develop Barking Sands Army Air Base. During World War II, units from all branches of the armed forces and the Hawai'i National Guard were assigned to the base. The base was transferred to the Air Force in 1948. During the 1950s, the facility was redesignated Bonham Air Force Base, and the Navy, as a tenant of the base, began testing, evaluating, and training sailors on using guided missile systems. In 1958, the Navy's activity was named the Pacific Missile Range Facility as part of a newly designated larger Pacific Missile Range used by the Department of Defense (DoD) and NASA (NAVFAC Pacific, 2012). It was during this period that the Air Force transferred Bonham Air Force Base (which had been redesignated Bonham Auxiliary Landing Field) to the Navy. The transfer was finalized in 1966, at which time the entire installation became PMRF. A more detailed history of land use at PMRF is in Appendix A.

1.3.2 Historic Land Use at KPGO

Desktop and documentary research for historic land use at KPGO is ongoing. The Draft EIS will include additional information on historic land use at KPGO.

1.3.3 Navy Mission at PMRF

PMRF is the world's largest instrumented multi-environment range, capable of simultaneously supporting surface, subsurface, air, and space operations. As a Major Range and Test Facility Base, PMRF is part of the designated core set of DoD Test and Evaluation (T&E) infrastructure and associated workforce components that must be preserved as a national asset to provide T&E capabilities to support the DoD acquisition system. PMRF's unique location includes broad ocean areas to the north, south, and west with a relatively isolated and encroachment-free environment that safely and effectively supports these operations, as well as Navy Fleet training, as analyzed in the NEPA document titled *Hawaii-Southern California Training and Testing Final EIS/OEIS* (Navy, 2018).

The Navy's primary military mission at PMRF is to provide integrated range services in a modern, multi-threat, multi-dimensional environment that ensures the safe evaluation and execution of research, development, test and evaluation (RDT&E) missions. These capabilities are critical for DoD's ability to achieve its statutory Title 10 military readiness requirements[1], to provide commercial entities with the ability to conduct commercial T&E activities (see 10 U.S.C. § 4175 providing for the use of T&E installations by commercial entities), and Title 51 national and commercial space program requirements

[1] The legal basis for the roles, missions, and organization of each of the services are set forth in 10 U.S.C. § 7062 (Army), 10 U.S.C. § 8062 (Navy), 10 U.S.C. § 8063 (Marine Corps), 10 U.S.C. § 9062 (Air Force), and 10 U.S.C. § 9082 (Space Force).

by supporting commercial space activities (see 51 U.S.C. §§ 50504, 50901—50909 authorizing commercial space launch and reentry activities).

Activities at PMRF are monitored with real-time tracking and command/control capabilities located at or connected to the land-based PMRF facilities. This unique facility provides a realistic environment for training and testing in the use of surface, subsurface, air, and space weapons systems as well as land-based weapons systems located at the Main Base. The Navy conducts missile systems tests and has supporting facilities to track and evaluate these tests from the ocean floor to the outer atmosphere.

PMRF's space, air, surface, and subsurface tracking are accomplished from radar sites at multiple elevations. PMRF is linked to other range and data-processing facilities and can transmit real-time training and testing data anywhere in the world. The Navy, Air Force, Army, Marine Corps, allied foreign forces' RDT&E programs, and other non-DoD agencies (including NASA and commercial entities), all utilize PMRF's unique capabilities.

On Kaua'i, the Navy is the largest high-tech employer and third largest overall employer. It employs approximately 900 military and civilian personnel and contributes approximately $150 million annually in salary, contract goods, and services to the local economy. Moreover, as described in Section 1.3.6, *Environmental Management and Stewardship*, the Navy actively manages the natural and cultural resources at PMRF for the leased and easement lands.

1.3.4 NASA KPGO Space Geodesy Mission

Geodesy is the science of the Earth's shape, orientation in space, and gravity, and underpins modern navigation technology such as the Global Positioning System (GPS) that is used every day in a wide variety of devices, from handheld smartphones to satellites. NASA's Space Geodesy Project (SGP) was initiated to develop and maintain a global network of space geodetic observing instruments. The network is composed of core sites around the world that use four primary space-geodetic observation platforms: the Very Long Baseline Interferometry (VLBI), the Satellite Laser Ranging, the Doppler Orbitography by Radiopositioning Integrated on Satellite (DORIS), and the Global Navigation Satellite System (GNSS). The SGP maintains the International Terrestrial Reference Frame (ITRF), which is the foundation for virtually all Earth observations and georeferenced data used by society. Additionally, the SGP is fundamental for spacecraft tracking, as well as terrestrial, airborne, and maritime navigation. The scientific disciplines that rely on these data include sea level change, earthquake early warning systems, volcano deformation, flooding patterns, and glacier dynamics.

One of the core sites for NASA's SGP is KPGO, located within the Kōke'e State Park. The observatory sits at an elevation of approximately 3,600 feet above sea level near Waimea Canyon. KPGO is composed of five sites (Sites A through E), all of which have differing technologies and supportive infrastructure to collectively aid in the observatory's responsibilities. The mission of KPGO is to host three of the four primary geodetic platforms of NASA's SGP: VLBI, DORIS, and GNSS. KPGO collects these geodetic data to support satellites globally, and is a critical component of the SGP as part of its global network of space geodetic observatories.

KPGO consists of 16 acres of State leaseholds and 7 acres of easement lands (see Figure 1-4). The Navy holds a Use Permit and Memorandum of Understanding with NASA for portions of KPGO to utilize

NASA's facilities for the purpose of conducting PMRF mission support with radar, telemetry, and communications services at the NASA facilities.

1.3.5 Navy and NASA Use of State Lands

The Navy and NASA began leasing property on Kaua'i from the State of Hawai'i in 1964 and 1965, respectively. The Navy required the land to develop sophisticated testing, evaluation, and training of military weapons systems at PMRF. Since then, PMRF's mission has expanded in response to new technologies and geopolitical threats. NASA's lease began in 1965 when KPGO was part of the NASA Manned Space Flight Network. Since that time, KPGO has supported many NASA and other projects with a variety of equipment. It is a highly versatile and multifunctional geodetic site.

Navy and NASA uses of the lease and easement areas that will be analyzed in the EIS are summarized in Table 1-1 and depicted in Figures 1-3 and 1-4. Appendix D includes details about Navy and NASA activities at KPGO (see Figure 1-4). A detailed and current list of leases and easement uses is included in Appendix D with a description of current activities and operational elements.

Table 1-1 Navy and NASA Activities on Leaseholds and Easement Lands

Area[1]	*Agency*	*Description of Activities*	*Figure Number*
Main Base	Navy	The Main Base includes the following: 1,933 acres of fee simple land, 392 acres of leaseholds, and 7,267 acres of easement lands. The systems that support activities on the Main Base are integrated across fee simple land, leaseholds, and easements. The Main Base is the principal operations area for PMRF and supports surface, subsurface, air, and space activities. Activities on the leased parcels at the Main Base include ordnance assembly, operation and maintenance of drainage ditches and pumps to protect adjacent land from flooding, travel along roadways, and accessing utilities. Additionally, undeveloped land serves as safety zone buffers for missile/target launch operations and explosives safety. GHA safety arcs have a radius between 6,000 and 10,000 feet from the missile launch location; the public is excluded from being within this area prior to, during, and immediately following a launch. For the portion of the GHA on leased lands adjacent to the Main Base, the Navy works with DLNR Division of State Parks to establish safety controls during missile launches and restricts entry to the southern portion of Polihale Beach Park prior to launches. Explosives storage and munitions assembly locations have ESQD arcs for explosives safety zones based on quantities and types of ammunition stored in magazines, being transported, and staged on ordnance handling pads. ESQD arcs overlay ground areas of restricted non-ammunition-related facilities and activities located on an easement subject to a MOA with DLNR.	1-3
Kamokalā Ridge	Navy	Kamokalā Ridge includes 444 acres consisting of the following: 89 acres of leaseholds and 355 acres of easement lands. Kamokalā Ridge provides ordnance storage for the Navy, Hawai‘i Air National Guard, Department of Energy, and other military commands with requirements for training and storage. The site consists of ordnance storage magazines that have been excavated into the cliff face of Kamokalā Ridge. The magazines provide secure storage for Class 1.1 explosives. Activities on easements at Kamokalā Ridge include roadways to access utilities and ordnance storage. This area also serves as a tsunami evacuation site.	1-3

Area[1]	*Agency*	*Description of Activities*	*Figure Number*
Mānā Water Well	Navy	The Mānā Water Well includes 0.29 acre of leaseholds. Activities on leased land include maintenance and use of the Mānā Water Well, which is the primary source of potable water for PMRF and critical to all activities at the facility.	1-3
Miloliʻi Ridge	Navy	Miloliʻi Ridge includes 0.015 acre of leaseholds. Activities at Miloliʻi Ridge leaseholds include passive use of the frequency shift reflectors (a specific type of antenna system), which work with the radar and telemetry stations on Mākaha Ridge. The reflectors help calibrate and operate the radar systems used at the Main Base.	1-4
Mākaha Ridge	Navy	Mākaha Ridge consists of 245 acres composed of 203 acres of leaseholds and 42 acres of easement lands. The Mākaha Ridge Tracking Station serves as PMRF's secondary missile tracking and surveillance station. The station has tracking and surveillance radars as well as primary telemetry systems for the range. The site is also used by other agencies to test new radar technologies. Due to the sensitivities of the technology and the erosion rate at Mākaha Ridge, public access is restricted at this location. Activities on easement lands at Mākaha Ridge include roadways to and around the features.	1-4
KPGO	Navy and NASA	KPGO consists of 16 acres of leaseholds and 7 acres of easement lands. The Navy has a Use Permit for Sites A through D which support surveillance and tracking. Navy infrastructure at KPGO supports tracking radars as well as command and control systems. Sites A through E support KPGO activities which include collecting and coordinating geodetic data and contributing to daily measurements of the Earth's orientation in space and rotation. The diesel generator at Site B provides backup power to Sites A, C, D, and E.	1-4

Note: [1]See Figures 1-3 and 1-4.

Key: DLNR = Department of Land and Natural Resources; ESQD = Explosive Safety Quantity-Distance; GHA = Ground Hazard Area; KPGO = Kōkeʻe Park Geophysical Observatory; MOA = Memorandum of Agreement; NASA = National Aeronautics and Space Administration; PMRF = Pacific Missile Range Facility.

1.3.6 Environmental Management and Stewardship

The Navy manages natural and cultural resources on PMRF including leased and easement lands. Conservation management of natural and cultural resources is a priority for both stewardship and mission readiness. This includes activities such as protecting the endangered Hawaiian monk seal (*Neomonachus schauinslandi*), green sea turtle (*Chelonia mydas*), wetlands, archaeological sites, iwi kupuna (sensitive human remains), and historic buildings and structures. The Navy also protects natural and cultural resources, including native Hawaiian sacred resources, against encroachment. PMRF's awareness of the importance of Native Hawaiian cultural values is embodied in PMRF's slogan: E Pane Mai Ka Nonoi O Nohili – Answering the Requests of Nohili.

Table 1-2 lists Navy funded and managed natural and cultural programs on State lands.

Table 1-2 Navy Programs on State Lands

Program	*Description*
REPI Projects	Mitigation for the effects of sea level rise on agricultural land on the Mānā Plain by: • creating an open floodable space to reduce the quantity and improve the quality of stormwater runoff discharged from agricultural drainage ditches into the nearshore environment at PMRF; • reducing the threat erosion poses to PMRF infrastructure; and • promoting the regeneration of historic wetland habitat for endemic and endangered Hawaiian waterbirds. https://www.repi.mil/Portals/44/Documents/Buffer_Fact_Sheets/Navy/PMRF_BarkingSands.pdf
PMRF INRMP	Natural resource management that includes erosion management, invasive plant management, native plant management, federally listed plant species management (at Mākaha Ridge), wildland fire management, nuisance and invasive animal management, special-status species management, terrestrial invertebrate and pollinator management, data collection, database and records management, outdoor recreation, and natural resources awareness, education, and training.
PMRF ICRMP	Cultural resource management, including implementation of the cultural resources management program and oversight of all cultural resource operations and activities at the range. Nohili Dunes, at the Main Base, is a spiritual place for Native Hawaiians where their ancestors were buried as an ascending point to lani (heaven). The Navy, in collaboration with Na ʻOhana Papa O Mana, respectfully re-inters exposed remains in the Lua Kupapau O Nohili crypt located on base.
Agricultural Preservation Initiative	Ensures agricultural land areas surrounding the installation remain in agricultural use, which is compatible with PMRF operations.

Key: ICRMP = Integrated Cultural Resources Management Plan; INRMP = Integrated Natural Resources Management Plan; PMRF = Pacific Missile Range Facility; REPI = Readiness and Environmental Protection Integration.

Specific Navy environmental stewardship activities that occur on leased and easement lands at PMRF and KPGO are presented in detail in Section 2.5, *Best Management Practices* (see Table 2-6), and include:

- Responding to requests for public access and for cultural access to individuals and organizations.
- Maintaining ungulate exclusion fencing for erosion control at Mākaha Ridge.
- Out-planting and managing native plants in areas identified as having erosion and soil compaction issues.
- Improving and protecting habitat for the federally endangered Niʻihau panicgrass (*Panicum niihauense*) and Hawaiian picture-wing fly (*Drosophila musaphilia* and *D. sharpi*).
- Continuing predator control to protect Migratory Bird Treaty Act (MBTA)-listed species including Laysan albatross (*Phoebastria immutabilis*).
- Working with the PMRF Archery Club to control ungulate populations at the Kamokalā Ridge site.
- Conducting observations to identify feral cats at Kamokalā Ridge (with possibility of expanding cat trapping if necessary).

- Removing deadfall in high-risk fire areas including near the Main Base missile launch site and the Kamokalā Ridge Magazines and replanting with native, low fire risk species.
- Coordinating with U.S. Fish and Wildlife Service (USFWS), Division of Forestry and Wildlife (DOFAW), PMRF Air Ops, and PMRF Public Works to update and implement nēnē (*Branta sandvicensis*) management procedures.

See Chapter 2, Section 2.5 for a more detailed description of Navy and NASA Best Management Practices (BMPs) and management strategies for natural and cultural resources.

1.4 Purpose of and Need for the Proposed Action

The Navy's purpose of the Proposed Action is to maintain long-term DoD use of 8,348 acres of State lands (including leaseholds and easement lands) on Kauaʻi, Hawaiʻi, for operational continuity and sustainment of the military readiness mission. NASA's purpose of the Proposed Action is to maintain long-term use of 23 acres of State lands (including leaseholds and easement lands) on Kauaʻi for continued operations of KPGO. The Proposed Action is needed because the existing real estate agreements for these State lands are set to expire between 2027 and 2030. Preserving the long-term DoD and NASA use of these State lands is critical for military readiness, continuation of ongoing military training and testing, and maintaining data collection efforts of global significance. It also ensures the continued conservation management by the Navy and NASA of natural and cultural resources on these lands.

For DLNR, in addition to its role as the lessor of State lands, the proposed real estate action presents an opportunity for the agency to secure a revenue source to support its management of public lands and associated environmental and conservation programs. Fees from leases and easements are put into a State fund as required by law.

By ensuring continued Navy and NASA operations on Kauaʻi, the real estate action would also preserve local jobs and income for the residents of Kauaʻi, financially contribute to the overall economic well-being of Kauaʻi, and maintain continued conservation management of natural and cultural resources on State lands at no cost to the State of Hawaiʻi.

1.5 Scope of Environmental Analysis

The EIS will evaluate the potential environmental effects of the Proposed Action and alternatives that includes current activities that occur on leaseholds and easements, including the No Action Alternative. The EIS will satisfy both federal and State of Hawaiʻi requirements and provide the necessary analyses to allow the Navy, NASA, and DLNR to consider the environmental effects of the Proposed Action as part of their decision making.

Consistent with CEQ regulations and HAR § 11-200.1-24(b) the scope of the analysis for the alternatives in the EIS will be proportionate to the potential for environmental impacts.

1.6 Relevant Laws and Regulations

The Navy and NASA are preparing this EIS in accordance with applicable federal and State of Hawaiʻi laws, statutes, regulations, and policies applicable to implementation of the Proposed Action. A

description of the Proposed Action's consistency with these laws, policies, and regulations, as well as the names of regulatory agencies responsible for their implementation, is described in Appendix B.

1.7 Public and Agency Participation and Intergovernmental Coordination

Public participation is a key component of the EIS process (Figure 1-5). Opportunities for public input and participation in the EIS process occur during two stages:

1. During the scoping period, following the joint publication of the NOI (40 CFR 1501.7), and the Environmental Impact Statement Preparation Notice (EISPN) (HAR § 11-200.1-23); and
2. During the comment period following publication of the Draft EIS.

Figure 1-5 illustrates the stages of public involvement in the NEPA and HEPA environmental processes. Table 1-3 provides a summary of public engagement for these processes, and Appendix C provides a list of interested parties who were contacted as part of scoping. The public involvement processes for NEPA and HEPA for this EIS are running concurrently to meet the requirements of both State of Hawai'i and federal laws and regulations.

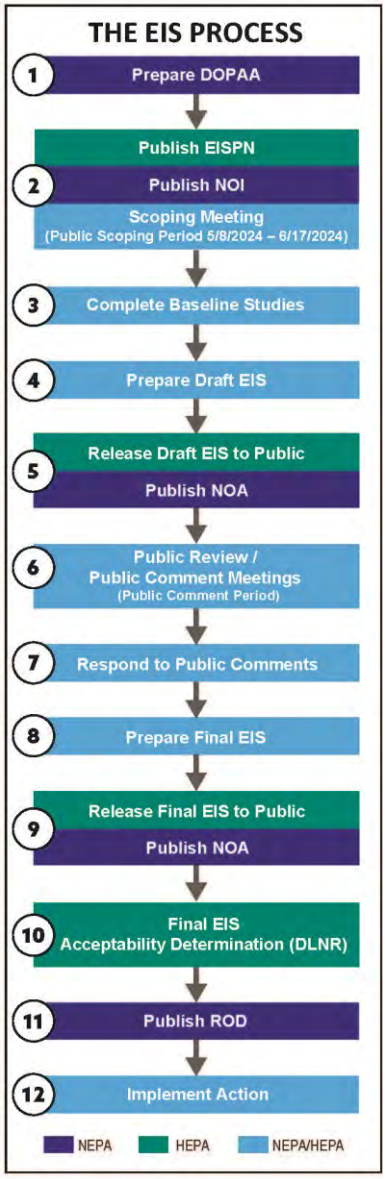

Figure 1-5 EIS Process

1.7.1 Scoping

Public scoping meetings during the scoping period for this EIS will be held on June 4, 5, and 6, 2024, from 5:00–8:00 p.m. at the Kaua'i Veterans Center in Līhu'e (3215 Kaua'i Veterans Memorial Highway, Līhu'e), Kekaha Neighborhood Center (8130 Elepaio Road, Kekaha), and Sheraton Kaua'i Coconut Beach Resort (650 Aleka Loop, Kapa'a), respectively (Table 1-3). Public scoping will serve as an opportunity to obtain input from the community, agencies, and other stakeholders regarding the issues and resources they would like to see addressed and analyzed throughout the EIS process, as well as identify reasonable alternatives. The public is invited to provide oral and written comments at the scoping meetings. The scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act (NHPA) and HRS § 6E-42.

Methods to solicit public input during the scoping period for this EIS include notification, publication of project information, and invitations to participate in scoping. Additionally, a joint notice will be published on May 8, 2024, in *The Garden Island*, *MidWeek Kaua'i*, and *The Honolulu Star-Advertiser* announcing the publication of the EISPN and NOI and the date and time of the scoping meetings.

Table 1-3 Public Engagement under NEPA and HEPA

Date	*Description*
May 2024	Notification letters sent to stakeholders (individuals, agencies, and organizations)
May 2024	NOI published in the *Federal Register* (NEPA), EISPN Published in *The Environmental Notice* (HEPA)
May 2024	Public website available: http://www.PMRF-KPGO-EIS.com
June 2024	Public scoping meetings on Kauaʻi: Kekaha, Līhuʻe, and Kapaʻa
Summer 2025	• NOA of Draft EIS for public review • Public meetings for Draft EIS: Kekaha, Līhuʻe, and Kapaʻa • Draft EIS public review period closes
Winter 2025	Publication of NOA for Final EIS in the *Federal Register* (NEPA), Publication of Final EIS (NEPA, HEPA) and DLNR Decision in *The Environmental Notice* (HEPA)
Winter 2025	30-day wait period
Spring 2026	Publication of Record of Decision (NEPA)

Key: DLNR = Department of Land and Natural Resources; EIS = Environmental Impact Statement; EISPN = Environmental Impact Statement Preparation Notice; HEPA = Accepted Term for Hawaiʻi Revised Statutes Chapter 343; NEPA = National Environmental Policy Act; NOA = Notice of Availability; NOI = Notice of Intent.

Letters with similar information will be sent to individual, agency, and organization stakeholders (Appendix C). Stakeholders consist of agencies with a regulatory role, individuals and organizations interested in the project, and elected officials whose jurisdiction includes PMRF and KPGO.

1.7.2 Draft EIS

All comments received during the public scoping period will be considered during EIS preparation. A summary of public comments and responses to substantive scoping comments will be provided in the Draft EIS.

1.7.3 Final EIS

Substantive public comments on the Draft EIS will be considered in the development of the Final EIS. A detailed summary of public comments, revisions made to the Draft EIS in response to comments, and responses to substantive comments will be provided in the Final EIS.

1.7.4 Intergovernmental Coordination

The Navy and NASA are consulting with USFWS and National Marine Fisheries Service (NMFS) in compliance with the Endangered Species Act (ESA) Section 7 for federally listed species. The Navy and NASA are coordinating with DLNR's DOFAW regarding potential impacts to state-listed species pertaining to the leased lands under the Proposed Action. The Navy and NASA are also consulting with the Hawaiʻi State Historic Preservation Officer (SHPO) as part of their NHPA requirements and coordinating with the DLNR, State Historic Preservation Division (SHPD) to satisfy HRS § 6E-42 requirements. The Navy is coordinating with the State of Hawaiʻi Office of Planning and Sustainable Development, Planning Division under the Coastal Zone Management Act (CZMA). The Navy and NASA will coordinate with DLNR, Office of Conservation and Coastal Lands, as applicable, as part of any Conservation District Use Permit application. Applicable State of Hawaiʻi and federal laws, regulations, and policies are described in Appendix B.

2 Proposed Action and Alternatives

This chapter includes a description of the Proposed Action, the screening factors used to determine reasonable alternatives, alternatives carried forward for analysis, alternatives considered but eliminated from detailed analysis, and BMPs included in the Proposed Action.

2.1 Proposed Action

The Navy proposes to retain the use of 8,348 acres of State land on Kaua‘i in support of continued and ongoing military training and testing at PMRF. NASA proposes to retain the use of 23 acres of State land on Kaua‘i in support of maintaining data collection efforts of global significance at KPGO. The Proposed Action includes current operations that occur on leased and easement lands.

2.2 Alternative Screening Process

NEPA’s implementing regulations provide guidance on the consideration of alternatives and require rigorous exploration and objective evaluation of reasonable alternatives. Only those alternatives that meet the purpose and need of the Proposed Action and are deemed reasonable following the application of alternatives screening criteria are carried forward for detailed analysis in the Draft EIS, as is the No Action Alternative.

For NEPA and HEPA, an EIS “shall describe in a separate and distinct section discussion of the alternative of No Action as well as reasonable alternatives that could attain the objectives of the action” (HAR § 11-200.1-24(h) and 40 CFR 1502.14(c), respectively).

The screening factors used to select reasonable alternatives that would allow the Navy and NASA missions to be fulfilled are:

1. Maintain long-term use of State land currently used to support DoD and NASA missions on Kaua‘i;
2. Preserve current DoD and NASA operations on Kaua‘i;
3. Retain existing DoD and NASA infrastructure on Kaua‘i; and
4. Support DLNR management of public lands and associated environmental and conservation programs on Kaua‘i.

All screening factors must be met for an alternative to be considered reasonable. Table 2-1 identifies the five alternatives considered.

Table 2-1 Description of Alternatives Identified

Alternative Name	*Alternative Description*
Alternative 1: Succeeding Current Real Estate Agreements	The Navy and NASA would apply to DLNR for new long-term real estate agreements in the same manner and for the same uses as the current leases and easements.
Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds	The Navy and NASA would pursue fee simple acquisition of 700 acres (684–Navy, 16–NASA) of leaseholds, and otherwise obtain use of the remaining acreage as described in Alternative 1.
Alternative 3: No Action Alternative	The Navy and NASA would not seek any real estate agreements for the State lands on Kauaʻi after expiration of the leases and easements between 2027 to 2030. The current real estate agreements for 8,348 acres with the Navy and 23 acres with NASA would expire. All existing infrastructure would be removed, or abandoned in place (as determined by the existing real estate agreements), from the Navy and NASA leased and easement lands.
Alternatives Considered but Not Carried Forward for Detailed Analysis	
Succeeding Leases and Easements Except for Current Leases at Mākaha Ridge and KPGO	The Navy and NASA would obtain succeeding leases and easements on leased land not currently located in the State of Hawaiʻi's Conservation District. These would include leases at the Main Base, Kamokalā Ridge, Mānā Water Well, and Miloliʻi Ridge, but would not include succeeding leases or easements at Mākaha Ridge or KPGO.
Succeeding Leases Only with No Easements	The Navy and NASA would only obtain succeeding lease agreements and not succeeding easements. These would include succeeding leases at the Main Base, Kamokalā Ridge, Mānā Water Well, Miloliʻi Ridge, Mākaha Ridge, and KPGO, but not easements at the Main Base, Kamokalā Ridge, or Mākaha Ridge.

Key: DLNR = Department of Land and Natural Resources; KPGO = Kōkeʻe Park Geophysical Observatory; NASA = National Aeronautics and Space Administration; PMRF = Pacific Missile Range Facility.

Table 2-2 summarizes the application of the screening factors to these alternatives and the results. Two alternatives met all screening factors: (1) extend succeeding current real estate agreements in their present form, and (2) fee simple acquisition of all leased parcels. Section 2.3 includes a description of alternatives carried forward for detailed analysis and Section 2.4 includes a description of alternatives considered but eliminated from detailed analysis.

Table 2-2 Screening Evaluation Factors and Results

Screening Factors	*Alternatives Carried Forward for Detailed Analysis*			*Alternatives Considered but Not Carried Forward for Detailed Analysis*	
	Alternative 1: Succeeding Current Real Estate Agreements[1]	*Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds*[2]	*Alternative 3: No Action Alternative*[3]	*Succeeding Leases and Easements Except for Current Leases at Mākaha Ridge and KPGO*[4]	*Succeeding Leases Only (Current Easements are Not Renewed)*[5]
Maintain long-term use of State land currently used to support DoD and NASA missions on Kaua‘i	Yes	Yes	No	No	No
Preserve current DoD and NASA operations on Kaua‘i	Yes	Yes	No	No	No
Retain existing DoD and NASA infrastructure on Kaua‘i	Yes	Yes	No	No	No
Support DLNR management of public lands and associated environmental and conservation programs	Yes	Yes	Yes–with limitations	Yes	Yes–with limitations
Alternative Carried Forward	**Yes**	**Yes**	**Yes**[6]	**No**	**No**

Notes: See Section 2.3 for detailed analysis of alternatives carried forward and Section 2.4 for alternatives considered but eliminated from detailed analysis.

[1]See Section 2.3.1, *Alternative 1: Succeeding Current Real Estate Agreements*.

[2]See Section 2.3.2, *Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds*.

[3]See Section 2.3.3, *Alternative 3: No Action Alternative*.

[4]See Section 2.4.1, *Succeeding Leases and Easements Except Current Leases at Mākaha Ridge and KPGO are Not Renewed.*

[5]See Section 2.4.2., *Succeeding Leases Only (Current Easements are Not Renewed).*

[6]Carried forward per NEPA and HEPA requirements.

Key: DLNR = Department of Land and Natural Resources; DoD = Department of Defense; KPGO = Kōke‘e Park Geophysical Observatory; NASA = National Aeronautics and Space Administration.

2.3 Alternatives Carried Forward for Detailed Analysis

The screening analysis resulted in two action alternatives (Alternatives 1 and 2), depicted in Figures 2--1 and 2-2. Alternative 3 is the No Action Alternative, which will be carried forward for analysis in the Draft EIS (Section 2.3.3, *No Action Alternative*) as required by NEPA and HEPA. This alternative is depicted in Figure 2-3.

A comparison of these alternatives is provided in Table 2-3, which lists the acres of leaseholds and easements under existing conditions.

2.3.1 Alternative 1: Succeeding Current Real Estate Agreements

Under this alternative, the Navy and NASA would apply to DLNR for new long-term real estate agreements in the same manner, similar duration, and for the same uses as the current leases and easements (see Table 1-1 and Appendix D). The Navy's agreements would include 684 acres of land leased exclusively by the Navy and 7,664 acres of easements (for a total of 8,348 acres). NASA's agreements would include 16 acres of land leased exclusively by NASA, 7 acres of easement lands (for a total of 23 acres) and would continue its Use Permit with the Navy.

Securing the new real estate agreements from DLNR must occur prior to expiration of the current real estate agreements to ensure uninterrupted operation of all federal agency missions. Under this alternative, there are no proposed changes to the type or frequency of current activities occurring on state leased and easement lands. This alternative would not change any use or maintenance of existing infrastructure and would not involve construction, renovation, or demolition of facilities. This alternative would also preserve the Navy and NASA-funded natural and cultural resource management activities on the leased and easement lands.

The leased areas are currently used for safety buffers, Anti-Terrorism (AT) security requirements (Main Base), ordnance storage-related facilities (Kamokalā Ridge), potable water (Mānā Water Well), radar and telemetry related facilities (Miloliʻi and Mākaha Ridges), and data collection and tracking (KPGO). The easement areas are currently used for utilities, roadways, and as encroachment buffers for Navy activities on fee simple lands. Many of these easements also preserve existing land use and prevent incompatible development that would affect the ability of PMRF to meet its mission requirements.

Under this alternative, the Navy and NASA would maintain succeeding agreements for the current real estate agreements, and this alternative meets all screening factors (see Section 2.2, *Alternative Screening Process*).

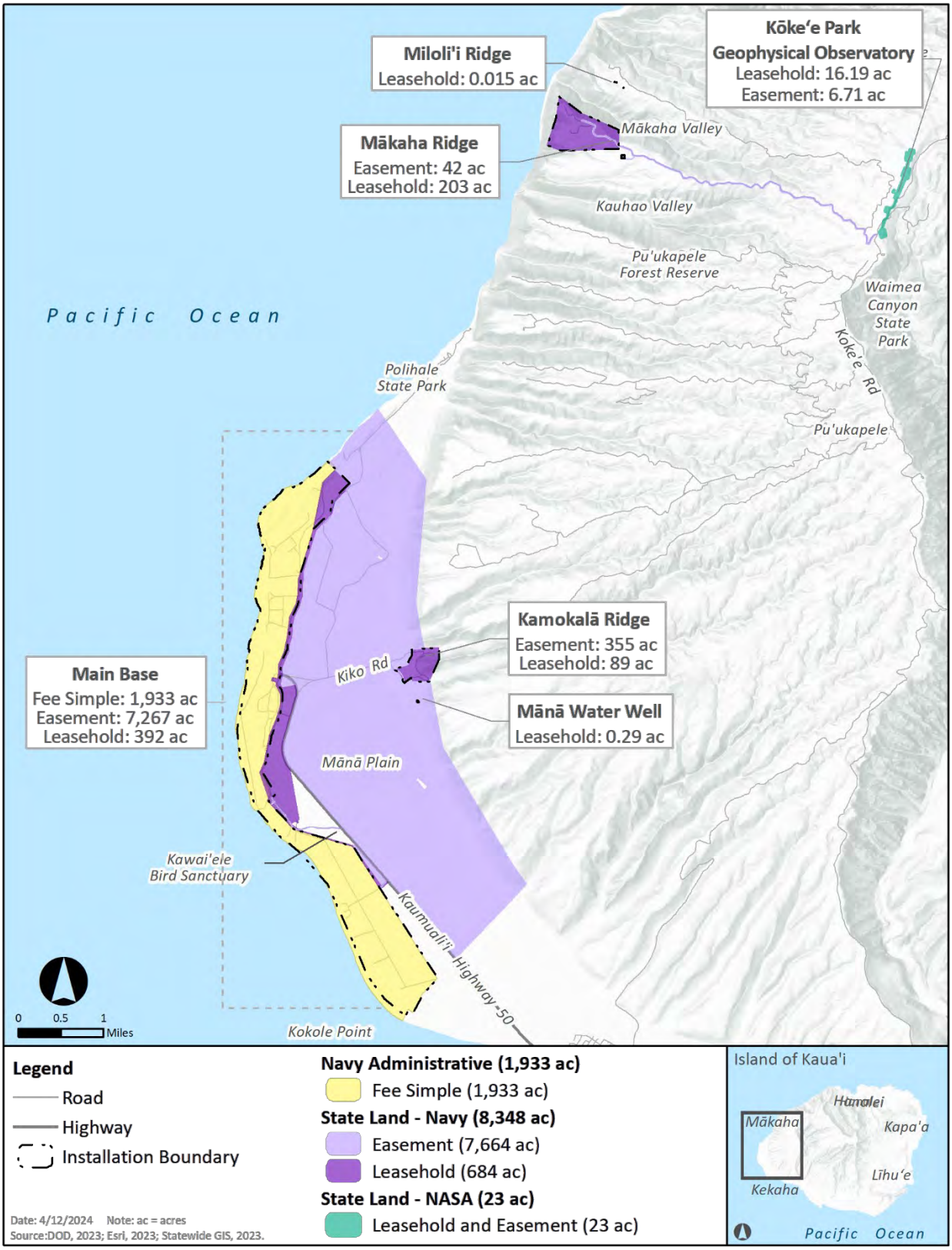

Figure 2-1 Alternative 1: Succeeding Current Real Estate Agreements

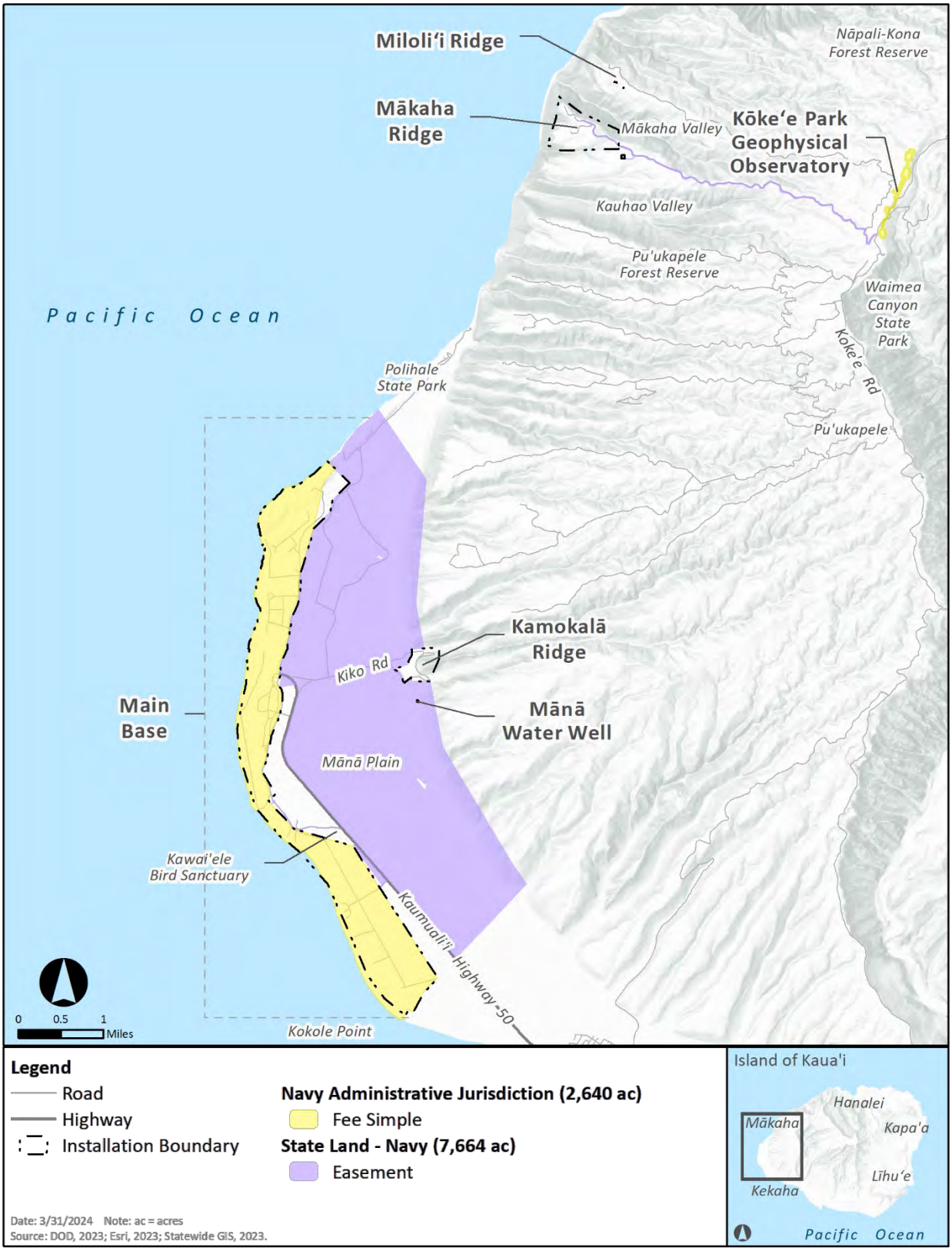

Figure 2-2 Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds

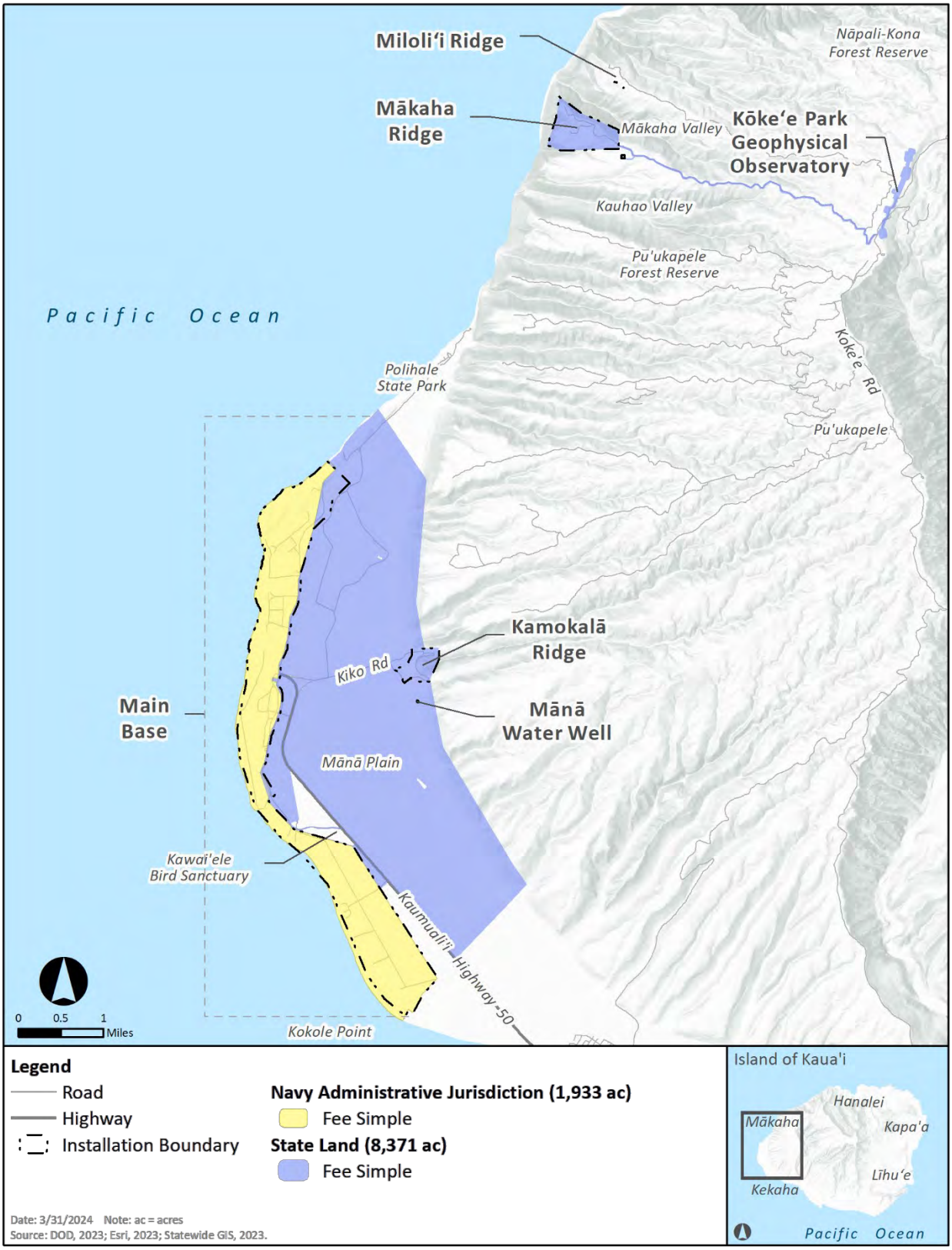

Figure 2-3 Alternative 3: No Action Alternative

Table 2-3 Comparison of Alternatives: Navy and NASA Land Status and Acreages by Location

Location	Existing Conditions/Alternative 1 (acres)				Alternative 2 (acres)				Alternative 3 (acres)			
	Lease-hold	Ease-ment	Fee Simple	Total	Lease-hold	Ease-ment	Fee Simple	Total	Lease-hold	Ease-ment	Fee Simple	Total
Navy												
Main Base	392	7,267	1,933	9,592	NA	7,267	2,325	9,592	NA	NA	1,933	1,933
Kamokalā Ridge	89	355	NA	444	NA	355	89	444	NA	NA	NA	NA
Mānā Water Well	0.29	NA	NA	0.29	NA	NA	0.29	0.29	NA	NA	NA	NA
Miloli‘i Ridge	0.015	NA	NA	0.015	NA	NA	0.015	0.015	NA	NA	NA	NA
Mākaha Ridge	203	42	NA	245	NA	42	203	245	NA	NA	NA	NA
Total	**684**	**7,664[1]**	**1,933**	**10,281**	**NA**	**7,664**	**2,617**	**10,281**	**NA**	**NA**	**1,933**	**1,933**
NASA												
KPGO	16	7	NA	23	NA	NA	23	23	NA	NA	NA	NA
Total	**16**	**7**	**NA**	**23**	**NA**	**NA**	**23**	**23**	**NA**	**NA**	**NA**	**NA**

Note: [1]7,664 acres includes 7,491 acres of Restrictive Use Easements and 173 acres of Utility and Roadway Easements.
Key: KPGO = Kōke‘e Park Geophysical Observatory; NASA = National Aeronautics and Space Administration; NA = not applicable.

Under Alternative 1, in addition to the operational missions, Navy and NASA natural and cultural resource activities and responsibilities on these lands would continue as currently conducted (see Section 1.3, *Background*). This includes continued Navy funding and managing resource management actions and public use programs (see Section 1.3.6, *Environmental Management and Stewardship*); pursuing Readiness and Environmental Protection Integration (REPI) projects; continuing general natural resource management as identified in the PMRF Integrated Natural Resources Management Plan (INRMP); and continuing cultural resource management as identified in the PMRF Integrated Cultural Resources Management Plan (ICRMP).

Additionally, the Navy and NASA would continue to adhere to applicable federal and state laws as well as policies and regulations applicable to Navy and NASA regarding investigation, removal, and cleanup of hazardous and toxic materials and wastes.

The six locations are shown in Figure 2-4 (Main Base), Figure 2-5 (Kamokalā Ridge and Mānā Water Well), Figure 2-6 (Miloliʻi Ridge), Figure 2-7 (Mākaha Ridge), and Figure 2-8 (KPGO).

2.3.2 Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds

Under this alternative, the Navy and NASA would pursue fee simple acquisition of 700 acres (684 acres for Navy use and 16 acres for NASA use) of leaseholds, and otherwise obtain use of the remaining acreage as described in Alternative 1. The new Navy fee simple land of 684 acres would include 392 acres of land at the Main Base, 89 acres at Kamokalā Ridge, 0.29 acre at the Mānā Water Well, 0.015 acre at Miloliʻi Ridge, 203 acres at Mākaha Ridge, and the NASA fee simple land would include 16 acres at KPGO. This acreage would be transferred from ownership by the State of Hawaiʻi to the United States.

This alternative would not change any use or maintenance of existing infrastructure and would not involve construction, renovation, or demolition of facilities. The activities at these sites would continue as currently used (see Section 1.3, *Background* and Section 2.3.1, *Alternative 1: Succeeding Current Real Estate Agreements*). The land would be managed in perpetuity by the Navy and NASA according to federal requirements. Under this alternative, Navy and NASA activities and responsibilities on these lands would continue as currently conducted (see Section 1.3, *Background* and the description above for Section 2.3.1, *Alternative 1: Succeeding Current Real Estate Agreements*). Under this alternative, the Navy would continue to operate at KPGO under the Use Permit with NASA.

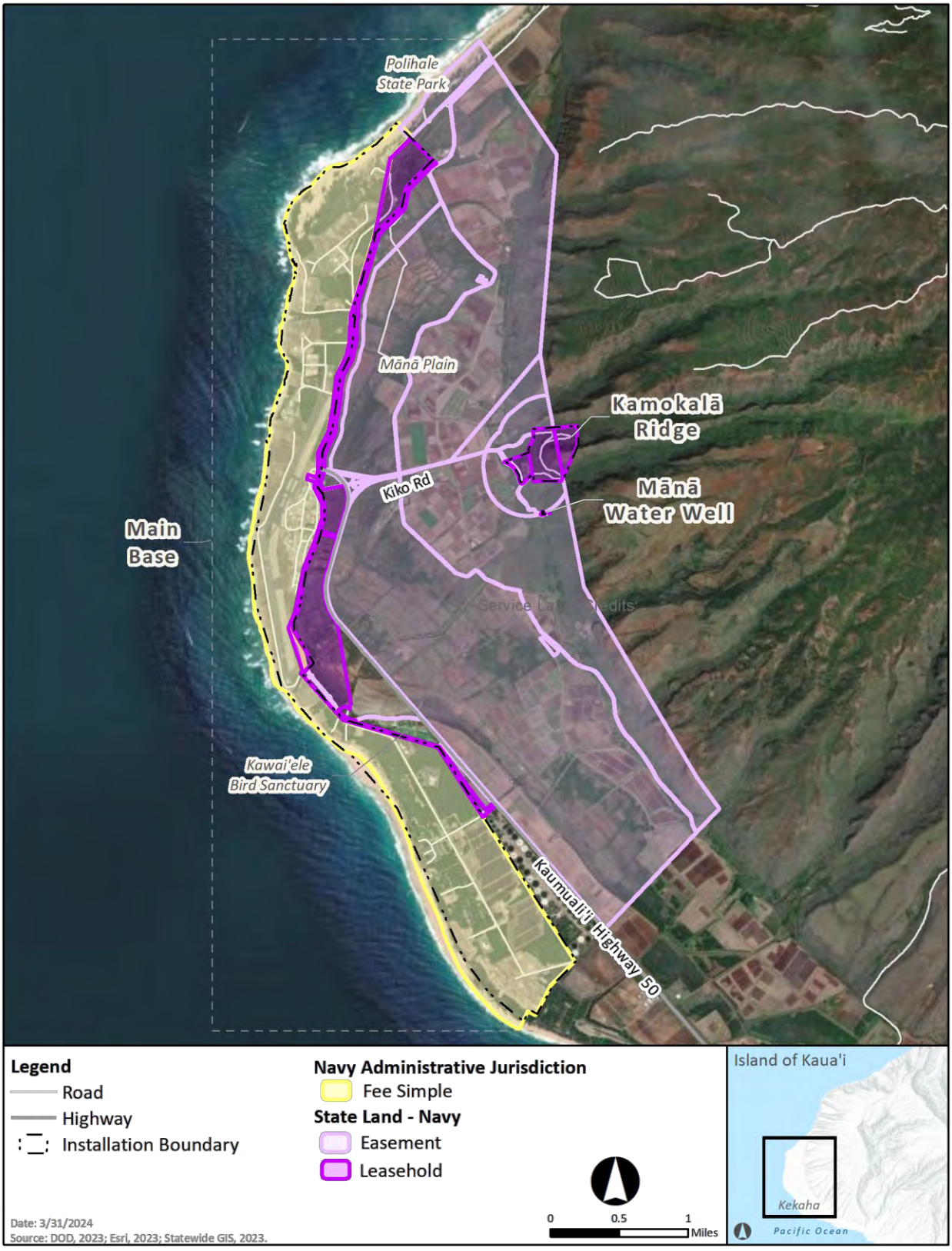

Figure 2-4 Alternative 1: Main Base: Aerial View

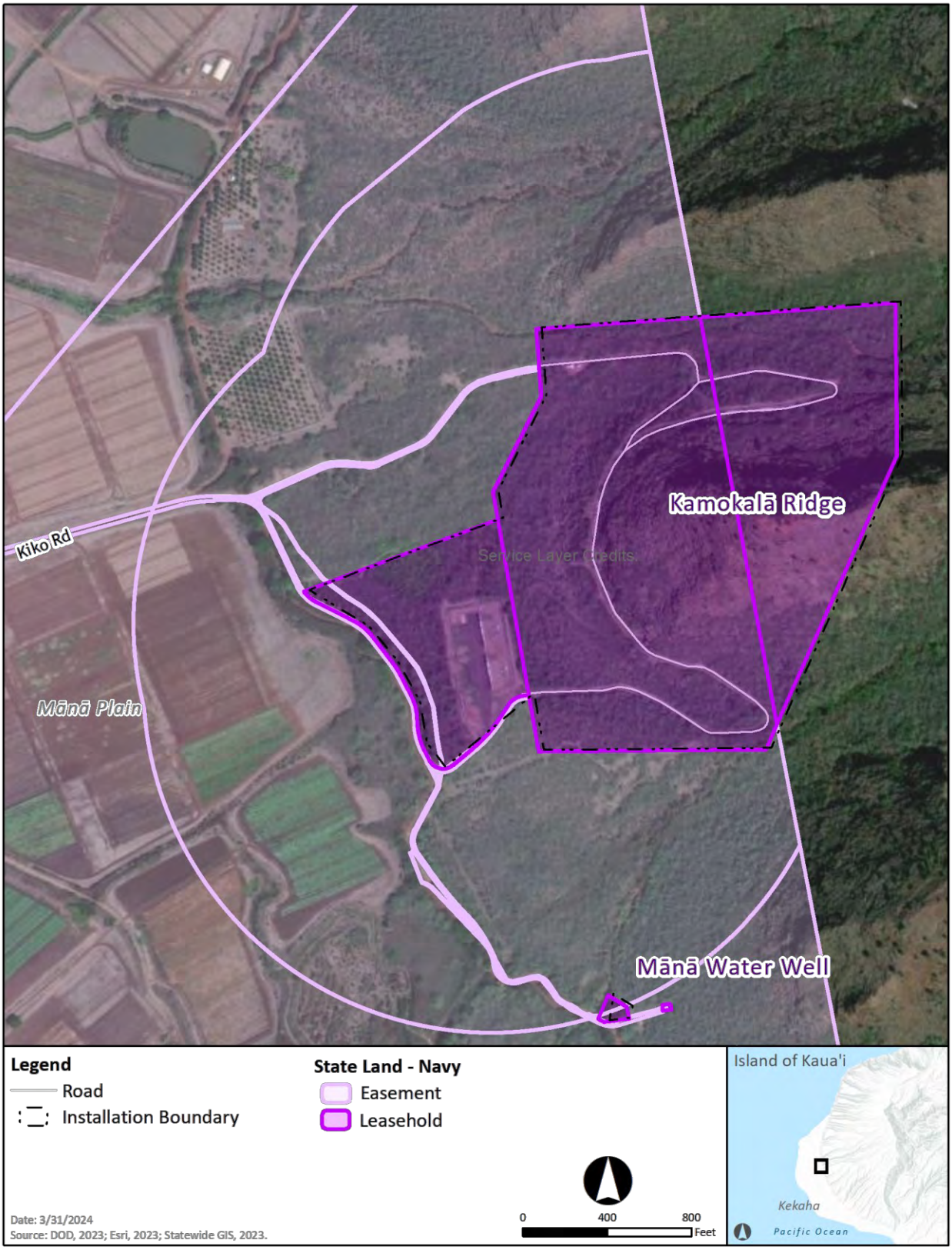

Figure 2-5 Alternative 1: Kamokalā Ridge and Mānā Water Well

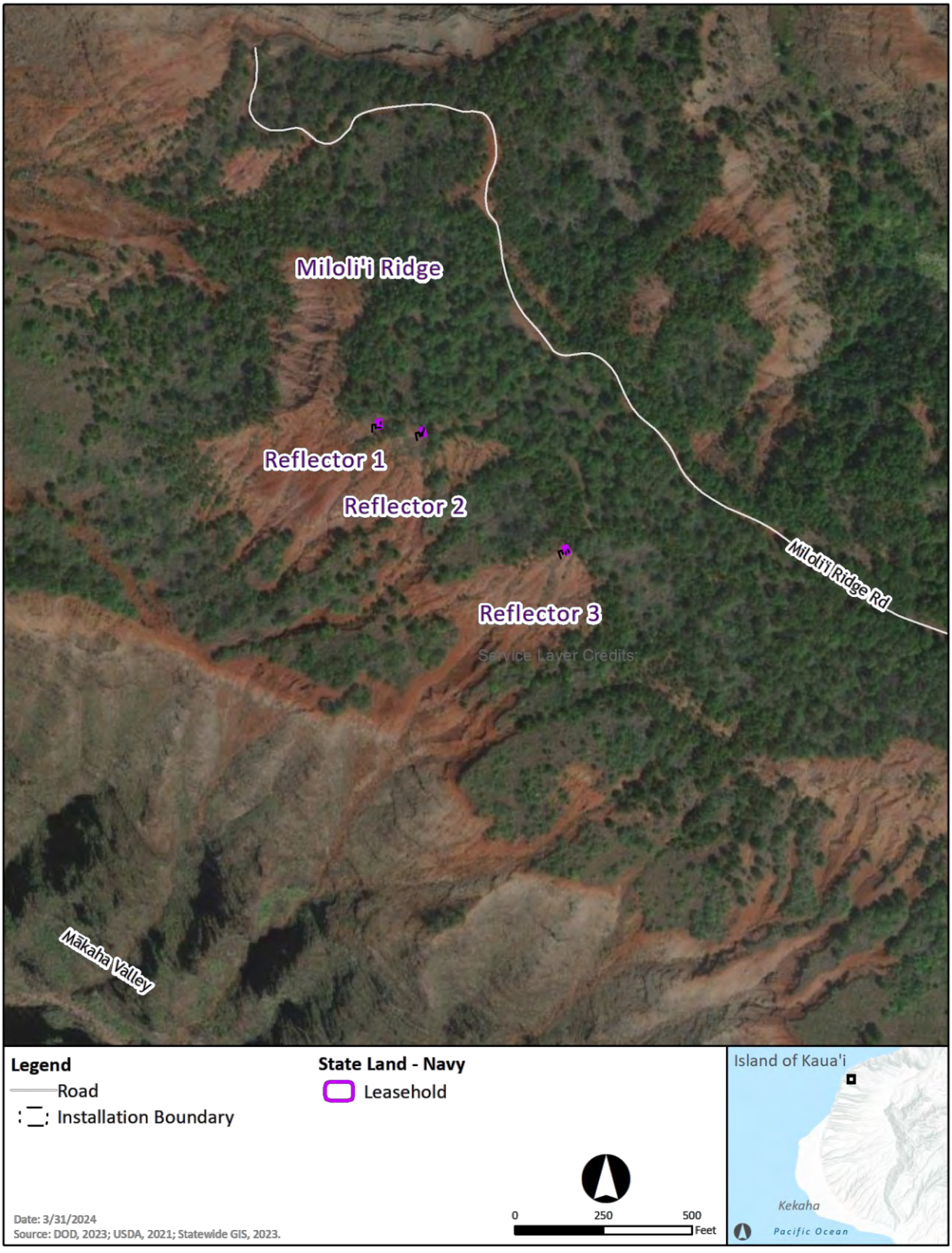

Figure 2-6 Alternative 1: Miloli‘i Ridge

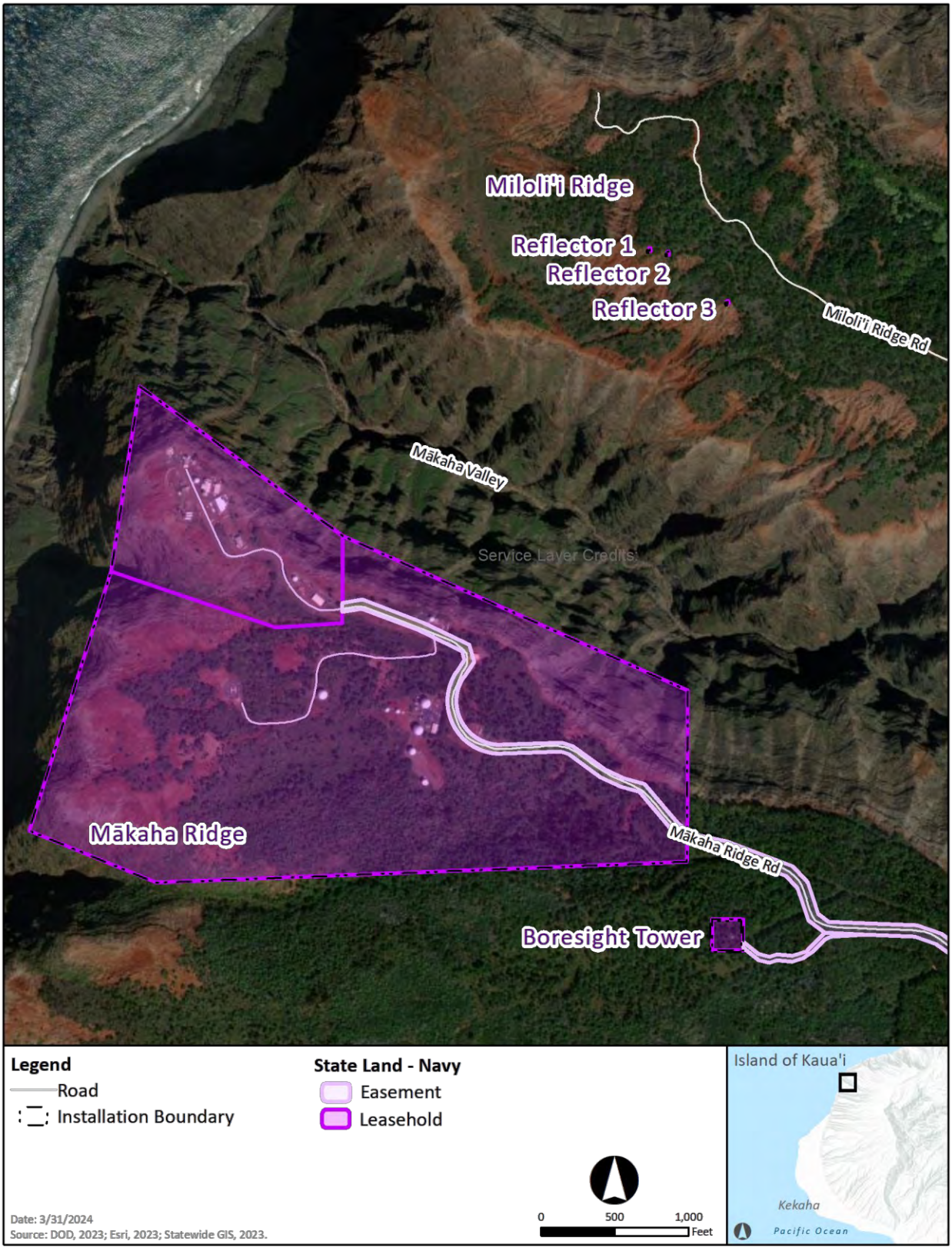

Figure 2-7 Alternative 1: Mākaha Ridge

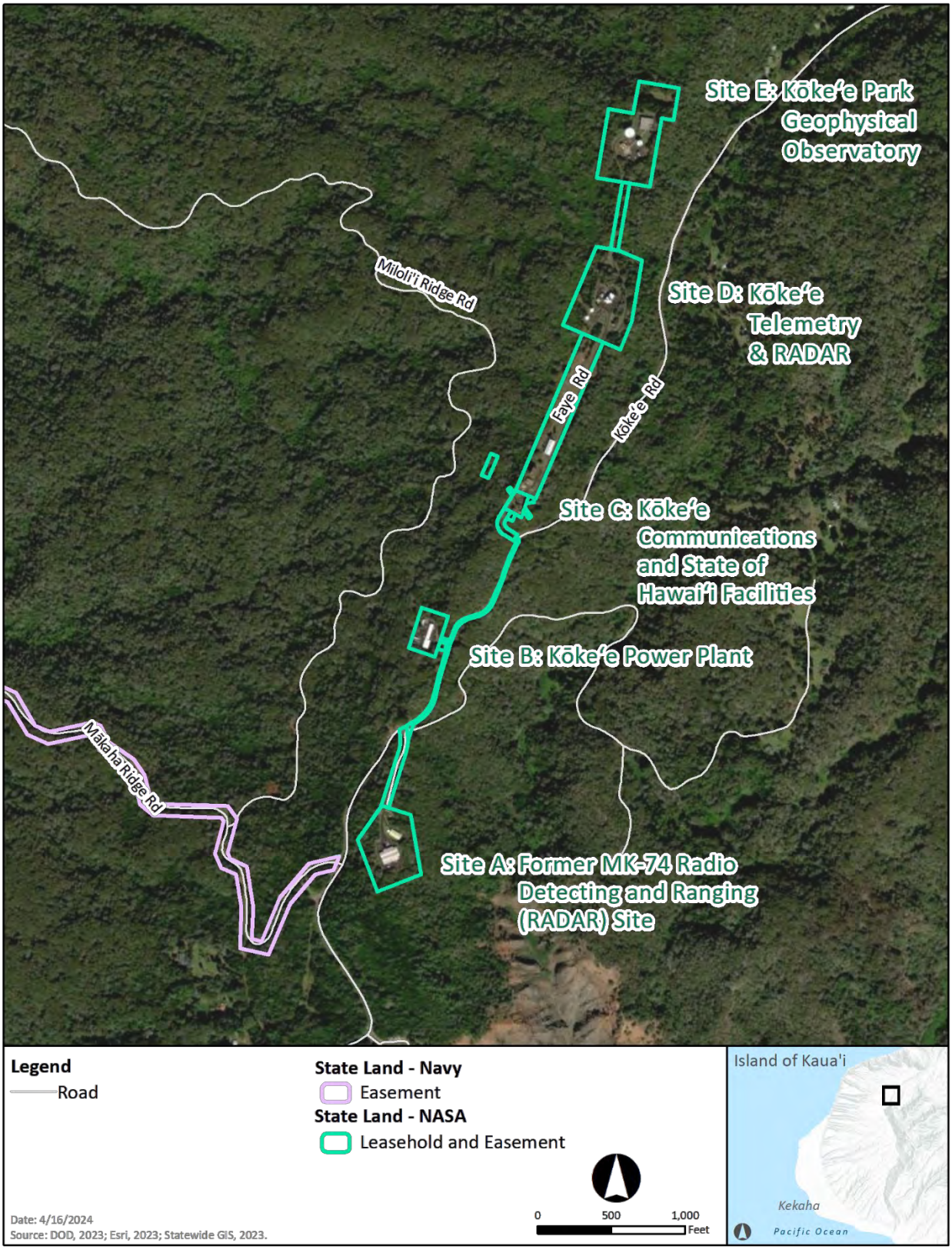

Figure 2-8 Alternative 1: KPGO

By acquiring the leased parcels, this alternative meets the purpose and need of the Proposed Action, secures the long-term Navy and NASA use of State lands near Navy lands on Kaua‘i, and preserves the long-term use of State land for military readiness and continuation of Navy activities, as well as NASA’s current geodetic activities. This alternative also meets all of the screening factors (see Section 2.2, *Alternative Screening Process*). It would result in federal ownership of land that is currently leased from the state, which would allow the Navy to maintain long-term use of DoD land on Kaua‘i, preserve current DoD operations, and retain existing DoD infrastructure. Under this alternative, the Navy and NASA would continue current management of natural and cultural resources on these lands, which are consistent with DLNR’s environmental and conservation programs.

2.3.3 Alternative 3: No Action Alternative

Under the No Action Alternative, the Navy and NASA would not seek any real estate agreements for the State lands on Kaua‘i after expiration of the leases and easements between 2027 to 2030. The current real estate agreements for 8,348 acres with the Navy and 23 acres with NASA would expire. All existing infrastructure would be removed, or abandoned in place, from Navy and NASA leased and easement lands.

Under the No Action Alternative, the Navy would not be able to conduct a substantial portion of training and testing events because of the loss of safety and buffer areas for missile and target launches and access to critical infrastructure necessary to support ongoing operations at PMRF. This includes Mānā Water Well (the primary potable water source for operations at the Main Base), support facilities at Mākaha Ridge, ordnance storage at Kamokalā Ridge, utility infrastructure and roads at the Main Base, secondary and operation access roads to the Main Base and Mākaha Ridge, frequency shift reflectors at Miloli‘i Ridge, utility and drainage easements, and the secondary access gate necessary for ensuring a safe route for ordnance transport to and from the Main Base. The Navy would not be able to calibrate instrumentation and antennas used to ensure safety on the range, resulting in a loss of support to surface, subsurface, air, and space operations. Loss of Navy radar and telemetry systems at KPGO would also limit effectiveness during data collection and could result in safety issues related to tracking on the range. The loss of ordnance storage at Kamokalā Ridge would prohibit the Navy from supporting certain missions at PMRF. The loss at KPGO would impact NASA’s ability to maintain a global network of space geodetic observatories that work together to maintain a stable terrestrial reference system contributing to NASA missions, military and civilian navigation, and the scientific community.

In addition, the environmental management and stewardship currently conducted by Navy and NASA on leased land and by the Navy on easement lands would no longer occur (see Section 1.3.6, *Environmental Management and Stewardship*).

The sections below provide details about the No Action Alternative in relation to state actions and responsibilities, as well as federal actions and responsibilities (DoD and NASA). A more detailed description of impacts by lease and easement from the No Action Alternative are included in Appendix E. The No Action Alternative does not meet the purpose and need (see Section 1.4, *Purpose of and Need for the Proposed Action*). However, the analysis associated with the No Action Alternative is carried forward as required by NEPA and HEPA for comparative purposes.

2.3.3.1 State Actions and Responsibilities

The No Action Alternative would result in the State of Hawai‘i assuming full control and management of the leased and easement lands after expiration of the leases and easements in 2027, 2029, and 2030. This would result in DLNR assuming sole responsibility, including funding, for the natural and cultural resources and public activities that are presently maintained by the Navy on the leased and easement lands.

2.3.3.2 Federal Actions and Responsibilities

Under this alternative, there would be a considerable change in how the Navy uses its fee simple property, and for NASA, its operations at KPGO would cease, severely impacting the SGP. The existing leases and easements impose certain obligations on the Navy and NASA prior to returning the property to the State. These obligations include reforestation, removal of signs, demolition and removal of existing and abandoned structures, and removal of surface weapons used in connection with DoD training activities.

2.3.3.2.1 Navy Actions and Responsibilities

PMRF Training and Testing Mission

Under the No Action Alternative, the Navy would conduct only a portion of its current mission at PMRF. Without succeeding long-term real estate agreements, most of the current training and testing could not occur, resulting in an irreplaceable loss of capabilities that would severely diminish the military value of PMRF and cause severe disruption to the DoD mission and negatively impact national security.

A summary of impacts to the Navy is provided in Table 2-4.

Table 2-4 Impacts to PMRF Training and Testing Mission from the No Action Alternative

Activities	*Impact to Mission from the No Action Alternative*
Missile/Target Launches	The loss of required setback distances and easement areas would substantially reduce essential safety buffer zones required for training and testing missions as well as for preventing incompatible development. Without these setbacks and safety buffer zones, operations at the Main Base could not continue as currently conducted. Only a limited set of aerial targets could potentially be launched without the land needed for safety buffer zones.
Encroachment Planning	The loss of required setback distances and easement areas would eliminate the ability of the Navy to maintain encroachment buffers that help prevent real estate development around the installation incompatible with the PMRF training and testing mission.
Facility Use and Management	The Navy would have no access to critical infrastructure facilities that support operations at Mākaha Ridge (including a guard shack, a Frequency Interference Control Building, Maintenance Facility, Telemetry Building, a boresight tower, telemetry antennas, water tanks, a laboratory, radar sites, communications, a power plant, antennas, and a helicopter pad), ordnance storage at Kamokalā Ridge, 22 buildings with utility infrastructure and roads at the Main Base, secondary and operation access roads to the Main Base, access roads to Mākaha Ridge, and frequency shift reflectors at Miloli‘i Ridge, as well as utility and drainage easements. This alternative would also result in the loss of the Navy’s environmental management and stewardship programs described in Section 1.3.5, *Environmental Management and Stewardship*.

Activities	*Impact to Mission from the No Action Alternative*
Flood Protection	Loss of drainage easements could impact range and daily operations until drainage management is established to prevent flooding of adjacent agricultural lands.
Support Facilities and Utilities Transmission	Buildings at the Main Base located on leased lands are strategically located and cannot be moved; therefore, the loss of these buildings and the utility easements that support them would result in losing the ability to conduct missions at PMRF associated with this infrastructure. Loss of utility easements would impact all range and daily operations unless new utility connections could be established.
Potable Water	Loss of access to the Mānā Water Well would result in severe impacts to daily operations as it is the primary source of all potable water for PMRF. Without access to a steady, reliable source of potable water, there would be effects on overall living conditions and PMRF would not have water for a myriad of operations, such as for supply chillers and fire suppression.
Instrumentation	With the loss of Mākaha Ridge, most of the training and testing operations would cease since there would be an inability to calibrate instrumentation and antennas, which would limit effectiveness during data collection and could result in safety issues related to tracking on the range. This would result in a loss of support to surface, subsurface, air, and space operations. Loss of frequency shift reflectors at Miloli'i Ridge would result in the inability to calibrate instrumentation and antennas, which would limit effectiveness during data collection and could result in safety issues related to tracking on the range. Loss of radar and telemetry systems at KPGO would also limit effectiveness during data collection and could result in safety issues related to tracking on the range.
Ordnance Storage/ Management	With the loss of ordnance storage at Kamokalā Ridge, the base would not be able to meet explosive safety storage requirements and could not support certain missions at PMRF. Without storage, the missile assembly building could not be used since there would be no safe place to store the assembled munitions.
Access	Loss of access roads at the Main Base located on State land would result in impacts to operations, since the secondary access gate is utilized by personnel during peak commute times and is used as a primary access point when the primary access gate is closed. The loss of the ordnance gate would result in shifting of ordnance transport through the primary gate, which could result in impacts to safety and would limit access to and from the base during times when ordnance is being transported.
Power	Loss of Site B, which includes the back-up plant diesel generator for Sites A, C, D, and E, would impact the source of reliable power when systems at KPGO are supporting range operations.

Key: KPGO = Kōke'e Park Geophysical Observatory; PMRF = Pacific Missile Range Facility.

Navy Environmental Management and Stewardship

Under the No Action Alternative, environmental management and stewardship activities conducted by the Navy on lease and easement lands would cease. These activities include, but are not limited to, REPI projects, implementation of the PMRF INRMP and PMRF ICRMP, as well as the Agricultural Preservation Initiative.

2.3.3.2.2 NASA Actions and Responsibilities

Under the No Action Alternative, NASA would lose access to Sites A through E at KPGO. Without succeeding long-term real estate agreements, all of NASA's current activities at KPGO would cease. This would result in a loss of capabilities to the larger SGP which includes a global network of interconnected

instruments that are the foundation for Earth observations and georeferenced data used by virtually all of society. A summary of impacts to the NASA mission from this alternative is provided in Table 2-5.

Table 2-5 Impacts to NASA Activities from the No Action Alternative

NASA Activities	*Impact to NASA Activities from the No Action Alternative*
Space Geodesy Project	Without use of KPGO Sites A through E, NASA would lose its northern Pacific VLBI and DORIS stations, and two GNSS stations, substantially reducing the capability of NASA's global SGP to support the following: spacecraft tracking; as well as military and civilian terrestrial, airborne, and maritime navigation; and the scientific disciplines that rely on the data produced at KPGO.

Key: DORIS = Doppler Orbitography and Radio-positioning Integrated by Satellite; GNSS = Global Navigation Satellite System; KPGO = Kōkeʻe Park Geophysical Observatory; NASA = National Aeronautics and Space Administration; SGP = Space Geodesy Project; VLBI = Very Long Baseline Interferometry.

The loss at KPGO would impact NASA's ability to maintain a global network of space geodetic observatories that work together to maintain a stable terrestrial reference system which provides the foundation for virtually all other Earth observations and georeferenced data used by society. It is fundamental for spacecraft tracking, as well as terrestrial, airborne, and maritime navigation. The scientific disciplines that rely on these data include areas of study such as sea level changes, earthquake early warning systems, volcano deformation, flooding patterns, and glacier dynamics. This loss would impact NASA missions, military and civilian navigation, the scientific community, and society overall.

The No Action Alternative would not meet the purpose of and need for the Proposed Action; however, as required by NEPA and HEPA, this alternative is carried forward for analysis in the Draft EIS. The No Action Alternative will be used to analyze the consequences of not undertaking the Proposed Action and will serve to establish a comparative baseline for analysis.

2.4 Alternatives Considered but Not Carried Forward for Detailed Analysis

As part of the alternative identification process, agencies are required to describe the alternatives considered but eliminated from detailed analysis and to provide a brief discussion of the rationale for not studying the alternative in detail. The following alternatives were considered but not carried forward for detailed analysis because they do not meet the purpose and need for the Proposed Action.

2.4.1 Succeeding Leases and Easements Except Current Leases at Mākaha Ridge and KPGO are Not Renewed

Under this alternative, the Navy would obtain succeeding leases and easements on leased land not currently located in the State of Hawaiʻi's Conservation District, except for leases at Polihale State Park. These would include leases at the Main Base, Kamokalā Ridge, Mānā Water Well, and Miloliʻi Ridge, but would not include succeeding leases or easements at Mākaha Ridge or KPGO. Under this alternative, the Navy would not have access to the secondary missile tracking and surveillance station. Without this secondary operations area, the Navy could not conduct radar tracking, telemetry receiving/recording, frequency monitoring, or target control and would lose access to the land with the buildings and facilities located there. Without leaseholds at KPGO, NASA operations, including support of navigation systems and spacecraft tracking, would cease. This alternative does not meet screening factors (1) maintain long-term use of land currently used to support DoD and NASA missions on Kauaʻi, (2) preserve

current DoD and NASA operations on Kaua‘i, and (3) retain existing DoD and NASA infrastructure on Kaua‘i.

2.4.2 Succeeding Leases Only (Current Easements are Not Renewed)

Under this alternative, the Navy and NASA would only obtain succeeding lease agreements and not succeeding easements. These would include succeeding leases at the Main Base, Kamokalā Ridge, Mānā Water Well, Miloli‘i Ridge, Mākaha Ridge, and KPGO, but not easements at the Main Base, Kamokalā Ridge, Mākaha Ridge, and KPGO. Without succeeding easements, the Navy would lose required setback distances that provide essential safety buffer zones required for training and test missions, access roads, and utility easements. Without access to or use of the roads, the Navy would not be able to access the leaseholds located at Kamokalā Ridge, Mānā Water Well, or Mākaha Ridge. Additionally, the Navy would not be able to continue environmental management or stewardship programs. This alternative does not meet screening factors (1) maintain long-term use of land currently used to support DoD and NASA missions on Kaua‘i, (2) preserve current DoD operations, (3) retain existing DoD infrastructure, and (4) support DLNR management of public lands and associated environmental and conservation programs. Under this alternative, NASA could also not continue its mission.

2.5 Best Management Practices

BMPs are policies, practices, and measures the Navy uses to reduce the environmental impacts of designated activities, functions, or processes. Although these actions mitigate potential impacts by avoiding, minimizing, or reducing/eliminating impacts, they are distinguished from potential mitigation measures because these actions are (1) existing requirements for the Proposed Action; (2) on-going, regularly occurring practices; or (3) not unique to this Proposed Action. More specifically, these conservation measures are inherently part of the Proposed Action and are not potential mitigation measures proposed as a function of the environmental review or approval process for the Proposed Action.

Table 2-6 lists currently used PMRF and KPGO BMPs which include Standard Operating Procedures (SOPs) from the ICRMP and resource management strategies from the INRMP, as well as those established by the applicable regulations, policy, and other installation SOPs. Proposed mitigation measures to minimize the impacts of the Proposed Action will be discussed in the Draft EIS. Under the No Action Alternative, the Navy and NASA would not continue the BMPs and management strategies listed in Table 2-6 on leaseholds and easement lands.

NASA’s contractor operates KPGO (Site E) in accordance with the Environmental Management Plan under the Space Exploration Network Services and Evolution contract. Implementation of the Environmental Management Plan includes the following steps: implementation of the plan; evaluation, checking, and corrective action; environmental planning and impact process (see Table 2-6); water management; air quality management; and waste management.

Table 2-6 PMRF and KPGO Best Management Practices and Resource Management Strategies

Best Management Practice	*Impacts Reduced/Avoided*	*Description of Best Management Practices and Management Strategies*	*Applicability*
PMRF – Cultural Resources Management (CRM)[1]			
CRM-1	Impacts to historic properties	ICRMP SOP # 1: NHPA Section 110 Compliance. The Navy has an ongoing management responsibility to identify, preserve, and protect the significant cultural resources at PMRF. Section 110 mandates agencies to assume responsibility for the preservation of historic properties under their jurisdiction and, to the maximum extent feasible, use historic properties available to the agency.	Ongoing and future activities.
CRM-2	Impacts to historic properties	ICRMP SOP #2: Coordination with Natural Resources Management. DoD Instructions 4715.03 and 4715.16 and Office of the Chief of Naval Operations Instruction (OPNAVINST) 5090.1E require that cultural resources management programs be integrated with natural resources programs. This coordination is meant to make certain, to the maximum extent feasible, that the Navy complies with all applicable Executive Orders and federal natural and cultural resources statutory and regulatory requirements. The PMRF CRM is responsible for the coordination of cultural and natural resources at PMRF and conducting NHPA Section 106 reviews in conjunction with NEPA reviews and Section 7 of the ESA. SOP #2 of the ICRMP describes this process at PMRF.	Ongoing and future activities.
CRM-3	Impacts to historic properties	ICRMP SOP #3: Cultural Resources Data Management. The Navy maintains an effective data management system to facilitate compliance with Sections 106 and 110 of the NHPA as well as NEPA and requirements for curating federally owned and administered archaeological collections (36 CFR Part 79). SOP #3 of the ICRMP describes the Cultural Resources Data Management program at PMRF.	Ongoing and future activities.
CRM-4	Impacts to historic properties	ICRMP SOP #4: NHPA Section 106 Compliance. Section 106 of the NHPA is a process designed to ensure that historic properties are taken into account during the planning and execution of federal undertakings. SOP #4 describes the integration of the Section 106 process of the NHPA, implemented by regulations of the ACHP (36 CFR Part 800), as well as ARPA and the provisions of the Commander, Navy Region Hawai‘i (CNRH) PA for Navy undertakings in Hawai‘i that is followed at PMRF.	Ongoing and future activities.

Best Management Practice	*Impacts Reduced/Avoided*	*Description of Best Management Practices and Management Strategies*	*Applicability*
CRM-5	Impacts to historic properties	ICRMP SOP #5: ARPA Compliance. Per this Act, it is a federal offense to excavate, remove, damage, alter, or otherwise deface archaeological resources on federal lands without authorization. The sale, purchase, exchange, transport, or receipt of archaeological resources obtained in violation of this law also is a federal offense. SOP #5 of the ICRMP describes the enforcement of ARPA at PMRF.	Ongoing and future activities.
CRM-6	Impacts to historic properties and traditional Hawaiian cultural resources	ICRMP SOP #6: Native Hawaiian Consultation. Consultation is mandated by federal laws, including the NHPA, American Indian Religious Freedom Act, NAGPRA, and ARPA. Consultation is also mandated by the MOA among the U.S. Navy, PMRF, Hawai‘i SHPO, and ACHP regarding activities proposed within the 1998 PMRF Enhanced Capacity Final EIS, DoD Directive 4710.03, and CNRH PA. SECNAVINST 4000.35A also specifies that appropriate consultation will be initiated with Native Hawaiians “whenever the [Navy] conducts or supports undertakings that may affect any National Register resource, whether [Navy]-managed or not.” SOP #6 describes this process at PMRF.	Ongoing and future activities.
CRM-7	Cultural resource protection	ICRMP SOP #7: Management of Historic Properties. In cases in which Navy undertakings will have effects or adverse effects on cultural resources, the PMRF CRM will activate the Section 106 consultation process with the Hawai‘i SHPO and the ACHP. If the project, however, meets The Secretary of the Interior’s Standards for the Treatment of Historic Properties, including preserving, rehabilitating, restoring, and reconstructing historic buildings, the undertaking may be determined to be exempt from the full Section 106 consultation process. The PMRF CRM must consult with CNRH, the Hawai‘i SHPO, ACHP, and Native Hawaiian organizations regarding any effects to historic properties as a result of base activities, and shall also refer to, and comply with, existing MOAs, PAs, and The Secretary of the Interior’s Standards for the Treatment of Historic Properties.	Ongoing and future activities.

Best Management Practice	*Impacts Reduced/Avoided*	*Description of Best Management Practices and Management Strategies*	*Applicability*
CRM-8	Cultural resource protection	ICRMP SOP # 8: Monitoring During Construction and/or Ground-Disturbing Activities. Archaeological monitoring will be conducted during construction and/or ground-disturbing activities within areas of potential effect identified as archaeologically sensitive areas. The primary responsibility for carrying out this BMP lies with on-site managers of the undertaking, professional archaeological monitors, the PMRF CRM, and the Navy Region Hawai'i Historic Preservation Officer. SOP #8 of the ICRMP describes this process, and a copy of the SOP should be provided to all on-site managers and supervisors who are carrying out work in archaeologically sensitive areas.	Ongoing and future activities.
CRM-9	Cultural resource protection	ICRMP SOP# 9: Inadvertent Discovery of Archaeological Remains. Inadvertent discovery refers to the unintentional discovery of archaeological resources during the course of operations at PMRF. On-site managers of undertakings, the PMRF CRM, and the Navy Region Hawai'i Historic Preservation Officer are responsible for planning for subsequent discoveries through PAs pursuant to 36 CFR Part 800, Section 800.14(b) (agency program alternatives) or other agreement documents when a survey indicates that historic properties are likely to be discovered during implementation of an undertaking. PMRF shall make reasonable efforts to avoid, minimize, or mitigate adverse effects to such properties until a mitigation plan is carried out. SOP #9 of the ICRMP describes this process, and a copy of the SOP should be provided to all on-site managers and supervisors who are carrying out work that could result in inadvertent discovery of remains.	Ongoing and future activities.
CRM-10	Cultural resource protection	ICRMP SOP #10: Inadvertent Discovery of Human Remains. Inadvertent discovery refers to the unintentional discovery of human remains during the course of operations at PMRF. In 2011, the Navy and Na Ohana Papa o Mana executed a NAGPRA CA to address all federal agency land management activities that could result on the intentional excavation or inadvertent discovery of NAGPRA items. The CA documents the process for carrying out the requirements of 43 CFR 10, Subpart B for standard consultation procedures, determination of custody, treatment, and disposition of NAGPRA items. SOP #10 of the ICRMP describes this process, and a copy of the SOP should be provided to all on-site managers and supervisors who are carrying out work that could result in inadvertent discovery of human remains.	Ongoing and future activities.

Best Management Practice	*Impacts Reduced/Avoided*	*Description of Best Management Practices and Management Strategies*	*Applicability*
CRM-11	Cultural resource protection	ICRMP SOP #11: Curation. The Navy's cultural resources responsibilities include providing for the curation of artifact collections and historical documents recovered from agency-owned or -leased property as required under 36 CFR Part 79, 36 CFR Part 1220, and 36 CFR Part 1228, as well as SECNAVINST 4000.35A and OPNAVINST 5090.1E.	Ongoing and future activities.
CRM-12	Cultural resource protection	ICRMP SOP #12: Use of Historic Properties. In accordance with Section 110 of the NHPA and SECNAVIST 4000.35A, the Navy should use available historic buildings to the maximum extent feasible (while preserving their historic character and function) prior to new construction, lease, or the acquisition of buildings used to carry out its responsibilities as long as reuse does not conflict with the mission of the Navy. SOP #12 of the ICRMP provides uniform guidelines for PMRF staff and tenants/users when planning projects that involve demolition, removal, or replacement of a historic building or structure that is listed, or is eligible for listing, in the NRHP, or has not been evaluated for eligibility.	Ongoing and future activities.
CRM-13	Cultural resource protection	ICRMP SOP #13: Historic Asset Management Process. The HAMP is a project planning tool that provides access to information and a standard method to support compliance with the NHPA and NEPA. Once a proponent identifies project requirements, the HAMP tools guide the proponent through steps to identify project alternatives that will have the least effect on built-environment historic properties, including reuse/rehabilitation, new construction, or demolition footprint reduction.	Ongoing and future activities.
CRM-14	Cultural resource protection	ICRMP SOP #14: Emergency Situations. Provides guidelines in the event of (1) emergencies involving imminent threat to national security, to life or property, or a declaration of a natural disaster, and (2) damage to sites from natural actions such as erosion.	Ongoing and future activities.

Best Management Practice	*Impacts Reduced/Avoided*	*Description of Best Management Practices and Management Strategies*	*Applicability*
CRM-15	Cultural resource protection	ICRMP SOP #15: Public Involvement and Outreach. The PMRF CRM routinely coordinates with CNRH and the Hawai'i SHPO on cultural resources management issues. Additionally, DoD Instruction 4715.16 states, "all installations with cultural resources will have a public outreach program." PMRF has an active and robust public outreach program, ranging from educational programs to facilitating public access to culturally important sites. Outreach visitors and participants have included, and will continue to include, local residents and Hawaiian descendants, plantation, and military community members; Native Hawaiian organizations; congressional delegations; officials from DoD and the Missile Defense Agency, as well as state and county officials; and local school groups and a myriad of nongovernmental organizations.	Ongoing and future activities.
CRM-16	Cultural resource protection	ICRMP SOP #16: Public and Cultural Access. SOP #16 provides guidelines and procedures for responding to requests for public access and for cultural access to individuals and organizations, including any Native Hawaiian organization that attaches cultural significance to historic properties on PMRF.	Ongoing and future activities.
CRM-17	Cultural resource protection	ICRMP SOP #17: Permits, Leases, and Contracts. SOP #17 provides standardized ARPA statements for inclusion in permits, leases, contracts, or other legal agreements between CNRH and other military branches, government agencies, individuals, businesses, or organizations. It is based on ARPA and OPNAVINST 5090.1E. The primary responsibility for implementing this SOP lies with real estate, contracting, and legal staff preparing permits, leases, contracts, or other legal agreements	The Proposed Action and future activities.

Best Management Practice	*Impacts Reduced/Avoided*	*Description of Best Management Practices and Management Strategies*	*Applicability*
PMRF – Natural Resources[2]			
Soil management	Impacts to soils	• Conduct general monitoring for coastal dune habitat and soil compaction issues annually to prevent and minimize the potential for soil degradation. • Mitigate and prevent soil erosion of coastal dune habitat by outplanting, establishing, and monitoring native dune building plants in areas identified as having erosion issues. • Implement additional security measures such as increased signage and roping off specific areas to alleviate undue pressures from off-road vehicle presence, especially in Nohili Dune areas. • Maintain Mākaha Ridge ungulate exclusion fencing for erosion control. • Outplant native, drought tolerant plants in areas identified as having erosion and soil compaction issues. Ensure that a regular monitoring schedule and a sufficient irrigation system are in place until plants are well established.	Ongoing and future activities.
Designated critical habitat	Impacts to designated critical habitat for panicgrass	• Work to improve protection, habitat, and/or consider outplanting Ni‘ihau panicgrass. • Protections will be aimed at preventing unauthorized off-road vehicle use, and invasive plant removal and to demonstrate benefit to the species. • Outplant native species and remove invasive species in areas with suitable Ni‘ihau panicgrass habitat and ensure an irrigation system is in place until plants become well established. • Consider undergoing the approval process to outplant the endangered *Panicum niihauense* in the effort to remove or reduce amount of PMRF property designated as critical habitat for the species. Coordinate with federal and state partners to secure material for outplanting if pursued.	Ongoing and future activities. Construction.
Hawaiian picture-wing fly management	Impacts to Hawaiian picture-wing flies	• Conduct surveys every 5 years to assess presence/absence of endangered Hawaiian picture-wing fly species at and directly adjacent to KPGO. • Conduct invasive plant removals annually in areas near known Hawaiian picture-wing fly habitat to promote native tree health and propagation and reduce introductions of invasive species into adjacent habitat due to Navy operations.	Ongoing and future activities.

Best Management Practice	***Impacts Reduced/Avoided***	***Description of Best Management Practices and Management Strategies***	***Applicability***
Marine nearshore management	Impacts to nearshore environments	• Establish a monitoring program for the nearshore environment of PMRF to inform future management decisions and monitor changes over time. • Partner with DLNR Division of Aquatic Resources (DAR) to incorporate regular monitoring site(s) in PMRF's nearshore waters into the state's regular monitoring schedule, as feasible.	Ongoing and future activities.
Monk seal management	Impacts to Hawaiian monk seals	• Continue to ensure that Security reports sightings of monk seals during daily patrols at PMRF beaches and erects signage and barricades if observed where people frequent. • Continue to report observations of hauled-out Hawaiian Monk Seals to NOAA as soon as possible and provide high-quality photos to assess seal health, identification, and aid in population abundance monitoring. • Conduct regular surveys approximately 5 times per week on beaches near the Nohili Ditch outfall and Diver's Landing for monk seal presence, and all other beaches approximately twice per week. • Continue to conduct surveys through partnership with NOAA Fisheries for Hawaiian Monk Seals on Niʻihau.	Ongoing and future operations.

Best Management Practice	***Impacts Reduced/Avoided***	***Description of Best Management Practices and Management Strategies***	***Applicability***
Sea turtle management	Impacts to sea turtles	• Continue to partner with Security in ensuring daily patrols of PMRF's beaches for sea turtles to collect observational data and check for stranded, injured, or entangled turtles. • Conduct surveys by biologists approximately 5 times per week on beaches near the Nohili Ditch outfall and Diver's Landing for sea turtle presence and ensure that marine surveys in nearshore areas quantify sea turtles and potential foraging or resting habitat. • Continue to survey beaches for sea turtle nesting activity during the nesting season, protect all nests observed with ropes and signage, mitigate light attraction issues on beaches, and coordinate with DAR to excavate nests. • Continue to encourage good communication between Security and natural resources staff regarding sea turtle activity on PMRF beaches to reduce negative impacts to the species from Security beach patrol vehicles. • Develop and use USFWS-approved outreach, educational materials, and signage with the objective to educate and provide information to residents, recreational users, visitors, and staff about proper procedures and acceptable activities within sea turtle habitat and how to act when coming in contact with sea turtles.	Ongoing and future operations.
Marine mammal management	Impacts to marine mammals	• Continue to report all observations of marine mammal strandings or deaths to NMFS and assist in response efforts. • Range users continue to adhere to protective measures for all training and testing per requirements under *Hawaii-Southern California Training and Testing Final EIS/OEIS* authorizations.	Ongoing and future operations.
Ungulate management	Impacts to natural resources habitats ESA terrestrial species	• Maintain efficacy of ungulate-proof fence at Mākaha Ridge. • Conduct regular monitoring for ungulates inside the fence, as well as vulnerable areas along the fence. • Maintain Mākaha Ridge fence for erosion control.	Ongoing and future operations.
Predator management	Impacts to MBTA species and Laysan albatross	• Continue base-wide predator control to protect MBTA-listed species including Laysan albatross; monitor for pigs, dogs, and cats in known breeding areas prior to the albatross breeding season and increase control efforts as needed.	Ongoing and future operations.

Best Management Practice	***Impacts Reduced/Avoided***	***Description of Best Management Practices and Management Strategies***	***Applicability***
Predator management	Impacts to monk seals	• Continue base-wide predator control to remove feral cats and collaborate with partners on studies regarding toxoplasmosis at PMRF to inform these efforts; conduct outreach about the disease and its effects on wildlife and human health.	Ongoing and future operations.
Predator management	Impacts to natural resources	• Work with the PMRF Archery Club to control ungulate populations at the Kamokalā Ridge site by implementing trapping and baiting stations if the animals become a nuisance to Navy operations or pose a risk to protected species. • Conduct observations to identify feral cats at Kamokalā Ridge and consider expanding cat trapping if use is consistent or becomes a nuisance.	Ongoing and future operations.
Wildland fire management	Impacts to natural resources	• Remove deadfall (woody debris) in high-risk areas including near the Barking Sands missile launch site and the Kamokalā Ridge Magazines and replant with native, low fire risk species.	Ongoing and future operations.
Wildland fire management	Impacts to natural and cultural resources	• Coordinate with the PMRF Fire Department on developing updates to the existing Fire Management Plan.	Ongoing and future operations.
Nēnē management	Impacts to nēnē	• Coordinate with USFWS, DOFAW, PMRF Air Ops, and PMRF Public Works to annually review and update the PMRF Nēnē Management Plan. • Work with PMRF Air Ops and USDA-WS to insure nēnē hazing efforts are increased prior to and during the breeding season with the possibility of including weekends, especially if a nēnē pair has been regularly observed on or near the airfield. • Collaborate with DOFAW to have all nēnē that hatch at PMRF banded and pursue permission and permits for PMRF natural resources staff to band birds if allowable.	Ongoing and future operations.
Nēnē management	Impacts to nēnē	• Continue to conduct regular, standardized surveys for nēnē at PMRF Barking Sands, Mākaha Ridge, and KPGO sites to effectively detect nēnē nests and inform management and determine habitat types that attract the species.	Ongoing and future operations.

Best Management Practice	*Impacts Reduced/Avoided*	*Description of Best Management Practices and Management Strategies*	*Applicability*
Nēnē management	Impacts to nēnē	• Continue to communicate with facilities maintenance personnel about nēnē nest locations and collaborate to develop effective protective measures for the species and ensure that no vegetation removal or other persistent disturbances occur within 100 feet of nest sites and goslings to reduce risk of take. • Support regular outreach to PMRF visitors and personnel on the importance of not providing food and water to nēnē and develop outreach material aimed at increasing awareness of the species.	Ongoing and future operations.
Nēnē management	Impacts to nēnē	• For all new construction at Barking Sands, including construction for tenant or customer DoD commands or other federal agencies, concrete, asphalt, gravel, xeriscaping, or native vegetation that does not act as a nēnē attractant, rather than lawn, will be installed in open areas surrounding buildings and parking areas to decrease attraction of nēnē.	Construction.
Waterbird risk management	Impacts to waterbirds, public health, and safety	• Continue to coordinate closely with Facilities Maintenance regarding restrictions on vegetation removal practices within a 100-foot radius of waterbirds or their nests. • Discourage waterbird presence and nesting at the oxidation pond complex by maintaining vegetation at a height of less than 6 inches and by funding the installation of exclusionary measures. • Continue to coordinate with Facilities Maintenance to obtain environmental data on the oxidation pond regularly to better inform causes of avian botulism outbreaks and identify high-risk conditions that require management actions. • Coordinate with Public Works to develop oxidation pond flushing protocols in response to avian botulism outbreaks or high-risk conditions. • Coordinate with Facilities Maintenance on all oxidation pond complex construction and restoration plans. • Supplement ongoing water quality testing to detect particulates and soluble chemicals in waters at PMRF. Testing should be conducted at least quarterly.	Ongoing and future operations.
Waterbird risk management	Impacts to waterbirds	• Replace and improve waterbird crossing signage at PMRF as needed to reduce risk of vehicle strikes, evaluate efficacy of signs, and explore new tools to reduce vehicle strikes.	Ongoing and future activities.
Waterbird Risk management	Impacts to waterbirds	• Continue to conduct regular monitoring for Hawaiian waterbird species at Barking Sands to effectively detect and reduce impacts to nests.	Ongoing and future activities.

Best Management Practice	***Impacts Reduced/Avoided***	***Description of Best Management Practices and Management Strategies***	***Applicability***
MBTA management	Impacts to MBTA species	• Continue to incorporate monitoring of shorebirds, cattle egrets (*Bubulcus ibis*), and black-crowned night herons (*Nycticorax nycticorax*) at wetland sites. Record opportunistic observations of barn owls (*Tyto alba*) and pueo (*Asio flammeus sandwichensis*) at all other areas of base to inform control measures for non-native species and protective measures for native species. • Keep track of non-native songbird species at PMRF and their numbers by participating in the annual Audubon Christmas Bird Count.	Ongoing and future activities.
MBTA management	Impacts to MBTA species	• Continue to advise development projects at PMRF that have potential to negatively impact native MBTA species and their habitat on how to avoid impacts. • Advise development projects at PMRF on how to avoid creating habitat and foraging availability for non-native MBTA species at PMRF especially near the PMRF airfield.	Ongoing and future activities.
Laysan albatross management	Impacts to Laysan albatross	• Coordinate with DOFAW on potential new albatross release sites. • Work with partners to ensure that as many albatross eggs as possible stay on Kaua‘i and find new suitable egg relocation locations. • Closely monitor re-sights of translocated albatross by working with partners on the north shore of Kaua‘i to enter data into the Airtable application database.	Ongoing and future activities.
Laysan albatross management	Impacts to Laysan albatross	• Continue the PMRF Laysan Albatross Egg Swap program. • Continue to translocate albatross to the north shore of Kaua‘i from January–April. • Support research on PMRF albatross populations that increases the understanding of their behavior as it relates to the PMRF airfield.	Ongoing and future activities.
Shearwater management	Impacts to shearwater nesting	• Enhance wedge-tailed shearwater (*Ardenna pacifica*) habitat in areas far from the PMRF airfield and human presence and develop deterrent measures for burrows in areas of human traffic and near the airfield. • Research and work with facilities and Morale, Welfare, and Recreation to implement methods for discouraging wedge-tailed shearwater burrowing in the immediate vicinity of the PMRF Beach Cottages. • Continue to implement protective measures that prevent the crushing of burrows in the beach cottages area (e.g., signage, temporary rope fencing, wooden burrow tents, outreach materials in cottages).	Ongoing and future activities.

Best Management Practice	***Impacts Reduced/Avoided***	***Description of Best Management Practices and Management Strategies***	***Applicability***
Shearwater management	Impacts to shearwater populations	• Conduct annual wedge-tailed shearwater population surveys in the Kinikini Ditch, beach cottages, and Nohili Dune areas. • Work with partners to collect additional data that supports adaptive management on PMRF and regional conservation objectives for shearwater species.	Ongoing and future activities.
Bat management	Impacts to Hawaiian hoary bat (pupping season)	• Tree trimming/removal activities shall be conducted outside of the bat pupping season of June 1 to September 15 to the maximum extent practicable to avoid and minimize effects of base infrastructure, operations, and maintenance. • Conduct follow-up acoustic surveys for Hawaiian hoary bats every 5 years. • In situations where trimming or removal of a tree with a known bat roost is determined necessary, the Navy shall work with the USFWS to develop and implement an SOP for bat roosting surveys.	Ongoing and future activities. Construction.
Invasive plant species management	Impacts to natural resources	• Native vegetation shall be used as practicable, and recommended by agencies, for revegetation efforts. • Ensure species identified as invasive in Hawai‘i are not utilized for outplanting, landscaping, or erosion control efforts. Develop a Landscaping Guide to include in all base contracts and integrate into the installation appearance plan.	Ongoing and future activities.
Invasive plant species management	Impacts to natural resources	• Ensure early detection and a rapid response to invasive plant species in sensitive areas. Conduct removal of invasive plant species in sensitive areas, monitor for re-growth, and restore with outplantings, if necessary, with a target of 80% reduction in invasive species within the areas of concern.	Ongoing and future activities.
Invasive animal species management	Impacts to natural resources	• Include biosecurity requirements and provisions in Base Operating Support (BOS) and construction contracts to ensure invasive ants, frogs, and other non-native wildlife are not introduced via equipment or landscaping efforts.	Ongoing and future activities. Construction.

Best Management Practice	***Impacts Reduced/Avoided***	***Description of Best Management Practices and Management Strategies***	***Applicability***
Invasive animal species management	Impacts to natural resources	• Increase outreach to base personnel on reporting and early detection for invasive species not yet established at PMRF. Ensure all observations or reports of high-risk invasive species are communicated to KISC and to all other appropriate agencies. • Increase outreach with all personnel on PMRF about the hazards of feeding feral/invasive species and assist in the enforcement of such policies by practicing good communication with Security.	Ongoing and future activities.
Invasive animal species management	Impacts to natural resources	• Conduct surveys to improve baseline knowledge of populations of invasive animals at PMRF. • Conduct ant surveys to assess presence of invasive ants including the little fire ants (*Wasmannia auropunctata*) at the Nohili Dune's wedge-tailed shearwater colony. If little fire ants are detected, report to KISC and implement active control by using granular bait after fledglings have left the area. • Continue to partner with the Hawai'i Department of Agriculture to ensure Coconut Rhinoceros Beetle (*Oryctes rhinoceros*) traps are checked and maintained at PMRF.	Ongoing and future activities.
Endangered seabird management	Impacts from night lighting (disorientation/ fallout)	• Whenever feasible, exterior night lighting shall include bat- and bird-friendly design features such as shielded lights (to reduce ambient light), use of motion detectors and/or other automatic controls, and lighting design that uses shields to prevent light from shining upward into the sky.	Ongoing and future activities.

Best Management Practice	*Impacts Reduced/Avoided*	*Description of Best Management Practices and Management Strategies*	*Applicability*
Endangered seabird management	Impacts from exterior facility lighting	• Exterior lighting shall be architecturally integrated with the character of all structures, energy efficient, and shielded or recessed so that direct glare and reflections shall be confined, to the maximum extent feasible, within the boundaries of the site. Shielded lighting directs rays toward the ground, and the light source, whether bulb or tube, shall not be visible from adjacent properties. • Exterior lighting shall be directed downward and away from adjacent properties. • Parking and security lighting shall consist of full-cutoff fixtures, which permit no upward light, unless a different cutoff classification is specifically authorized through the architectural review process. • Obtrusive light shall be minimized by limiting outdoor lighting that is misdirected, excessive, or unnecessary, and light required for the development shall be directed downward to minimize spill over onto adjacent properties and reduce vertical glare or up-lighting.	Ongoing and future activities.
Native plant habitat management	Impacts to native plant communities	• Continue to update baseline floral surveys to improve understanding of plant communities at PMRF. • Ensure post-planting care, including irrigation, invasive plant removal, and long-term monitoring and maintenance is implemented for all native plant restoration projects.	Ongoing and future activities.
Native plant habitat management	Impacts to pollinators	• Identify suitable locations for planting native Hawaiian plants, particularly those that benefit native pollinators in support of national pollinator objectives. • Ensure that plant communities found to support native terrestrial invertebrate species are protected, enhanced, and that construction or removal projects have minimal effects on these populations.	Ongoing and future activities. Construction.
Terrestrial invertebrate management	Impacts to pollinators	• Conduct species inventory at additional PMRF sites and conduct monitoring for native invertebrate species.	Ongoing and future activities.
Terrestrial invertebrate management	Impacts to pollinators	• Coordinate all use of pesticides by natural resources staff with the NAVFAC PAC Pest Management Consultant (PMC) and ensure that all applicators have received appropriate certifications. • Ensure that treatments will not have negative effects on protected species. Prohibit the use of neonicotinoids at PMRF sites.	Ongoing and future activities.

Best Management Practice	***Impacts Reduced/Avoided***	***Description of Best Management Practices and Management Strategies***	***Applicability***
Endangered seabird management	Impacts to seabirds	• Continue to host a Save Our Shearwaters (SOS) aid station at PMRF and monitor station during business days with SOS monitoring on weekends and holidays. • Advise various tenants on PMRF on appropriate safety lighting that is less attractive to endangered seabirds (i.e., motion sensing lights that go off after a set time period, shielded lights, facing light away from the coast, lower lumen, and lower to the ground). • Provide a 10-year calendar to mission planners with high-risk dates for endangered seabird fall out.	Ongoing and future activities.
Endangered seabird management	Impacts to seabirds	• Continue to fund and implement surveys to assess seabird strikes at KPGO Site C. • Minimize the potential for death or injury of seabirds due to collisions with PMRF communication towers located at KPGO Site C.	Ongoing and future activities.
Endangered sea bird management	Impacts to seabirds from night lighting (disorientation/fallout)	• Continue to promote base-wide awareness and implementation of the PMRF Dark Skies Program through annual trainings. • Continue Dark Skies implementation in areas adjacent to colonial nesting grounds at high elevation nesting sites during critical fledging timeframes. • Conduct systematic ground searches for fallen out seabirds after high-risk night operations.	Ongoing and future activities.
Public health and safety management	Impacts to public health and safety	• Continue to restrict access during missile testing and launches at the restricted easement adjacent to Barking Sands. • Adhere to applicable regulations and policy to limit interaction with vessel traffic when range activities occur.	Ongoing and future operations.
Public health and safety management	Impacts to public health and safety	• PMRF will coordinate with the Agribusiness Development Corporation to ensure compliance with the Clean Water Act and other environmental regulatory requirements where there is a nexus with federal monies or property.	Ongoing and future operations.

Best Management Practice	*Impacts Reduced/Avoided*	*Description of Best Management Practices and Management Strategies*	*Applicability*
KPGO – Environmental Management Plan[3]			
Endangered Species	Impacts to endangered and threatened species	• Space Exploration Network Services and Evolution (SENSE) has surveyed the endangered and threatened species around the area. Any changes to SENSE operations or construction activities are planned with the consideration of endangered and threatened species impacts to minimize or eliminate the effects on wildlife. SENSE leverages local agencies for guidance on current regulatory requirements and reduction of impacts.	Ongoing and future operations.

Key: ACHP = Advisory Council on Historic Preservation; ARPA = Archaeological Resources Protection Act; BMP = Best Management Practice; BOS = Base Operating Support; CA = Comprehensive Agreement; CFR = Code of Federal Regulations; CNRH = Commander, Navy Region Hawaii; COMPACFLT = Commander, U.S. Pacific Fleet; CRM = Cultural Resources Management; DAR = Division of Aquatic Resources; DoD = Department of Defense; DOFAW = Division of Forestry and Wildlife; DOI = Department of the Interior; EIS = Environmental Impact Statement; ESA = Endangered Species Act; HAMP = Historic Asset Management Process; ICRMP = Integrated Cultural Resources Management Plan; KISC = Kaua'i Invasive Species Committee; MBTA = Migratory Bird Treaty Act; MOA = Memorandum of Agreement; NAGPRA = Native American Graves Protection and Repatriation Act; NAVFAC PAC = Naval Facilities Engineering Systems Command Pacific; NEPA = National Environmental Policy Act; NHPA = National Historic Preservation Act; NMFS = National Marine Fisheries Service; NOAA = National Oceanic and Atmospheric Administration; NRHP = National Register of Historic Places; OPNAVINST = Office of the Chief of Naval Operations Instruction; PA = Programmatic Agreement; PMC = Pest Management Consultant; PMRF = Pacific Missile Range Facility; SECNAVINST = Secretary of the Navy Instruction; SENSE = Space Exploration Network Services and Evolution; SHPO = State Historic Preservation Office; SOH = Safety and Occupational Health; SOP = Standard Operating Procedure; SOS = Save our Shearwaters; USDA-WS = United States Department of Agriculture-Wildlife Services; USFWS = United States Fish and Wildlife Service.

Sources: [1]NAVFAC Pacific, 2012.
[2]NAVFAC Pacific, 2023.
[3]Space Exploration Network Services and Evolution, 2023.

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3 Project Setting

This chapter provides a preliminary overview of the project setting, or existing environmental conditions, for the resources within the State land (leaseholds and easement lands) at PMRF and KPGO. The Draft EIS will include further details on the existing conditions and potential effects of the Proposed Action and alternatives, as well as measures to minimize or mitigate these potential environmental effects.

The EISPN provides a preliminary overview of existing conditions relevant to the analysis of the Proposed Action and alternatives. The following 13 resources will be analyzed in the Draft EIS: archaeological and historic resources, cultural practices, biological resources, land use, socioeconomics, environmental justice, water resources, utilities, public health and safety, air quality and greenhouse gases, transportation, hazardous materials and wastes, and visual resources.

3.1 Archaeological and Historic Resources

The term "historic resource" as used in both NEPA and HEPA applies broadly to a variety of resources such as historic buildings, historic districts, archaeological sites, traditional places, and traditional ways of life. Several federal laws and regulations address cultural resources, including the NHPA and the Archaeological Resources Protection Act (ARPA), as well as agency-specific instructions and policies. The NHPA defines a historic property as any "prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places (NRHP), including artifacts, records, and material remains related to such a property or resource." Hawai'i State law also regulates historic properties in HRS Chapter 6E. Under HRS Chapter 6E, historic properties include any building, structure, object, district, area, or site, including heiau (a Hawaiian sacred temple) and underwater site, which is over 50 years old; and burial sites, defined as any specific unmarked location where prehistoric or historic human skeletal remains and their associated burial goods are interred, and its immediate surrounding archaeological context. Through the HRS Chapter 6E-42 review process, historic properties are assessed for "significance" as defined in HAR § 13-284-2 before project effects are analyzed.

Under the NHPA, the affected environment for historic properties is called the Area of Potential Effects (APE). The APE is defined in 36 CFR § 800.16(d) as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist." Under HRS Chapter 6E, the affected environment for cultural resources is referred to as a "Project Area," which is defined in HAR § 13-284-2 as "the area the proposed project may potentially affect, either directly or indirectly" and includes "not only the area where the proposed project will take place, but also the proposed project's area of potential effect."

The NEPA/HEPA impact analysis will be conducted within the NHPA APE and the HRS-6E Project Area to determine potential impacts on historic resources. These areas are the same and comprise the leaseholds and easement lands at the Main Base, Kamokalā Ridge, Mānā Well, Miloli'i Ridge, Mākaha Ridge, and KPGO. The APE for the Proposed Action is depicted as the State lands shown in Figure 1-2.

The Draft EIS will characterize the affected environment for cultural resources for Navy and NASA leasehold and easement lands. The document will identify cultural resources and assess the impacts resulting from implementation of the Proposed Action and alternatives to those cultural resources. Surveys are currently being conducted to identify cultural resources. These resources will be evaluated

for NHPA eligibility and HRS Chapter 6E significance. Both the Navy and NASA are responsible for managing historic properties under their control. PMRF's NHPA responsibilities are governed by the Commander, Navy Region (COMNAVREG) Hawai'i Programmatic Agreement (PA) with the SHPO and the Advisory Council on Historic Preservation (ACHP) (NAVFAC Pacific, 2012). Analysis of potential impacts to cultural resources will be conducted in accordance with the PA. The Draft EIS will evaluate potential impacts to archaeological and historic resources from implementation of the Proposed Action and alternatives.

3.2 Cultural Practices

The State of Hawai'i has an affirmative obligation to preserve and protect Native Hawaiians' customary and traditional rights to the extent feasible under the Hawai'i State Constitution, Article XII, Section 7.

Hawaii Session Law H.B. No. 2895, known as "Act 50", provides that "there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawai'i's culture, and traditional and customary rights" (H.B. No. 2895). Act 50 requires state agencies and other developers to assess the effects of proposed land use or shoreline developments on the "cultural practices of the community and State" as part of the HEPA environmental review process. In *Ka Pa'akai O Ka 'Āina v. Land Use Commission*, 94 Hawai'i 31, 7 P.3d 1068 (2000), the Hawai'i Supreme Court provided government agencies an analytical framework to ensure the protection and preservation of traditional and customary Native Hawaiian rights while reasonably accommodating competing interests. HEPA requires including natural or human-made resources of historic, cultural, archaeological, or aesthetic significance in this assessment.

Traditional land uses near the Project Area include habitation, subsistence activities, burial, and travel. It is likely that permanent settlements were concentrated at the inland edge of the Mānā Plain. Small fishing communities, possibly limited to temporary camps, were scattered along the coast. The people of Mānā were noted fishermen, taking advantage of the rich waters of the channel between Kaua'i and Ni'ihau. Fishing was not confined to the ocean and shoreline of Mānā, but also included the swamps and ponds on the coastal plain, where wild resources could be obtained alongside those raised through aquaculture. The coastal plain was a source of natural resources that were collected and used for a variety of purposes, including 'a'ali'i shrubs for firewood, hi'aloa and other plants for medicine, and makaloa and neki for weaving. The coastal dunes of the Mānā Plain were the burial grounds of ancient Hawaiians. Past and present cultural practices have been identified through prior consultation with Native Hawaiian Organizations and other stakeholders.

A Cultural Impact Assessment (CIA) will be prepared for the Proposed Action consistent with HEPA and Act 50 (Session Laws of Hawai'i, H.B. No. 2895), and will follow the State of Hawai'i's 1997 *Guidelines for Assessing Cultural Impacts*. The CIA will collect information relating to the practices and beliefs of Native Hawaiians who have knowledge of the Project Area. The area evaluated for the proposed CIA will be larger than the area associated with implementation of the Proposed Action to account for cultural practices that may be affected but are not included within the boundaries of the Project Area. Consequently, a large portion of the Mānā Plain inland from the Main Base will be included in the CIA. The information used in the CIA will be obtained through ethnographic and oral history interviews with knowledgeable organizations and persons such as traditional cultural practitioners, and through archival research that will include Hawaiian language sources. The assessment will consider cultural practices

and beliefs related to subsistence (e.g., fishing, gathering, and agriculture), habitation, commercial activities, access issues, recreation, religious/spiritual activities, and customs. Previously documented traditional cultural and other historic properties that are essential to these cultural practices and beliefs will be included in the analysis. The analysis conducted in the CIA will be incorporated into the Draft EIS.

3.3 Biological Resources

The Draft EIS will include a description of the biological resources in the Project Area. It will also include a discussion of known occurrences and potential habitat for species that are federally listed as endangered or threatened, habitats with substantial populations of native plants or animals, and designated critical habitats. Currently flora and fauna surveys, as well as wetland delineations, are being conducted in the area of interest.

Undeveloped leased lands at the Main Base comprise scrubland vegetation, sparse wetlands, and rolling sand dunes; easement areas include agricultural plains containing an interconnected system of irrigation ditches (Figure 3.3-1). Elevations at the Main Base range from sea level to 60 feet above sea level. Agricultural fields in the Project Area consist of both fallow and active landscapes with predominantly non-native vegetative scrub in and around the fields. Isolated wetland features support ESA-listed waterbirds, including the Hawaiian coot (*Fulica alai*), Hawaiian duck (*Anas wyvilliana*), Hawaiian gallinule (*Gallinula galeata sandvicensis*), Hawaiian stilt (*Himantopus mexicanus knudseni*), and Hawaiian goose or nēnē (*Branta sandvicensis*). ESA-listed plant species, including lauʻehu (*Panicum niihauense*) and ʻakoko (*Euphorbia celastroides*), occur within coastal vegetation communities. The state-recognized endemic Hawaiian short-eared owl or pueo (*Asio flammeus sandwichensis*) has been observed; however, it is only state-listed as endangered on Oʻahu. The endangered Hawaiian monk seal (*Neomonachus schauinslandi*), threatened green sea turtle (*Chelonia mydas*), and endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) have been observed in the coastal regions of the Main Base. Hawaiian stilts and Hawaiian yellow-faced bees (*Hylaeus* sp.) have also been observed in coastal areas adjacent to the Main Base.

Kamokalā Ridge is above adjacent agricultural lands with limited features that could provide ESA-listed flora or fauna habitat. Elevations at Kamokalā Ridge range from 240 to 320 feet above sea level. Vegetation, though sparse and lacking diversity, is consistent throughout steep cliff areas. Non-native and native trees provide canopy, while non-native scrub provides sparse understory amongst rocky terrain. The Hawaiian hoary bat, the state's only terrestrial ESA-listed mammal, has been observed in the Kamokalā Ridge area.

Mānā Well, located southeast of Kamokalā Ridge, is a small area containing an underground aquifer that provides potable water to the Main Base at an elevation of 120 feet above sea level. Mānā Well is in proximity to unmanaged lands with no known restoration efforts at the location, potential habitat for protected species is minimal.

The reflectors on Miloliʻi Ridge are situated amongst mixed coastal cliff vegetation, containing sparse native species at elevations from 1,760 to 1,790 feet above sea level. Much of the canopy comprises non-native trees with a mixed understory consisting of native and non-native shrubs and grasses.

Figure 3.3-1 Vegetation Types

Mākaha Ridge, with its diverse topography, varies in landscape and vegetation. Elevations at Mākaha Ridge range from 1,400 to 1,850 feet above sea level. Its features include eroded ridges with ruderal vegetation, as well as non-native canopies with dense understory patches. The following five federally listed plants have been documented within the coastal cliff plant communities at Mākaha Ridge: Niʻihau lobelia (*Lobelia niihauensis*), makou (*Peucedanum sandwicense*), Hawaiʻi scaleseed (*Spermolepis hawaiiensis*), dwarf iliau (*Wilkesia hobdyi*), and māʻoliʻoli (*Schiedea apokremnos*). The Hawaiian hoary bat and nēnē are ESA-listed species that have been observed in the region, as well as the state-listed pueo. ESA-listed seabirds including Newell's shearwater (*Puffinus auricularis newelli*), Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), and the band-rumped storm petrel (*Oceanodroma castro*) have the potential to fly over Mākaha Ridge or utilize the area.

KPGO consists of maintained landscaped grass, planted fruit trees, and non-native shrubs surrounding isolated building structures located along Kaunuohua Ridge, 3,700 feet above sea level. Mixed vegetation is sparse and consists of native and non-native plant communities. The Hawaiian hoary bat, nēnē, Hawaiian petrel, Newell's shearwater, band-rumped storm petrel, Hawaiian picture-wing fly (*Drosophila musaphilia* and *Drosophila sharpi*), and ʻakoko are ESA-listed species present in the montane mesic forest region dominated by native trees. Rare state-recognized endemic forest birds such as scarlet honeycreeper or ʻiʻiwi (*Vestiaria coccinea* syn. *Drepanis coccinea*), ʻapapane (*Himatione sanguinea*), and ʻamakihi (*Chlorodrepanis stejnegeri*) have been observed in the region. Critical habitat for bluegrass (*Poa mannii*), ʻakoko (*Euphorbia halemanui*), ʻaiakeakua (*Solanum sandwicense*), *Xylosma crenatum*, *Dubautia latifolia*, ʻaiea (*Nothocestrum peltatum*), and Hawaiian picture-wing fly (*D. musaphilia*), occur outside of KPGO, along the western region of Kaunuohua Ridge.

The Draft EIS will evaluate potential impacts to biological resources from implementation of the Proposed Action and alternatives.

3.4 Land Use

The State of Hawaiʻi has a unique system of classifying and managing lands in which both state and county agencies hold distinct responsibilities. The State Land Use Law (HRS § 205) classifies all lands in Hawaiʻi into one of four State Land Use Districts (SLUDs): urban, rural, agricultural, and conservation. The land that is leased and in easement by the Navy and NASA is classified as a conservation or agricultural district. The conservation district is further divided into five subzones: limited, resource, general, protected, and special. Navy and NASA leased and easement lands lie within the following conservation subdistricts: limited, resource, and general. In addition, each county has its own classification system of zoning districts that complement the SLUD designations. The County of Kauaʻi Zoning for the Project Area includes agriculture, conservation, open space, and special treatment – ecological. Table 3.4-1 summarizes SLUD and zoning designations in the Project Area.

Table 3.4-1 State Land Use Districts and Zoning Designations in and Surrounding the Project Area

Geographical Area	*Tax Map Key Parcel*[1]	*County of Kaua'i Zoning*	*State Land Use Districts*	*Conservation Subzone*	*Owner*
Main Base	1-2-002:001, 011, 012, 013, 015, 024, 025, 026, 030; 1-2-016:011	Agriculture, Open Space, Conservation, Special Treatment–- Ecological	Agriculture, Conservation	Limited, General Subzone	State of Hawai'i, U.S. Government
Kamokalā Ridge	1-2-002:001, 027, 029	Agriculture, Open Space	Agriculture	None	State of Hawai'i
Mānā Well	1-2-002:028	Open Space	Agriculture	None	State of Hawai'i
Miloli'i Ridge	1-2-001:006	Conservation	Conservation	Resource Subzone	State of Hawai'i
Mākaha Ridge	1-2-001:001, 006, 010; 1-4-001:002, 013, 014, 999	Conservation	Conservation	Resource Subzone	State of Hawai'i
KPGO	1-4-001:013	Conservation	Conservation	Resource Subzone	State of Hawai'i

Note: [1]Some Tax Map Key Parcels may be only portions or included for more than one geographical area.
Legend: KPGO = Kōke'e Park Geophysical Observatory; U.S. = United States.
Source: State Land Use Law (Chapter 205, Hawai'i Revised Statutes).

The Main Base consists of the fee simple lands held by the U.S. Government. Mānā Plain is east of the Main Base and is utilized for agriculture and is bordered by the Kekaha Game Management Area (which encompasses Kamokalā Ridge and Mānā Well). The southern boundary for the Main Base ends at Kokole Point. Miloli'i Ridge and Mākaha Ridge are located within the Pu'u Ka Pele Forest Reserve managed by DLNR, DOFAW. Adjacent to Mākaha Ridge, KPGO is located within Kōke'e State Park, which is managed by DLNR, State Parks Division. Both are accessible by Kōke'e Road (Figure 1-2).

Land uses in the Project Area include public beach access, local and federal government activities, agriculture, hiking, hunting, and other public uses. Highway 50 (also known as Kaumuali'i Highway) is the primary public access route through the Main Base (Figure 1-2).

The Draft EIS will evaluate potential impacts to land use from implementation of the Proposed Action and alternatives.

3.5 Socioeconomics

The area that will be considered for socioeconomic analysis is the County of Kaua'i.

Population Characteristics. In 2021, the population of the County of Kaua'i was 73,247, representing approximately 5 percent of the total population for the state. The population of the County of Kaua'i grew 9.2 percent from 2010 to 2021. This growth rate was faster than for the state (6.9 percent) and U.S. (6.8 percent) over the same period. Table 3.5-1 shows 2010 and 2021 population data.

Table 3.5-1 Population of the County of Kaua'i, State of Hawai'i, and United States (2010 and 2021)

Location	*2010*	*2021*	*Percent Change*
United States	308,745,538	329,725,481	6.8
State of Hawai'i	1,360,301	1,453,498	6.9
County of Kaua'i	67,091	73,247	9.2

Sources: U.S. Census Bureau, 2010, 2022a.

Employment Characteristics. In 2021, 36,294 individuals in the County of Kaua'i were employed in the civilian labor force and 239 individuals in the armed forces (U.S. Census Bureau [USCB], 2022b). The three largest civilian-employed industries in the County of Kaua'i in terms of workforce employed are arts, entertainment, recreation, accommodations, and food services (23.1 percent); educational services, health care, and social assistance (17.8 percent); and retail trade (11.4 percent) (USCB, 2022b). PMRF is currently the largest high-tech and third-largest overall employer on Kaua'i with nearly 1,000 personnel, including defense personnel and civilian contractors (State of Hawai'i Department of Business, Economic Development, and Tourism 2023). The median household income for the County of Kaua'i was $86,287 compared to the statewide median household income of $88,005 (USCB, 2022b). In 2021, the Bureau of Labor Statistics reported an 8.1 percent unemployment rate in the County of Kaua'i, which is higher than the U.S. (5.3 percent) and the State of Hawai'i (6.0 percent) (Bureau of Labor Statistics, 2021, 2023).

The Draft EIS will include an analysis of potential socioeconomic impacts from implementation of the Proposed Action and alternatives.

3.6 Environmental Justice

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* directs agencies to address environmental and human health conditions in minority and low-income communities. Environmental justice addresses the disproportionate and adverse impacts of a federal action on low-income or minority populations. The intent of the order and related directives and regulations is to ensure that low-income and minority populations do not bear a disproportionate burden of adverse impacts resulting from federal actions.

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, directs each federal agency to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, and ensure that its activities and standards address disproportionate risks to children that result from environmental health or safety risks.

Impacts associated with environmental justice would be to disadvantaged communities that could be adversely affected by the Proposed Action. The West Kaua'i Community Plan was adopted in 2020 and guides the long-term development, growth, and maintenance in the Waimea-Kekaha and Hanapēpē-'Ele'ele districts. The West Kaua'i Community Plan recognizes that challenges, such as a lack of housing to the growing effects of climate change, will negatively impact vulnerable households disproportionately (County of Kaua'i, 2020). The potential disadvantaged communities would be identified based on the spatial distribution of low-income and minority populations in the Project Area. As defined by the Environmental Justice Guidance under NEPA (CEQ, 1997), minority populations include persons who identify themselves as Asian, Native Hawaiian or other Pacific Islander, Native American or Alaskan Native, Black (not of Hispanic origin), or Hispanic or Latino. A minority population

exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. In addition, a minority population also exists if there is more than one minority group present and the minority percentage, when calculated by aggregating all minority persons, meets one of the above thresholds (CEQ, 1997).

The Draft EIS will consider whether there are such disadvantaged communities on West Kaua‘i within the vicinity of PMRF and, if so, assess whether the Proposed Action results in disproportionate and adverse impacts on environmental and human health conditions in minority and low-income communities. Potentially disadvantaged communities will be identified by comparing communities on West Kaua‘i within the vicinity of PMRF to demographic and socioeconomic indicators for the County of Kaua‘i as a whole.

3.7 Water Resources

Water resources include surface water (e.g., streams, lakes, rivers, and wetlands), groundwater, floodplains, and coastal waters, which comprise watershed hydrology.

Mean annual rainfall at the Main Base is approximately 20 inches. The developed water system, consisting of three human-made open irrigation ditches through the agricultural lands on Mānā Coastal Plain draining into the Pacific Ocean, is fed by upland streams, surface waters, and associated sediment. Wetlands, floodplains, mudflats, and shallow ponds are present along the lowlands and coastal regions (Figure 3.7-1). The only natural wetland habitat on the Main Base comprises estuarine and marine systems along the shoreline region. A human-made sewage oxidation pond complex is located on the southern portion of the Main Base.

Mean annual rainfall in the Kamokalā Ridge area is 20 inches. Surface water from Nahomalu Valley (north) and Ka‘awaloa Valley (south) of Kamokalā Ridge drains into the Mānā Plain. A basal unconfined dike aquifer is located in the Waimea Aquifer Sector within the Kekaha Aquifer System (Figure 3.7-2).

Mean annual rainfall in Mānā is approximately 20 inches. Mānā Well, located at the southeastern end of Kamokalā Ridge, pumps water upwards from a below-ground aquifer. The water from the well is properly treated before it is piped into the PMRF drinking water distribution system. Drinking water on the Main Base is provided by Mānā Well, as well as the County of Kaua‘i’s Waimea-Kekaha system.

Mean annual rainfall on Miloli‘i Ridge is 30 inches. Due to the rocky, stony, and volcanic makeup of the terrain on Miloli‘i Ridge, runoff is rapid and erosion is prevalent. There are no perennial water features and no groundwater resources.

Mean annual rainfall at Mākaha Ridge is 30 inches. Due to the rocky, stony, and volcanic makeup of the terrain on Mākaha ridge, runoff is rapid and erosion is prevalent. There are no perennial water features, only intermittent streams in the region. Two aquifers, both part of the Waimea Aquifer Sector of the Kekaha Aquifer System, are beneath this site (Figure 3.7-2).

Mean annual rainfall on the Kaunuohua Ridge at KPGO ranges from 50 to 60 inches. Surface water runoff is medium due to highly-eroded volcanic terrain on the ridgeline, and generally follows a northwesterly/southeasterly course. Numerous streams are located around the base of the mountains. One unconfined dike aquifer, located in the Waimea Aquifer Sector within the Kekaha Aquifer System, lies beneath KPGO.

Figure 3.7-1 NWI Wetlands

Figure 3.7-2 Aquifers

The Draft EIS will evaluate potential impacts to water resources from implementation of the Proposed Action and alternatives.

3.8 Utilities

There are utility leases and easements included as part of the Proposed Action. Utility systems' usage, available supply capacity, and the overall real property condition of the utility systems will be analyzed. The primary utilities that will be assessed in the Draft EIS are potable water, wastewater, electrical, and communications.

Potable water for the Main Base lease areas comes primarily from Mānā Water Well. Potable water resources for Kamokalā Ridge, Mākaha Ridge, and KPGO are supplied by either existing wells or municipal sources from several reservoirs. The Navy treats water from all sources, except water provided by the State of Hawai'i (Navy, 2008).

Wastewater services for PMRF include domestic sewage treatment facilities and a collection system that services PMRF (Navy, 2008). The Kamokalā Ridge, Mākaha Ridge, and KPGO wastewater utility supply and uses will be identified in the Draft EIS.

Primary electric power is supplied to the Main Base, Kamokalā Ridge, and Mānā Water Well by purchase from the Kaua'i Island Utility Cooperative and a 14-megawatt solar facility with a 70 megawatt-hour battery energy storage system on the Main Base (Figure 3.8-1). KPGO power is supplied by a Navy-operated power plant at Mākaha Ridge. Electricity is provided through both overhead and underground transmission lines. Emergency diesel backup generators provide alternate power when needed at KPGO. Communications infrastructure for the Main Base, Kamokalā Ridge, Mākaha Ridge, and KPGO consist of cable, fiber optics, cellular towers, and communications towers.

The Draft EIS will analyze potential impacts to utilities from implementation of the Proposed Action and alternatives.

Photo courtesy of U.S. Navy, November 16, 2021.

Figure 3.8-1 Solar Facility and Battery Energy Storage System

3.9 Public Health and Safety

Public health and safety pertains to activities, occurrences, and training, and RDT&E activities that have the potential to affect the well-being, safety, and health of the public.

NASA operates KPGO in accordance with the Environmental Management Plan under the Space Exploration Network Services and Evolution contract. To ensure operations at KPGO do not result in impacts to public safety or the environment, the Environmental Management Plan describes procedures for the following: environmental planning; risk assessment; spill prevention; operational controls; education, training, awareness, and competency; evaluation, checking, and corrective action; water management; air quality management; and waste management.

Range Safety at PMRF is controlled by Range Control, which is responsible for hazard area surveillance and clearance and control of all operational areas. Range Control maintains real-time surveillance, clearance, and safety at all PMRF areas. The PMRF Range Safety Officer is responsible for establishing Ground Hazard Areas (GHAs) and Launch Hazard Areas over water. The Ground and Launch Hazard Areas for missile launches are determined by size and flight characteristics of the missile, as well as individual flight profiles of each flight test. Data processed by ground-based or onboard missile computer systems may be used to recognize malfunctions and terminate missile flight. Before a launch is allowed to proceed, the Navy uses input from ship sensors, visual surveillance from aircraft and range safety boats, radar data, and acoustic information to ensure the offshore range is clear of vessels and aircraft.

PMRF operates pursuant to Range Commanders Council 321, *Common Risk Criteria for National Test Ranges*. Range Commanders Council 321 sets requirements for minimally acceptable risk criteria to occupational and non-occupational personnel, test facilities, and non-military assets during range operations.

Ordnance safety includes procedures to prevent premature, unintentional, or unauthorized detonation of ordnance. All programs require an Explosive Safety Approval before ordnance is allowed on PMRF or used on a test range. This approval involves a detailed analysis of the explosives and of the proposed training and RDT&E activities. The analysis also covers procedures and facilities for surveillance and control, an adequacy analysis of movement and control procedures, and a design review of the facilities where the ordnance items will be handled.

PMRF transports ordnance by truck from Nāwiliwili Harbor to the Main Base along Highway 50 (Figure 3.9-1). The barges carrying ordnance are met at Nāwiliwili Harbor by trained ordnance personnel and special vehicles for transit and delivery to PMRF. PMRF Instruction 8023.G controls the handling and transportation of ammunition, explosives, and hazardous materials on the facility. All ordnance is transported in accordance with PMRF Instruction 8023.G and U.S. Department of Transportation regulations.

Ambulance and Class II Emergency Medical Technician services are provided by Emergency Medical Technicians assigned to Crash/Fire. These contractor-operated services are available to military, civil service, and non-government personnel at PMRF, 24 hours a day, 7 days a week. More extensive emergency medical services are available from the West Kauaʻi Medical Center in Waimea, 10 miles from PMRF's main gate (Figure 3.9-1).

Figure 3.9-1 Ordnance Transport Route and Emergency Medical Services Route

Fire service at the Main Base includes PMRF Crash/Fire equipment located at the Air Traffic Control Tower. Personnel are trained to respond to activities such as aircraft firefighting and rescue in support of airfield operations, hazardous material incidents, confined space rescue, and hypergolic fuel releases, plus structure and brush firefighting, fire prevention instruction, and fire inspections.

The Draft EIS will evaluate potential impacts to public health and safety from implementation of the Proposed Action and alternatives.

3.10 Air Quality and Greenhouse Gases

3.10.1 Air Quality

The U.S. Environmental Protection Agency (USEPA) has established National Ambient Air Quality Standards (NAAQS) for the criteria pollutants sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), lead, particulate matter (PM) measured less than or equal to 10 microns in diameter (PM_{10}), and PM less than or equal to 2.5 microns in diameter [$PM_{2.5}$]).

The Hawai‘i Department of Health (DOH), Clean Air Branch regulates and monitors air pollutants under HAR Chapter 11-59, *Ambient Air Quality Standards*, and HAR Chapter 11-60.1, *Air Pollution Control*. Based on ambient air monitoring results, the island of Kaua‘i is designated unclassified/attainment for all criteria pollutants (USEPA, 2023). The Clean Air Branch currently operates one monitoring station on the island of Kaua‘i approximately 1.0 mile downwind of Nāwiliwili Harbor to measure SO_2 emissions from cruise ships (DOH, 2023).

The prevailing winds on Kaua‘i (known as trade winds) blow in from east-northeast and prevail approximately 9 months of the year. When there is volcanic activity, trade winds blow volcanic fog (“vog”) from Hawai‘i Island volcanoes. When trade winds are absent for prolonged periods, vog travels up the island chain and can affect air quality by increasing levels of airborne SO_2 and $PM_{2.5}$.

Sources of air emissions from the Navy include vehicle traffic, diesel-fuel powered generators, aircraft, power generation, and rocket launches. Sources of air emissions from NASA include vehicle traffic and the diesel power generator.

The Draft EIS will assess the potential impacts to air quality from implementation of the Proposed Action and alternatives.

3.10.2 Greenhouse Gases

Gases that trap heat in the atmosphere are called greenhouse gases (GHGs). Global climate change is impacting temperature, precipitation, wind, sea level, and other elements of Earth’s climate system. The recent buildup of GHGs in the atmosphere from human activities has changed the earth’s climate and has resulted in adverse effects to human health and welfare, and to ecosystems.

Sea level rise, altered rainfall patterns, and rising ocean and air temperatures result from climate change. These changes impair access to clean water and healthy food, undermine human health, threaten the cultural and built environment, exacerbate inequities, and disrupt economic activity and diversity of ecosystems in Hawai‘i (U.S. Global Change Research Program, 2023).

The Draft EIS will analyze potential impacts from GHGs and climate change from implementation of the Proposed Action and alternatives.

3.11 Transportation

The roadways used to access or in the vicinity of PMRF include Highway 50, Kōkeʻe Road, Kao Road/Kiko Road, Mānā Road, Mākaha Ridge Road, and Miloliʻi Ridge Road.

Highway 50 is a principal arterial roadway providing regional mobility in the western part of Kauaʻi. It begins in Līhuʻe and ends in the vicinity of PMRF, where it is a two-lane, undivided roadway with painted shoulders along both sides of the road. There are median left turn lanes at selected intersections along Highway 50.

Kōkeʻe Road branches north from Highway 50 in Waimea and provides access from Kekaha to Waimea Canyon State Park and Kōkeʻe State Park. It also provides access to the KPGO site. In the vicinity of the KPGO site, it is a two-lane, undivided roadway with grass shoulders along both sides of the road.

The Draft EIS will analyze the potential impacts of the Proposed Action and alternatives on the roadway facilities in the vicinity of the PMRF and KPGO sites along with multi-modal facilities, such as pedestrian, bicycle, and public transit facilities.

3.12 Hazardous Materials and Wastes

Hazardous materials are currently utilized or present on lease and easement lands at KPGO, the Main Base, and Mākaha Ridge.

Hazardous materials present on the Main Base leased area include the following: cleaning agents, solvents, lubricating oils, jet fuel, diesel fuel, propane, gasoline, aqueous film forming foam[2] (AFFF), chlorine, used oil, and paint. No known components within the Main Base leased area contain polychlorinated biphenyls (PCBs). PMRF's management and disposal procedures for used oils and fuels are in its Hazardous Waste Management Plan. Most waste is collected and containerized at the Main Base leased area for direct offsite disposal through the Defense Reutilization and Marketing Office, which also provides for the transportation and disposal of the waste to a final disposal facility.

PMRF uses gasoline and diesel fuel to power trucks and equipment across leasehold areas. Table 3.12-1 includes a summary of fuel storage on PMRF leased lands and KPGO.

Hazardous materials on Mākaha Ridge include diesel storage tanks and oil storage tanks. Used oil is taken to the Main Base to be recycled.

KPGO Site B has multiple diesel fuel tanks used for emergency power generation. Site B also has a hazardous material storage facility which holds paint, oil, mechanical lubricating fluids, and cleaning

[2] Based on guidance from the Assistant Secretary of the Navy, DON has strict firefighting performance requirements for AFFF formulations to protect the safety of our personnel and the public in the event of an emergency. DON amended the MILSPEC in September 2017 setting limits for PFOS and PFOA at the lowest levels of quantitation while maintaining fire-fighting performance requirements. DON is in the process of removing legacy AFFF and replacing it with new MILSPEC compliant AFFF. DON has also implemented system requirements to ensure DON installations and facilities are tested and certified in a manner that does not allow the release of legacy AFFF into the environment. MIL-PRF-32725 limits per- and polyfluoroalkyl substances (PFAS) to 1 part per billion, and Section 322 of the National Defense Authorization Act for Fiscal Year 2020 requires DoD to stop using AFFF containing PFAS on all installations by 1 October 2024.

substances. Used oil is taken to the Main Base to be recycled. NASA's Environmental Management Plan for KPGO describes waste management processes including handling of solid waste, recyclable materials, hazardous waste management, hazardous waste shipment, universal waste management, asbestos management, PCBs, and compliance with the Emergency Planning and Community Right-to-Know Act.

Table 3.12-1 PMRF Leased Area and KPGO Fuel Storage Locations

Fuel Storage Types	*Quantity*	*Capacity (nominal capacity) in gallons*	*Details*
Diesel ASTs	2	8,000	Mākaha Ridge
Diesel AST	3	275	Mākaha Ridge
Diesel USTs	1	25,000	KPGO Site B
Diesel USTs	2	500	KPGO Site B
Diesel ST	2	55	KPGO Site B
Diesel ST	1	244	KPGO Site B
Diesel ST	1	256	KPGO Site B

Key: AST = aboveground storage tank, UST = underground storage tank, ST = Storage Tank.

PMRF has a pollution prevention plan for all sites on Kaua'i, which follows the Navy's Consolidated Hazardous Materials Reutilization and Inventory Management Program for controlling, tracking, and reducing hazardous materials use and waste generation. Current programs involve waste elimination from toner cartridges, mercury from mercury lamps, and acid/lead batteries and asbestos management. Asbestos is managed in accordance with the base asbestos management plan which requires all structures on leased and easement land areas to be surveyed, and any asbestos removed by a certified asbestos contractor prior to disturbance/construction. Lead-based paint waste removal follows Department of Energy protocols, and all facilities on PMRF leased lands follow the lead-based paint management plan.

The Draft EIS will evaluate potential impacts to hazardous materials and wastes from implementation of the Proposed Action and alternatives.

3.13 Visual Resources

The discussion of visual resources includes the natural and built features of the landscape visible from viewpoints that contribute to an area's visual quality. Under NEPA, federal agencies should consider visual impacts of proposed projects on scenic resources, historic properties, and scenic experiences of public who view the landscape. Aesthetics and views of proposed projects at PMRF and the NASA lease area are mainly guided by the Kaua'i County General Plan (County of Kaua'i, 2018) or the West Kaua'i Community Plan (County of Kaua'i, 2020). Both plans include policies to preserve scenic views of ocean, coastline/beach areas, mountains, and other elevated landforms.

The Main Base leaseholds and easements are situated on the west coast of Kaua'i on the Mānā Coastal Plain (refer to Figure 1-2). The leased and easement areas in this area are relatively flat and consist primarily of agricultural and other undeveloped, partially-vegetated lands. The ridges that run east of these areas are the dominant view from the Main Base. The Pacific Ocean and coastlines can be viewed from higher elevation vantage points. Kaumuali'i Highway (Highway 50) is the main paved roadway in this area. Typical views from the highway include mixed vegetation and agricultural areas along both

sides of the road, with the mountains visible in the distance to the east, if travelling northbound on Kaumualiʻi Highway toward Barking Sands Beach and Polihale State Park. The facilities on these leaseholds and fee simple lands are visible to the west for some stretches when travelling northbound on Kaumualiʻi Highway.

The Kamokalā Ridge leaseholds are located upland from the Main Base. The ordnance storage facility and paved access roads are the primary human-made structures in the area. Vegetation of various heights is adjacent to both sides of the access roads. Obscured views of the Pacific Ocean and coastlines occur from certain vantage points along the roadway. Due to its higher elevation and the relatively dense vegetation in this area, the ordnance storage facility is not visible from the Main Base, Kaumualiʻi Highway, or other public roads west of the Kamokalā Ridge lease area.

The Mānā Water Well is approximately a quarter mile south of the Kamokalā Ridge area. The well is located at the point where the topography changes from flat to steep mountain cliffs. The site is reached by an access road from Kiko Road (Figure 1-4). Mountain views are dominant from this location because the nearest cliff line is less than a quarter mile from the well. No ocean or coastline views are available from this location.

Miloliʻi Ridge and Mākaha Ridge are both finger ridges of the Nāpali Coast on the west-northwest side of Kauaʻi within Puʻukapele Forest Reserve areas. The Miloliʻi Ridge lease area is approximately 8 miles north of the Main Base. Views of the Pacific Ocean and coastlines are not available due to dense vegetation coverage at this site. The facilities at Miloliʻi Ridge are not visible from public vantage points because of its secluded location.

The Mākaha Ridge area is located on the cliffs of the Nāpali Coast State Wilderness Park, approximately 1 mile south of Miloliʻi Ridge. Mākaha Ridge is accessed via the Mākaha Ridge Road (refer to Figure 2-7), which can be accessed by the public up to a gate outside of the radar site. Mākaha Ridge Road has forest vegetation lining both sides of the road, obstructing a view of any vista. The radar facilities are only partially visible from the segment of the Mākaha Ridge Road near the radar site gate.

The NASA lease area is located at the Kōkeʻe Park, approximately half a mile northeast of Mākaha Ridge Road. The site can be accessed through Kōkeʻe Road and Faye Road. Site facilities are located on landscaped or paved areas. The site is surrounded by taller forest vegetation. The heavily vegetated setting and mountain views are the main scenic resources from this area. The NASA facilities are partially visible to Kōkeʻe State Park visitors while traveling along Mākaha Ridge Road.

As part of the visual resources impacts evaluation, the Draft EIS will discuss visual resources in detail from the perspectives of dominant landscape features, visual diversity, elements of line, color, form, and texture, historic and cultural importance, as well as overall landscape character. The Draft EIS will evaluate potential impacts to visual resources from implementation of the Proposed Action and alternatives.

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4 Consistency with State and Local Government Plans and Policies

The Draft EIS will evaluate the Proposed Action's conformance with relevant state and local land use plans and policies.

4.1 Land Use Laws

The Draft EIS will include a discussion of the Proposed Action's conformance with relevant federal, state, and County of Kaua'i land use plans, policies, and controls.

4.2 Hawai'i State Plan and Hawai'i State Functional Plans

The Hawai'i State Plan, codified as HRS Chapter 226, establishes a set of themes, goals, objectives, and policies that are meant to guide the state's long-term growth and development activities. The Hawai'i State Plan also provides a basis for determining priorities, allocating limited resources, and improving the coordination between State and County plans, policies, programs, projects, and regulatory activities. These goals seek to promote a strong economy, a desired physical environment, and nourished community life. The State Plan also establishes objectives for each goal. The Proposed Action meets the statewide objectives by encouraging federal expenditures and national defense that is consistent with "Hawai'i's social, environmental, and cultural goals by building upon dual-use and defense applications" (HRS § 226-9). As stewards of the natural and cultural environment, the Navy and NASA work to enhance Hawai'i's scenic assets, natural beauty, and multi-cultural resources pursuant to HRS § 226-12.

The State Plan (HRS § 226-65) also initiated the Hawai'i 2050 Sustainability Plan to serve as long-range planning to achieve sustainability and climate adaptation goals, principles, and policies. Published in 2008, the plan reinforces the goals and objectives of the State Plan (above) in terms of economic, physical, and community sustainability with the objectives of promoting these sectors through renewable energy, water conservation, and increased food security, among others; an approach fully supported by the Proposed Action (Sustainability Task Force, 2008).

The Statewide Planning System identified in HRS Chapter 226 also requires State Functional Plans, which implement state and county actions. There are 13 Functional Plans used to assist with establishing the policies, statewide guidelines, and priorities within a specific field of activity when such an activity or program is proposed, administered, or funded by any state agency. Due to the nature of the leased and easement lands that fall under the Proposed Action, multiple Functional Plans may be applicable for the Draft EIS, including the Agriculture Functional Plan, the Conservation Lands State Functional Plan, the Historic Preservation State Functional Plan, and the Recreation State Functional Plan. All of these applicable Functional Plans were developed in 1991.

4.3 Kaua'i County General Plan, West Kaua'i Community Plan, Kaua'i Island Plan

The Kaua'i County General Plan underwent a comprehensive update in 2018 and serves as the county's guiding policy framework for growth, land use, and development issues. The Project Area falls within the Waimea-Kekaha Planning District and land uses include agriculture, natural preserve, and parks and recreation. The Proposed Action fits within this General Plan's future land use concept and is consistent with applicable goals and policies (County of Kaua'i, 2018). As stated in the Kaua'i County General Plan, Section 3.3 fostering High Tech and Clean Tech Jobs:

> The Pacific Missile Range Facility (PMRF), located on the West Side, is one of the foremost aerospace test sites in the United States. PMRF leverages Kaua'i's location in the center of the Pacific Ocean for the benefit of aerospace and space launch testing .... Historically, PMRF has been the driving force behind the establishment of technology-based business on Kaua'i. PMRF's continued vitality contributes significantly to Kaua'i's high technology industry and provides opportunities for supportive businesses and entrepreneurs (County of Kaua'i, 2018).

Land uses at PMRF are consistent with the 2020 West Kaua'i Community Plan, and include the following three general areas: Hanapēpē, Kekaha, and Waimea uplands (County of Kaua'i, 2020). The project is consistent with the applicable policies regarding heritage resources, resiliency, and shared spaces in the West Kaua'i Community Plan. As stated in the West Kaua'i Community Plan, Part IV: Other Communities and Significant Areas:

> Over the decades, PMRF has increased its connection with Kekaha and the West Kaua'i Community, such as development of the Junior Professional Program for high school students, restoration of the Kawai'ele Bird Sanctuary, establishment of protocols for the care and internment of inadvertently uncovered iwi, and support and partnership with local businesses and nonprofits (County of Kaua'i, 2020).

A separate Kaua'i Island Plan, last updated in 2004 and produced by the State of Hawai'i Department of Hawaiian Home Lands (DHHL), covers lands owned by the DHHL, which includes 15,061 acres adjacent to the Project Area in Waimea (DHHL, 2004) (Figure 4-1). PMRF is located in the coastal plain below the DHHL Mānā Plain property, and just north of State of Hawai'i Department of Hawaiian Home Lands Kekaha tracts. The project is consistent with land use plans for these two areas.

4.4 List of Potentially Required Permits, Consultations, Reviews, and Approvals

The Navy and NASA will prepare the Draft EIS with input, analysis, and review from the public and local, state, and federal agencies. The anticipated permits, consultations, reviews, and approvals required for implementation of the Proposed Action will depend on the features of the selected alternative. The list of anticipated permits and approvals in Table 4-1 will be refined as alternatives are developed. Input on other processes that may be necessary will be requested from government agencies and other participants as part of this environmental review process.

The Draft EIS will list all permits, consultations, reviews, and approvals necessary to implement the Proposed Action, including those overarching requirements listed in Table 4-1. Because the Proposed Action is a land management proposal, the associated permits and approvals are related to land use arrangements and resource management.

Table 4-1 Potential Required Permits, Consultations, Reviews, and Approvals for the Proposed Action

Potential Required Permits and Approvals	*Regulatory Agency*
Approval of request for new real estate agreements (HRS Chapter 171)	**BLNR**
Conservation District Use Application (HAR Title 13, ch. 5)	**DLNR, Office of Conservation and Coastal Lands**
NHPA (54 U.S.C. section 100101)	ACHP and the Hawai'i SHPO
ESA (16 U.S.C. section 1531 et seq.)	USFWS and NMFS[1]
CWA (33 U.S.C. section 1344)	USEPA and Hawai'i State Department of Health
CZMA, Subpart C (16 U.S.C. section 1451, et seq.)	Hawai'i Office of Planning and Sustainable Development
Hawai'i Historic Preservation Review HRS Chapter 6E-42 and HAR Chapter 13-275	DLNR, SHPD

Note: **Bold text** in table indicates approvals necessitating HRS Chapter 343 environmental review.

[1] This is pending review of monk seal haul-out on easement land; additional review of ESA species is covered in the *Hawaii-Southern California Training and Testing Final EIS/OEIS* (Navy, 2018).

Key: ACHP = Advisory Council on Historic Preservation; BLNR = Board of Land and Natural Resources; CWA = Clean Water Act; CZMA = Coastal Zone Management Act; DLNR = Department of Land and Natural Resources; ESA = Endangered Species Act; HAR = Hawai'i Administrative Rules; HRS = Hawai'i Revised Statutes; NHPA = National Historic Preservation Act; NMFS = National Marine Fisheries Service; SHPD = State Historic Preservation Division; SHPO = State Historic Preservation Officer; U.S.C. = United States Code; USEPA = U.S. Environmental Protection Agency; USFWS = United States Fish and Wildlife Service.

Figure 4-1 Terrestrial Land Ownership

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Appendix A
Summary of Land Use at the Pacific Missile Range Facility

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ACRONYMS AND ABBREVIATIONS

ft	foot or feet	mi	mile
ha	hectare	Navy	Department of the Navy, United States
ICRMP	Integrated Cultural Resources Management Plan	PMRF	Pacific Missile Range Facility
		U.S.	United States
km	kilometer	WWII	World War II
m	meter		

GLOSSARY OF HAWAIIAN LANGUAGE WORDS

Hawaiian Spelling [a]	**Definition**
ʻaʻaliʻi	Hawaiian hopseed, *Dodonaea viscosa*; native shrubs and small trees
ahupuaʻa	land division usually extending from the uplands to the sea, so called because the boundary was marked by a heap (*ahu*) of stones surmounted by an image of a pig (*puaʻa*), or because a pig or other tribute was laid on the altar as tax to the chief
heiau	temple, shrine
hiʻaloa	small, downy, American weed, *Waltheria indica* var. *americana*; leaves and inner bark of root are very bitter and are used for tea or chewed to relieve sore throat
koa	the largest of native forest trees (*Acacia koa*), with light gray bark, crescent-shaped leaves, and white flowers in small, round heads
konohiki	headman of an ahupuaʻa land division under the chief
loko	pond, lake, pool
makaloa	a perennial sedge, *Cyperus laevigatus*
mauka	toward the mountain, or inland
neki	great bulrush
puʻuone	pond near the shore connected to the sea by a stream or ditch; sand dune

[a] Adapted from Mary K. Pukui and Samuel H. Elbert, 1986, *Hawaiian Dictionary*, University of Hawaiʻi Press, Honolulu, unless otherwise noted.

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1 Introduction

1.1 Project Scope

The Pacific Missile Range Facility (PMRF) consists of approximately 10,281 acres (ac), of which approximately 1,933 ac are United States (U.S.) fee simple lands under the administrative jurisdiction of the U.S. Department of the Navy (Navy). The balance of 8,348 ac is state land comprised of 684 ac of leaseholds and 7,664 ac of easements.

No active training or testing occurs on state-owned property. Infrastructure that supports PMRF operations is located in the leaseholds. The easement areas provide safety buffer zones for training and testing missions and prevent incompatible development. The existing leases and easements were acquired from the State of Hawai‘i, Department of Land and Natural Resources, and will expire between 2027 and 2030. The Navy is proposing to secure continued long-term Department of Defense use to support continued operational and mission requirements at PMRF. See Figure 1 and Figure 2 for the project areas of this summary.

The project consists of land that PMRF currently leases or has an easement for from the State of Hawai‘i.

1.2 Project Location

The entirety of the project area is on the western edge of Waimea Ahupua‘a, Kona District, Kaua‘i Island. The Controlled Industrial Area encompasses the Mākaha Ridge Tracking Station, Mākaha Ridge Road, boresight tower adjacent to Mākaha Ridge Road, and several large parcels east of PMRF Barking Sands on the Mānā Plain. The three primary study locations include Barking Sands, Mākaha Ridge Road and Kamokalā Ridge and portions of the surrounding area.

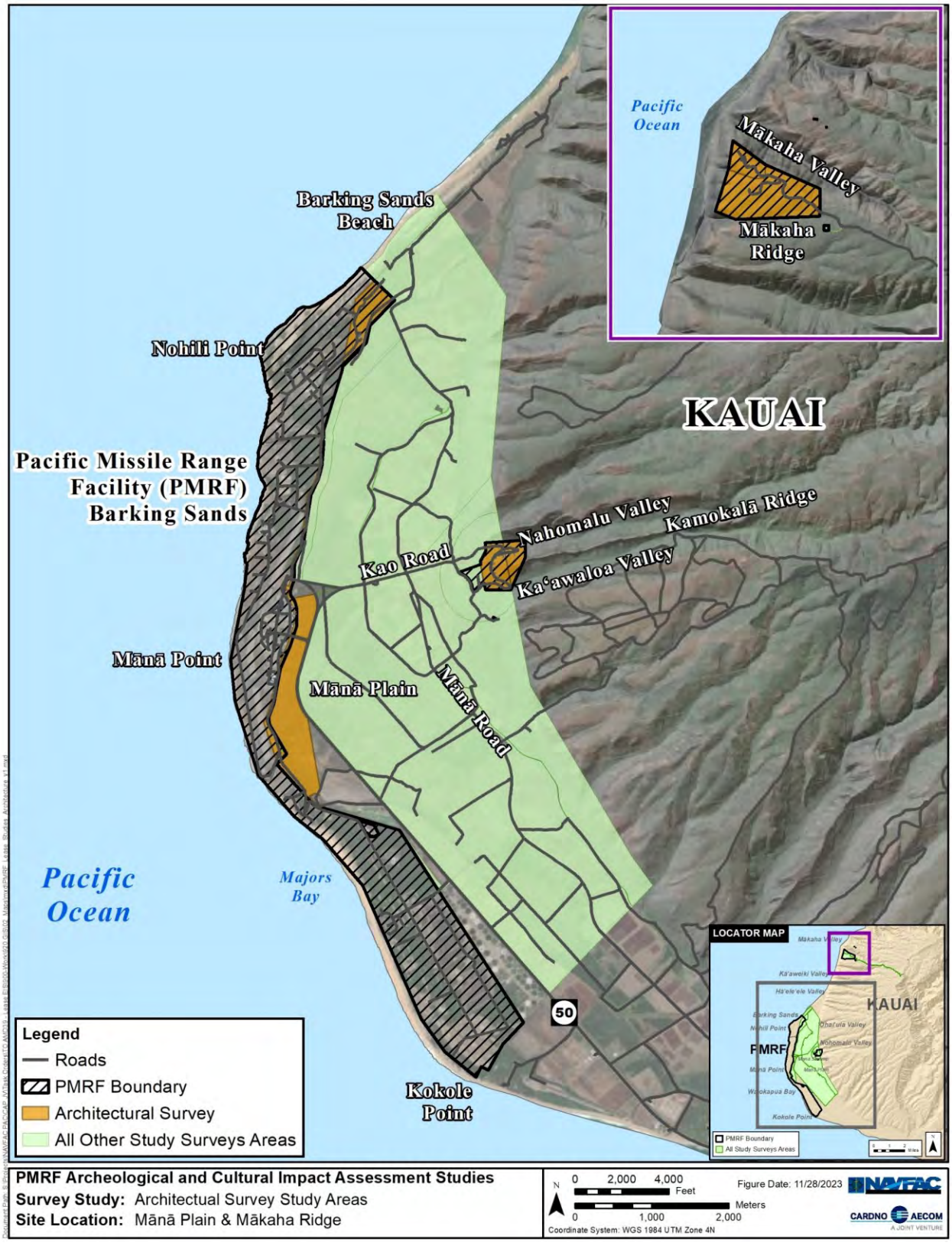

Figure 1 **Architectural survey areas in relation to PMRF Installation boundary and other survey areas.**

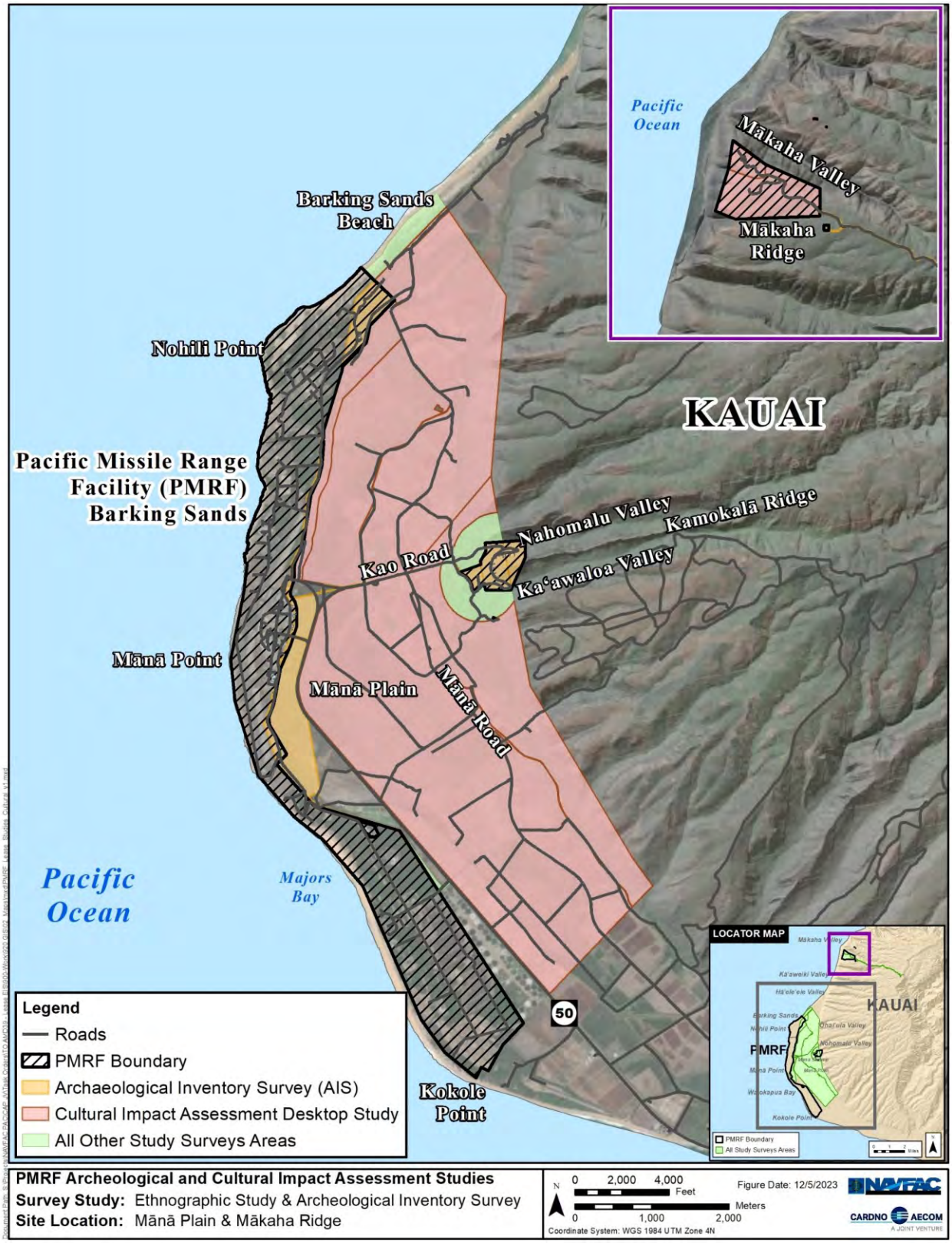

Figure 2 **Archaeology survey and Cultural Impact Assessment study area in relation to PMRF Installation boundary.**

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2 Background

This section presents background information to contextualize the current project and summarizes the physical environment, cultural and historical context, and previous archaeological research. Much of this information has been adapted from the 2005 and 2012 Integrated Cultural Resources Management Plans (ICRMPs) for PMRF (SEARCH 2012; Tomonari-Tuggle and Yoklavich 2005), Bell and Morrison (2009), Knecht and Rieth (2016). Clark et al. (2015) is a synthesized report summarizing information from previous ICRMPs and recent archaeological investigations and is also a common source for this background information. More detailed information about PMRF and the surrounding area can be found in the ICRMPs.

2.1 Physical Environment

PMRF occupies over 2,454 ac (993.5 ha) in five separate areas of the island of Kaua‘i: Barking Sands, Mākaha Ridge, Kōke‘e, Kamokalā Ridge on the west side, and Port Allen on the south shore. Barking Sands and Port Allen are coastal locations. Mākaha Ridge and Kōke‘e are situated on the central mountain mass of the island. Kamokalā Ridge is at the inland edge of the Mānā Plain at the base of the central mountain. The current cultural project is within and around the west side components of PMRF, which is the primary focus of this summary.

PMRF Barking Sands (the installation) covers more than 2,134 ac (864 ha) on the Mānā Plain. The installation occupies most of the coastal fringe of the plain, extending 7.77 miles (mi) (12.5 kilometers [km]) from Kokole Point in the south to Polihale State Park in the north. At its northern and southern boundaries, the installation is slightly over 0.62 mi (1 km) wide, narrowing to less than 0.31 mi (0.5 km) in the central portion. The northern two-thirds of the plain is a complex of three key physiographic features: coastal dune and back beach sands formed by aeolian and wave action, an arc of alluvial/colluvial deposition at the inland edge of the plain, and wetlands in the intermediate area. The southern third of the plain, in contrast, has a low dune, with relatively level soils extending back to the edge of the central mountain.

PMRF Mākaha Ridge Facility encompasses approximately 245 ac (99 ha) of a prominent Nā Pali ridgeline that overlooks the Mānā Plain. The ridge rises from 1,246.72 feet (ft) (380 meters [m]) to 1,853.67 ft (565 m) above sea level with an overall slope from east to west. The terrain surrounding the facility is steep, dropping quickly to the ocean along the west side and into narrow V-shaped drainages along the north and south sides.

PMRF Kamokalā Ridge is just inland from the Mānā Plain, in an area where the ancient 492.13 ft (150 m) to 656.17 ft (200 m) high sea cliffs have been incised by narrow, steep-walled gullies. The more gently sloped foothills at the base of the cliffs and mouths of the gullies have formed alluvial and colluvial arcs that project seaward. Kamokalā Ridge is bound by Nahomalu Valley to the north and Ka‘awaloa Valley to the south.

Rainfall across the survey area is very low, with mean annual precipitation averages of 15 to 20 inches (38–50.8 centimeters), increasing to 36 inches (91.44 centimeters) at Mākaha Ridge Tracking Station and gradually increasing further along Mākaha Ridge to the east with an average of 48 inches (121.92 centimeters) (Giambelluca et al. 2013). Most rain falls between October and April. The aridity of this region is caused by its location in the rain shadow of Mount Kawaikini and Mount Wai‘ale‘ale (Tuggle and Tomonari-Tuggle 1997:37). The average minimum annual temperature occurs in January and is approximately 71°F, and the average maximum temperature occurs in August and is 78°F (Giambelluca et al. 2013).

Numerous soil types are found in the survey area due to the variation in terrain (Figure 3 and Figure 4). The following soil descriptions are adapted from Foote et al. (1972).

Along the coastal survey areas, five primary soil series are present. The Jaucas series, and Jaucas loamy fine sand (JfB), soils are excessively drained, calcareous soils that occur as strips on coastal plains. These soils develop by alluvial and aeolian deposition of sand formed from coral and seashells. Jaucas loamy fine sand (JfB, 0–8 percent slopes) occurs on old beaches and windblown sand deposits in the western and southern areas of Kaua'i. The Kaloko series, and Kaloko clay (Kf) and clay loam (Kfa), are poorly drained soils on coastal plains. These soils developed in alluvium derived from basic igneous rocks; the alluvium has been deposited over marly lagoon deposits. The Mamala series, and Mamala stony silty clay loam (MnC), 0-12% slopes, consist of shallow, well-drained soils along coastal plains. These soils formed in alluvium deposited over coral limestone and consolidated calcareous sand. The Lualualei series, and Lualualei clay (LuA), 0-2% slopes, consist of well-drained soils on coastal plains, alluvial fans, and talus slopes. These nearly level to gently sloping soils developed in alluvium and colluvium. The Nohili series, and Nohili clay (Nh), are poorly drained soils on coastal plains. These soils developed in alluvium that was deposited over marly lagoon deposits. Also present within this area are fill lands, which are low-lying or wetland areas that have been filled with bagasse and slurry from sugarcane processing, and dune lands, which are hills and ridges of sand drifted and piled by wind.

Along Kamokalā Ridge, two primary soil series are present. The Kekaha series, and Kekaha extremely stony silty clay loam (KOYE), 0-35% slopes, consist of well-drained soils on alluvial fans and flood plains that developed in alluvium washed from upland soils. The Waiawa series, and Waiawa extremely rocky clay (WJF), 30-80% slopes, are well-drained, very shallow, extremely rocky upland soils. These soils developed in colluvium and material weathered from basic igneous rock. Also present within this area are rubble lands, where 90 percent or more of the surface is covered by stones and boulders at the base of steep slopes.

Along Mākaha Ridge, five primary soil series are present. The Paaiki series, and Paaiki loam (PGE and PGF) 6-70% slopes, consists of well-drained soils on dissected uplands. These soils developed mainly in material weathered from basic igneous rock but partly in volcanic ash and ejecta. The Oli series, and Oli silt loam (OME and OMF), 10-70% slopes, consists of well-drained, moderately deep to deep soils on uplands. These soils developed in volcanic ash deposited over basic igneous rock. The Mahana series, and Mahana silt loam (MaD and MaE) 12-35% slopes, consists of well-drained soils on uplands. These soils developed in volcanic ash. The Puu Opae series, and Puu Opae silty clay loam (PwC and PwD), 8-40% slopes, consists of well-drained soils on uplands. These soils developed in material weathered from basic igneous rock. The Niu series, and Niu silty clay loam (NcC and NcD), 6-35% slopes, consists of well-drained soils on uplands. These soils developed in material weathered from basic igneous rock, possibly mixed with volcanic ash.

2.2 Traditional Land Use

Traditional land uses near the survey area include habitation, subsistence activities, burial, and travel. These topics are briefly summarized in the following sections.

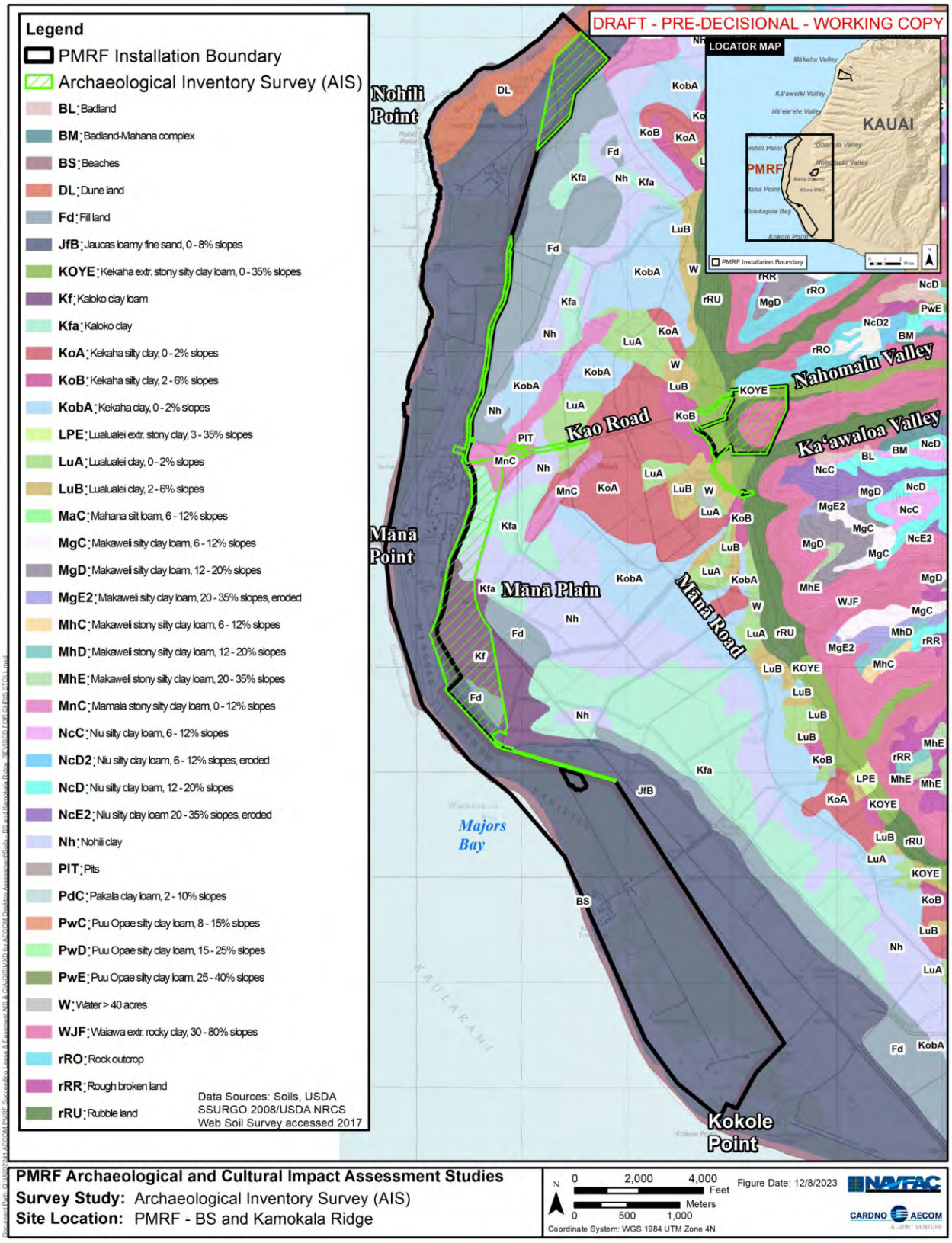

Figure 3 USDA soil classes in the vicinity of the survey area at Barking Sands and Kamokalā Ridge.

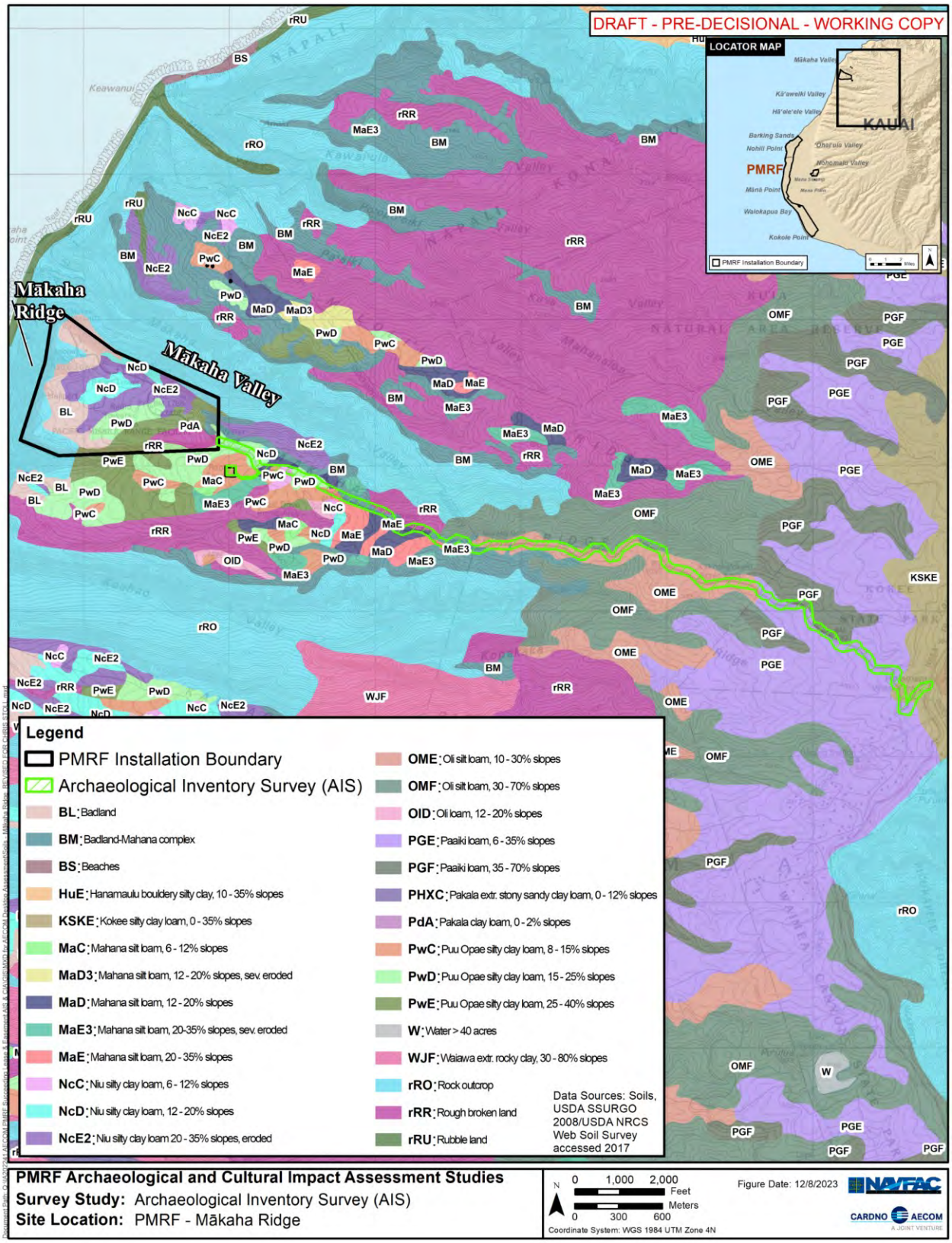

Figure 4 USDA soil classes in the vicinity of the survey area at Mākaha Ridge.

2.2.1 Settlement on the Mānā Plain

Wichman (1991:12), in relaying the story of Polihale, a konohiki (headman of an ahupua'a land division under the chief), describes the Mānā area in pre-Contact times as:

> … a land that stretched from the western cliffs of Na Pali to the eastern boundary shared with Waiawa. Mānā is a land of long white beaches with the ocean on one side and a large swamp that teemed with birds on the other. Inland of the marsh was a fertile strip of land where sweet potatoes and gourds were grown. Above these fields cliffs rose stiff backed, broken wide by valleys down which constantly flowed fresh spring or rain water. The ridges, covered with sandalwood and koa (*Acacia koa*) trees, stretched into the mountains wreathed with cold and misty rain.

It is likely that permanent settlements were concentrated at the inland edge of the Mānā Plain, where houses, temples, and agricultural complexes were built in the foothills at the base of the cliffs, on high ground overlooking the wetlands and coastline.

Small fishing communities, possibly limited to temporary camps, were scattered along the coast, concentrating near optimal localities such as breaks in the reef where canoes could be launched or where reefs provided rich habitat for near-shore marine resources. Some camps were located on the protected, lee sides of the high dunes from Nohili Point to Polihale. Bennett (1931:102) observed house sites marked "by single rows of stones … or by low walls" along the inland side of the dunes. Flores and Kaohi (1992:44) suggest that the sites on the inland side of the high dunes may have been permanent homes for:

> … Those families whose time was mostly occupied with fishing … [The dunes] provided them protection from ocean storm waves, flood waters, and strong on-shore winds—yet, still close enough to easily access the ocean resources. Taro was cultivated in portions of Kolo Swamp that were adjacent and mauka of these house sites.

2.2.2 Resource Collection and Subsistence

The people of Mānā were noted as fishermen, taking advantage of the rich waters of the channel between Kaua'i and Ni'ihau. Fishing was not confined to the ocean and shoreline of Mānā, but also included the swamps and ponds on the coastal plain. The swamp areas of Limaloa, Kawaiele, Nohili, and Kolo were utilized as brackish water loko pu'uone fishponds (Kikuchi 1987:5, 9; Kilauano 1991).

Although their modern forms are clearly related to the plantation era, the Nohili Ditch and the Kawaiele Ditch may have had earlier iterations as traditional Hawaiian ditches related to the functioning of the inland ponds for aquaculture. The Mānā Plain ponds were formed by water accumulating behind the dune berms with the natural ponds enhanced by excavation of channels through the dunes to allow the flow of ocean water into the ponds during high tide (Kikuchi 1987:9). The wetlands were also a place where wild resources could be collected.

Taro, sweet potato, bananas, and other food crops were also grown in and at the mouths of the narrow gulches that fed onto the plain; however, the aridity of the plain limited the amount of farming. Pukui (1983:271) writes of the proverb "Ola i ka 'ai uwahi 'ole o ke kini o Mānā, the inhabitants of Mānā live on food cooked without smoking." She says that in ancient days, the people of Mānā "did very little poi-making, except in a place like Kolo, where taro was grown" (see also Kilauano 1991). Handy (1940:61) notes that "wet taro has been grown at the northern end of the Mānā swamp, near the Barking Sands." However, most Mānā people exchanged fish and dryland products (like gourds) with taro producers from other parts of the island. Thus, because "all the taro cooking and poi-making was done elsewhere, the people of Mānā were said to live on 'smokeless food'" (Pukui 1983:271).

The coastal plain was a source of natural items that were collected and used for a variety of purposes. These included ʻaʻaliʻi shrubs for firewood, hiʻaloa and other plants for medicine, and makaloa and neki for weaving. The neki and makaloa were used in plaiting mats and other articles, the fashioning of which was called moena makaloa.

2.2.3 Burials

Hawaiians share a special connection to birthplace and homeland. As a consequence, burials were often placed close to households and those that have passed away are still considered to be part of the living family system (Flores and Kāohi 1992: 207). According to the Hawaiian tradition, upon death, the spirit travels to a leaping-off place where it is then assisted in its journey to the next realm by its ʻaumakua (Pukuʻi 1972: 40, cited in Flores and Kāohi 1992: 206). Burials form an incredibly important part of the Hawaiian spiritual world and many Hawaiians feel the spirit resides near the physical remains of the bones. When burials are disturbed, the spirit is insulted, resulting in shame and humiliation to the living descendants (Pukuʻi 1972: 109 cited in Flores and Kāohi 1992: 206).

The coastal dunes of the Mānā Plain were the burial grounds of ancient Hawaiians. Human skeletal remains have been found in the sands of PMRF Barking Sands, as well as in mixed sandy soils nearly 1 km inland, from the north end of the installation to Waiokapua Bay and Kokole to the south. References to burials in the Nohili area appear in oral traditions and literature (e.g., Fornander 1917).

In addition to burial locations, the spiritual significance of the Mānā Plain is also evidenced by the presence of several important *heiau*, most notably Polihale and ʻElekuna *heiau.* ʻElekuna was known as a particularly important and special *heiau* that King Kalakaua and his priests visited many times (Flores and Kāohi 1992: 45). Polihale *heiau* was a site of religious observance where rites associated with departing souls would be carried out. A sacred spring in a nearby cliff was used for purification of those souls making their journeys into the next realm (Flores and Kāohi 1992: 45).

2.2.4 Transportation

There were two primary traditional land routes across the Mānā Plain: one along the shoreline and the other along the base of the cliffs and ridges. Other trails ran inland from the coastal plain to the mountains. People also traveled by canoe, particularly going to and from the valleys of the Nā Pali coast, by launching from beaches with unobstructed reefs and passageways such as at Palaiholani, Keanapuka, Poʻoahonu, Keawanaiʻa, and Polihale.

An unusual means of travel in this area is noted in historical accounts that describe the Mānā Plain after heavy flooding from Kona storms. These accounts note that one could travel by canoe from Waimea to Kolo through Mānā swamps and marsh lands. Faye (1981) recalls that “in a low bottomed canoe you could row for miles on this lake.… The canoe would tip over and if you were very short you wouldn’t be able to touch bottom, but if you were taller, you could sort of tread over.”

2.3 Historical Land Use

Historical land uses in this area include agriculture and U.S. military activities.

2.3.1 Agriculture

Early Western explorers were not particularly interested in the Mānā Plain, which was described as a hot and dry place with large sections of marshland (Portlock 1789:170-171; SEARCH 2012). The inhabitants of Mānā largely lived in the traditional ways of their ancestors until the 1848 Māhele, which wrought wide-ranging social changes and provided for private land ownership. Shortly after the Māhele, commercial agricultural practices were brought to the Mānā Plain by leases on crown lands to Archibald Archer and

eventually Valdemar Knudsen, and practices included grazing cattle, harvesting timber, and cultivating crops such as tobacco, coffee, fruit, rice, and sugarcane (Jones 1992:6; Sweeney 1994:10; SEARCH 2012).

As commercial crop cultivation increased, so, too, did the number of agricultural workers. The majority of these agricultural workers came from China, Japan, and the Philippines. With the influx of agricultural workers, the need for workers' housing increased, and according to Smith (1989:4), the first camp for housing agricultural workers dates to 1852. As agricultural production on the Mānā Plain expanded, much of the marshland was filled in or drained to provide more arable land, with increasing amounts of land being converted to sugarcane cultivation. Much of this was operated by the Kekaha Sugar Company, Ltd, which was formed in 1898 by Knudsen and L'Orange and continued operations through the 20th century (SEARCH 2012).

At Kamokalā Ridge, the area developed in the mid-nineteenth century for cattle grazing and ranching as well as commercial sugar and rice plantations. Plantation workers lived in camps throughout Mānā Plain, including between Kamokalā Ridge and PMRF, and railroad lines extended through fields connecting the agricultural goods to the wharf at Waimea. Plantation operations in the area had all closed by 2000 (TEC Inc.–JV 2011a).

2.3.2 U.S. Military

The following section provides a brief historical overview of U.S. Military land use in the three primary survey areas.

2.3.2.1 Barking Sands

One of the first non-agricultural land uses in the study area was an airstrip. This facility was established by the Territory of Hawai'i in 1921 and constructed by 1928 on a portion of the land that would later become PMRF Barking Sands (SEARCH 2012). The landing field at Barking Sands was not intended to be a commercial airport due to its distance from Waimea but was considered a good location as a stopover for transpacific flights. However, the airfield was seldom used and poorly maintained. Figure 5 shows the location of the landing field in 1935.

In 1940, the airfield at Barking Sands was designated for military use by the U.S. Army (SEARCH 2012). The airfield was expanded by 2,058 ac (832.8 ha) in 1941, quadrupling in size. Figure 5 shows the location of the landing field in 1935 and Figure 6 shows the airfield in 1941, before U.S. involvement in World War II (WWII). The massive land acquisition occurred primarily to the north and south of the existing airstrip along the coast. In May 1942, following the Pearl Harbor attack, the airfield became Barking Sands Army Air Base (TEC Inc.–JV 2011a). Figure 7 shows the landing field in 1943 after the expansion and improvements were completed. After its establishment as an Air Base, Barking Sands was used for flight training and aircraft refueling as the U.S. became involved in WWII (SEARCH 2012). In 1943, Kamokalā Ridge underwent construction, and 10 tunnel magazines with monorail transportation were built for bomb storage. As World War II progressed, Barking Sands was designated as a Combat Crew Replacement Center in 1944, establishing the base as an aircraft maintenance center and training grounds for crew prior to deployment to the Pacific Theater (SEARCH 2012). After World War II ended in 1945, base activity gradually decreased.

The late 1940s saw a decline in military activities as Barking Sands was transferred from the Army to the U.S. Air Force, becoming Barking Sands Air Force Base in 1948 (SEARCH 2012). The U.S. Navy established PMRF at the airfield in 1958 after using the area in 1956 for training operations on Regulus guided missiles, the first major Cold War mission at Barking Sands. The Atomic Energy Commission was a major tenant on base and created the Kauai Test Facility in the early 1960s, operated by Sandia

National Laboratories. Mākaha Ridge, a northern outpost near Waimea Canyon, was developed by the Navy in 1966 to aid the new Barking Sands Tactical Underwater Range and to house radar and telemetry facilities (SEARCH 2012).

Figure 5 Barking Sands Landing Field in 1935. Source: National Archives.

Figure 6 Barking Sands Army Air Base in 1941. Source: National Archives.

Figure 7 Barking Sands Army Air Base in 1943. Source: National Archives.

2.3.2.1 Kamokalā Ridge

The naval facilities at Kamokalā Ridge were developed in 1942-43, shortly after the attack on Pearl Harbor (SEARCH 2012). As PMRF Barking Sands was expanded to include strategic offensive facilities to provide service, equipment, and maintenance for B-24 bombers heading into the Pacific, several critical facilities were built underground to provide greater protection from aerial attacks. It was during this initial construction phase that the Kamokalā Ridge magazines were dug out of its basalt cliffs, some with monorails to transport munitions (TEC Inc.–JV 2011a) in 1943 (see Figure 8 and Figure 9). Records also indicate that during the 1960s, the Navy stored High Altitude Sounding Projectile (HASP) boosters in the hard-rock magazines at Kamokalā Ridge as part of Cold War missions at PMRF (SEARCH 2012). Between 1966 and 1992, the Hawaii Air National Guard occupied portions of PMRF and, during this period, acquired one of the 10 hard-rock magazines to use for storage of weapons and ordinance. Two large, earth-covered missile magazines were constructed at Kamokalā Ridge in 2002 (TEC Inc.–JV 2011a).

Known extant historic-era built resources within Kamokalā Ridge include 10 National Register of Historic Places-eligible tunnel magazines (Facilities 1-10) (SEARCH 2012). Kamokalā Ridge is accessed via the Ordnance Gate of Barking Sands and Kamokalā Ridge Road, which follows its original 1942 alignment and includes an extant vehicular bridge (Facility 20) (TEC Inc.–JV 2011a).

2.3.2.2 Mākaha Ridge

Mākaha Ridge was formally developed by the Navy in 1966 to aid the new Barking Sands Tactical Underwater Range and to house radar and telemetry facilities (SEARCH 2012). Construction at Mākaha

Ridge was a large undertaking and required extensive development of the landscape, including the installation of access roads (Weitze 2008). The site is accessed by the Mākaha Ridge Access Road, which is a long, narrow, paved road located in the forested lands stemming from Kōkeʻe Road to the southeast (TEC Inc. 2011a).

Prior to the Cold War, one facility existed at Mākaha Ridge, The Command Control Transmit Van Site (Building 200531) was constructed in 1946. Facilities built during the Cold War on Mākaha Ridge included a communications facility (Building 708), power station (Building 711), tracking radar (Building 713), and surveillance radar (Building 715) (Weitze 2008). A filling station (Building 733) was added in 1960. A helicopter pad was installed on the western portion of the Mākaha Ridge site sometime after 1966.

Several additional facilities were added between 1967 and 1970, including a telemetry facility (Building 725) and three telemetry towers (Buildings 726, 727, and 728) (see Figure 10 and Figure 11) (Weitze 2008, SEARCH 2012). An electric and communication maintenance shop (Building 742) was added to Mākaha Ridge in 1983. Mākaha Ridge, in combination with the Barking Sands Tactical Underwater Range and PMRF launch complex, comprised a National Missile Range and an underwater range (TEC Inc. 2011a). These ranges were used to train personnel in nuclear submarines operations and anti-submarine warfare during the Cold War era, and Mākaha Ridge supported naval weapons tests and evaluations during Navy fleet exercises (SEARCH 2012). Prior historic building surveys conducted at Mākaha Ridge include Dowden and Rosendahl in 1993, Drolet et al. in 1996, and Maly and Wulzen in 1997.

Figure 8 Example of Kamokalā Ridge missile magazine. Source: Tomonari-Tuggle and Yoklavich (2005).

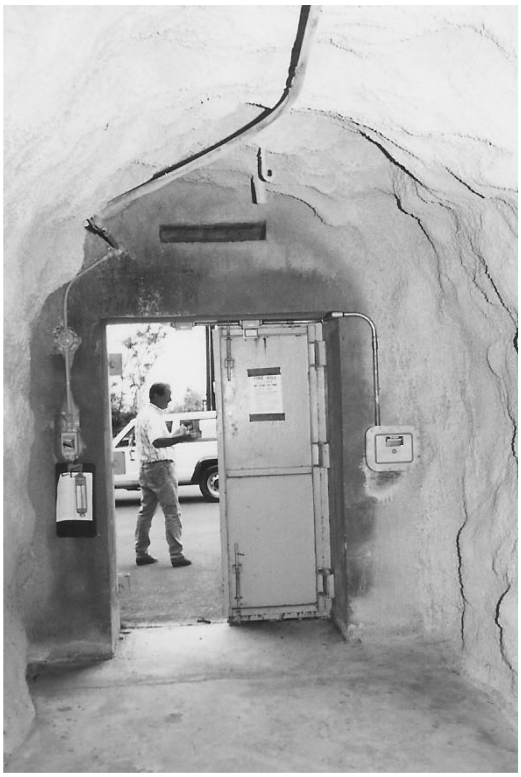

Figure 9 **Example of Kamokalā Ridge missile magazine. Source: Tomonari-Tuggle and Yoklavich (2005).**

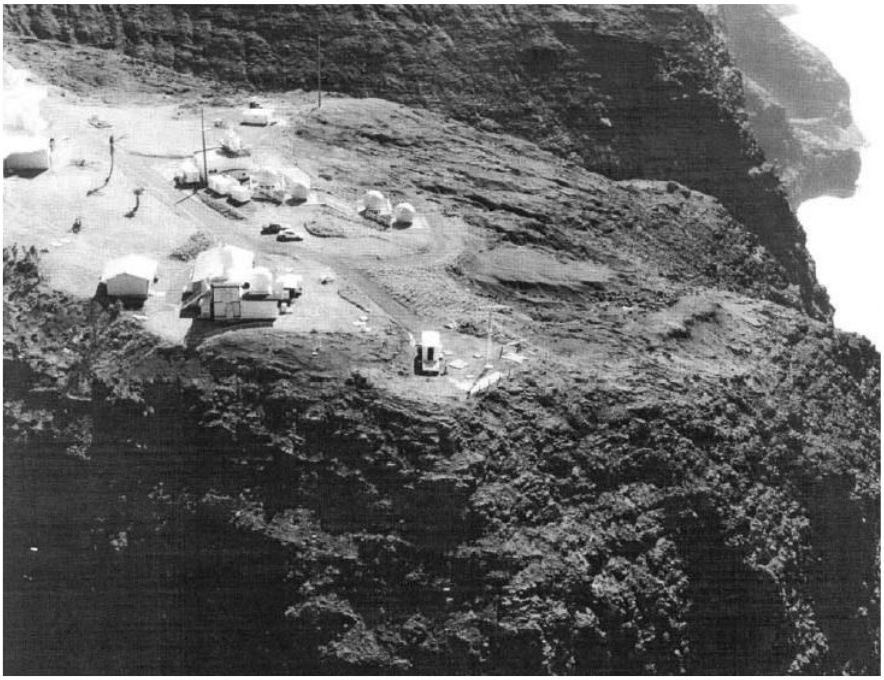

Figure 10 **Mākaha Ridge Tracking Station in the 1960s. Courtesy of PMRF.**

Figure 11 Mākaha Ridge Tracking Station with Mākaha Ridge Road in the background. Courtesy of PMRF.

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Appendix B
Regulatory Setting

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Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
County of Kaua'i	Kaua'i Kakou – Kaua'i County General Plan	The Kaua'i General Plan serves as the county's guiding policy framework concerning growth, land use, and development issues. The plan seeks to enhance and improve Kaua'i's physical and natural environment and overall quality of life. The plan is built upon a countywide vision and goals statement and sets forth key objectives and actions. The General Plan underwent a comprehensive update in 2018. Although the development plan does not apply to projects on federal property, protection of mountain and ocean views that benefit the visual quality of the ROI should be considered.	Visual Resources and Land Use	This EIS was developed in accordance with the guidance in this plan.
County of Kaua'i Transportation Agency – The Kaua'i Bus	County of Kaua'i Transportation Agency standards for public transit operation (physical and operational) and DTS Roadway and Traffic Operations Guidelines	County of Kaua'i Transportation Agency operates the Kaua'i Bus, the public transit system that provides service to PMRF.	Traffic	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
CEQ; Navy	NEPA; CEQ NEPA implementing regulations; Navy procedures for implementing NEPA (42 U.S.C. § 4331; 40 CFR parts 1500-1508; 32 CFR part 775)	Regulations applicable to and binding on all federal agencies for implementing the procedural provisions of NEPA.	All Resources	This EIS has been prepared in accordance with the President's revised CEQ Regulations implementing NEPA and Navy NEPA procedures effective for actions initiated after September 14, 2020. Preparation of this EIS and provisions for its public review are being conducted in compliance with NEPA.
CEQ	NEPA 40 CFR § 1502.16(a)(10)	States that environmental consequences should include "economic and technical considerations, including the economic benefits of the proposed action," where applicable.	Socioeconomics	Following these regulations, the socioeconomic analysis in this EIS evaluates economic benefits of the Proposed Action.
CEQ	NEPA 40 CFR § 1508.1(g)(1)	States that effects include "aesthetic, historic, cultural, economic (such as the effects on employment), social, or health" effects.	Socioeconomics	Following these regulations, the socioeconomic analysis in this EIS evaluates how elements of the human environment such as population, employment, housing, economic activity, and local government revenue might be affected by the Proposed Action.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
CEQ	NEPA 40 CFR § 1508.1(m)	States that the human environment means "comprehensively the natural and physical environment and the relationship of present and future generations of Americans with that environment."	Socioeconomics	Following these regulations, the socioeconomic analysis in this EIS uses this definition for the human environment.
CEQ	Environmental Justice Guidance Under the National Environmental Policy Act	Guidance document to assist federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed in accordance with EO 12898.	Environmental Justice and Protection of Children	This EIS was developed in accordance with this guidance.
CEQ	Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews	Guidance to assist federal agencies in their consideration of the effects of GHG emissions and climate change when evaluating proposed federal actions in accordance with NEPA.	All Resources	This EIS was developed in accordance with this guidance.
CEQ	Fiscal Responsibility Act of 2023, PL 118-5	Amendments to NEPA	All Resources	This law was used to determine the joint status of NASA and Navy for the preparation of this EIS.
CEQ and Office of Science and Technology Policy	EO 13840 Ocean Policy to Advance the Economic, Security, and Environmental Interest of the U.S.	Ensure protection, maintenance, and restoration of the health of the ocean.	Water Resources; Marine Biological Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order.
CNRH	IAP	The IAP is a guidance document that provides aesthetic and functional direction in site design, architecture, landscape architecture, and signage for new development and renovation efforts. The IAP helps to protect and preserve the installation's natural and historic integrity and ensures a unified appearance for each installation and continuity across the region.	Visual Resources	This EIS was developed in accordance with the guidance in this plan.
DLNR-SHPD	Hawai'i Revised Statutes 6E-42	Project requires compliance with state laws for preservation of historic properties.	Cultural Resources	Compliance with this law will be conducted.
DoD	DoD Inst. 4715.06 – Environmental Compliance in the United States	Establishes policies, assigns responsibilities, and provides procedures for achieving and maintaining environmental compliance in the U.S.	Hazardous Materials and Wastes	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
DoD	DoD Inst. 6050.05 – DoD Hazard Communication Program	Manages hazardous substances to minimize health and environmental risks and operational costs. Provides known hazard information to military personnel and civilian employees using hazardous chemicals, including engineered nanomaterials.	Hazardous Materials and Wastes	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
DoD	NAVSUP Pub. 573 (DLA Instruction 4145.11) – Storage and Handling of Hazardous Materials	Procedures for the receipt, storage, and handling of hazardous materials and wastes by DoD components, installation, and activities.	Hazardous Materials and Wastes	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
DoD	Defense Explosives Safety Regulation 6055.09	Establishes explosives safety standards for the DoD that are designed to manage explosives related risk associated with DoD operations and installations by providing protection criteria.	Hazardous Materials and Wastes	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
DoD	DoD Directive 4710.03, Consultation with Native Hawaiian Organizations (October 25, 2011, incorporating Change 1, August 31, 2018)	Provides policy, prescribes procedures, and assigns responsibilities for the management of archaeological and historic resources located in and on waters and lands under DoD control. It is the policy of DoD to integrate historic preservation requirements with the planning and management of activities under DoD control.	Cultural Resources	Consultation with NHOs, if required for compliance with NHPA according to the Programmatic Agreement, would be conducted in accordance with this directive.
DoD	Danger Zone and Restricted Area Regulations (33 CFR part 334)	Hazardous materials and wastes exposure, including MEC.	Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
DoD	Final Military Munitions Rule (40 CFR part 266, Subpart M)	Hazardous materials and waste exposure, including MEC.	Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
DoD	Naval Ordinance Safety and Security Activity Instruction 8020.15E. Explosives Safety Review, Oversight, and Verification of Munitions Responses	Munition exposure.	Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
EPA; DoD	CWA (33 U.S.C. §§ 1313, 1314, 303(d), 305(b) and most recent 304(a) list)	Mitigates impacts to surface water from construction activities and discharge to navigable waters.	Hazardous Materials and Wastes; Water Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
EPA; HDOH-CWB	CWA section 402, NPDES Program (42 U.S.C. § 7401 et seq.); Hawai'i Water Quality Standards (HAR 11- 55; HRS Chapter 342D) *includes NPDES and SWPPP	Regulates discharges of pollutants from point source to WOTUS and requires compliance with standards, limitations, and regulations. NPDES permits authorized discharges of stormwater associated with construction and industrial activities.	Hazardous Materials and Wastes; Water Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
EPA; HDOH-CWB	CWA section 401 (33 U.S.C. § 1341; 40 CFR §§ 121.2(a)(3), (4), and (5) Water Quality Certification); Hawai'i Water Quality Standards (HAR 11- 54; HRS Chapter 342D)	Any federally authorized activity that may result in any discharge into state waters requires a Water Quality Certification. Water pollutants that enter state waters from all sources, point or non-point, shall comply with applicable requirements as established in HAR, Chapter 11-54.	Marine Biological Resources; Water Resources; Public Health and Safety; Geological Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
EPA	Title 40 CFR et seq.: Protection of the Environment	EPA protects human health and the environment.	Hazardous Materials and Wastes; Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
EPA	40 CFR § 125.94	Compliance with BTA Standards.	Water Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
EPA	National Primary Drinking Water Regulations 40 CFR part 141	Affects management of water sources by way of setting standards for drinking water quality. Groundwater quality and quantity are regulated under several statutes and regulations, including the Safe Drinking Water Act.	Water Resources; Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
EPA	Energy Independence and Security Act; PL 110-140 section 438	Federal agencies are required to reduce stormwater runoff from federal development and redevelopment projects to protect water resources.	Water Resources; Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
EPA	RCRA 42 U.S.C. § 6901 et seq. and 40 CFR parts 260-272 as relates to hazardous waste management	Hazardous materials and wastes exposure. The EPA controls hazardous waste including generation, transportation, treatment, storage, and disposal of hazardous waste.	Hazardous Materials and Wastes; Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in compliance with this Act.
EPA	Toxic Substances and Disease Registry – CERCLA 42 U.S.C. §§ 9601–9675; 40 CFR parts 300–311; 40 CFR part 373	Hazardous materials and waste exposure.	Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in compliance with this Act.
EPA	Pollution Prevention Act of 1990 (42 U.S.C. §§ 13101–13109)	Hazardous materials and waste exposure.	Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
EPA	Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. § 11001 et seq.; 40 CFR parts 350–372)	Hazardous materials and wastes exposure. Helps communities plan for chemical emergencies and requires industry to report on the storage, use, and releases of hazardous substances to federal, state, and local government.	Hazardous Materials and Wastes; Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with this Act.
EPA	EO 13045, Protection of Children from Environmental Health Risks and Safety Risks	Health and safety of children (vulnerable population).	Public Health and Safety; Environmental Justice and Protection of Children	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order. The EIS includes an analysis to determine if federal actions would have disproportionate human health or environmental impacts to children.
EPA	Federal Insecticide, Fungicide, and Rodenticide Act of 1996 (7 U.S.C. § 136 et seq.)	Hazardous materials and waste exposure.	Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
EPA	Federal Environmental Pesticide Control Act of 1972 (7 U.S.C. §§ 136–136y)	Hazardous materials and waste exposure.	Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
EPA	Federal Facilities Compliance Act of 1992 (PL 102–386)	Hazardous materials and waste exposure.	Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
EPA	Noise Control Act of 1972 (PL 92- 574, 42 U.S.C. § 4901 et seq.) and Amendments of 1978 (PL 95-609)	Establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare.	Noise; Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in compliance with this Act.
EPA	40 CFR part 50	NAAQS.	Air Quality	The Proposed Action would not cause a violation of the NAAQS.
EPA	40 CFR part 60	New Source Performance Standards.	Air Quality	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
EPA	40 CFR parts 61-63	NESHAPs.	Air Quality	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.
EPA	40 CFR part 70	State Operating Permits.	Air Quality	The Proposed Action analyzed in this EIS would be implemented in accordance with these requirements.
EPA	Memorandum addressing Children's Health through Reviews Conducted Pursuant to the NEPA and section 309 of the Clean Air Act	Memorandum on addressing the Protection of Children from environmental health risks and safety risks in NEPA and section 309 Clean Air Act Reviews in accordance with EO 13045.	Environmental Justice and Protection of Children	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order. The EIS includes an analysis to determine if federal actions would have disproportionate human health or environmental impacts to children.
Federal Law	National Historic Preservation Act (NHPA), as amended (54 U.S.C. 300101 et seq.).	Establishes national policy for the preservation of historic properties. Section 106 of the NHPA requires federal agencies to consider the effects of proposed undertakings, mitigate adverse effects of projects, and afford the ACHP and interested parties the opportunity to comment.	Cultural Resources	Compliance with the NHPA will be conducted according to the 2012 COMNAVREG Hawaii Programmatic Agreement and any applicable amendments.
Federal Law	Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. §§ 3001-3013).	Provides for the protection and repatriation of Native American and Native Hawaiian human remains and cultural items discovered on federal or tribal lands or currently curated by federal or federally assisted curation facilities.	Cultural Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this law and its implementing regulation.
Federal Law	Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aa-470ll).	Provides for the protection of archaeological resources and sites on public and Indian lands by requiring permits from the federal land manager for excavation or removal of archaeological resources.	Cultural Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this law and its implementing regulation.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
Federal Law	American Indian Religious Freedom Act of 1978 (42 U.S.C. § 1966)	Establishes the policy of the United States to protect and preserve the rights of American Indians, Eskimos, Aleuts, and Native Hawaiians to believe, express, and exercise their traditional religions.	Cultural Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this law and its implementing regulation.
FEMA	Floodplain Management, EO 11988	Requires federal agencies to avoid long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development. Flood potential of a site is usually determined by the 100-year floodplain, which is defined as the area that has a 1 percent chance of inundation by a flood event in a given year.	Water Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order.
HDOH	CWA section 401 (33 U.S.C. § 1341, 40 CFR §§ 121.2(a)(3), (4), and (5) Water Quality Certification); Water Pollution Control Act (33 U.S.C. § 1251 et seq.)	Any federally authorized activity that may result in a discharge into state waters requires a Water Quality Certification. Potential impacts from the Proposed Action through impacts on water quality. The Kawaiʻele Pumping Station as well as Canal discharge may fall under these regulations.	Marine Biological Resources; Hazardous Materials and Wastes	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
HDOH	22 HAR Title 11, Chapter 59	State AAQS.	Air Quality	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
HDOH	22 HAR Title 11, Chapter 60.1	Air Pollution Control.	Air Quality	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
HDOH	Hawaiʻi Underground Storage Tanks Act HAR 19-342L	Regulations pertaining to underground storage tanks, which includes hazardous substances release.	Hazardous Materials and Wastes	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
HDOH	Solid Waste Management Control HAR 11-58	Establishes minimum standards governing design, construction, installation, operation, and maintenance of solid waste disposal, recycling, reclamation, and transfer systems.	Hazardous Materials and Wastes	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
HDOT	HDOT traffic operational and safety standards and HDOT roadway design standards	Regional and sub-regional roadways providing access to PMRF are under the jurisdiction of HDOT, specifically Kuhio Highway.	Traffic	The Proposed Action analyzed in this EIS would be implemented in accordance with these standards.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
NASA	NASA's Procedures for Implementing NEPA, 14 CFR part 1216, et seq.	Regulations governing NASA's compliance with NEPA and CEQ's 40 CFR parts 1500–1508.	All Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
NASA	NASA Environmental Management, NPD 8500.1	NASA's environmental management policy	All Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these policies.
NASA	NASA National Environmental Policy Act Management Requirements, NPR 8580.1	Establishes procedures and responsibilities for complying with requirements of NEPA, CEQ's implementing regulations, EO 12114 – Environmental Effects Abroad of Major Federal Actions, and NPD 8500.1.	All Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these requirements.
Navy	PMRF Installation Development Plan	Land use constraints.	Land Use	This EIS was developed in accordance with the guidance in this plan.
Navy	OPNAVINST 11010.40	Establishes an encroachment management program to ensure operational maintenance that has direct bearing on land use planning on installations.	Land Use	The Proposed Action analyzed in this EIS would be implemented in accordance with these guidelines.
Navy	OPNAVINST 11010.36C	Provides guidance administering the AICUZ program, which recommends land uses that are compatible with noise levels, accident potential, and obstruction clearance criteria for military airfield operations.	Land Use	The Proposed Action analyzed in this EIS would be implemented in accordance with these guidelines.
Navy	OPNAVINST 3550.1A	Provides guidance for the RAICUZ program. This program includes range safety and noise analyses and provides land use recommendations that are compatible with Range Compatibility Zones and noise levels associated with military range operations.	Land Use	The Proposed Action analyzed in this EIS would be implemented in accordance with these guidelines.
Navy	OPNAVINST 5090.1 Environmental Readiness	Provides guidance for the management of the environmental, natural, and cultural resources for all Navy ships and shore activities.	Cultural Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these guidelines.
Navy	Environmental Readiness Program Manual (OPNAV-M 5090.1)	Navy's policy guidance for environmental readiness. It discusses requirements, delineates responsibilities, and issues policy guidance for the management of the environmental, natural and cultural resources for all Navy ships and shore activities.	All Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this manual.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
Navy	SECNAVINST 4000.35B Department of the Navy Cultural Resource Program	Provides clarification on the responsibilities for management of historic buildings, structures, districts, archaeological sites and artifacts, historic ships and aircraft, and other cultural resources.	Cultural Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these guidelines.
Navy	SECNAVINST 11010.14B Department of the Navy Policy for Consultation with Federally Recognized Indian Tribes, Alaska Native Tribal Entities, and Native Hawaiian Organizations	Provides policy, procedures, and responsibilities when consulting with representatives of federally recognized Indian tribes, including Native Hawaiian Organizations.	Cultural Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with these guidelines.
NAVFAC	PW6 600-01, Public Works Utilities Criteria for Design and Construction of Electrical, Sewer, and Water, April 10, 2006	Utilities design criteria.	Utilities	The Proposed Action analyzed in this EIS would be implemented in accordance with these requirements.
NAVFAC	PW6 600-01 Public Works Utility Criteria for Design and Construction of Water Utilities	Utilities design criteria.	Utilities	The Proposed Action analyzed in this EIS would be implemented in accordance with these requirements.
NOAA; SOH, Office of Planning and Sustainable Development	National Coastal Zone Management Act (16 U.S.C. § 1451, 15 CFR part 930); Coastal Zone Management Act section 307(c)(1), HRS Chapter 205A – Coastal Zone Management	Federal actions or activities that affect any land or water use or natural resource of the coastal zone are to be carried out in a manner consistent to the maximum extent practicable with the enforceable policies of federally approved state coastal management program.	Hazardous Materials and Wastes; Land Use; Water Resources; Geological Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this Act to the extent practicable, consistent with the enforceable policies of Hawai'i's federally approved coastal management program.
NOAA NMFS; USFWS; SOH, DLNR	ESA (16 U.S.C. § 1531 et seq.); State of Hawai'i Endangered Species Laws (HAR 12-124, Exhibit 2 and HRS § 195D)	Potential impacts to federally and state listed species.	Terrestrial Biological Resources; Marine Biological Resources; Land Use	Informal consultation with NMFS and USFWS has been initiated and is ongoing, and the Proposed Action analyzed in this EIS would be implemented in compliance with the ESA. Potential impacts to state-listed species are addressed in this EIS. This is pending review of monk seal haul-out in the leasehold area; additional review of ESA species is covered in the Hawaii-Southern California Training and Testing EIS.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
NOAA NMFS; SOH, DLNR; EPA	EO 13089, Coral Reef Protection	All federal agencies whose actions may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.	Marine Biological Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order.
NOAA NMFS; HDOH	EO 12088, Federal Compliance with Pollution Control Standards	Ensures federal compliance with applicable pollution control standards. Related to impacts from sediment resuspension and runoff due to operations.	Marine Biological Resources; Water Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order.
NOAA NMFS	Section 305 of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq.)	EFH is not expected but could be designated in the study area.	Marine Biological Resources	The project is within areas designated as EFH; therefore, the Navy will provide NMFS with a written assessment of the effects of the Proposed Action on EFH. This analysis is covered in the Hawaii-Southern California Training and Testing EIS.
NOAA NMFS	Marine Mammal Protection Act (16 U.S.C. § 1361-1407)	Presence of one marine mammal, Hawaiian monk seal (*Neomonachus schauinslandi*), which is known to appear in study area.	Marine Biological Resources	Informal consultation with NMFS has been initiated under the ESA.
OSHA	Occupational Safety and Health Act of 1970 (PL 91-596); OSHA Occupational Noise Exposure (29 CFR § 1910.95)	Workforce safety, including occupational noise exposure limits.	Public Health and Safety; Noise	The Proposed Action analyzed in this EIS would be implemented in accordance with these requirements.
Office of the President	EO 11990, Protection of Wetlands (42 FR 26961, May 24, 1977)	Requires federal agencies to adopt a policy to avoid long- and short-term adverse impacts associated with destruction and modification of wetlands and to avoid the direct and indirect support of new construction in wetlands whenever there is a practicable alternative.	Water Resources; Hazardous Materials and Wastes	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
Office of the President	EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (59 FR 7629; February 16, 1994)	Requires agencies to identify and address any disproportionately high and adverse human health or environmental effects their programs, policies, and activities may have on minority populations and low-income populations.	Environmental Justice and Protection of Children	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order. The EIS includes an analysis to determine if federal actions would have disproportionate human health or environmental impacts on low income populations, minority populations, or the Native Hawaiian population.
Office of the President	EO 13045, Protection of Children from Environmental Health Risks and Safety Risks (62 FR 19885; April 23, 1997)	Requires agencies to identify and assess environmental health risks and safety risks that may disproportionately affect children and ensure that their policies, programs, activities, and standards address those disproportionate risks.	Environmental Justice and Protection of Children; Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order.
Office of the President	EO 13112, Invasive Species (64 FR 6183; February 3, 1999)	Requires federal agencies whose actions may affect the status of invasive species to identify those actions and use relevant programs and authorities to prevent and manage the introduction of invasive species in consultation with the Invasive Species Council.	Terrestrial Biological Resources; Marine Biological Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order.
Office of the President	EO 14008, On Tackling the Climate Crisis at Home and Abroad (86 FR 7619; January 27, 2021)	Amends EO 12898 by updating the interagency working group and requiring the working group to report back with recommendations to improve environmental justice.	Environmental Justice and Protection of Children	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order. The EIS includes an analysis to determine if federal actions would have disproportionate human health or environmental impacts on low income populations, minority populations, or the Native Hawaiian population.
State of Hawai'i - Office of Planning and Sustainable Development (OPSD)	Coastal Zone Management Act Section 307/CZM Program	The national Coastal Zone Management Act (CZMA), Section 307, requires federal agency activities and development projects affecting any coastal use or resource to be undertaken in a manner consistent to the maximum extent practicable with the state's CZM program. The CZM area encompasses the entire state because there is no point of land more than 30 miles from the ocean, a definite land-sea connection exists throughout the state. The project exists within the CZM area.	All Resources	A CZM federal consistency review and application will be completed and submitted to the State of Hawai'i CZM program office.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
State of Hawai'i – Department of Land and Natural Resources (DLNR)	Hawai'i Revised Statutes Chapter 343 commonly referred to as The Hawai'i Environmental Policy Act ("HEPA"). The trigger for compliance is the use of state lands.	The State of Hawai'i Department of Land and Natural Resources will be the accepting agency for the EIS document for Hawai'i Revised Statutes Chapter 343.	All Resources	This EIS was developed in accordance with the Hawai'i Revised Statutes Chapter 343
SOH	Hawai'i Administrative Code Title 19, 342F Noise Pollution	Describes environmental noise levels appropriate for noise sensitive land uses.	Noise	The Navy will consider state regulations for noise-sensitive land uses. Sources of noise and the associated sensitive receptors in the human environment are analyzed in this EIS.
USDA, NRCS	Farmland Protection Policy Act (7 U.S.C. §§ 4201-4209 7)	Requires federal agencies to evaluate the adverse effects of their activities on farmland, which includes prime and unique farmland and farmland of statewide or local importance, and to consider alternative actions that could avoid adverse effects.	Geological Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this Act. The EIS includes an analysis to determine if federal actions would have adverse effects on farmland, which includes prime and unique farmland and farmland of statewide or local importance.
USDOT	49 CFR §§ 171.1-172.558	Regulates and ensures the safe and secure movement of hazardous materials to industry and consumers by all modes of transportation, including pipelines.	Hazardous Materials and Wastes	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
USDOT	USDOT Hazardous Materials Ground Transport Regulations/Hazardous Materials Transportation Act (49 CFR parts 100–185)	Transportation safety; hazardous materials and waste exposure.	Public Health and Safety	The Proposed Action analyzed in this EIS would be implemented in accordance with these regulations.
USFWS	Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703–712)	Potential impacts to bird species protected by the Act.	Terrestrial Biological Resources; Land Use	The Proposed Action analyzed in this EIS would be implemented in accordance with this Act.

Agency	Federal, State, Local, and Regional Laws; Land Use Plans; Policies; Controls; and Guidance	Relevance to the Proposed Action	Relevant Resources	Status of Compliance
USFWS	EO 13186: Responsibilities of Federal Agencies to Protect Migratory Birds	Potential impacts to migratory birds.	Terrestrial Biological Resources	The Proposed Action analyzed in this EIS would be implemented in accordance with this Order.

Key: § = section(s); AAQS = ambient air quality standards; ACHP = Advisory Council on Historic Preservation; AICUZ = Air Installation Compatible Use Zone; BTA = Best Technology Available; CEQ = Council on Environmental Quality; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CFR = Code of Federal Regulations; CNRH = Commander Navy Region Hawaii; CWA = Clean Water Act; CWB = Clean Water Branch; DLA = Defense Logistics Agency; DLNR = Department of Land and Natural Resources; DoD = Department of Defense; DTS = Department of Transportation Services; ECF = entry control facility; EFH = Essential Fish Habitat; EIS = Environmental Impact Statement; EO = Executive Order; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; FEMA = Federal Emergency Management Agency; FR = Federal Register; GHG = greenhouse gas; HAR = Hawai'i Administrative Rules; HDOH = Hawai'i Department of Health; HDOT = Hawai'i Department of Transportation; HRS = Hawai'i Revised Statutes; IAP = Installation Appearance Plan; Inst. = Instruction; MEC = munitions and explosives of concern; Navy = U.S. Department of the Navy; NAAQS = National Ambient Air Quality Standards; NAVFAC = Naval Facilities Engineering Systems Command; NAVSUP = Naval Supply Systems Command; NEPA = National Environmental Policy Act; NESHAP = National Emission Standards for Hazardous Air Pollutant; NHPA = National Historic Preservation Act; NMFS = National Marine Fisheries Service; NOAA = National Oceanic and Atmospheric Administration; NPD = NASA Policy Directive; NPDES = National Pollutant Discharge Elimination System; NPR = NASA Procedural Requirement; NRCS = Natural Resources Conservation Service; OPNAVINST = Office of the Chief of Naval Operations Instruction; OSHA = Occupational Safety and Health Administration; PL = Public Law; Pub. = Publication; RAICUZ = Range Air Installation Compatible Use Zone; RCRA = Resource Conservation and Recovery Act; ROI = region of influence; SECNAVINST = Secretary of the Navy Instructions; SHPD = State Historic Preservation Division; SOH = State of Hawai'i; SWPPP = Stormwater Pollution Prevention Plan; U.S.C. = United States Code; USDA = U.S. Department of Agriculture; USCG = U.S. Coast Guard; USDOT = U.S. Department of Transportation; USFWS = U.S. Fish and Wildlife Service; WOTUS = Waters of the U.S.

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Appendix C
List of Interested Parties Contacted During Scoping

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Category	Group

Federal, state, and local elected officials	• Federal Elected Officials
	  ▪ U.S. Senators
	  o Mazie K. Hirono
	  o Brian Schatz
	• U.S. House of Representatives
	  ▪ Congressional District I: Ed Case
	  ▪ Congressional District II: Jill N. Tokuda
	• State Elected Officials
	  ▪ Governor: Josh Green
	  ▪ Lieutenant Governor: Sylvia Luke
	  ▪ Attorney General: Anne E. Lopez
	  ▪ State Senate
	  o District 8: Ronald D. Kouchi
	• State Assembly
	  ▪ House District 15: Nadine K. Nakamura
	  ▪ House District 16: Luke A. Evslin
	  ▪ House District 17: Dee Morikawa
	  ▪ Senate Committees
	  o Public Safety and Intergovernmental Affairs and Military
	  o Water and Land
	  o Ways and Means
	  ▪ House Committees
	  o Corrections, Military and Veterans
	  o Water and Land
	  o Finance
	• Local Elected Officials
	  ▪ County of Kaua‘i
	  o Mayor Derek S.K. Kawakami
	  ▪ County Council
	  o Mel Rapozo (Council Chair)
	  o KipuKai Kuali‘i (Council Vice Chair)
	  o Addison Bulosan (Councilmember)
	  o Bernard P. Carvalho, Jr. (Councilmember)
	  o Felicia Cowden (Councilmember)
	  o Bill DeCosta (Councilmember)
	  o Ross Kagawa (Councilmember)

Federal, state, and local regulatory and non-regulatory government agencies	• Federal Agencies
	  ▪ Advisory Council on Historic Preservation
	  ▪ National Oceanic and Atmospheric Administration Fisheries
	  ▪ U.S. Army Corps of Engineers Honolulu District
	  ▪ U.S. Coast Guard District 14
	  ▪ U.S. Department of the Interior, Office of Hawaiian Relations
	  ▪ U.S. Environmental Protection Agency
	  ▪ USFWS, Kilauea Point National Wildlife Refuge
	  ▪ USFWS, Pacific Islands Fish and Wildlife Office
	  ▪ USDA Forest Service, Institute of Pacific Islands Forestry
	  ▪ USDA, Hawai‘i and Western Pacific State Office
	  ▪ U.S. Geological Survey, Honolulu Field Station
	  ▪ National Park Service

Category	Group
	• State Agencies ▪ Department of Agriculture ▪ Agribusiness Development Corporation ▪ DLNR ▪ DLNR BLNR ▪ DLNR DOFAW ▪ DLNR Land Division (Kaua‘i District) ▪ DLNR OCCL (Conservation District) ▪ DLNR-SHPD ▪ DLNR Division of State Parks ▪ DLNR Commission on Water Resource Management ▪ Department of Transportation ▪ OHA ▪ OHA, Kaua‘i Burial Council ▪ Department of Health, Clean Water Branch ▪ OPSD ▪ OPSD, Environmental Review Program ▪ OPSD, CZM Program ▪ Department of Business, Economic Development and Tourism ▪ Department of Hawaiian Homelands ▪ Department of the Attorney General ▪ Department of Defense (State of Hawai‘i) ▪ Boards and Commissions ▪ Kaua‘i Circuit Court ▪ Kaua‘i District Office, Division of State Parks ▪ Hawai‘i State Parks • Regional/Local Agencies ▪ County of Kaua‘i Departments: o Parks and Recreation o Water o Kaua‘i Emergency Management Agency o Fire o Police o Economic Development o Planning o Public Works o Transportation o County of Kaua‘i Office of Boards and Commissions ▪ University of Hawai‘i System o Kaua‘i Community College o Kaua‘i Agricultural Research Center o Pacific Cooperative Studies Unit ▪ Native Hawaiian Federal Interagency Working Group, current members include: o Advisory Council on Historic Preservation o Office of the Deputy Under Secretary of Defense for Installations and Environment o Small Business Administration o Office of Native Hawaiian Relations

Category	Group
Native Hawaii Organizations	• ʻĀina Momona (State of Hawaiʻi) • Association of Hawaiian Civic Clubs (State of Hawaiʻi) • Hawaiian Native Corporation (supports NHOs – State of Hawaiʻi) • Koʻolau Foundation (State of Hawaiʻi) • Native Hawaiian Hospitality Association (State of Hawaiʻi) • Kawaileo Law A Limited Liability Law Company (State of Hawaiʻi) • Council For Native Hawaiian Advancement (State of Hawaiʻi) • Na Koa Ikaika Ka Lahui Hawaiʻi (Kauaʻi) • Na ʻOhana Papa O Manā (Kauaʻi) • EAO Hawaiʻi Inc. (Kauaʻi) • Nā Kuleana o Kānaka ʻŌiwi (Kauaʻi) • Hanalei River Heritage Foundation (Kauaʻi) • ALU LIKE, Inc. (Kauaʻi) • Kauaʻi Kupuna Council • Kauaʻi Burial Council
Community planning groups, and other community and civic organizations	• Community Planning Groups ▪ Kauaʻi Planning & Action Alliance • Community Organizations ▪ Hui Makaʻāinana O Makana ▪ Waipā Foundation ▪ Waimea Community Association • DON Advocacy Groups ▪ AMVETS Department of Hawaiʻi • Civic Groups ▪ Kauaʻi Planning & Action Alliance ▪ Hawaiʻi Community Foundation ▪ Kilauea Community Agricultural Center - Aina Hoʻokupu O Kilauea ▪ Kauaʻi Philippine Cultural Center ▪ Ke Kumu O Hihinui Cultural Center ▪ Kauaʻi Museum ▪ Kōkeʻe Natural History Museum
Small business associations, economic development/ tourism organization, and recreational and real estate interests	• Economic Development Organizations ▪ Kauaʻi Chamber ▪ Kauaʻi Filipino Chamber of Commerce • Tourism ▪ Camp Sloggett ▪ Waimea Japanese Cemetery ▪ Kauaʻi Visitors Bureau (Sue Kanoho) ▪ Smith Family Garden Luau ▪ Kōkeʻe Lodge ▪ The Cabins at Kōkeʻe
Local environmental organizations and other Non-Governmental Organizations	• Government Programs ▪ DLNR DOFAW Natural Area Reserves System ▪ Kauaʻi Seabird Habitat Conservation Plan • Environmental Organizations – Local ▪ National Tropical Botanical Gardens, Plant Extinction Prevention Program

Category	Group
	▪ Kaua‘i Forest Bird Recovery Project ▪ Kaua‘i Watershed Alliance ▪ Hanalei Watershed Hui ▪ Kaua‘i North Shore Community Foundation ▪ North Shore Community Land Trust ▪ Kaua‘i Invasive Species Committee ▪ Kōke‘e Resource Conservation Program ▪ Keahole Defense Coalition • Environmental Organizations – Regional/National ▪ Earthjustice ▪ Surfrider Foundation ▪ Sierra Club – Kaua‘i Chapter ▪ Reef Guardians ▪ Save our Shearwaters ▪ Conservation Council for Hawai‘i ▪ Kahea – The Hawaiian Environmental Alliance ▪ Hawai‘i Audubon Society ▪ Hawaiian Islands Land Trust ▪ Native Hawaiian Plant Society ▪ Hawai‘i Wildlife Center ▪ Nā Kia‘i Kai ▪ Nature Conservancy - Hawai‘i Chapter ▪ Pesticide Action Network North America • Fishing/Diving ▪ Hawai‘i Big Game Fishing Club ▪ Hawai‘i Freshwater Fishing Association • Boating/Yacht Clubs/Marinas ▪ Nawiliwili Yacht Club ▪ Kaua‘i Sailing Association ▪ West Side Boaters Association ▪ Holo Holo Charters ▪ Catamaran Kahanu ▪ Captain Andy’s ▪ Kauai Sea Tours ▪ Napali Odyssey ▪ Makana Charters ▪ Seasport Divers ▪ Nā Pali Riders ▪ Blue Dolphin Charters
Local media outlets	• Print ▪ Kaua‘i Island News ▪ The Garden Island ▪ MidWeek Kaua‘i ▪ The Honolulu Star-Advertiser ▪ Hawai‘i Tribune-Herald ▪ Ka Wai Ola • TV ▪ KITV 4 (ABC) ▪ KHON2 (Fox and CW)

Category	Group
	▪ Hawai‘i News Now • Radio ▪ Kong Radio 93.5 ▪ KHKU 94.3 FM ▪ KFMN FM 97 ▪ KJMQ Jamz 98.1 ▪ Sunny 101.3 ▪ Hawai‘i Public Radio (HPR) • Online ▪ Honolulu Civil Beat ▪ Kaua‘i Now ▪ Waimea Theater On-Screen Advertising
Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	• Dennis Eguchi • Pastor Daryl Kua • Alethea Kaohi • Bob Westerman • Toni Ricci • Lyle Tabata • Charlie Iona • Marissa Faye • Josh Mori • Keiko Napier • Kaua Mata • Tia Korete • Terry Lily • Barbara “Maka‘ala” Ka‘aumoana
Residents, business, agricultural operations, schools, and property owners near PMRF	• Communities of Kekaha, Waimea, Hanapepe, Ele‘ele, Port Allen, Kalaheo, Lawai, Omao, Koloa, Poipu, Kapa‘a, and Līhu‘e • Schools – Kaua‘i District, Waimea Complex ▪ Kekaha Elementary School ▪ Ni‘ihau High and Elementary School ▪ Waimea High School ▪ Waimea Canyon Middle School ▪ Ke Kula Ni‘ihau O Kekaha Public Charter School ▪ Kula Aupuni Ni‘ihau A Kahelelani Aloha Public Charter School ▪ St. Theresa’s School

Legend: AMVETS = American Veterans; BLNR = Board of Land and Natural Resources; CZM = Coastal Zone Management; DLNR = Department of Land and Natural Resources; DOFAW = DLNR Division of Forestry and Wildlife; DON = Department of the Navy; NHO = Native Hawaiian Organization; OHA = Office of Hawaiian Affairs; OPSD = Office of Planning and Sustainable Development; SHPD = State Historic Preservation Division; U.S. = United States; USDA = U.S. Department of Agriculture; USFWS = U.S. Fish and Wildlife Service.

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Appendix D
Detailed List of Activities and Operational Elements Under Current Real Estate Agreements

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D.1 List and Description of Navy Leaseholds and Easements

List and Description of Leases and Easements at the Main Base

Table D.1-1 includes a list of activities or operational elements for leaseholds and easements at the main base.

Table D.1-1 Navy Leases and Easements on State Land at the Main Base

Name	Grant Type	Activity/Operational Element	Size (ac)
Tract E-1	Lease	Contains ordnance related facilities, and lands required to comply with Federal ATFP guidelines regarding setback distances around military bases.	69.562
Tract E-2 Tract E-2-A	Lease	Operations. Includes lands required to comply with Federal ATFP guidelines regarding setback distances around military bases.	45.268 0.777
Lot B	Lease	Encroachment.	32.070
Lot 1	Lease	Drainage.	47.937
Lot 9	Lease	Drainage.	12.422
Lot 3	Lease	Access.	0.232
Lot 10	Lease	Drainage. Includes lands required to facilitate the operation and maintenance of drainage ditches and pumps to protect adjacent lands from flooding.	5.171
Lot 13	Lease	Access. Includes lands required to facilitate access in support of the operation and maintenance of drainage ditches and pumps to protect adjacent lands from flooding.	0.434
Lot 7	Lease	Access. Includes Exclusive Roadway Access Easement.	1.618
Lot A-1	Lease	Encroachment/Drainage. Includes Non-Exclusive Drainage Easement and Roadway Access Easement.	176.16
		Main Base Leases Subtotal	**391.651**
Easement 100 Easement 101 Easement 102 Easement 103 Easement 104 Easement 105	Easement	Includes use of the lands for agricultural purposes to preclude encroachment on operations by development.	122.011 1,841.53 3,150.093 8.691 9.489 17.875
Easement 107 Easement B Easement B-1 Easement B-2 Easement B-3 Easement B-4	Easement	Includes Non-Exclusive Roadway Access Easement.	0.170 3.084 0.069 0.069 0.044 0.067
Easement D	Easement	Electrical.	1.363
Easement E	Easement	Roadway.	0.441
Easement F	Easement	Cable.	0.049
Easement G Part 1	Easement	Water.	0.671
Easement G Part 2	Easement	Water.	0.138
Easement H	Easement	Roadway.	0.028
Easement A Part 1	Easement	Access.	2.141

Name	Grant Type	Activity/Operational Element	Size (ac)
GHA Easement 1 GHA Easement 2	Easement	Ground hazard area.	2,039.167 69.579
		Main Base Easements Subtotal	**7,266.769**
		Main Base Total Leases and Easements	**7,658.42**

Key: ATFP = Antiterrorism and Force Protection; GHA=Ground Hazard Area.

List and Description of Leases and Easements at Kamokalā Ridge

Table D.1-2 includes a list of activities or operational elements for leases and easements at Kamokalā Ridge.

Table D.1-2 Navy Leases and Easements on State Land at Kamokalā Ridge

Name	Grant Type	Activity/Operational Element	Size (ac)
Tract E-3 Parcel 1 Tract E-3 Parcel 2	Lease	Magazines 1-12 are utilized for proper storage of explosives with effective flexibility to separate incompatible explosives.	25.686 48.777
Kamokalā Ridge Add	Lease	Magazines 12-13 are required for proper storage of explosives with effective flexibility to separate incompatible explosives.	14.372
		Kamokalā Ridge Leases Subtotal	**88.835**
Easement 106	Easement	Includes use of the lands for agricultural purposes to preclude encroachment on operations by development.	176.372
Easement A Part 2 Por. A Easement A Part 2 Por. B Easement A Part 2 Por. C Easement A Part 2 Por. D Easement A Part 3	Easement	Includes Non-Exclusive Roadway Access Easement.	0.627 0.558 0.042 0.221 0.455
Easement G Part 3 Easement G Part 4 Easement G Part 5 Easement G Part 6	Easement	Water pipeline.	0.186 0.153 0.006 0.021
ESQD Easement S5604	Easement	Restrictive Use.	176.371
		Kamokalā Ridge Easements Subtotal	**355.012**
		Kamokalā Ridge Total Leases and Easements	**443.847**

Key: ESQD = Explosive Safety Quantity Distance.

List and Description of Leases at the Mānā Water Well

Table D.1-3 includes a list of leases at the Mānā Water Well.

Table D.1-3 Navy Leases on State Land at the Mānā Water Well

Name	Grant Type	Activity/Operational Element	Size
Tract E-4	Lease	Infrastructure associated with well.	0.264
Lot 12	Lease	Location of water well.	0.026
		Water Well Total Leases	**0.29**

List and Description of Leases at Miloliʻi Ridge

Table D.1-4 includes a list of activities or operational elements for leases at Miloliʻi Ridge.

Table D.1-4 Navy Leases on State Land at Miloliʻi Ridge

Name	Grant Type	Activity/Operational Element	Size (ac)
Miloliʻi Ridge No. 1 Miloliʻi Ridge No. 2 Miloliʻi Ridge No. 3	Lease	Location of frequency shift reflector used with radar and telemetry stations.	0.005 0.005 0.005
		Miloliʻi Ridge Total Leases	**0.015**

List and Description of Leases and Easements at Mākaha Ridge

Table D.1-5 includes a list of activities or operational elements for leases and easements at Mākaha Ridge.

Table D.1-5 Navy Leases and Easements on State Land at Mākaha Ridge

Name	Grant Type	Activity/Operational Element	Size
Parcel A – Mākaha Parcel B – Mākaha	Lease	The location has a guarded, secured entrance, a Frequency Interference Control Building, Maintenance Facility, Telemetry Building, a boresight tower, telemetry antennas, water tanks, a laboratory, radar sites, communications, a small power plant, antennas, and a helicopter landing pad. Most of these structures are on the top of the ridgeline and are in the line of sight of the Main Base. Unique location due to geography allowing coverage of both the base and ocean range.	35.04 167.05
Bore Site	Lease	Used to locate bore site targets for use with radar and telemetry stations.	1.012
		Mākaha Ridge Lease Subtotal	**203.102**
Parcel E Road	Easement	Includes Non-exclusive Roadway Access Easement.	4.53
Parcel D Road Parcel C Road	Easement	Includes Non-exclusive Roadway Access Easement.	26.25 10.82
Bore Site Access Road	Easement	Includes Non-exclusive Roadway Access Easement.	0.613
		Mākaha Ridge Easement Subtotal	**42.213**
		Mākaha Ridge Total Leases and Easements	**245.315**

D.2 List and Description of NASA Leaseholds

Table D.2-1 includes a list of activities or operational elements for leaseholds and easements at Kōkeʻe Park Geophysical Observatory (KPGO).

Table D.2-1 Navy Leases and Easements on DLNR Land at KPGO

Name	Grant Type	Activity/Operational Element	Size
Sites A – E (6 parcels)	Lease	Facility housing radar antenna. Unique location due to geography allowing coverage of both the base and ocean range.	22.900

D.3 General Description of Navy and NASA Real Estate Agreements with DLNR

Tables D.3-1 and **D.3-2** provide the location, number, size, type, expiration, and general type of associated actions for the existing leaseholds and easements. *Note to reviewer: This table, including acreages, will be updated when the Report to Congress is updated.*

Table D.3-1 Navy Leases on Kauaʻi with State of Hawaiʻi

Site Name	City	Size (acres)	Type	Lessor	Expiration Fiscal Year	Renewal Fiscal Year
PMRF Lease S-3852	Kekaha	480.78	LEASE	State of HI	2029	2029
PMRF Lease S-3852	Kekaha	10.18	EASEMENT	State of HI	2029	2029
PMRF Mākaha Ridge Lease S-3952	Kekaha	203.10	LEASE	State of HI	2030	2030
PMRF Mākaha Ridge Lease S-3952	Kekaha	7722.21	EASEMENT	State of HI	2030	2030
PMRF Miloliʻi Ridge Easement S-5352	Kekaha	2108.75	EASEMENT	State of HI	2030	2030
PMRF Miloliʻi Ridge Easement S-5804	Kekaha	5326.23	EASEMENT	State of HI	2029	2029
PMRF Easement S-5604	Kekaha	176.37	EASEMENT	State of HI	2029	2029

Source: Draft Report to Congress on the Department's Efforts to Renew Department of Defense Leases and Easements in Hawaiʻi, September 2023.

Table D.3-2 NASA Leases on Kauaʻi with State of Hawaiʻi

Site Name	City	Size (acres)	Type	Lessor	Expiration Fiscal Year	Purpose and Associated Actions
Kōkeʻe Park Geophysical Observatory (6 parcels)	Waimea	23	LEASE, EASEMENT	State of HI	2030	Collect geodetic data, contribute to daily measurements of the Earth's orientation in space and rotation.

Appendix E
No Action Alternative: Detailed List of Activities/Operations

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Table E-1 lists the operational impacts by lease and easement if succeeding agreements are not secured.

Table E-1 No Action Alternative: Operational Impacts

Name of Parcel	Grant Type (Lease/ Easement)	Activity/Operational Element	Operational Impact if Agreement Not Renewed
Main Base			
Tract E-1	L	Contains ordnance related facilities, and lands required to comply with Federal ATFP guidelines regarding setback distances around military bases.	Leased area contains ordnance related facilities critical to the support of the PMRF mission. Inability to perform launch operations would result in lack of ability to support various Navy missions. Also, reduction in security posture and increased costs to meet ATFP requirements. Due to land limitations, there is nowhere else to relocate the buildings on Navy fee simple lands.
Tract E-2 Tract E-2-A	L	Operations. Includes lands required to comply with Federal ATFP guidelines regarding setback distances around military bases.	Reduction in security posture and increased costs to meet ATFP requirements.
Lot B	L	Encroachment.	Reduction in security posture and increased costs to meet ATFP requirements.
Lot 1	L	Drainage.	If existing agricultural lands were to flood, PMRF would experience increased vulnerability to encroachment and BASH hazards. Without PMRF management of that land, State of Hawai'i would take over management of the drainage.
Lot 9	L	Drainage.	If existing agricultural lands were to flood, PMRF would experience increased vulnerability to encroachment and BASH hazards. Without PMRF management of that land, State of Hawai'i would take over management of the drainage.
Lot 3	L	Access.	Used as secondary entrance to the base and is the ordnance gate (for transport of ordnance from main base to Kamokalā Ridge). There would be impacts to public safety if ordnance transport went through the main gate.
Lot 10	L	Drainage. Includes lands required to facilitate the operation and maintenance of drainage ditches and pumps to protect adjacent lands from flooding.	If existing agricultural lands were to flood, PMRF would experience increased vulnerability to encroachment and BASH hazards. Without PMRF management of that land, State would take over management of the drainage.
Lot 13	L	Access. Includes lands required to facilitate access in support of the operation and maintenance of drainage ditches and pumps to protect adjacent lands from flooding.	If existing agricultural lands were to flood, PMRF would experience increased vulnerability to encroachment and BASH hazards. Without PMRF management of that land, State would take over management of the drainage.

Name of Parcel	Grant Type (Lease/ Easement)	Activity/Operational Element	Operational Impact if Agreement Not Renewed
Lot 7	L	Access. Includes Exclusive Roadway Access Easement.	Operations gate, which is open in the morning and afternoon, and provides secondary entrance to the base. Without this access, there would be no other entrance if the primary entrance were to be temporarily shut down, and this would impact access to critical PMRF facilities.
Lot A-1	L	Encroachment/Drainage. Includes Non-Exclusive Drainage Easement and Roadway Access Easement.	If existing agricultural lands were to flood, PMRF would experience increased vulnerability to encroachment and BASH hazards. Without PMRF management of that land, State would take over management of the drainage. Also, would impact access to critical PMRF facilities.
Easement 100 Easement 101 Easement 102 Easement 103 Easement 104 Easement 105	E	Includes use of the lands for agricultural purposes to preclude encroachment on operations by development.	If existing agricultural lands were to flood, PMRF would experience increased vulnerability to encroachment and BASH events. 100-103 within GHA and ESQD arcs, 104-105 to prevent encroachment.
Easement 107 Easement B Easement B-1 Easement B-2 Easement B-3 Easement B-4	E	Includes Non-Exclusive Roadway Access Easement.	This would impact access to critical PMRF facilities, and impact access to the base's main source of potable water.
Easement D	E	Electrical.	Lack of access to critical PMRF facilities.
Easement E	E	Roadway.	Lack of access to critical PMRF facilities.
Easement F	E	Cable.	Lack of electrical service to critical PMRF facilities.
Easement G Part 1	E	Water.	Lack of communication service to critical PMRF facilities.
Easement G Part 2	E	Water.	Lack of water service to critical PMRF facilities.
Easement H	E	Roadway.	Lack of access to critical PMRF facilities.
Easement A Part 1	E	Access.	Lack of access to critical PMRF facilities.
GHA Easement 1 GHA Easement 2	E	The GHA for many of the ballistic and hypersonic missiles launched from PMRF extends into the Mānā Plain.	Restriction of the GHA to only federal property will mean no ballistic or hypersonic missiles can be safely launched from PMRF.
Kamokalā Ridge			
Tract E-3 Parcel 1 Tract E-3 Parcel 2	L	Magazines 1-12 are utilized for proper storage of explosives with effective flexibility to separate incompatible explosives.	Inability to meet ordnance safety storage requirements would result in lack of ability to support aerial target and ballistic and hypersonic missile missions.
Kamokalā Ridge Add	L	Magazines 12-13 are required for proper storage of explosives with effective flexibility to separate incompatible explosives.	Inability to meet explosive safety storage requirements resulting in lack of ability to support various missions at PMRF.
Easement 106	E	Includes use of the lands for agricultural purposes to preclude encroachment on operations by development.	Potential for encroachment due to development and incompatible uses to current Navy operations to include RF spectrum interference, lighting that may impact NVG training, AICUZ concerns, etc.

Name of Parcel	Grant Type (Lease/ Easement)	Activity/Operational Element	Operational Impact if Agreement Not Renewed
Easement A Part 2 Por. A Easement A Part 2 Por. B Easement A Part 2 Por. C Easement A Part 2 Por. D Easement A Part 3	E	Includes Non-Exclusive Roadway Access Easement.	Lack of access to critical PMRF facilities.
Easement G Part 3 Easement G Part 4 Easement G Part 5 Easement G Part 6	E	Water pipeline.	Lack of access to critical PMRF facilities.
ESQD Easement S5604	E	Restrictive Use.	Lack of access to critical PMRF facilities.
Mānā Water Well			
Tract E-4	L	Infrastructure associated with well.	Reduced reliability of potable water source and increased cost of water. Impacts to range operations from loss of water source.
Lot 12	L	Location of water well.	Reduced reliability of potable water source and increased cost of water.
Miloli'i Ridge			
Miloli'i Ridge No. 1 Miloli'i Ridge No. 2 Miloli'i Ridge No. 3	L	Location of frequency shift reflector used with radar and telemetry stations.	Inability to calibrate instrumentation and antennas which would limit effectiveness during data collection and could result in safety issues related to tracking of vehicles on the range.
Mākaha Ridge			
Parcel A – Mākaha Parcel B – Mākaha	L	Facility housing radar antenna. Unique location due to geography allowing coverage of both the base and ocean range. The vast majority of PMRF instrumentation exists at Mākaha Ridge to include radar systems, telemetry, communications, electronic warfare assets, etc.	Without the instrumentation located at Mākaha Ridge, almost all of PMRF's training and testing missions will be unsupportable since loss of the data provided by that instrumentation will make it impossible to provide range safety oversight, management and coordination of air and sea space under the control of PMRF, execution of exercises/tests and collection of customer required data.
Bore Site	L	Used to locate bore site targets for use with radar and telemetry stations.	Loss of this facility would limit PMRF support of Pacific Fleet training operations and national test initiatives. Inability to calibrate instrumentation and antennas which would limit effectiveness during data collection and could result in safety issues related to tracking of vehicles on the range.
Parcel E Road	E	Includes Non-exclusive Roadway Access Easement.	Lack of access to critical PMRF facilities.
Parcel D Road Parcel C Road	E	Includes Non-exclusive Roadway Access Easement.	Lack of access to critical PMRF facilities.
Bore Site Access Road	E	Includes Non-exclusive Roadway Access Easement.	Lack of access to critical PMRF facilities.

Name of Parcel	Grant Type (Lease/ Easement)	Activity/Operational Element	Operational Impact if Agreement Not Renewed
Kōkeʻe Park Geophysical Observatory			
S-3917 6 parcels	L	Includes facilities (buildings, RADAR, antenna, transmitters) that support Navy and NASA operations.	Loss of Navy radar and telemetry systems at KPGO would also limit effectiveness during data collection and could result in safety issues related to tracking on the range. Loss of Site B which includes the back-up plant diesel generator for Sites A, C, D, and E would impact the source of reliable power when systems at KPGO are supporting Navy range operations and NASA SGP activities. Without use of Sites A through E at KPGO, NASA would lose its northern Pacific VLBI and DORIS stations, and two GNSS stations, substantially reducing the capability of NASA's global Space Geodesy Project to support the following: spacecraft tracking; as well as military and civilian terrestrial, airborne, and maritime navigation; and the scientific disciplines that rely on the data produced at KPGO.

Key: AICUZ = Air Installation Compatible Use Zone; ATFP = Antiterrorism and Force Protection; BASH = Bird/Wildlife Aircraft Strike Hazard; DORIS = Doppler Orbitography and Radio-positioning Integrated by Satellite; ESQD = Explosive Safety Quantity Distance; GHA = Ground Hazard Area; GNSS = Global Navigation Satellite System; KPGO = Kōkeʻe Park Geophysical Observatory; NASA = National Aeronautics and Space Administration; NVG = Night Vision Goggles; PMRF = Pacific Missile Range Facility; RADAR=Radio Detecting and Ranging; RF=Radio Frequency; SGP = Space Geodesy Project; VLBI=Very Long Baseline Interferometry.

Attachment C

SoEVENTFUL

A SUNRISE TO SUNSET LOOK AT SOME OF THE BIGGEST EVENTS ON KAUA'I

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MAY 25
YOGA MORNING

Participate in a yoga practice and a class at the Hanalei farmers market in Hale Hālāwai 'Ohana O Hanalei. Learn from international yoga and meditation teacher Mary Susan Stults. The farmers market will run from 9:30 a.m. to noon. Admission is $25.

PHOTO COURTESY GETTY IMAGES/ AJA KOSKA

Saturday, May 25, 10-11:30 a.m.
For more info, visit eventbrite.com (search "Yoga at the Farmers' Market in Hanalei, Hawaii")

23 MAY
DOG THERAPY

Youth ages 12-18 are welcome to de-stress with Gus Gus the mini golden-doodle at Līhu'e Public Library. Gus Gus will visit with his owner, Jeff. Attendees can pet, sit, talk to and hang out with the pup. A same-day sign-up is required and limited slots are available.

Thursday, May 23, 2:30-3:30 p.m.
For more information, call 808-241-3222

26 MAY
MAKERS MARKET

Every fourth Sunday of the month, the Wailua Bay Creators Fair takes over Hilton Garden Inn Kauai Wailua Bay. Vendors sell everything from art, clothing and accessories to photography, wood carvings, home decor and so much more — and it's all Kaua'i-made. There will also be live entertainment and food for purchase.

Sunday, May 26
8:30 a.m.-1 p.m.
For more information, visit gohawaii.com.

Full Time Service Driver
UNITEK SOLVENT SERVICES
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CDL $24.00+
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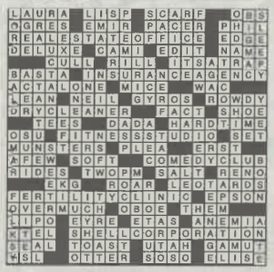
Answers To This Week's
SUDOKU PUZZLE

6	4	2	7	1	9	5	3	8
9	5	1	2	8	3	7	6	4
3	7	8	5	6	4	2	9	1
7	3	9	1	2	8	6	4	5
1	2	4	6	3	5	8	7	9
8	6	5	9	4	7	1	2	3
2	9	6	3	5	1	4	8	7
4	1	7	8	9	6	3	5	2
5	8	3	4	7	2	9	1	6

Answers To This Week's
CROSSWORD PUZZLE



Answers To This Week's
SPOT 10 DIFFERENCES

U.S. Navy Pacific Missile Range Facility and NASA Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement

The Navy and NASA invite you to participate in the environmental planning process and submit comments.

The U.S. Department of the Navy (Navy) and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts of proposed real estate agreements with the State of Hawai'i for the Pacific Missile Range Facility (PMRF) and the Kōke'e Park Geophysical Observatory (KPGO). The Navy and NASA invite you to participate in the environmental planning process.

The Navy proposes to maintain long-term Department of Defense use of 8,348 acres of State of Hawai'i lands on Kaua'i for operational continuity and sustainment of the military readiness mission. The Navy operates on 410 acres of the total acres leased from the State. The majority of the leased and easement areas remain intentionally undeveloped as they are used as an encroachment buffer and security for the facility's mission. NASA proposes to maintain long-term use of 23 acres of State of Hawai'i land on Kaua'i for continued operations of KPGO. The Proposed Action is needed because existing real estate agreements for these State lands are set to expire between 2027 and 2030.

The Navy and NASA will host public scoping meetings at three locations on Kaua'i. Attend any of the public scoping meetings to talk story, learn more, and submit written or oral comments. Your voice is important to this planning process. Meetings will be held from 5 to 8 p.m. HST at the following locations:

PUBLIC SCOPING MEETINGS

Tuesday, June 4, 2024	Wednesday, June 5, 2024	Thursday, June 6, 2024
Kaua'i Veterans Center 3215 Kaua'i Veterans Memorial Hwy. Līhu'e	Kekaha Neighborhood Center 8130 Elepaio Road. Kekaha	Sheraton Kaua'i Coconut Beach Resort 650 Aleka Loop. Kapa'a

AGENDA

5 to 8 p.m.	6 to 6:30 p.m.
Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment.	Project presentation by Navy and NASA.

The Navy and NASA are initiating a public scoping period under the National Environmental Policy Act and Hawai'i Revised Statutes (HRS) Chapter 343 to receive comments on the scope of the EIS. Members of the public are encouraged to participate in the environmental planning process by providing input on the proposed real estate action including potential alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS. The scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and HRS Section 6E-42. Your voice is important to this planning process.

The public scoping period begins ***May 8, 2024, and ends June 17, 2024***. Please attend a public scoping meeting and visit the project website to learn more. For language assistance or special accommodations, contact the PMRF Public Affairs Officer, at (808) 335-4740 or PMRFPublicAffairs@us.navy.mil. Requests for language assistance or special accommodations should be made at least seven days prior to the public meeting.

Submit Comments in Person, Online, or by Mail. Submit comments by ***June 17, 2024***. The public may submit comments in any of the following ways: In person at a public scoping meeting, through the project website at PMRF-KPGO-EIS.com, by email to info@PMRF-KPGO-EIS.com, or by mail, postmarked by ***June 17, 2024*** to the following address: Naval Facilities Engineering Systems Command, Hawai'i, Environmental OPHEV2, Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells, 400 Marshall Road, Building X-11, Pearl Harbor, HI 96860.

For more information visit PMRF-KPGO-EIS.com

SALARY

Continued from A1

the department's median pay by Lopez-Pellot's estimate. "That would've been drawn from the unemployed, the lower, or the lower, or the unemployed was previously," he said.

Lawmakers Wednesday still will have to grapple with the issue, however, as Senate and House conferees work to reconcile their versions of the bill.

The Senate's version would require a $500 million, or 10%, whichever is less, pay increase for the Police Department, Fire Department, Department of Emergency Management and Department of Corrections and Rehabilitation.

"We're talking about 1,000 officers, so that's $500 million," Wakai said. "Maybe we can't do that, but we're going to have to do something with the police."

The House's version, which was approved by the Senate, would require the counties to provide a 10% pay increase for police officers, firefighters, emergency medical technicians and lifeguards.

Wakai said Wednesday that the Senate is willing to accept the House's version of the bill, but that the House is willing to accept the Senate's version.

"We're willing to go with the House's version, but the House is not willing to go with the Senate's version," Wakai said. "So we're trying to figure out how we can get to a point where we can agree on something."

Rep. Tina Wildberger (D-Waipahu, Village Park), chair of the House Finance Committee, said Wednesday that the House is willing to accept the Senate's version of the bill, but that the Senate is not willing to accept the House's version.

"We're willing to go with the Senate's version, but the Senate is not willing to go with the House's version," Wildberger said. "So we're trying to figure out how we can get to a point where we can agree on something."

Rep. Tina Wildberger (D-Waipahu, Village Park), chair of the House Finance Committee, said Wednesday that the House is willing to accept the Senate's version of the bill, but that the Senate is not willing to accept the House's version.

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CAMERAS

Continued from A1

on Thursday. "There appears to be a demand for these cameras and services."

According to the bill, "Lawmakers have to balance cameras, employee wellness, and law enforcement's ability to do their jobs while working to ensure public safety. The Legislature also recognizes that the use of automated camera-based violations may be a burden on drivers, and that the use of these cameras should not be for the purpose of generating revenue."

The bill also would require the Department of Transportation to post signs at least 1,000 feet before any speed camera, and would require the signs to be placed at least 1,000 feet before any speed camera.

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The bill

O'ahu housing market bounces back in April

Andrew Gomes
THE GARDEN ISLAND

HONOLULU — O'ahu's housing market rebounded in April with a surge in sales after a slow start to the year in March.

Median sales prices also improved, with new records for single-family homes and condominiums in April compared with the same months in 2023, according to data released by the Honolulu Board of Realtors.

The single-family home market had the biggest gains, with a 20 percent jump in sales to 674 in April from 562 a year earlier, and a 10 percent increase in the median sales price to $1,100,000 from $999,000.

For condos, the number of sales edged up 2 percent to 601 in April from 589 a year earlier while the median price increased 5.5 percent to $565,000 from $535,000.

The uptick in April followed a mostly lackluster start to the year. Sales for the O'ahu housing market in March ranged from 12 percent for single-family home sales to 6.8 percent for condos.

Median prices in March were mixed, with a 1.8 percent lift higher for single-family home sales and a 5.7 percent drop for condos.

The median price over a period, at which half the sales were for more and half were for less.

Jason Orndorff, president of the Honolulu Board of Realtors and principal broker at JMG Properties Inc., said in a statement that despite the uneven numbers change, sales were somewhat stabilized with comparable months over years.

The report from the trade association said that new listings in April declined 9.9 percent to 1,262 from 1,401 in March, but were up 2.6 percent from 1,230 in April 2023.

This duplex property with a combined five bedrooms and four bathrooms on a 5,963-square-foot lot in Liliha sold in April for $1.1 million, which also was the median sale price for all single-family home sales on O'ahu in April.

Inventory of homes for sale at the end of April was 2,262, down 6.4 percent from January. Overall, the report said the positive movement in O'ahu's housing market, from March to April, was a good sign.

"The market was met with new real estate sales by buyers and sellers in the month, despite higher mortgage rates," the report said.

Chad Tibbetts, chief operating officer for local real estate brokerage firm Locations, said in a Monday company report that O'ahu's housing market is "undeniably resilient."

Tibbetts expects steady sales and median sales prices to continue through summer and the Hawaiian real estate buying season.

"Pent-up buyer demand will continue driving the competition for limited inventory, higher mortgage rates and economic uncertainty," he said in the report.

Tibbetts also said that, even with the condo market, there has been due to challenges with the cost and availability of property insurance, it's likely that sales will be somewhat suppressed to be temporary because consumer confidence will accelerate and availability of single-family homes will drive ownership in the condo market.

Generally, levels of inventory of homes for sale and buyer demand continue to favor sellers.

Inventory of homes for sale at the end of April was 2,262, down 6.4 percent from January. Overall,

nation&world

The U.S. has stepped up its criticism of Israel, arguing it's not doing enough to protect Palestinian civilians in the Gaza Strip. People inspected an impact crater Wednesday at the site of a building bombed by Israel in Rafah, in the southern Gaza Strip.

U.S. delays weapons shipment to Israel over invasion concerns

Jordan Fabian, Gabe Ahearn and Rosiana Tiron
Bloomberg News

Defense Secretary Lloyd Austin said the U.S. has paused the supply of "high-payload" munitions to Israel over concerns about a planned military offensive on the Gaza city of Rafah.

The delivery was supposed to contain 3,500 bombs, eight of nearly two thousand 2,000-pound (907-kilogram) bombs, according to a senior administration official. Austin, speaking separately, said a final decision has been made on the shipment.

Israel's need to account for the protection of civilians in Rafah, where the U.S. says it "is on the cusp of a military operation," Austin said.

At the same time, Biden has said he supports Israel's right to defend itself against Hamas, and that's been a key point of dialogue between Austin and Israeli officials.

Austin said 2,000-pound bombs can be used in "additional ways."

Israel's prime minister's office declined to comment on the weapons delay and Netanyahu will have a meeting about the military operation on Sunday, a spokesperson said. Netanyahu is expected to travel to Washington next week, Axios reported.

Israel's military says it has killed more than 14,000 militants in Gaza since the Oct. 7 attack, which started the war. Hamas-led militants killed about 1,200 people and took 250 hostages, according to Israeli officials.

Israel's military has been under increasing pressure from the Biden administration to do more to protect civilians in Gaza, where the United Nations says more than 1 million people have been displaced by the war. The Israel Defense Forces has said it's taken steps to allow more humanitarian aid into the territory.

Israel's military also has come under fire for the high number of civilian casualties in Gaza. More than 34,000 people have been killed since the war began, according to Gaza's Ministry of Health.

The week, Israeli Defense Minister Yoav Gallant said Israel would not allow Hamas to survive in Rafah. Israeli Prime Minister Benjamin Netanyahu has said Israel will enter Rafah with or without a deal to release hostages held by Hamas.

Israel's decision on the arms supply was made as one of the most significant cease-fire deals between Israel and Hamas appeared to be within reach, according to Oct. 7 Israeli officials briefed on the negotiations, despite Israel's ongoing military campaign in Rafah.

Israel's military also is facing growing pressure from the Biden administration to do more to protect civilians in Gaza.

Israel's relationship with Egypt has been strained by Israel's military operation in Rafah, which is on the Egyptian border. Egypt has warned that a ground offensive in Rafah could lead to a mass influx of Palestinians into the Sinai Peninsula, which could destabilize the region.

On Wednesday, Israeli troops opened fire on the Kerem Shalom crossing, a key point for aid entering Gaza. Israel's military said it killed three militants who had fired rockets from the area.

Israel's military also is in control of the Rafah border crossing between Gaza and Egypt. On Tuesday, it flew an empty pass for aid pumping into Gaza as the Biden administration held bilateral negotiations.

On Wednesday, Israel reopened the border's Kerem Shalom crossing and said Israeli and Palestinian trucks supplied by Gaza's Coordination and Liaison Administration would be allowed to enter Gaza. Coordinated deliveries had been suspended since the opening of the Rafah border crossing.

Israel's military also said it would open a new port in Gaza to receive aid from Cyprus.

Airstrikes further strain Ukrainian energy system

Kyiv mayor asks residents to avoid heat; Russia launches more than 200 drones, missiles

By Yuras Karmanau and Pavel Polityuk
Associated Press

Kyiv, Ukraine — Russia launched one of its most widespread attacks on Ukraine's energy system in weeks, damaging power plants and causing blackouts in the capital, Kyiv, and several other regions, officials said.

Ukraine's air force said Wednesday that Russia launched more than 200 drones and missiles in the overnight attack, which appeared to target the country's energy system. It was the first major attack on the energy system since Russia launched a similar wave of strikes in March.

"Another massive attack on our energy system," Ukrainian Energy Minister German Galushchenko wrote on the Telegram app.

Two people were injured in the Kyiv region, and debris was found in the Kyiv and Poltava regions, Ukraine's air force said.

Galushchenko said power plants and transmission facilities in Kyiv, Kharkiv, Zaporizhzhia, Lviv, Ivano-Frankivsk and Vinnytsia regions were targeted.

Four DTEK power units used to maintain the stable supply of energy to Ukraine, 24 hours, public transport, vehicles, cars on the streets, the telecommunications and.

Ukraine's power grid operator Ukrenergo said several transformers were destroyed in substations and that it would expand power blackouts for businesses and households.

Kyiv Mayor Vitali Klitschko urged residents to avoid using electrical appliances during peak hours.

"Avoid the use of electrical appliances in the morning and evening hours," Klitschko said on Telegram.

Russia launched its first major attack on Ukraine's energy system in March, causing widespread blackouts. Ukrainian officials said Russia launched 11 missiles and 60 drones in that attack

Johnson survives Greene's ouster attempt

Caleb Edwards and Chad Hudson and Nicole Gaouette
THE NEW YORK TIMES

WASHINGTON, D.C. — Speaker Mike Johnson on Wednesday easily batted down an attempt by Rep. Marjorie Taylor Greene of Georgia to oust him from his post, after Democrats linked arms with a few Republicans to lend all seven additional votes he'd need to hang on to the gavel from their party leader.

The vote to kill the effort, won on a procedural tabling bill 359-43, with seven voting "present," Democratic Rep. Rashida Tlaib's motion to vacate Johnson's speakership, with all but 11 of the votes cast by Republicans to block the effort to oust him.

Members of the minority party in the House have never propped up the other party's speaker, and when the last Republican to hold the post, Kevin McCarthy, lost a comparable vote in April, Democrats voted en masse to allow the motion to move forward and then to help oust him, helping lead to his historic ouster.

This time, the Democrats' support made the critical difference, allowing Johnson, who has a razor-thin majority, to send down several votes together.

While for weeks Greene had appeared to be on a political kamikaze drive to get rid of Johnson, another GOP speaker, 11 Republicans ultimately voted to kill her motion to move forward.

That was the same number of Republicans who voted in October to allow the bid to move with Gaetz's backing — but back then, they were joined by every Democrat.

Taper to that lower total of confidence from any colleague to defend Johnson's guided effort," Johnson told reporters shortly after Wednesday's vote.

"As I've said time and time again, and I've said it clear here every day, I intend to do today, I intend to do what I believe to be the right thing, with this vital, I was elected to do, and I'll believe that's what there is a majority in this House to do that."

Tlaib said, "I decided, 'This is the end of the personally political and the divisive chaos that we've seen that has defined the 118th Congress.'"

The lopsided vote solidified the dynamic that has defined Johnson's speakership, like McCarthy's before him: Both times the Republican has had to rely on critical votes from Democrats to survive challenges from the right, while Democrats have largely refused to help Republicans who have tried to oust them.

Johnson's survival Wednesday was also a testament to his ability to navigate the complex politics of the House Republican Conference, which has been bitterly divided over how to handle Greene and other right-wing Republicans who have broadly opposed sending additional aid to Ukraine.

Rep. Marjorie Taylor Greene (R-Ga.) speaks to reporters outside the Capitol in Washington, D.C., after she filed a motion to oust House Speaker Mike Johnson (R-La.) from his post on Wednesday, May 8, 2024.

Last, such a vote aligns a government shutdown and catastrophic default on the nation's debt, both of which Republicans have blamed on bipartisan coalitions of moderates in the House in order to drum up support for opposition and provide the votes to accomplish it.

There will be no bipartisan coalition of Democrats at the urging of the hard right, the very phenomenon that Greene rapped up to the moment on the House floor Wednesday — driving bipartisanship out of her colleagues — to try to do anything, care against Johnson and what she called the "uniparty" he was powered.

"Your decision to stop Marjorie Taylor Greene from pursuing the House of Representatives and the country is but further chaos is rooted in our committee and love problems for every day American families bipartisan manner," Rep. Andrew Ritter of New York, the Democratic leader, told reporters shortly after the vote. "We will continue to govern in a responsible and results-oriented fashion, and put people over politics all day and every day."

Greene's move to oust Johnson came roughly three weeks after the speaker pushed through a long-stalled $95 billion national security spending package, which included funds for Israel and Ukraine and other foreign allies, over the objections of Greene and other right-wing Republicans who broadly opposed sending additional aid to Ukraine.

Lawmakers loudly jeered Greene as she called up the resolution and read it aloud. Johnson defended the measure, arguing that it targeted no other Democratic leaders or other Republicans, Republicans lined up on the floor to criticize Johnson's hand and pat him on the back.

"When a choice between a standing Republican speaker or sitting with Democrats to preserve his own personal power, Johnson regularly chooses to ally himself with Democrats," Greene said, reading from her resolution.

She concluded with the official call for his removal: "Be it therefore resolved, That the office of the speaker of the House of Representatives is hereby declared to be vacant."

It lasted three seconds like in less than a year that Republicans have sought to depose their own speaker, coming just seven months after GOP rebels succeeded, with Democratic support, in removing McCarthy.

Earlier in the week, Greene had vowed to her colleagues whether she would actually call the motion vote. For two consecutive days, she met for hours with Johnson, first at his other digs, Rep. Thomas Massie of Kentucky, and Hakeem S. Jeffries of Democrats in exchange for not calling the vote.

Just as the demands were rolling, did it future U.S. aid to Ukraine, defund the Justice Department and disrupting a New Year the board cut on all spend Republicans' threats are unable to negotiate a deal to fund the government in September.

But Johnson, in the announced cost to their enemies, and told reporters that he was not negotiating with Greene and Massie.

That put Greene, whose constituents polled at brand is prevailing upon her core leaning upon Democrats to fight with the orbit of the end of her party, out on a limb.

She had little choice but to call up a vote she knew would stall, but had been threatening for weeks. Even after Johnson made it clear that Democratic votes would shield Republicans from a motion to oust him, Greene pressed on, arguing that Democrats would be more likely to work with Republicans if they knew that Johnson could be ousted at any time.

Democrats had also been pressuring Johnson to bring the Ukraine aid package to the floor, arguing that it was the only way to get enough votes to pass it. Johnson had resisted, saying that he would not bring a bill to the floor that did not have a majority support from Republicans.

Greene's motion to vacate the chair was the first time a speaker had been subjected to such a vote since 1910, when Democrats moved to oust Joseph G. Cannon, a Republican who had wielded the gavel with an iron fist.

Johnson's allies had been working behind the scenes to try to head off Greene's effort, arguing that pulling down a Republican speaker at a time of divided government would only benefit Democrats.

Greene's allies said they had been working to try to get Johnson to bring the Ukraine aid package to the floor

World

General Assembly to back Palestinian membership

UNITED NATIONS >> The United States now expects the General Assembly today to vote to back a Palestinian bid for de facto full U.N. membership, a measure that could open the door to Palestinians joining more U.N. agencies — after the U.N. Security Council Apr. 18 vetoed the Palestinian bid. Read more at U.N. Security Council.

Japan to allow commercial hunting of large fin whales

TOKYO >> Japan will additionally allow the whaling industry to conduct commercial whaling operations, government officials announced Wednesday, in an effort to maintain the industry's existence through the expansion of the commercial hunt. The move comes amid concerns.

Japan resumed commercial whaling in 2019 after withdrawing from the International Whaling Commission.

The week's talks have a "quasi-judicial" weight, public comment, and a draft version of the agreement is expected to be ready by the end of the week. Read more at Japan to allow commercial hunting of large fin whales.

Camera footage released of police killing Black airman

Video footage released by police showing the fatal shooting of a Black police officer by a U.S. Air Force veteran remains the focus of a week in Los Angeles, as family and friends of Tyre Nichols, 29, mourning the death of the police officer who killed him. Read more at Camera footage released of police killing Black airman.

From Star-Advertiser news services

Justices rule against women whose cars were confiscated

By Adam Liptak
New York Times

WASHINGTON >> The Supreme Court on Thursday ordered a hearing for people whose property had been seized by police because of its use in crimes.

By a 9-0 vote, the court ruled that a lawsuit against Los Angeles County could proceed. The case was brought by a woman whose car was confiscated after her son was arrested on drug charges.

"Allowing state and local governments to permanently deprive people of property without due process of law is unacceptable," Justice Amy Coney Barrett wrote for the majority.

In a concurring opinion, Justice Brett Kavanaugh said the ruling "will help state and local governments to address the problem of illegal drug trafficking."

The case was brought by Tyler Culley, who was arrested in 2019 after police found methamphetamine in his car. Culley was not charged with a crime, but the police kept the car.

Culley's mother, Tina Lindsey, was also arrested and charged with drug crimes. She was released on bail and got her car back after a hearing.

Lindsey then sued the county, arguing that the seizure violated her rights under the Fourth Amendment, which protects against unreasonable searches and seizures.

The Supreme Court has long held that the government may seize property used in crimes, even if the owner is innocent. But it has also said that people are entitled to a hearing before the government can keep their property permanently.

The court's decision in the case, Culley v. Marshall, is the latest in a series of rulings that have limited the power of police and prosecutors to take property from people suspected of crimes.

In 2019, the court unanimously ruled that excessive fines violate the Eighth Amendment's ban on cruel and unusual punishments.

In 2021, it said that police officers generally need a warrant to search a car, even if they have probable cause to believe that it contains evidence of a crime.

The court's decision on Thursday was a victory for Culley and other people whose cars were seized by the police.

"This is a big win for people who have had their cars taken away from them," said Jeffrey Stein, a lawyer who represented Culley. "The court has made it clear that the government can't just take your property without a hearing."

The case is Culley v. Marshall, No. 22-1178.

Associated Press / Jacquelyn Martin

By a 6-3 vote Thursday, the Supreme Court ruled that innocent owners of cars seized by police must be afforded a hearing to recover their vehicles.

The Constitution requires that people be given notice and a chance to be heard before the government takes away their property, the court said in an opinion by Justice Clarence Thomas.

Justice Ketanji Brown Jackson wrote a dissenting opinion that was joined by Justices Sonia Sotomayor and Elena Kagan.

Jackson said the ruling would "force state and local governments to provide a hearing to anyone who asserts an interest in property that has been seized, no matter how implausible that assertion may be."

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Ukraine attacks Russian oil facilities

By Carol Morello
Washington Post

WASHINGTON >> Ukrainian drones struck two oil depots and a refinery in southwestern Russia in a third overnight period, the latest in a campaign to disrupt Russian logistics, officials said. Ukraine also launched a missile attack on Russia's Kursk region, which borders Ukraine, on Thursday, according to Russian news agencies.

Russia's Defense Ministry said it shot down 34 Ukrainian drones overnight, including 13 over the Rostov region, which borders Ukraine. Rostov Governor Vasily Golubev said on Telegram that debris from a downed drone caused a fire at a fuel depot in the city of Taganrog, but there were no casualties.

Ukraine's military intelligence agency said it struck the Taganrog depot and another depot in the city of Millerovo, also in Rostov region, as well as the Novoshakhtinsk oil refinery in Rostov.

In a video released by Ukraine's special services, a drone can be seen approaching the Taganrog depot before exploding in a ball of flame. Ukrainian military analysts said Ukraine was behind the overnight attacks, which they said were aimed at disrupting Russian military operations.

Ukraine's drone campaign has targeted Russian oil refineries and depots as well as other energy infrastructure, including power plants, in an effort to cripple the Russian economy and weaken President Vladimir Putin's ability to wage war.

Ukraine's drones have struck refineries deep inside Russia, including in the Volga region, more than 600 miles from the border. Ukraine's drones are also capable of striking targets in Moscow and St. Petersburg, Russia's two largest cities.

Ukraine's attacks have reduced Russia's refining capacity by about 14% since the start of the year, according to Bloomberg News, and have driven up the price of gasoline in Russia.

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U.S. Navy Pacific Missile Range Facility and NASA Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement

The Navy and NASA invite you to participate in the environmental planning process and submit comments.

The U.S. Department of the Navy (Navy) and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts of proposed real estate agreements with the State of Hawai'i for the Pacific Missile Range Facility (PMRF) and the Kōke'e Park Geophysical Observatory (KPGO). The Navy and NASA invite you to participate in the environmental planning process.

The Navy proposes to renew lease, lease the portion of State lands currently utilized by the Navy at PMRF, and grant the Navy an easement over State lands for military readiness activities. The Navy proposes to renew the lease of the land currently leased from the State. The majority of the leased land is currently used for training and testing activities and associated infrastructure and operations within the Barking Sands Underwater Range Expansion and 42 acres of State of Hawai'i land on Kaua'i's Westside. NASA proposes to enter into a long-term lease of 135 acres of State of Hawai'i land on Kaua'i for continued operation of KPGO. The Proposed Actions would authorize existing real estate agreements for these State lands and would not require new construction.

The Navy and NASA will hold public scoping meetings at three locations on Kaua'i. All members of the public are encouraged to attend any, but not more, and will hold identical open house and comment sessions. Your voice is important to this planning process. Meetings will be held from 5 to 7 p.m. HST at the following locations:

PUBLIC SCOPING MEETINGS		
Tuesday, June 4, 2024 Waimea Canyon Middle School Cafeteria 3500 Kaumuali'i Highway, Waimea, Kaua'i	Wednesday, June 5, 2024 Kapa'a Middle School Cafeteria 1445 Kuamo'o Road, Kapa'a, Kaua'i	Thursday, June 6, 2024 Hanalei Elementary School Cafeteria 5-5620 Kuhio Highway, Hanalei, Kaua'i

AGENDA	
5 to 6 p.m. Informational open house. Learn about the proposed actions, talk with subject matter experts one-on-one, and submit comments. Visit the various stations to ask questions, learn about the EIS process, and provide comments.	6 to 7 p.m. Formal public meeting. Presentation by Navy and NASA.

The Navy and NASA will also hold a scoping period to solicit written comments from Federal, State, and local agencies and the public. Pursuant to Section 106 of the National Historic Preservation Act and 36 CFR 800.8(c), the Navy is using the environmental planning process to initiate consultation with the State Historic Preservation Officer and other consulting parties. Pursuant to Section 106 of the National Historic Preservation Act and 36 CFR 800.8(c), the Navy is using the environmental planning process to initiate consultation with the State Historic Preservation Officer and other consulting parties.

The public scoping period begins May 6, 2024, and ends June 17, 2024. There are three ways for the public to submit scoping comments during this period. Comments may be submitted at the public scoping meetings, through the project website at https://PMRF-KPGO-EIS.com, by email to info@PMRF-KPGO-EIS.com, or by mail, postmarked by June 17, 2024, to the following address: Naval Facilities Engineering Systems Command, Hawai'i, Environmental (EV41/JV), Attention: PMRF and KPGO EIS, EIS Project Manager, Bldg. 1, Navy Wells, 400 Kuwili Loop, Building 1041, Pearl Harbor, HI 96860.

For more information visit PMRF-KPGO-EIS.com.

Submit Comments in Person, Online, or by Mail. Submit comments by June 17, 2024. The public may submit comments during the Public Scoping Meeting, through the project website at https://PMRF-KPGO-EIS.com, by email to info@PMRF-KPGO-EIS.com, or by mail, postmarked by June 17, 2024, to the following address: Naval Facilities Engineering Systems Command, Hawai'i, Environmental (EV41/JV), Attention: PMRF and KPGO EIS, EIS Project Manager, Bldg. 1, Navy Wells, 400 Kuwili Loop, Building 1041, Pearl Harbor, HI 96860.

For more information visit PMRF-KPGO-EIS.com.

In Budapest, China's Xi hails ties with Hungary

By Aleksandra Bielakowska
Bloomberg News

BUDAPEST >> Chinese President Xi Jinping on Thursday hailed his close relationship with Hungarian Prime Minister Viktor Orban, who has positioned himself as a champion of the country's economic and investment ties with China, at a time when the European Union is pressuring countries to reduce their dependence on Beijing.

Xi's visit to Hungary is the latest stop on a European tour that has already taken him to France and Serbia. Ahead of the trip, Xi published an article in Hungarian media outlets in which he said China and Hungary have "stood together through the storm of international changes."

Orban, who has been a vocal supporter of Russian President Vladimir Putin's war in Ukraine, has also been a champion of Chinese investment in Hungary, which has become a key hub for Chinese companies looking to expand in Europe.

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obituaries

H. Wallace 'Wally' Jaynes

1945-2024

A very good son, brother, devoted father and a proud and loving dad, grandad, great grandad and a strong, true friend to many and a man who loved and respected God and country. Beloved, loyal friend and loving friend of animals. Wally lived his life learning and doing what needed to be done and with real vision, whatever challenge life presented. A man of many interests, Wally loved working, driving, flying, reading and music; playing guitar, banjo and keyboard. Wally started his early working career in the logging industry of Northern California, by the age of 18, he owned his own logging truck. Moving on, Wally worked hard and was always very family oriented. Wally's boys Kenny, Steven and Brian, Wally was also a fine carpenter, a builder and a contractor. Living in the Laguna Beach area was a major part of his life, he was naturally a water enthusiast and body surfer, along with his friends long before diving became such a popular sport. Diving and construction translated into Wally's love for underwater construction and owning his own underwater construction company, Orca Divers in Laguna Beach. While working in that field he became a commercial diver expert, and handled the employee work program to build out the Dana Point Harbor and other projects along the So. California coast.

Strangely enough, Wally's love of photography. When underwater photographers needed for a hard hat underwater inspection job, he worked on underwater cameras and successfully (with Brian's older brother's help from the camera store owner) took photos requested along with the diving, the mechanical drawings he also was provided for the job. Wally was one, Virginia was a wonderful sister. Who worked for Wally's money and Wally's character, from the day and the brother Ken was a Mathematician who taught basic mechanical drawing, Steve that experience Wally's overall schools. Coast College to study photography records open his own rental darkroom. The Darkroom soon became Laguna Beach's one of a kind 16 years, darkroom, camera store, custom printing, studio, wedding and event photography work for reproduction, etc.

Wally was a man of many interests and skills. He also enjoyed, drove planes and boats. He was a sailor and was a skilled hunter and natural athlete.

At the age of 44 he met, and eventually married the wife Donna, they had a daughter Lorena who is the family favorite Donald and John & Angela became other boys, and they were blessed to have him as a father and friend.

Wally would have a work ethic and a love of life that was second to none. He had a great memory of the many years down the road and could tell story after story.

Wally was a patriot at heart. Wally loved the country was built on, as proven by his service and 40 plus years as a volunteer with the Air Force Auxiliary Civil Air Patrol. He loved the challenge of flying, search and rescue missions, and serving those members he had served as a war when landing a crash site with the plane crew above and sending air rescue (as of 'Linda' don't have such happy endings). Many evenings he came with Civil Air Patrol as Lt. Colonel with many years at Bradley Office and both California and here in Kauai's.

Wally would say the best part of life was being a friend and helping others. That is what really was up to him. And of course, being the best husband and father ever. Love you forever.

A Celebration of the Life will be held on Thursday May 16, 2024, at St. Catherine Church with visitation beginning 10:00 a.m., funeral mass beginning at 10 a.m. and burial to follow at St. Catherine's Keiki Cemetery.

In lieu of flowers the family requests donations be made to Kauai Lifeguard Association in memory of Wally's love.

Kauai Memorial Gardens and St. Catherine's Church is entrusted with arrangements.

Michael Miyuki Cardinez

Michael Miyuki Cardinez, beloved father, devoted husband and servant at heart, passed away peacefully at his residence on April 16, 2024, at the age of 76.

Michael was born on November 13, 1947, at the Kauai Veterans Memorial Hospital in Waimea, Kauai, to Joseph Kaoru Cardinez and Mary Kiyoko Cardinez (Kawamoto). He was raised in Waimea and graduated from Waimea High School in 1965. He served in the United States Navy for four years before becoming a Radar Technician at Wahiawa Ridge, Kokee and was honorably discharged.

Michael was preceded in passing by his father Steven Cardinez, mother Florence Cardinez (Kawamoto), brother Ronald Cardinez, sister Lydia Castillo, brother-in-law Edward Enriquez and his one other child, Wanda Abreu.

Michael was survived by his brother Steven (Carmen) Cardinez of California, Marvin (Dot) Dolor Reyes of Kauai, Kauai, Jesse (Angela) Dolor Reyes of Kauai, Kauai, Steven (Karen) Cardinez of Florida, Alan (Ellen) Cardinez of California, sister-in-law Bonnie (Larry) Carol (Earl) Ogawa of California, Alice Estrada of Arizona, Christine Hemmings of Oregon, Sheila Enriquez of Arizona, and her stepmother Evelyn "Tita" Cardinez of Kauai and his many loved nieces, nephews and cousins.

Michael is also survived by his children Kale (Jaden) Cardinez of Minnesota, Kanani Kaleo Cardinez of Minnesota, Kaiulani Miyuki Cardinez of Minnesota, Kaleo Cardinez, Megan Rego, Keoni Abreu Jr., Kimora Abreu, Kaiya Rego, Abreya Cardinez, June Cardinez, Daniel Mikaelu and Brenton Mikaelu to as well as his seven great-great grandchildren Taden Cardinez, Tia Cardinez, Kaneha Rego and Kanale Elizabeth Yap and his grandpaw Abigail Abreu, Deja Mikaelu, Ty'Shawn Mikaelu and Elio Mikaelu. He is also survived by numerous cousins, nieces and nephews.

A celebration of his life will be held on Tuesday May 14, 2024, at the Kauai Veterans Memorial Convention Hall, starting at 11:00 a.m. The family requests casual aloha wear and welcomes everyone to share stories, laugh, cry and enjoy hearty food and drink with the 'Ohana.

In lieu of flowers, Kauai Memorial Gardens is entrusted with the arrangements.

Francisco 'Cisco' Campos Jr.

Francisco "Cisco" Campos Jr. passed away on Monday, April 29, 2024, at Kauai Medical Center.

Campos

Mr. Campos was 76 years old. He was born on March 2, 1948, in Waimea, Kauai.

He was a veteran of the U.S. Air Force and who served in the Vietnam War. He worked for the County of Kauai Public Works Department and Solid Waste Division for over 30 years and then retired as a baggage supervisor for United Airlines in 2016.

He is survived by his two daughters Tasha (Tommy) Butler of Hanapepe, Leona Campos (Kaeden Gomes) of Waimea, Leilani Campos of Honolulu, Leah Campos (Chadette Ann) of Waimea, Bree Campos (Kawai Raposo) of Waimea, grandchildren Jacey (Mina) Aquino, Draysden, Jaycob Dayden Gomes and Lorenzo Soares, Mahi, Kaelyn, Kara, Ivory Kaiya, great-grandchildren Kayson-Mina, Tyson, Tadyn Mina, Kaine, Ine Rego, and Kaelyn Gomes and siblings Joseph, Ramona, our uncles, aunts, cousins, nephews and nieces.

A service will be held on Sunday, May 12, 2024, at the Garden Island Funeral Chapel, Lihue, beginning at 1 p.m., and burial will be on Monday, May 13, 2024, at 11 a.m. at Kauai Veterans Cemetery in Waimea.

The family appreciates casual aloha wear and requests that flowers be omitted.

Garden Island Mortuary is entrusted to carry out all arrangements.

birth

- Kaiden Makakaua and Chelsea Kanoa proudly announce the birth of their daughter, Kalani Kaipolina Kanoa, on Friday, April 26, 2024, at 7 pounds, 14 ounces, at Wilcox Memorial Hospital.
- Ashleigh and Nathan Gallik proudly announce the birth of their daughter, Emma Rose Gallik, on Friday, April 26, 2024, at 7 pounds, 11 ounces, at Wilcox Memorial Hospital.
- Kaimi Gaddis and Jael Bernadette Gill proudly announce the birth of their son, Gabriel Kaimi Gaddis, on Friday, April 26, 2024, at 7 pounds, 3.3 ounces, at Wilcox Memorial Hospital.
- Rosalind Riley Rodrigues and Brandon Rodrigues proudly announce the birth of their daughter, Lyric Rose Rodrigues, on Friday, April 26, 2024, at 7 pounds, 7.8 ounces, at Wilcox Memorial Hospital.
- Melissa Kapuanoa and Jason Kanoa proudly announce the birth of their son, Kaipo Kanoa, on Friday, April 26, 2024, at 7 pounds, 7 ounces, at Wilcox Memorial Hospital.
- Chelsea Shaffer Olds and Joseph Olds proudly announce the birth of their son, Ryder Kalik Rae Olds, on Friday, April 26, 2024, at 8 pounds, 5 ounces, at Wilcox Memorial Hospital.
- Kaimi Makekauwai Hanawahine and Rachel Hanawahine, proud parents of Kealiinui, Kaiulani Hanawahine, Kaimi Hanawahine, Kaiwakea Hanawahine, and Kaiwakea Hanawahine, proudly announce the birth of their son, Kaiwakea Hanawahine, on Friday, April 26, 2024, at 7 pounds, 6 ounces, at Wilcox Memorial Hospital.

U.S. Navy Pacific Missile Range Facility and NASA Kokee Park Geophysical Observatory Real Estate Environmental Impact Statement

The Navy and NASA invite you to participate in the environmental planning process underway now.

The U.S. Department of the Navy (Navy) and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts associated with a proposed real estate agreement with the State of Hawai'i for the Pacific Missile Range Facility (PMRF) and the Kōke'e Park Geophysical Observatory (KPGO). The Navy and NASA invite you to participate in the environmental planning process.

The Navy proposes to obtain long-term Department of Defense use of 6,618 acres of land at PMRF Barking Sands on the island of Kaua'i for the military purposes listed below. The Navy proposes the use of land and submerged areas for the military purposes listed below. The majority of the land and submerged areas are already used by the Navy for these purposes. The Navy proposes to obtain long-term use of 20 acres of State of Hawai'i land at Kōke'e for continued operations of KPGO. The Proposed Action includes all actions necessary to enter into agreements for these State lands and associated facilities between 2027 and 2061.

The Navy and NASA will host public scoping meetings at the locations on Kaua'i shown below and the public scoping meetings for both virtual, in-person, and submit written or oral comments. Your voice is important to the planning process. Meetings will be held over Six days. RSVP at the following locations:

PUBLIC SCOPING MEETINGS

Thursday, June 6, 2024 Kaua'i Veterans Center 3599 Kaua'i Veterans Memorial Hwy, Lihue, HI	Wednesday, June 5, 2024 Waimea High School Cafeteria 9600 Waimea Road, Waimea, HI	Thursday, June 6, 2024 Hanalei Kaua'i Community Center 5520 Aku Rd, Hanalei, HI

VIRTUAL

5:30-7:30pm Interactive website will be live at least 30 days prior to each meeting, with videos, and maps and more. Visit the website to submit comments and ask questions via chat and live Q&A.	5:30-7:30pm Project presentation by the Navy and NASA.

The Navy and NASA are initiating public scoping pursuant to the National Environmental Policy Act and Hawai'i Revised Statutes (HRS) Chapter 343. We also welcome comments or questions on the EIS. In addition to the public scoping meetings, participation in the environmental planning process by providing input or asking questions at any time including, potential alternatives, environmental concerns/considerations, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS. The scoping meetings will also serve as an opportunity to educate public representatives, government officials, and interested parties on the Proposed Action and the EIS process. Federal and State agencies, Native Hawaiian Organizations, and other interested parties are encouraged to participate in the planning process.

The public scoping period begins on May 10, 2024, and ends on June 24, 2024. Please submit your public scoping comments by the end of the public scoping period. Following the publication of a Draft EIS, a separate 45-day public review period will be held. Public notices will be published in the Honolulu Star-Advertiser, Hawai'i Tribune-Herald, West Hawai'i Today, and The Garden Island. Please check the PMRF Public Affairs Office's website at https://www.cpf.navy.mil/pmrf/ for updates.

Submit Comments In Person, Online, or by Mail. Submit comments by June 24, 2024. The public may submit comments during the following virtual and in-person public scoping meetings, through the project website at PMRF-KPGO-EIS.com, by email to info@PMRF-KPGO-EIS.com, or by mail, postmarked by June 24, 2024 to the following: Naval Facilities Engineering Systems Command, Hawai'i, Environmental Division, Attention: PMRF Real KPGO REDA Project Manager, Joint Base Pearl Harbor-Hickam, Building X-11, Pearl Harbor, Hawai'i 96860.

For more information, visit PMRF-KPGO-EIS.com

NEWS OF THE WEIRD

Brown Bear, Brown Bear And 2 Driving Fools

A Scottish woman, Moira Gallacher, 72, and her friend, Charmian Widdowson, were touring Romania in April, enjoying a drive through the Carpathian Mountains, *People* reported. They happened upon two brown bears and stopped to get a picture with them. Then, Widdowson pulled up to the bear for another photo-op.

"I rolled down the window; I thought he wanted to be friends," Widdowson told STV News. "He started getting into the car and bit my friend."

She said she thought the bear approached because he heard the women talking about getting something to eat.

"I think he … decided he had to eat my friend."

Gallacher was wearing a thick jacket with two layers underneath; although the bear clamped down on her hand with its jaws, she escaped with minor wounds.

In other Weird happenings:

Shopping Cart Spree

On April 9, investigators caught their targets in a puzzling money-making scheme in Rochelle Park, New Jersey.

SEE PAGE 7

How These Bandits Roll

ILLUSTRATION BY MARK GALACGAC

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U.S. Navy Pacific Missile Range Facility and NASA Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement

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The Navy proposes to maintain long-term Department of Defense use of 8,348 acres of State of Hawai'i lands on Kaua'i for operational continuity and sustainment of the military readiness mission. The Navy operates on 410 acres of the total acres leased from the State. The majority of the leased and easement areas remain intentionally undeveloped as they are used as an encroachment buffer and security for the facility's mission. NASA proposes to maintain long-term use of 23 acres of State of Hawai'i land on Kaua'i for continued operations of KPGO. The Proposed Action is needed because existing real estate agreements for these State lands are set to expire between 2027 and 2030.

The Navy and NASA will host public scoping meetings at three locations on Kaua'i. Attend any of the public scoping meetings to talk story, learn more, and submit written or oral comments. Your voice is important to this planning process. Meetings will be held from 5 to 8 p.m. HST at the following locations:

PUBLIC SCOPING MEETINGS

Tuesday, June 4, 2024	Wednesday, June 5, 2024	Thursday, June 6, 2024
Kaua'i Veterans Center 3215 Kaua'i Veterans Memorial Hwy, Līhu'e	Kekaha Neighborhood Center 8130 Elepaio Road, Kekaha	Sheraton Kaua'i Coconut Beach Resort 650 Aleka Loop, Kapa'a

AGENDA

5 to 8 p.m.	6 to 6:30 p.m.
Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment.	Project presentation by Navy and NASA.

The Navy and NASA are initiating a public scoping period under the National Environmental Policy Act and Hawai'i Revised Statutes (HRS) Chapter 343 to receive comments on the scope of the EIS. Members of the public are encouraged to participate in the environmental planning process by providing input on the proposed real estate action including potential alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS. The scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and HRS Section 6E-42. Your voice is important to this planning process.

The public scoping period begins ***May 8, 2024, and ends June 17, 2024***. Please attend a public scoping meeting and visit the project website to learn more. For language assistance or special accommodations, contact the PMRF Public Affairs Officer, at (808) 335-4740 or PMRFPublicAffairs@us.navy.mil. Requests for language assistance or special accommodations should be made at least seven days prior to the public meeting.

Submit Comments in Person, Online, or by Mail. Submit comments by ***June 17, 2024***. The public may submit comments in any of the following ways: In person at a public scoping meeting, through the project website at PMRF-KPGO-EIS.com, by email to info@PMRF-KPGO-EIS.com, or by mail, postmarked by ***June 17, 2024*** to the following address: Naval Facilities Engineering Systems Command, Hawai'i, Environmental OPHEV2, Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells, 400 Marshall Road, Building X-11, Pearl Harbor, HI 96860.

For more information visit PMRF-KPGO-EIS.com

SoEVENTFUL

A SUNRISE TO SUNSET LOOK AT SOME OF THE BIGGEST EVENTS ON KAUA'I

EMAIL APANG@MIDWEEK.COM

1 JUNE — MUSIC CONCERT

Ebb & Flow Arts presents Duo Diorama, featuring violinist Minghuan Xu and pianist Winston Choi, at St. Michaels All Angels Episcopal Church in Līhu'e. The concert will also feature works by Béla Bartók, Alfred Schnittke, Dmitri Shostakovich, John Corigliano, Augusta Read Thomas and Robert Pollock. Admission is free.

Saturday, June 1, 7 p.m.
For more info, visit ebbandflowarts.org

2 JUNE — FOOD FESTIVAL

Enjoy dishes prepared by more than 25 island chefs, various musical entertainment groups and more at Taste of Hawai'i at Smith's Tropical Garden in Kapa'a. Gate admission is $200 and advance tickets on eventbrite.com are $165.

Sunday, June 2, 11:30 a.m.-3:30 p.m.
Purchase tickets at eventbrite.com (search "Taste of Hawaii is the ultimate Sunday Brunch by Rotary Club of Kapaa")

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JUNE 1 — PRIDE PARADE

A Pride Parade to kick off Pride Month starts on Rice Street at Vidinha Stadium and ends at Historic County Lawn, where there will be a festival following the parade. Expect food trucks, small business and craft vendors, community resources, and live entertainment.

Saturday, June 1, 9 a.m.-2 p.m.
For more info, visit kauaipridеparade.com

PHOTO COURTESY AARON FEINBERG

U.S. Navy Pacific Missile Range Facility and NASA Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement

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The Navy proposes to maintain long-term Department of Defense use of 8,348 acres of State of Hawai'i lands on Kaua'i for operational continuity and sustainment of the military readiness mission. The Navy operates on 410 acres of the total acres leased from the State. The majority of the leased and easement areas remain intentionally undeveloped as they are used as an encroachment buffer and security for the facility's mission. NASA proposes to maintain long-term use of 23 acres of State of Hawai'i land on Kaua'i for continued operations of KPGO. The Proposed Action is needed because existing real estate agreements for these State lands are set to expire between 2027 and 2030.

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For more information visit PMRF-KPGO-EIS.com

Serial criminal can keep $12.5M settlement

Peter Boylan
THE GARDEN ISLAND

LIHU'E, Kaua'i — The Maui-based man awarded $12.5 million after he sued the city following injuries suffered in the 2018 Kapule Highway pursuit appeared in court Wednesday to face federal charges that he owned a ghost gun while selling methamphetamine in Waimea.

It is the second time Jonavon Bertino-Binapul was arrested on drug and gun charges after a crash.

Despite the criminal charges, there is no chance the city can recoup any of the $12.5 million awarded Bertino-Binapul in the civil case.

"The City's settlement agreements are generally not contingent upon future conduct but are intended to compensate plaintiffs for verifiable damages resulting from negligent acts of the City or its employees and/or for breaches of law by the City," according to a statement by the Honolulu Star-Advertiser from Todd Apo, Honolulu Star-Advertiser from Todd Apo, Honolulu Star-Advertiser from Todd Apo,

EARTHWEEK: DIARY OF A CHANGING WORLD

For week ending Friday *By Jane Mountain*

Orange rivers

Scientists say melting permafrost is likely turning dozens of Alaskan rivers and streams an orange color. The new rusty hue is believed to be caused by minerals once frozen in the soil now flushing into previously crystal-clear waterways. Researchers from the U.S. Geological Survey, the National Park Service and the University of California, Davis, say the degraded rivers and streams could have significant implications for drinking water and fisheries in Arctic watersheds. "We (now) see a lot of different types of metals in these waters," said researcher Taylor Erlinger. "One of the most dominant metals is iron. That's what's causing the color change."

Earthquakes

The Tongan capital and other low-lying areas were evacuated due to fears of a tsunami following a massive undersea tomb for that rocked the island nation.

• Earth movements were also felt in Vanuatu, Taiwan, northwestern Myanmar and from northern Morocco to Spain's Costa del Sol.

Bird flu vaccine

A new Dutch study finds that bird flu vaccines given to laying hens are effective and could soon be used to protect poultry from a virus that has ravaged birds and others across the world. The tests were carried out at two farms and showed the vaccine was effective against the virus for eight weeks after vaccination. Egg prices have soared as the highly pathogenic avian influenza killed or forced the culling of millions of poultry around the world. Since there is a threat of the H5N1 strain of bird flu mutating to more easily infect people, researchers say swift vaccine development would be our best protection.

Warming yardstick

Researchers at Brunel University of London have concluded that three-hundred years of very high global average temperatures will be enough to say that the world has breached the 1.5-degree Celsius climate warming goal set out in the 2015 Paris Agreement. Carbon emissions have already caused global temperatures to rise 1.26 degrees above pre-industrial levels, with some years almost reaching 1.5 degrees. "Once you've crossed the 1.5-degree threshold in your annual temperature changes on three occasions (or) so on one or not), it's very likely that we will have crossed the Paris Agreement 1.5-degree level," said climate expert Lawrence Jackson.

Tropical cyclones

Cyclone Remal left at least 65 people dead across eastern India and Bangladesh, one of the longest-lasting on record.

• Typhoon Ewiniar's fury in the northeastern Philippines killed at least seven people and flooding toppled trees and horse wind.

Vanished glaciers

Venezuela has become the first country in the Americas to lose all its glaciers due to global heating. The nation's most glaciated peaks in the state of Merida were once a source of great pride and the origin of legends that relate them to mythical white eagles. The International Climate and Cryosphere Initiative recently declared that the remaining Humboldt Glacier, also known as La Corona (or "the crown," is already too small to be classified as a glacier any longer. "Our tropical glaciers began to disappear in the 1970s and their absences felt," astrophysicist Alejandra Melfo told the TV network Telemundo. "It's a great sadness, and the only thing we can do is use their legacy to show children how beautiful our Sierra Nevada once were."

Iceland eruption

Iceland's restive Reykjanes Peninsula produced its fifth eruption since December and the most powerful since the volcanic area became active again three years ago. The country's Met Office said lava fountains reached 115 feet in height. Residents of the small fishing town of Grindavik were forced to evacuate yet again as lava surged from the new fissure. The nearby Blue Lagoon geothermal spa was also closed and evacuated again.

Distributed by Andrews McMeel Syndication. ©2024 UT Earth Environment Service

Make peace with nature, official warns

By Jake Spring
Reuters

SAO PAULO >> The world must make peace with nature or risk fueling more global conflicts like the war in Gaza, the president of the upcoming United Nations COP16 biodiversity summit said Friday.

The October summit in Colombia is charged with negotiating next steps to implement the landmark 2022 Kunming-Montreal accord — likened to the Paris Agreement on climate change, but for nature — in order to address the drastic decline in biodiversity globally.

Climate change, deforestation, pollution and habitat destruction have led to a 69% decline in global wildlife populations since 1970, according to nonprofit WWF.

Colombia's environment minister, Susana Muhamad, laid out her priorities as COP16 president, along with a warning if the world fails to reform global governance to solve problems like the climate crisis.

"The situation currently in Palestine, where humanity is observing how a people of the world is being crushed militarily. And there's not even the capacity of the U.N. to provide the humanitarian relief," Muhamad said during a five-minute speech at the Atlantic Council think tank in Washington.

"That's the situation is what we could expect in a lack of governance and in a chaotic world because of the climate crisis."

Muhamad said the "suicidal war against nature" is causing no effort to increase, but did not elaborate on the connection.

Multilateral institutions are not equipped to deal with unprecedented challenges like climate change and must be overhauled or risk the world shipping into rule by the strong through violence, Muhamad said.

Colombia's top priorities for COP16 include an "intense" discussion on how to reform the global financial system that will allow developing countries to make strong environmental commitments without taking on more debt, she said.

Countries must submit biodiversity targets before the summit. Colombia will prioritize working with U.N. officials to measure how those commitments line up with 2030 goals in the Kunming-Montreal agreement, she said.

Colombia also will seek to boost the participation of Indigenous people and traditional communities in the process, by organizing three pre-summit events giving them an opportunity to lobby governments.

EDUARDO MUNOZ / REUTERS FILE 2017

An aerial view shows deforested land in Brazil during "Operation Green Wave," conducted by a Brazilian environmental agency.

NOTICE REGARDING FILE OF DECEASED ATTORNEY
CLAYTON C. IKEI

Current and former clients of Clayton C. Ikei may attempt to recover their client files and funds. The Hawai'i Supreme Court appointed Eric Lee Niemeyer as Trustee who collected inventory Mr. Ikei's client files and funds and retain them which clients such clients may respond to the notice within the next 90 days using the information below. Thereupon Mr. Ikei will expend appellate Trustee will destroy retained files at their own time.

ERIC LEE NIEMEYER
700 Richards St., Ste. 1106
Honolulu, Hawai'i 96813
e-mail: haiwaiilawyer@hotmail.com
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AGENDA

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For more information visit PMRF-KPGO-EIS.com

Edward Jones

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Financial Advisor

Trump sees 'breaking point' for U.S. if he gets jail time

By Jonathan Ellis
Associated Press

Former President Donald Trump on Sunday said the verdict would "destroy the U.S." if he were to receive prison and one of his first days out was the trial conviction. Trump headed to a news conference in Florida.

WASHINGTON >> Donald Trump said Sunday he would accept a prison sentence instead of paying a fine for his hush money conviction, a scenario he described as a "breaking point" for the U.S. that would lead to "anarchy" and "mayhem."

Trump provided little to no evidence to back up his claim that a prison sentence would be more likely than a fine to lead to violence. He also suggested that a prison sentence would be unfair because he's a former president and the presumptive Republican nominee for president in November's election.

Trump has been convicted of 34 felony counts in his New York criminal case, which centered on hush money payments he made to a porn star during the 2016 presidential campaign. He is scheduled to be sentenced July 11, just days before the Republican National Convention begins in Milwaukee, where he is expected to officially accept the party's nomination for president.

Trump's comments came in an interview with Fox News Sunday host Shannon Bream that aired on the network's morning talk shows. Trump has repeatedly attacked the judge in the case, Juan Merchan, and his family, and he has been warned by Merchan that he could be jailed for violating a gag order barring him from making such attacks.

Trump said he would "absolutely" accept a prison sentence if it were handed down by Merchan, but he added that he thinks "it would be a very bad thing for the country."

"I think it would be the breaking point," Trump said. "I think it would be very bad for the country. I think it would be very bad for the system. I think it would be very bad for the election. I think it would be very bad for everything."

Trump's comments echoed those he made in a Truth Social post Friday, in which he said that a prison sentence would "destroy the U.S." and that "I would be forced to appeal immediately to the Supreme Court."

Trump's attorneys have asked the Supreme Court to block the case from moving forward, arguing that presidents have broad immunity from prosecution for official acts they take in office. The justices have not yet said whether they will hear the case.

Trump's lawyers have also asked Merchan to delay sentencing until after the election, arguing that the case should be dismissed because of the Supreme Court's immunity ruling. Merchan has not yet ruled on that request.

Trump's comments Sunday were the latest in a series of statements he has made suggesting that he would not accept the outcome of the election if he loses.

Trump has refused to say whether he will accept the results of the November election, and he has repeatedly made false claims about widespread fraud in the 2020 election, which he lost to Democratic President Joe Biden.

Trump's comments Sunday also echoed those he made in a Truth Social post Thursday, in which he said that a prison sentence would be "unprecedented, unfair, and unjust," and that "I would be forced to appeal immediately to the Supreme Court."

Trump's attorneys

Red Hill tank ventilation rattles some residents

Kevin Knodell
THE GARDEN ISLAND

HONOLULU — The Navy has begun tank ventilation and air quality monitoring at the Red Hill bulk fuel storage facility.

Navy Closure Task Force-Red Hill announced on its website that work this week began on the ventilation of the tanks to depressurize them, a step that officials say is necessary to safely begin defueling operations and venting of the facility's 20 tanks.

It's the latest step in the drawn-out process of shuttering Red Hill, but some residents are nervous about potential health and environmental risks as the plan moves forward.

Walter Chun, a member of the Red Hill Community Representation Initiative, said in an email that the Navy's plans to "intentionally discharge the vapor and particulates from the JP-8 petroleum fuel into Red Hill ... to the environment (air) (water) humans exposure to hazardous substances, especially for children and infants, and poses potential health risk for the nearby residential neighborhoods."

The Navy last June began installing three air quality monitoring stations around Red Hill's perimeter, including at the Halawa Correctional Facility. The city did not establish its own monitoring stations but will monitor air quality as well as take synthetic data such as air speed and wind direction.

"DOH-CWB has worked closely with DOH's Indoor Air Program to review the ventilation of the Lower Tank in a manner that will not pose risk to human health," said task force deputy commander Rear Adm. Blake Converse in a statement. Included in the review was an online app. "Our team is committed to working closely with the facility and Navy ventilation operations to support another step closer to this goal."

In November of 2021, DOH noted Aloha Fuel Spill Started the Navy's Galvanic water system that serves 93,000 people. The facility also put 19 fuel tanks over a critical aquifer which has not still not returned to service drinking water and the Navy to fully defuel and vent the fuel pools and remove the Navy's ability to begin and vent the Navy's ability to begin defueling operations. The Navy is fully permitted and critical for national security.

Also in one of restarting, a state-wide ongoing order to drain the Lower Tank, in March of 2021 the Navy announced that Red Hill would be defueled and permanently shut down.

It took a joint military task force nearly a year to make repairs and upgrades to the aging facility and the pipeline connecting them to Joint Base Pearl Harbor-Hickam. Over 104 million gallons of fuel from the tanks.

Repairs concluded in summer of 2023 and by March the defueling task force had drawn down all the fuel with the exception of residual fuel left within the tanks that would require deeper cleaning to remove.

The defueling task force commander Vice Adm. John Wade told the Honolulu Star-Advertiser in a mid-interview before DOH-CWB took over operations that while there would be challenges, one major risk out of the way, many more dangers remain before the closure process is over.

"Defueling has definitely been challenging and risky, closure and emptying are extremely challenging, and risky, closure and emptying are extremely challenging, and risky, closure and emptying are extremely challenging,

nation&world

Biden to sign order letting him seal border

By Josh Wingrove and Erik Wasson
Bloomberg News

President Joe Biden is expected to sign an executive order today letting him temporarily seal the U.S. border with Mexico to migrants when crossings surge. Biden boarded Air Force One as he departed Nantucket for Connecticut from Delaware at the National Guard Base in New Castle, Del.

As soon as today, President Joe Biden will sign an executive order that would allow him to shut down the U.S.-Mexico border to migrants who cross illegally, according to people familiar with the matter.

The move would be triggered if daily border crossings exceed 2,500 on average per day, the people said. Biden would allow migrants to resume seeking asylum at the border once daily crossings fall to about 1,500 a day, the people said. The Associated Press reported earlier on the executive order's plans.

The order by Biden's executive authority comes as Republicans step up attacks on the president's border record ahead of the November election. Former President Donald Trump, the Republican front-runner, has repeatedly blamed Biden for the record number of migrants who have crossed the border since he took office in 2021.

Trump's campaign has also seized on the issue, with Republicans in Congress pushing for a bill that would have given Biden similar authority to shut the border. That bill failed in the Senate on Feb. 7 after Trump urged Republicans to vote against it.

Biden's executive order would be the latest in a series of actions he has taken to address the issue, which has become a challenge for his reelection campaign. Trump's defeat of Biden in 2020 was driven in part by his hard-line immigration policies, which prevailed in the Republican Party after Trump's predecessor, Republican Mitt Romney, lost the 2012 election in part because of his more moderate stance on immigration.

Trump's actions while president, including the controversial family separation policy, also helped Democrats win the House of Representatives in 2018. Democrats were overwhelmingly opposed to Trump's policies, paving the way for Democrat Nancy Pelosi to become House speaker.

The Associated Press reported that Biden's plan to shut down the border is subject to change and that the White House was preparing for the possibility that a judge could block the plan. Biden's executive order is expected to be challenged in court, setting up the issue for possible Supreme Court review.

The American Civil Liberties Union said the change appeared to violate Trump's own asylum ban. On Monday, the ACLU said it was ready to challenge any order that limits asylum at the border.

Top Department of Homeland Security officials have been briefing Democratic lawmakers on the executive action, which Trump's campaign has criticized as not going far enough. The White House has prepared to send more border officials to the southern border, including active-duty troops, if needed, but the plan is not expected to be part of the executive order.

Biden will notify Congress of the action, which is expected to take effect immediately, but over the weekend, Democratic lawmakers were still seeking more details on the plan.

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City land donation proposed for homes

Andrew Gomes
THE GARDEN ISLAND

LIHUʻE — For the third time in two decades, the city could receive enough land to build several thousand units of affordable housing on a long-sought vacant city parcel in Kalāheo.

Two bills working their way through the City Council are seeking to authorize the donation of the 26-acre property to the Department of Hawaiian Home Lands (DHHL) for the agency to develop a multi-family housing project for beneficiaries.

If successful, the plan would dispose of a coveted property in the Kōloa-Lāwaʻi area that the city has owned since 2003, and which the city first offered to DHHL for housing in 2006.

Two prior attempts, however, have failed. And some neighbors previously have opposed development of housing on the parcel, which has been zoned for single-family housing.

Council Chair Mason Chock (D-Kōloa, Waimea, Kekaha, Hanapēpē, Eleele, Port Allen, Makaweli) said he supports the proposal.

"This initiative is consistent with the city's commitment to address Oʻahu's affordable housing crisis by partnering with other organizations that share the responsibility and desire to facilitate the availability of affordable housing for kūpuna and kamaʻāina — a community significant city lands dedicated by the siting code of Oʻahu," he said in a statement.

The effort by Chock and Waimea representatives third try in the past two decades by city officials to have the land once slated for an elementary school to become housing.

The city bought the property from Kaneohe Ranch in 1961 to provide land for a new elementary school. It's the site of the city's main landfill and recycling center.

In the 1990s, a new school development was considered to serve the Department of Education's planned Kōloa Elementary, but the project was abandoned because of low ridership, given many schools in the area — Kālaheo, Kōloa, Koloa and Makahu'a — were full or short.

"With no need for a school on the site, the Hawai'i Board of Education approved the city's decision to dispose of the parcel, which has a view of the ocean and borders Kōloa Avenue along with Old Koloa Town, a historic old school below roughly 30 acres of preservation land," Chock said.

In 1965, city leaders identified the site as one of a dozen city properties suitable for low-income or moderate-income housing.

But that effort, which envisioned condominiums, was put on hold after the city learned of federal urban renewal funding.

Then, in 2003, the city's Housing Development Corporation, a predecessor to the city's Housing Solutions Division, began exploring the property for affordable housing.

Those efforts, however, were never realized despite a donation to help address a critical need for affordable housing.

Another plan was finalized in 2015 for the property for hillside rental units and single-family homes, was

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EMAIL APANG@MIDWEEK.COM

PHOTO COURTESY KŌLOA LANDING RESORT

JUNE 8
POKE FEST

The fourth annual Kaua'i Poke Fest returns to Kōloa Landing Resort with celebrity chef Sam Choy. The festival will feature live entertainment, 20 professional and amateur chefs and more than 600 pounds of fresh 'ahi poke. Proceeds will go toward Hawai'i Community Foundation's Maui Strong Fund.

Saturday, June 8, 2-7 p.m.
To purchase tickets, visit bit.ly/4bT49yc

8 JUNE
COMIC CON

Enjoy a day full of fun family entertainment at Kaua'i Comic Con 3, which takes place at Royal Sonesta Kaua'i Resort (3610 Rice St.) in Līhu'e. Comic cans can expect special guests, a cosplay contest and other activities. The event also features an array of vendors offering a range of merchandise and collectibles. Tickets are $25 for adults and free for children age 12 and under when accompanied by a paying adult.

Saturday, June 8, 11 a.m.-6 p.m.
For more info and ticket purchases, visit kauaicomicconvention.com

8 JUNE
ART EXHIBIT

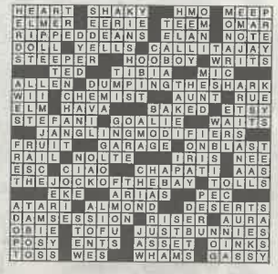
Kaua'i Society of Artists' annual art exhibit, Washed Up, will have its opening reception at 2600 Kaumuali'i Hwy. in Līhu'e. Attendees can view unique artworks created out of marine debris cleaned up off of Kaua'i shorelines. Admission is free.

Saturday, June 8-Friday, June 28
For more info, visit kauaisocietyofartists.org

Answers To This Week's
SUDOKU PUZZLE

8	9	7	2	3	6	4	5	1
2	5	1	8	4	7	6	3	9
4	6	3	1	5	9	8	2	7
7	3	6	4	8	1	2	9	5
9	2	8	5	7	3	1	4	6
1	4	5	6	9	2	3	7	8
5	7	2	3	1	8	9	6	4
3	1	9	7	6	4	5	8	2
6	8	4	9	2	5	7	1	3

Answers To This Week's
CROSSWORD PUZZLE



Answers To This Week's
SPOT 10 DIFFERENCES

U.S. Navy Pacific Missile Range Facility and NASA Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement

NASA

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For more information visit PMRF-KPGO-EIS.com

No ka Hōʻola ʻŌlelo Hawaiʻi ma ka Heʻenalu

Na Kaʻiwakīkahapono L. Foster, Grade 12
S.M. Kamakau Public Charter School

A ʻau mālie
Eia mai ka makakai heʻenalu
Kai heheʻe kākala o ka moku
ʻAuhea ʻoukou e nā hoa heʻenalu, nā hoa haku mele, nā hoa aloha ʻōlelo, aloha lāhui.
Oʻahu o Kākuhihewa
Koʻolauloa, Koʻolaupoko
Aia nō Kona, Aia nō ʻEwa
Aia ʻo Waialua, Aia ʻo Waiʻanae
Aia ka piko i Kūkaniloko
Hānau ʻia nā aliʻi
Kani mai ʻo ʻŌpuku me Hāweo
Ola nā mamo o Kākuhihewa

Ikēia mahina e hoʻohanohano ai kākou i ko kākou ʻōlelo makuahine, ka ʻōlelo Hawaiʻi, haʻaheo au e hāpai i kēia lono hoʻohauʻoli hauli.

I ka makahiki i hala iho nei, ua hoʻokumu ko Kamakau i ka pūʻali heʻenalu ʻōlelo Hawaiʻi piha, mua loa o ko Hawaiʻi pae ʻāina, o kēia au. A komo mākou ma nā hoʻokūkū heʻenalu ʻāpuni ʻo kō Oʻahu pae ʻāina. A paio aku paio mai mākou me nā kula kiʻekiʻe ʻē aʻe, e like hoʻi me kō Kamehameha, kō Punahou, kō Kahuku, kō Waialua, kō Waiʻanae, a pēlā wale aku.

Ma ka wā iā Kākuhihewa, aia kekahi kūlana nalu kaulana āna i heʻe ai. ʻO ia ʻo Mākāhā, i Kou, i Honolulu.

"Kū ka puna, ke koʻa i uka
Ka mākāhā o ka nalu o Kākuhihewa
Ua ʻō ʻia, nohāhā ka papa"

Aloha nō! ʻAʻole hoʻi i kamaʻāina nā maka o kēia hanauna i ia kūlana nalu. ʻAʻole paha i kamaʻāina nā pepeiao o kēia hanauna i ke kani haʻihaʻi o ia poʻinanalu. ʻAʻole paha i kamaʻāina nā ihu o kēia hanauna i ke ea ʻehukai ke pā mai ka makani Kona. ʻAʻole nō hoʻi i pae kēia hanauna ma ua nalu ala no ke kūkulu ʻia o kekahi pā pōhaku pale kai ma laila. Minamina!

Eia nō naʻe ka manawa e ʻau, pae, a heʻe nei i mua. Ola nō kēia mau lama ʻālohilohi o ka wā i hala ma o nā moʻolelo, nā mele hīmeni, me nā mele oli. No kākou, nā mamo ʻōlelo Hawaiʻi o kēia hanauna ke kuleana e hoʻāla i nā inoa o kēia mau wahi i ola ma o nā mele, ma nā waihona noʻonoʻo, ma nā naʻau, a ma nā waha hoʻi o kēlā me kēia kanaka o Hawaiʻi pae ʻāina.

No laila e nā hoa, eia nō mākou, ko Kamakau e kū nei i ka welo o kēia ʻohana ʻōlelo Hawaiʻi ma ka hoʻōla ʻana i ka ʻōlelo Makuahine ma kā mākou mau hana like ʻole, e laʻa hoʻi me ka hoe waʻa me ka heʻe nalu.

Ola nā iwi iā kākou
Ola ka inoa ʻo Mākāhā!
Ola ka ʻōlelo!
Ola ka lāhui! ■

U.S. Navy Pacific Missile Range Facility and
NASA Kōkeʻe Park Geophysical Observatory
Real Estate Environmental Impact Statement

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For more information visit PMRF-KPGO-EIS.com

Attachment D

DEPARTMENT OF THE NAVY
COMMANDER, PACIFIC MISSILE RANGE FACILITY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER

5090
Ser N4/0306
April 30, 2024

Dear Sir or Madam:

SUBJECT: U.S. NAVY PACIFIC MISSILE RANGE FACILITY AND NASA KŌKEʻE PARK GEOPHYSICAL OBSERVATORY REAL ESTATE ENVIRONMENTAL IMPACT STATEMENT

The U.S. Department of the Navy and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended by the Fiscal Responsibility Act of 2023, and in coordination with the Hawaiʻi Department of Land and Natural Resources (DLNR) (Hawaiʻi Administrative Rules [HAR] § 11-200.1-23 (a)(4)).

In the EIS, the Navy and NASA will evaluate the potential environmental consequences of the Navy's and NASA's proposal to retain the use of 8,348 acres and 23 acres, respectively, of State lands presently utilized pursuant to leases and easements on Kauaʻi, Hawaiʻi, for operational continuity and sustainment at the Pacific Missile Range Facility (PMRF), and NASA's continued operations, including measurements of the Earth's rotation and local land motion, at Kōkeʻe Park Geophysical Observatory (KPGO). The Proposed Action is needed because the existing real estate agreements for these State lands are set to expire between 2027 and 2030. Preserving the long-term Department of Defense and NASA use of these State lands is critical for military readiness, continuation of ongoing military training and testing, and maintaining data collection efforts of global and local significance.

For DLNR, in addition to its role as the lessor of State lands, the proposed real estate action presents an opportunity for the agency to secure a revenue source to support its management of public lands and associated environmental and conservation programs. Fees from leases and easements are put into a State fund as required by law.

By ensuring continued Navy and NASA operations on Kauaʻi, the real estate action would also preserve local jobs and income for the residents of Kauaʻi, financially contribute to the overall economic well-being of Kauaʻi, and maintain continued conservation management of natural and cultural resources on State lands at no cost to the State of Hawaiʻi.

The EIS will evaluate the potential environmental effects of the Proposed Action and alternatives, including the No Action Alternative. The EIS will satisfy both federal and State of Hawaiʻi requirements and provide the necessary analyses to allow the Navy, NASA, and DLNR to consider the environmental effects of the Proposed Action as part of their decision making.

For portions of PMRF, the Navy has lease agreements with the State of Hawai'i for 8,348 acres, comprised of 684 acres of leaseholds and 7,664 acres of easements. The Navy operates on 410 acres of the total acres leased from the State of Hawai‘i. The majority of the leased and easement areas remain intentionally undeveloped as they are used as an encroachment buffer and security for the range's mission. The Navy's current leases and easements support mission operations, access, and utilities at five general locations: Main Base, Kamokalā Ridge, Mānā Water Well, Miloli‘i Ridge, and Mākaha Ridge.

PMRF is the world's largest instrumented multi-domain training and testing facility. PMRF is an essential part of Department of Defense training, research, development, testing, and evaluation. PMRF is unique because of its ability to support simultaneous surface, subsurface, air, and space operations. On Kaua‘i, the Navy is the largest high-tech employer and third largest overall employer. Most of the 900 personnel at PMRF are civilians, including many from the local community. PMRF contributes approximately $150 million annually in salary, contract goods, and services to the local economy. PMRF supports operations from single-unit exercises to large-scale multiple-unit training events. PMRF is located on the southwest coast of the Hawaiian island of Kaua‘i.

NASA operates KPGO to collect geodetic data about the Earth's shape, orientation in space, and gravity. This data supports modern navigation technology such as the Global Positioning System (GPS) that is used every day in a wide variety of devices, from handheld smartphones to satellites. In addition, this data is used for scientific studies, spacecraft navigation, and the geolocation of Earth observations. Continued operation of KPGO is needed to ensure these data-related operations of global and local significance can continue, allowing multiple agencies' missions to persist without interruption. KPGO is located on a remote ridge within Kōke‘e State Park in the western portion of Kaua‘i. NASA has issued a Use Permit to the Navy for use of portions of KPGO for mission support with radar, telemetry, and communications services.

For more information about KPGO, visit https://space-geodesy.nasa.gov/NSGN/sites/KPGO/KPGO.html. For more information about PMRF, visit https://cnrh.cnic.navy.mil/Installations/PMRF-Barking-Sands/.

PUBLIC SCOPING PERIOD

The Navy and NASA are initiating a public scoping period to receive comments on the scope of the EIS. The Navy and NASA will conduct the public scoping efforts in accordance with NEPA and Hawai‘i Revised Statutes (HRS) Chapter 343. The scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and HRS Section 6E-42.

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Ser N4/0306
April 30, 2024

Members of the public are encouraged to participate in the environmental planning process by providing input on the proposed real estate action, including potential alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS.

The public scoping period for the EIS begins May 8, 2024, and ends June 17, 2024. The Navy and NASA are requesting public comments for consideration in development of the Draft EIS. Comments are requested to be postmarked by June 17, 2024. Public scoping meetings will be held June 4 to 6, 2024, on the island of Kaua‘i.

For more information, please review the enclosures and visit the project website at **PMRF-KPGO-EIS.com**. If you would like to request a briefing with our Navy and NASA team, please contact the PMRF Public Affairs Officer at **(808) 335-4740** or **PMRFPublicAffairs@us.navy.mil**. Thank you for your interest in the project.

Sincerely,

David A. Reth
Director, Management Operations
Goddard Space Flight Center
National Aeronautics and Space Administration

Sincerely,

B. A. STEVENSON
Captain, U.S. Navy
Commanding Officer
Pacific Missile Range Facility

Enclosures: 1. Public Scoping Meetings and How to Submit Public Scoping Comments
2. Project Location Map

Distribution: Commander, U.S. Pacific Fleet
Commander, Navy Region Hawaii
Commander, Navy Facility Engineering Systems Command Hawaii
Interested Parties Contacted During Scoping, Appendix C to Environmental Impact Statement Preparation Notice for PMRF and KPGO of May 2024

Public Scoping Meetings and How to Submit Public Scoping Comments

PUBLIC SCOPING MEETINGS

The Navy and NASA will host public scoping meetings at three locations on Kauaʻi. The public is encouraged to attend any of the public scoping meetings to talk story, learn more, and submit written or oral comments. All meetings will be held from 5 to 8 p.m. HST at the following locations:

Tuesday, June 4, 2024
Kauaʻi Veterans Center
3215 Kauaʻi Veterans Memorial Hwy, Līhuʻe

Wednesday, June 5, 2024
Kekaha Neighborhood Center
8130 Elepaio Rd., Kekaha

Thursday, June 6, 2024
Sheraton Kauaʻi Coconut Beach Resort
650 Aleka Loop, Kapaʻa

Meeting Times: 5 to 8 p.m.
Agenda:

- **5 to 8 p.m.** Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment.
- **6 to 6:30 p.m.** Project presentation by Navy and NASA.

HOW TO SUBMIT COMMENTS

Submit Comments in Person, Online, or by Mail

Submit comments by June 17, 2024. The Navy and NASA encourage the public to attend a public scoping meeting and visit the project website to learn more. Comments should be related to the proposed real estate action, including potential alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS.

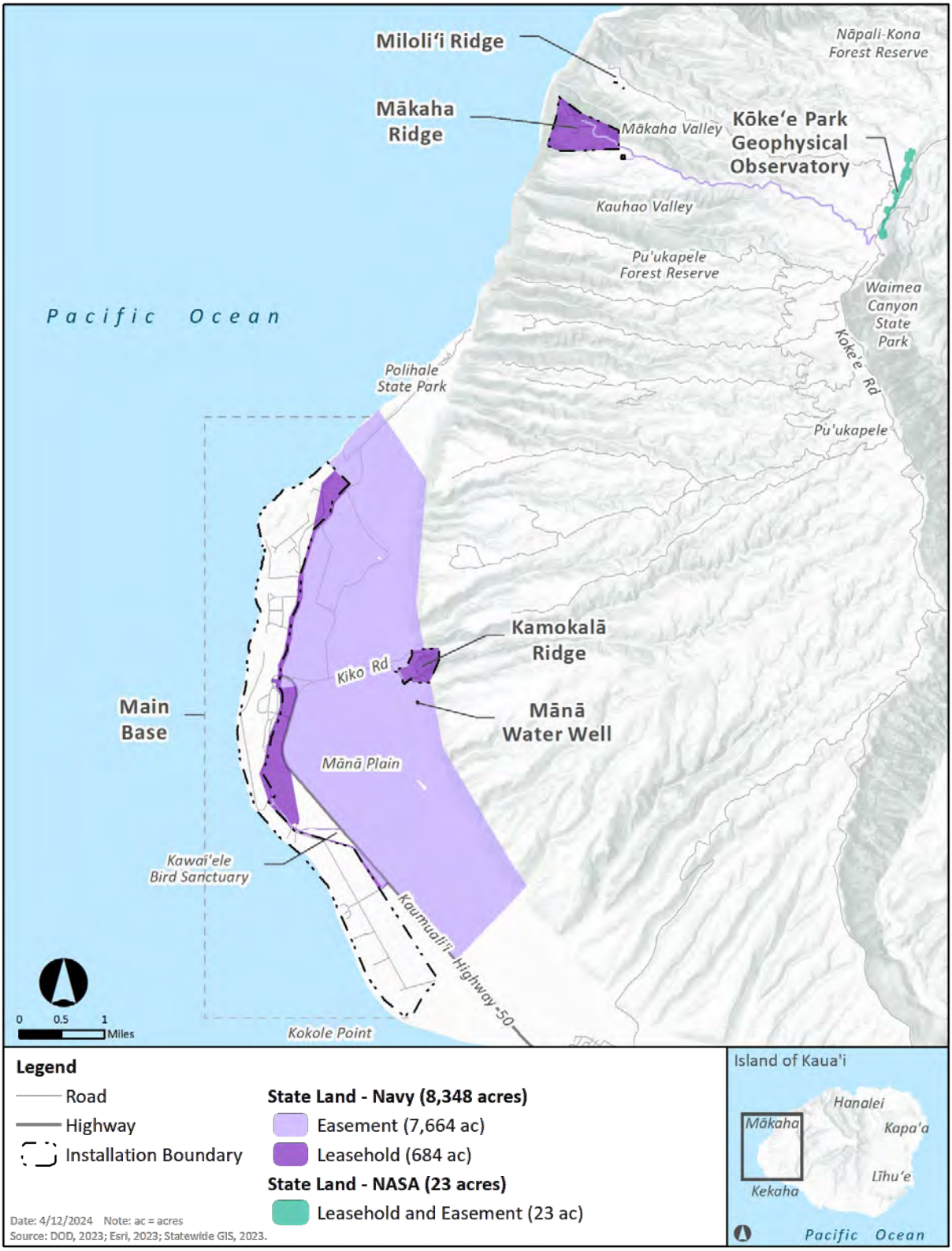
The public may submit comments in any of the following ways:

- In person at a public scoping meeting
- Through the project website at **PMRF-KPGO-EIS.com**
- By email to **info@PMRF-KPGO-EIS.com**
- By mail, postmarked by June 17, 2024, to the following address:
  Naval Facilities Engineering Systems Command, Hawai'i
  Environmental OPHEV2
  Attn: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
  400 Marshall Road, Building X-11
  Pearl Harbor, HI 96860

For more information, visit the project website at **PMRF-KPGO-EIS.com**.

For language assistance or special accommodations, contact the PMRF Public Affairs Officer at **(808) 335-4740** or **PMRFPublicAffairs@us.navy.mil**. Requests for language assistance or special accommodations should be made at least seven days prior to the public meeting.

Project Location Map



Enclosure (2)

Attachment E

E Pane Mai Ka Nonoi O Nohili

Answering the requests of Nohili

U.S. Navy Pacific Missile Range Facility and NASA Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

The Navy and NASA invite you to participate in the environmental planning process and submit comments.

The U.S. Department of the Navy (Navy) and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts of proposed real estate agreements with the State of Hawaiʻi for the Pacific Missile Range Facility (PMRF) and the Kōkeʻe Park Geophysical Observatory (KPGO). The Navy and NASA invite you to participate in the environmental planning process.

The Navy proposes to maintain long-term Department of Defense use of 8,348 acres of State of Hawaiʻi lands on Kauaʻi for operational continuity and sustainment of the military readiness mission. The Navy operates on 410 acres of the total acres leased from the State. The majority of the leased and easement areas remain intentionally undeveloped as they are used as an encroachment buffer and security for the facility's mission. NASA proposes to maintain long-term use of 23 acres of State of Hawaiʻi land on Kauaʻi for continued operations of KPGO. The Proposed Action is needed because existing real estate agreements for these State lands are set to expire between 2027 and 2030.

The Navy and NASA will host public scoping meetings at three locations on Kauaʻi. Attend any of the public scoping meetings to talk story, learn more, and submit written or oral comments. Your voice is important to this planning process. Meetings will be held from 5 to 8 p.m. HST at the following locations:

Public Scoping Meetings:

Tuesday, June 4, 2024
Kauaʻi Veterans Center, 3215 Kauaʻi Veterans Memorial Hwy., Līhuʻe

Wednesday, June 5, 2024
Kekaha Neighborhood Center, 8130 Elepaio Rd., Kekaha

Thursday, June 6, 2024
Sheraton Kauaʻi Coconut Beach Resort, 650 Aleka Loop, Kapaʻa

Agenda:

5 to 8 p.m.
Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment.

6 to 6:30 p.m.
Project presentation by Navy and NASA.

For more information, visit PMRF-KPGO-EIS.com

Naval Facilities Engineering Systems Command, Hawai'i
Environmental OPHEV2
Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
400 Marshall Road, Building X-11
Pearl Harbor, HI 96860

Public Comment Period

The Navy and NASA are initiating a public scoping period under the National Environmental Policy Act and Hawai'i Revised Statutes (HRS) Chapter 343 to receive comments on the scope of the EIS. Members of the public are encouraged to participate in the environmental review process by providing input on the proposed real estate action including potential alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS. The scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and HRS Section 6E-42. Your voice is important to this planning process.

The public scoping period begins ***May 8, 2024*** and ends ***June 17, 2024.*** Please attend a public scoping meeting and visit the project website to learn more.

For language assistance or special accommodations, contact the PMRF Public Affairs Officer at (808) 335-4740 or PMRFPublicAffairs@us.navy.mil. Requests for language assistance or special accommodations should be made at least seven days prior to the public meeting.

Submit Comments in Person, Online, or by Mail

Submit comments by ***June 17, 2024.***
The public may submit comments in any of the following ways:

- In person at a public scoping meeting
- Through the project website at PMRF-KPGO-EIS.com
- By email to info@PMRF-KPGO-EIS.com
- By mail, postmarked by ***June 17, 2024*** to the following address:
  Naval Facilities Engineering Systems Command, Hawai'i
  Environmental OPHEV2
  Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
  400 Marshall Road, Building X-11
  Pearl Harbor, HI 96860

The Navy and NASA propose to evaluate potential environmental impacts to the following resource areas. The public is invited to provide input on these and other resources that should be considered in the EIS.

Social Environment

- Archaeological and historic resources
- Cultural practices
- Visual resources
- Public health and safety
- Land use
- Socioeconomics
- Environmental justice

Physical Environment

- Air quality and greenhouse gases
- Water resources

Biological Environment

- Biological resources

Built Environment

- Utilities
- Transportation
- Hazardous materials and wastes

Attachment F

PMRF KPGO
Real Estate EIS
Mailing List

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	**Category**	**Prefix**	**First**	**Last**	**Title**	**Organization Name**	**Address 1**	**Address 2**	**City**	**State**	**Zip**	**Phone**	**Email**	**Notes**	**NOI Letter**	**NOI Postcard**
28	04 - Federal Agency	Ms.	Heather	Tonneson	Refuge Manager, National Wildlife Refuge System	Kaua'i National Wildlife Refuge Complex	P.O. Box 1128		Kīlauea	HI	96754	808-828-1413 x2223		Added from Navy stakeholder list		X
97	08 - Environmental organizations and other NGOs - R	Ms.	Rayne	Regush		Sierra Club of Hawai'i, Kaua'i Group							RAYNEREGUSH@aol.com	Added from Navy stakeholder list		X
104	09 - Environmental organizations and other NGOs - Local					Kaua'i Monk Seal Watch Program	P.O. Box 1836		Koloa	HI	96756			Added from Navy stakeholder list		X
121	10 - Native Hawai'ian Organizations and Cultural Centers - Local					Hui Mālama Polihale							huimalamapolihale@gmail.com	Added from One Kaua'i list		X
122	10 - Native Hawai'ian Organizations and Cultural Centers - Local					The Children of the Land	4-831 Kuhio Hwy.		Kapa'a	HI	96746	808-821-1234		Added from Navy stakeholder list		X
136	12 - Schools/Universities	Ms.	Margaret	Sanchez	Interim Chancellor	Kaua'i Community College	3-1901 Kaumualii Hwy.		Līhu'e	HI	96766	(808) 245-8283	masanche@hawaii.edu			X
137	12 - Schools/Universities	Ms.	Tia	Koerte	Director	Ke Kula Ni'ihau O Kekaha Public Charter School	P.O. Box 129		Kekaha	HI	96752	(808) 337-0481				X
138	12 - Schools/Universities	Mr.	Joseph	Hicks	Principal	Kekaha Elementary School	P.O. Box 580		Kekaha	HI	96752	(808) 337-7655				X
139	12 - Schools/Universities	Ms.	Hedy	Sullivan	Principal	Kula Aupuni Ni'ihau A Kahelelani Aloha Public Charter School	P.O. Box 610		Kekaha	HI	96752	(808) 337-2022				X
140	12 - Schools/Universities	Mr.	Daniel	Hamada	Principal	Ni'ihau High and Elementary School	C/O Department of Education, Kaua'i Complex Area Office 3060 Eiwa Street	Suite 305	Līhu'e	HI	96766	(808) 274-3502	daniel.hamada@k12.hi.us	Mr. Hamada is also the contact for the entire Kaua'i District, so there is no separate entry for that entity (Kaua'i District, Waimea Complex).		X
141	12 - Schools/Universities	Ms.	Wendy	Castillo	Principal	St. Theresa School	P.O. Box 277		Kekaha	HI	96752	(808) 337-1351	office@sttheresakauai.com			X
142	12 - Schools/Universities	Dr.	Robin	Tinghitella		University of Hawai'i Kaua'i Agricultural Research Center	7370-A Kuamo'o Road		Kapa'a	HI	96746	(808) 822-4984	lihue@ctahr.hawaii.edu			X
143	12 - Schools/Universities	Dr.	Shaya	Honarvar	Director	University of Hawai'i Pacific Cooperative Studies Unit	3190 Maile Way		Honolulu	HI	96822-2279	(808) 956-0808	honarvar@hawaii.edu			X
144	12 - Schools/Universities	Mr.	Ray	Carvalho	Interim Principal	Waimea Canyon Middle School	9555 Huakai Rd.		Waimea	HI	96796	(808) 338-6830 ext. 102				X
145	12 - Schools/Universities	Ms.	Mahina	Anguay	Principal	Waimea High School	P.O. Box 339		Waimea	HI	96796	(808) 338-6800	Mahina.Anguay@k12.hi.us			X
146	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests				President	Hanapepe Economic Alliance	4111 Noho Rd.	Suite A	Koloa	HI	96756			Added from Navy stakeholder list		X
147	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests					Kānehūnāmoku Voyaging Academy	47-705 Kamehameha Hwy.	Unit A	Kāne'ohe	HI	96744	808-286-4176	info@kanehunamoku.org	Added from Navy stakeholder list		X
148	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests	Mr.	Mark	Perriello	President/CEO	Kaua'i Chamber of Commerce	4268 Rice Street		Līhu'e	HI	96766	(808) 245-7363	mark@kauaichamber.org			X
149	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests	Ms.	Laurie	Yoshida	Chairman	Kaua'i Economic Development Board	P.O. Box 3921		Līhu'e	HI	96766	808-245-6692	info@kedb.com	Added from Navy stakeholder list		X
150	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests	Ms.	Cyndi	Ayonon	President	Kaua'i Filipino Chamber of Commerce	P.O. Box 3618		Līhu'e	HI	96766	(808) 645-6343	info@kauaifilipinochamber.org			X
151	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests	Mr.	Allan	Smith	Chairman	Kaua'i Island Utility Cooperative	4463 Pahee St.	Suite 1	Līhu'e	HI	96766	808-246-4300	info@kiuc.coop	Added from Navy stakeholder list		X
152	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests					Kaua'i Sea Rider Adventure Tours	3417 Po'ipū Rd., #105	P.O. Box 853	Kōloa	HI	96756	808-742-7422	reservations+ksr@islandactivitygroup.com	Added from Navy stakeholder list		X
153	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests	Ms.	Sue	Kanoho	Executive Director	Kaua'i Visitors Bureau	4473 Pahe'e Street	Suite F	Līhu'e	HI	96766	(808) 245-3971	kauai@hvcb.org			X
154	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests					Kekaha Agriculture Association	8297 Kekaha Rd.		Kekaha	HI	96752	808-337-9262		Added from Navy stakeholder list		X
155	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests					Kōke'e Lodge	P.O. Box 565		Waimea	HI	96796	(808) 335-6061	info@kokeelodge.com			X
156	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests	Mr.	Mark	Paikuli-Stride		Luluku Farmer's Association	45-559c Luluku Rd.		Kāne'ohe	HI	96744			Added from Navy stakeholder list		X
157	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests					The Cabins at Kōke'e, Akamai Hawaii Properties	P.O. Box 1198		Waimea	HI	96796	(808) 652-6852				X
158	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests	Mr.	Eric	Nordmeire		West Kaua'i Business and Professional Association	P.O. Box 903		Waimea	HI	96796					X
159	13 - Small business associations, economic development/ tourism organization, and recreational and real estate interests	Ms.	Renaé	Hamilton-Cambeilh	Executive Director	YWCA Kaua'i Camp Sloggett	3094 Elua Street		Līhu'e	HI	96766	(808) 245-5959 ext. 236	director@ywcakauai.org	The YWCA owns Camp Sloggett.		X
160	14 - Fishing/Diving	Capt.	Rob	McGuckin	President	Hawai'i Big Game Fishing Club	P.O. Box 471		Kailua-Kona	HI	96745	(808) 329-8252	info@hbgfc.org			X
161	14 - Fishing/Diving	Mr.	Lance	Marugame		Hawai'i Freshwater Fishing Association	330 Walker Ave.		Wahiawa	HI	96786	(808) 927-3264	hffabass@gmail.com lmmarugame@hotmail.com			X
162	15 - Community planning groups, and other community and civic organizations	Ms.	Emma Emalia	Keohokalole	Secretary-Treasurer	'Ohana Keohokālole	P.O. Box 565		Kāne'ohe	HI	96744	808-371-3398	eek4@hawaii.edu	Added from Navy stakeholder list		X
163	15 - Community planning groups, and other community and civic organizations	Mr.	Lewellyn 'Billy'	Kaohelaulii		Aha Moku Council Kaua'i - Mano O Kalanipo	2249 Kuai Rd.		Kōloa	HI	96756	808-742-9575	terriehayes@gmail.com	Added from Navy stakeholder list		X
164	15 - Community planning groups, and other community and civic organizations					Ahahui Kiwila Hawai'i O Mo'ikeha	P.O. Box 1383		Kilauea	HI	96754			Added from Navy stakeholder list		X
165	15 - Community planning groups, and other community and civic organizations	Mr.	Donovan Andrew	Lazarus	State Commander	AMVETS Department of Hawai'i	P.O. Box 2865		'Ewa Beach	HI	96706	(808) 888-0410 main (808) 382-6835 direct	admin@amvets-hawaii.org (main) donovan@amvets-hawaii.org (direct)			X
166	15 - Community planning groups, and other community and civic organizations					Boys and Girls Club, West Kaua'i	4590 Ola Rd.		Waimea	HI	96796	808-320-8353		Added from Navy stakeholder list		X
167	15 - Community planning groups, and other community and civic organizations					Church of Jesus Christ of Latter-Day Saints	4580 Ehiku St.		Līhu'e	HI	96766	808-425-7010		Added from Navy stakeholder list		X
168	15 - Community planning groups, and other community and civic organizations	Ms.	Roslyn	Cummings		E Ola Kākou Hawai'i	P.O. Box 315		Kalāheo	HI	96741	808-652-9918	mana.eolakakouhawaii@gmail.com	Added from Navy stakeholder list		X
169	15 - Community planning groups, and other community and civic organizations					E Ola Mau Na Leo O Kekaha	8130 Elepaio Rd.		Kekaha	HI	96752			Added from One Kaua'i list		X
170	15 - Community planning groups, and other community and civic organizations	Ms.	Mahealani	Cypher	Descendent	George K. Cypher 'Ohana	c/o Denise e DeCosta 45-342 Lilipuna Rd.	#308	Kāne'ohe	HI	96744	808-226-4195	jhd6@hawaii.edu	Added from Navy stakeholder list		X
171	15 - Community planning groups, and other community and civic organizations				President	Hanalei Hawaiian Civic Club	P.O. Box 68		Hanalei	HI	96714	808-639-4048		Added from Navy stakeholder list		X
172	15 - Community planning groups, and other community and civic organizations	Mr.	Micah	Kāne	Chief Executive Officer & President	Hawai'i Community Foundation	4268 Rice Street	Suite K	Līhu'e	HI	96766	(808) 245-4585				X
173	15 - Community planning groups, and other community and civic organizations					Hawai'i Health Systems Corp. Kaua'i Region	P.O. Box 669		Waimea	HI	96796			Added from Navy stakeholder list		X

PMRF KPGO
Real Estate EIS
Mailing List

Final for Approval 02MAY2024

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	**Category**	**Prefix**	**First**	**Last**	**Title**	**Organization Name**	**Address 1**	**Address 2**	**City**	**State**	**Zip**	**Phone**	**Email**	**Notes**	**NOI Letter**	**NOI Postcard**
174	15 - Community planning groups, and other community and civic organizations		Dawn N.S.	Chang, Esq.	Chair	Hoʻokano Family Land Trust	P.O. Box 6280		Kāneʻohe	HI	96744	808-539-3583	dnschang@kuiwalu.com	Added from Navy stakeholder list. However, Ms. Chang is already on this mailing list for two other organizations.		X
175	15 - Community planning groups, and other community and civic organizations					Hoʻōla Lāhui Hawaiʻi	4491 Rice St.		Līhuʻe	HI	96766	808-240-0100	info@hoolalahui.org	Added from Navy stakeholder list		X
176	15 - Community planning groups, and other community and civic organizations	Mr.	Presley	Wann	President	Hui Makaʻāinana O Makana	P.O. Box 1225		Hanalei	HI	96714		info@huimakaainanaomakana.org			X
177	15 - Community planning groups, and other community and civic organizations	Mr.	Jonathan Kānekoa	Kukea Shultz	Executive Director	Kākoʻo ʻŌiwi	P.O. Box 5307		Kāneʻohe	HI	96744	808-741-3403	info@kakooiwi.org	Added from Navy stakeholder list		X
178	15 - Community planning groups, and other community and civic organizations	Mr.	Mark	Hubbard	Chair	Kauaʻi Planning & Action Alliance	2959 Umi Street	Suite 201	Līhuʻe	HI	96766	(808) 632-2005	kpaa@kauainetwork.org			X
179	15 - Community planning groups, and other community and civic organizations	Dr.	Sarah	Styan	Founder, President & CEO	Kauaʻi Community Science Center	P.O. Box 60		Waimea	HI	96796	808-431-4332	info@kauaicsc.org	Added from Navy stakeholder list		X
180	15 - Community planning groups, and other community and civic organizations	Ms.	Malia	Nobrega-Olivera		Kauaʻi Council of the Association of Hawaiian Civic Clubs	Moku o Manokalanipō PO Box 383		Hanapēpē	HI	96716		malianob@gmail.com	Added from Navy stakeholder list		X
181	15 - Community planning groups, and other community and civic organizations	Ms.	Lynn Maile	Taylor	President and CEO	Kauaʻi Sea Farm	P.O. Box 746		Kalāheo	HI	96741	808-645-0527	info@kauaiseafarm.com	Added from Navy stakeholder list		X
182	15 - Community planning groups, and other community and civic organizations					Kekaha Host Benefits Program Citizen Action Committee.							info@kekahahcb.net	Added from One Kauaʻi list		X
183	15 - Community planning groups, and other community and civic organizations	Mr.	Jose	Felix-Keamoai	President	Kekaha Pop Warner	c/o Kauaʻi Pop Warner P.O. Box 1264		Lāwaʻi	HI	96765	808-651-6573	josefelix808@gmail.com	Added from Navy stakeholder list		X
184	15 - Community planning groups, and other community and civic organizations					Kilauea Community Agricultural Center - Aina Hoʻokupu O Kilauea	P.O. Box 1023		Kīlauea	HI	96754	(808) 652-1857	nfo@ainahookupuokilauea.org			X
185	15 - Community planning groups, and other community and civic organizations	Ms.	D. Ululani	Bierne-Keawe	Pelekikena	Koʻolauloa Hawaiian Civic Club	P.O Box 532		Hauʻula	HI	96717	808-548-9774	Khcc532@gmail.com	Added from Navy stakeholder list		X
186	15 - Community planning groups, and other community and civic organizations	Mr.	Charles	Naumu	President	Koʻolaupoko Hawaiian Civic Club	P. O. Box 664		Kāneʻohe	HI	96744		KoolaupokoHCC@gmail.com	Added from Navy stakeholder list		X
187	15 - Community planning groups, and other community and civic organizations		Kevin K.J.	Chang, Esq.	Executive Director	Kuaʻāina Ulu ʻAuamo	47-200 Waiheʻe Rd.	c/o Key Project	Kāneʻohe	HI	96744	808-672-2545	info@kuahawaii.org	Added from Navy stakeholder list		X
188	15 - Community planning groups, and other community and civic organizations					KVMH Auxiliary Association	P.O. Box 337		Waimea	HI	96796	808-338-9488		Added from Navy stakeholder list		X
189	15 - Community planning groups, and other community and civic organizations		Lani	Maʻa Lapilio, Esq.		Maʻa ʻOhana	P.O. Box 6087		Kāneʻohe	HI	96744	808-540-5741	lani@aukahi.com	Added from Navy stakeholder list		X
190	15 - Community planning groups, and other community and civic organizations	Mr.	Kamealoha	Smith	Board Member	Mahamoku Ohana Council	P.O. Box 510015		Keālia	HI	96751	808-212-4356	khs96703@gmail.com	Added from Navy stakeholder list		X
191	15 - Community planning groups, and other community and civic organizations					Malama Anahola	P.O. Box 7		Anahola	HI	96703			Added from Navy stakeholder list		X
192	15 - Community planning groups, and other community and civic organizations	Ms.	Sara	Bowen	Executive Director	Mālama Hulēʻia	P.O. Box 662092		Līhuʻe	HI	96766	808-626-5210	sara.ed@malamahuleia.org	Added from Navy stakeholder list		X
193	15 - Community planning groups, and other community and civic organizations	Ms.	Abigail K.	Nishida		Na Kuʻauhau ʻo Kahiwakaneikopolei	P.O. Box 5411		Kāneʻohe	HI	96744			Added from Navy stakeholder list		X
194	15 - Community planning groups, and other community and civic organizations	Mr.	Noa	Mau-Espirito		Na Mookupuna O Wailua	6200 Olohena Rd.	Unit A	Kapaʻa	HI	96746	808-855-5575	nkeliiua@gmail.com	Added from Navy stakeholder list		X
195	15 - Community planning groups, and other community and civic organizations		Keith & Bruce	Robinson		Niʻihau – Niʻihau O Kahele Lani	P.O. 232		Kaumakani	HI	96747	808-335-3500	niihauisland@hawaiiantel.net	Added from Navy stakeholder list		X
196	15 - Community planning groups, and other community and civic organizations	Ms.	Liberta	Albao		Queen Deborah Kapule Hawaiian Civic Club	P.O. Box 164		Kapa'a	HI	96746			Added from Navy stakeholder list		X
197	15 - Community planning groups, and other community and civic organizations					Ruff Ryderz Baseball	9555 Huakai Rd.		Waimea	HI	96796	808-651-5250	ruffryderzbaseballkauai@gmail.com	Added from Navy stakeholder list		X
198	15 - Community planning groups, and other community and civic organizations	Ms.	Robin Puanani	Danner	Chairman	Sovereign Councils of the Hawaiian Homestead Associations	P.O. Box 646		Anahola	HI	96703	808-431-4067	info@hawaiianhomesteads.org	Added from Navy stakeholder list		X
199	15 - Community planning groups, and other community and civic organizations	Rev. Fr.	Edwin	Conselva	Pastor	St. Theresa Catholic Church	P.O. Box 159	8355 Kaumualii Hwy.	Kekaha	HI	96752	808-337-1548		Added from Navy stakeholder list		X
200	15 - Community planning groups, and other community and civic organizations	Mr.	Lance Kamuela	Gomes	Konohiki Chief	Wahiawa Ahupuaa LCA 7714B Apana 6 RP 7813	P.O. Box 382		Kalāheo	HI	96741	808-631-1737	kamuela@live.com	Added from Navy stakeholder list		X
201	15 - Community planning groups, and other community and civic organizations	Mr.	Jesse	Cummings		Wai Koa Kauaʻi	P.O. Box 315		Kalāheo	HI	96741	808-651-1468	jessekekoacummings@yahoo.com	Added from Navy stakeholder list		X
202	15 - Community planning groups, and other community and civic organizations					Waimea Theater	9691 Kaumualii Hwy.		Waimea	HI	96796	808-338-0282		Added from Navy stakeholder list		X
203	15 - Community planning groups, and other community and civic organizations	Mr.	Mike	Faye	President	West Kauaʻi (Waimea) Rotary	9852 Kaumualii Hwy.		Waimea	HI	96796	808-639-3900		Added from Navy stakeholder list		X
204	15 - Community planning groups, and other community and civic organizations					West Kauaʻi Lions Organization	P.O. Box 665		Hanapēpē	HI	96716			Added from Navy stakeholder list		X
205	15 - Community planning groups, and other community and civic organizations				Pastor	West Kauaʻi United Methodist Church	P.O. Box 298		Kekaha	HI	96752	808-337-1464	westkauaiumc@gmail.com	Added from Navy stakeholder list		X
206	15 - Community planning groups, and other community and civic organizations					Westside Christian Center	8041 Kekaha Rd.		Kekaha	HI	96752			Added from One Kauaʻi list		X
208	16 - Boating/Yacht Clubs/Marinas					Blue Dolphin Charters	Port Allen Marina Center 4353 Waialo Road	7B	ʻEleʻele	HI	96705	(808) 335-5553				X
209	16 - Boating/Yacht Clubs/Marinas	Captain	Andy			Captain Andy's	P.O. Box 876		ʻEleʻele	HI	96705	(808) 335-6833	fun@napali.com	Could not locate last name, but operator is named Andy.		X
210	16 - Boating/Yacht Clubs/Marinas	Mr.	Lani	Swain	Captain	Catamaran Kahanu	4353 Waialo Road		ʻEleʻele	HI	96705	(808) 645-6176	captainkahanu@gmail.com			X
211	16 - Boating/Yacht Clubs/Marinas					Holo Holo Charters	P.O. Box 50940		ʻEleʻele	HI	96705	(808) 335-0815	reservations@holoholocharters.com			X
212	16 - Boating/Yacht Clubs/Marinas					Kauaʻi Sailing Association	P.O. Box 3786		Lihuʻe	HI	96766	(808) 346-6051	kauaisailing@gmail.com			X
213	16 - Boating/Yacht Clubs/Marinas					Kauaʻi Sea Tours	4353 Waialo Road	2B	ʻEleʻele	HI	96705	(808) 335-5309	info@kauaiseatours.com			X
214	16 - Boating/Yacht Clubs/Marinas					Kikiaola Westside Boaters Club	P.O. Box 986		Kekaha	HI	96796			Added from Navy stakeholder list		X
215	16 - Boating/Yacht Clubs/Marinas					Makana Charters	4516 Alawai Road		Waimea	HI	96796	(808) 338-9980	info@makanacharters.com			X
216	16 - Boating/Yacht Clubs/Marinas	Mr.	Brandon	Elsasser	Captain	Nā Pali Riders	9600 Kaumualiʻi Highway		Waimea	HI	96796	(808) 742-6331	napaliriderskauai@gmail.com			X
217	16 - Boating/Yacht Clubs/Marinas	Mr.	Aaron	Taylor	Captain	Napali Odyssey	Kīkiaola Small Boat Harbor 2494 Niumalu Road		Lihuʻe	HI	96766	(808) 652-0823	napaliodyssey@gmail.com	Address is for the harbor where the boat is; no address found for the business. Potential addresses for business 335 ʻAina Lani Pl, Kapaʻa, HI 96746		X
218	16 - Boating/Yacht Clubs/Marinas	Mr.	Jeff	Jakus	Commodore	Nawiliwili Yacht Club	P.O. Box 3661		Lihuʻe	HI	96766	(808) 264-4845	commodore@nawiliwiliyachtclub.org			X
219	16 - Boating/Yacht Clubs/Marinas					Seasport Divers	2827 Poipu Road		Koloa	HI	96756	(808) 742-9303				X
220	16 - Boating/Yacht Clubs/Marinas					West Side Boaters Association										X
221	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Mr.	Lyle	Tabata	Partner/RME	B&T Contractors, LLC	P.O. Box 662111		Lihu'e	HI	96766					X
222	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Mr.	Darryl	Kua	Pastor	Westside Christian Center Assembly of God	P.O. Box 593		Kekaha	HI	96752	(808) 482-1717				X
223	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Mr.	Dennis	Eguchi												X

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	**Category**	**Prefix**	**First**	**Last**	**Title**	**Organization Name**	**Address 1**	**Address 2**	**City**	**State**	**Zip**	**Phone**	**Email**	**Notes**	**NOI Letter**	**NOI Postcard**
224	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Ms.	Marissa	Faye												X
225	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Mr.	Charlie	Iona												X
226	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Ms.	Alethea	Kaohi & Ohana												X
227	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Ms.	Tia	Koerte										Already listed above as the director of a school.		X
228	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Mr.	Terry	Lily	Biologist											X
229	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.		Kaua	Mata												X
230	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Mr.	Josh	Mori												X
231	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Ms.	Keiko	Napier												X
232	17 - Individual community members (not associated with groups) interested in cultural and natural resources preservation, military use of the land, public access, etc.	Mr.	Toni	Ricci												X
233	18 - PMRF civilian and contract employees: Navy to send an All Hands message															X
301	20 - Libraries				Branch Manager	Hanapēpē Public Library	4490 Kona Rd		Hanapēpē	HI	96716					X
302	20 - Libraries				Branch Manager	Hawai'i State Library	478 S King St		Honolulu	HI	96813					X
303	20 - Libraries				Branch Manager	Kapa'a Public Library	4-1464 Kuhio Hwy		Kapa'a	HI	96746					X
304	20 - Libraries				Branch Manager	Koloa Public and School Library	3451 Poipu Rd		Koloa	HI	96756					X
305	20 - Libraries				Branch Manager	Līhu'e Public Library	4344 Hardy St		Līhu'e	HI	96766					X
306	20 - Libraries				Branch Manager	Princeville Public Library	4343 Emmalani Dr		Princeville	HI	96722			Temporarily Closed		X
307	20 - Libraries				Branch Manager	Waimea Public Library (Kaua'i)	9750 Kaumualii Hwy		Waimea	HI	96796					X

Attachment G

U.S. Navy Pacific Missile Range Facility and NASA Kōkeʻe Park
Geophysical Observatory Real Estate Environmental Impact Statement

The Navy and NASA invite you to participate in the environmental planning process and submit comments.

The U.S. Department of the Navy (Navy) and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts of proposed real estate agreements with the State of Hawaiʻi for the Pacific Missile Range Facility (PMRF) and the Kōkeʻe Park Geophysical Observatory (KPGO). The Navy and NASA invite you to participate in the environmental planning process.

The Navy proposes to maintain long-term Department of Defense use of 8,348 acres of State of Hawaiʻi lands on Kauaʻi for operational continuity and sustainment of the military readiness mission. The Navy operates on 410 acres of the total acres leased from the State. The majority of the leased and easement areas remain intentionally undeveloped as they are used as an encroachment buffer and security for the facility's mission. NASA proposes to maintain long-term use of 23 acres of State of Hawaiʻi land on Kauaʻi for continued operations of KPGO. The Proposed Action is needed because existing real estate agreements for these State lands are set to expire between 2027 and 2030.

The Navy and NASA will host public scoping meetings at three locations on Kauaʻi. Attend any of the public **scoping meetings to talk story, learn more, and submit written or oral comments. Your voice is important to this** planning process. Meetings will be held from 5 to 8 p.m. HST at the following locations:

PUBLIC SCOPING MEETINGS

Tuesday, June 4, 2024	Wednesday, June 5, 2024	Thursday, June 6, 2024
Kauaʻi Veterans Center 3215 Kauaʻi Veterans Memorial Hwy, Līhuʻe	Kekaha Neighborhood Center 8130 Elepaio Road, Kekaha	Sheraton Kauaʻi Coconut Beach Resort 650 Aleka Loop, Kapaʻa

AGENDA

5 to 8 p.m.	6 to 6:30 p.m.
Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment.	Project presentation by Navy and NASA.

The Navy and NASA are initiating a public scoping period under the National Environmental Policy Act and Hawaiʻi Revised Statutes (HRS) Chapter 343 to receive comments on the scope of the EIS. Members of the public are encouraged to participate in the environmental planning process by providing input on the proposed real estate action including potential alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS. The scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and HRS Section 6E-42. Your voice is important to this planning process.

The public scoping period begins *May 8, 2024, and ends June 17, 2024*. Please attend a public scoping meeting and visit the project website to learn more. For language assistance or special accommodations, contact the PMRF Public Affairs Officer, at (808) 335-4740 or PMRFPublicAffairs@us.navy.mil. Requests for language assistance or special accommodations should be made at least seven days prior to the public meeting.

Submit Comments in Person, Online, or by Mail. Submit comments by *June 17, 2024*. The public may submit comments in any of the following ways: In person at a public scoping meeting, through the project website at PMRF-KPGO-EIS.com, by email to info@PMRF-KPGO-EIS.com, or by mail, postmarked by *June 17, 2024* to the following address: Naval Facilities Engineering Systems Command, Hawaiʻi, Environmental OPHEV2, Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells, 400 Marshall Road, Building X-11, Pearl Harbor, HI 96860.

For more information visit PMRF-KPGO-EIS.com

Attachment H

The Environmental Notice

May 8, 2024

Josh Green, M.D., Governor
Mary Alice Evans, OPSD Director

The Environmental Notice provides public notice for projects undergoing environmental review in Hawai'i as mandated under Section 343-3, Hawai'i Revised Statutes, the Environmental Impact Statement Law. Along with publishing Environmental Assessments and Environmental Impact Statements for projects in Hawai'i, *The Environmental Notice* also includes other items related to the shoreline, coastal zone, and federal activities.

Engineered, uncemented rock revetments such as this may provide temporary protection and stability to sections of Kamehameha Hwy in windward O'ahu

Photo from project's Draft EA

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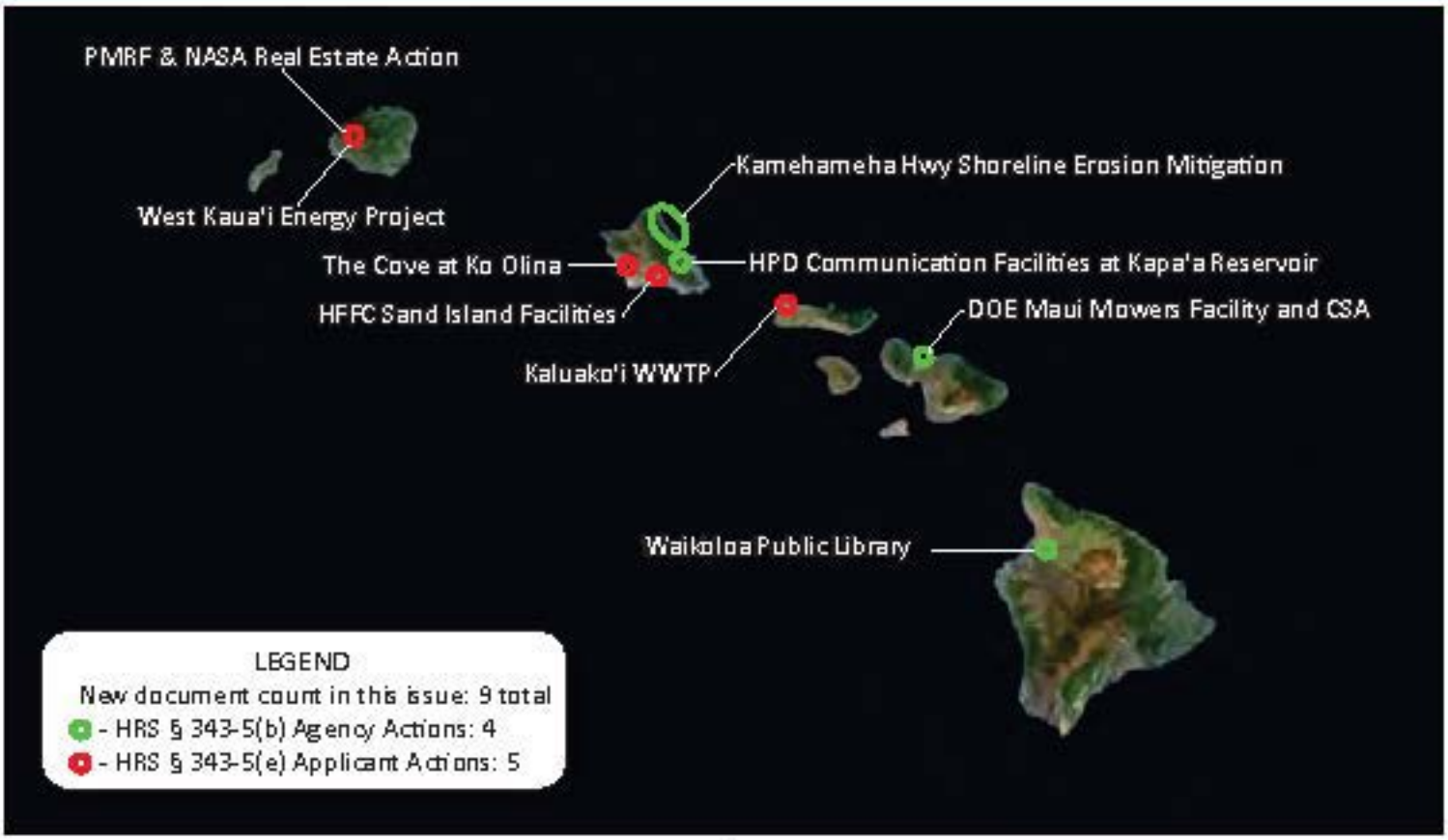
Statewide Map of New EA/EIS Documents & Determinations



Kaua'i EAs/EISs

Pacific Missile Range Facility and Kōke'e Park Geophysical Observatory Real Estate Action--(EISPN)

HRS §343-5(a) Triggers	(1) Propose the use of state or county lands or the use of state or county funds (2) Propose any use within any land classified as a conservation district
District(s)	Waimea
TMK(s)	Numerous (see document)
Permit(s)	Numerous (see document)
Approving Agency / Accepting Authority	State of Hawai'i, Department of Land and Natural Resources Russell Tsuji, (808) 587-0419, dlnr.land@hawaii.gov 1151 Punchbowl Street, Room 220, Honolulu, HI 96813
Applicants	US Department of the Navy; 400 Marshall Road, Building X-11, Pearl Harbor, HI 96860 Kerry Wells, (808) 473-0662, info@PMRF-KPGO-EIS.com US National Aeronautics and Space Administration, Goddard Space Flight Center, 34200 Fulton St., Wallops Island, VA 23337 Shari Miller, (757) 824-2327, Shari.A.Miller@nasa.gov
Consultant	Cardno GS-AECOM Pacific Joint Venture; 737 Bishop Street, Suite 3050, Honolulu, HI 96813 Michele Lefebvre, (808) 791-9872, info@PMRF-KPGO-EIS.com
Status	Administrative public review and comment period starts. Comments are due by June 17, 2024. Please address comments to the approving agency/accepting authority at info@PMRF-KPGO-EIS.com. EIS Public Scoping meetings will be held: June 4, 2024 - 5:00–8:00 p.m. at the Kaua'i Veterans Center in Līhu'e (3215 Kaua'i Veterans Memorial Highway, Līhu'e) June 5, 2024 - 5:00–8:00 p.m. at the Kekaha Neighborhood Center (8130 Elepaio Road, Kekaha) June 6, 2024 - 5:00–8:00 p.m. at the Sheraton Kaua'i Coconut Beach Resort (650 Aleka Loop, Kapa'a)

The Navy proposes to retain the use of 8,348 acres of State lands on Kaua'i, Hawai'i, for operational continuity and sustainment (in support of continued military training, testing, and facility operations) at Pacific Missile Range Facility (PMRF). NASA proposes to retain the use of 23 acres of State lands on Kaua'i, Hawai'i, in support of continued operations including measurements of the Earth's rotation and local land motion at Kōke'e Park Geophysical Observatory (KPGO). A similar entry for a federal Notice of Intent to prepare the joint HEPA/NEPA EIS is expected to be published in the Federal Register on May 9, 2024. The public scoping processes will run concurrently.

West Kaua'i Energy Project--Withdrawal of FONSI and Final & Draft EAs

HRS §343-5(a) Trigger	(1) Propose the use of state or county lands or the use of state or county funds (2) Propose any use within any land classified as a conservation district
District(s)	Kaua'i-multiple
TMK(s)	(4) 1-2-001: 003, 007; 1-2-002: 001, 016, 018, 019, 023; 1-4-001: 002, 003, 013, 014; 1-4-002: 008, 035, 036, 048, 066, 067, 068, 085
Permit(s)	Various (see EA)
Approving Agency	State of Hawai'i, Department of Land and Natural Resources Lauren Yasaka, (808) 587-0431, lauren.e.yasaka@hawaii.com 1151 Punchbowl Street, Room 220, Honolulu, HI 96813
Applicant	Kaua'i Island Utility Cooperative and AES West Kaua'i Energy Project, LLC; 4463 Pahe'e Street, Suite 1, Līhu'e, HI 96766 Dawn Huff, (360) 483-6488, admin@joulegroup.com
Consultant	n/a
Status	The approving agency is withdrawing the Draft EA (published 8/23/2021), 2nd Draft EA (published 9/8/2022), and Final EA & FONSI for the subject action.

Pursuant to a Stipulation and Order that was filed in First Circuit Court on March 28, 2024, regarding Civil No. 1CCV-23-0000165(SMK), the Department of Land and Natural Resources requests the withdrawal of the Draft Environmental Assessments (EA), Final EA, and Finding of No Significant Impact (FONSI) determination for the West Kaua'i Energy Project.

O'AHU EAs/EISs

Kamehameha Highway Shoreline Erosion Mitigation in NE O'ahu--Draft EA (AFNSI)

HRS §343-5(a) Triggers	(1) Propose the use of state or county lands or the use of state or county funds (2) Propose any use within any land classified as a conservation district (3) Propose any use within a shoreline area
District(s)	Ko'olauloa
TMK(s)	Numerous (see document)
Permit(s)	Numerous (see document)
Proposing/ Determining Agency	State of Hawai'i, Department of Transportation Mel Chung, (808) 832-3405, mungfa.chung@hawaii.gov 869 Punchbowl Street, Honolulu, HI 96813-5097
Consultant	AECOM; 1001 Bishop Street, Suite 1600, Honolulu, HI 96813 Courtney Hymes, (808) 529-7297, courtney.cacace@aecom.com
Status	Statutory 30-day public review and comment period starts. Comments are due by June 7, 2024. Please click on title link above to read the document, then send comments to the proposing/determining agency at courtney.cacace@aecom.com

The Kamehameha Highway Shoreline Erosion Mitigation in Kualoa, Ka'a'awa, Punalu'u, and Hau'ula Project would mitigate coastal erosion along nine discrete sections of the highway that the Hawai'i Department of Transportation has identified as needing action to maintain the usability of the highway in the near to mid-term, until a long-term plan to deal with the effects of sea level rise can be developed and implemented. The proposed action includes construction of rock revetments or hybrid seawalls with armor stone aprons at nine locations along the makai side of Kamehameha Highway.

The Cove at Ko Olina Redevelopment--Draft EIS Vol I, Vol II (Appendices), and public scoping meeting audio

HRS §343-5(a) Trigger	(3) Propose any use within a shoreline area
District(s)	'Ewa
TMK(s)	(1) 9-1-057:027
Permit(s)	Numerous (see document)
Approving Agency/ Accepting Authority	City and County of Honolulu, Department of Planning and Permitting Lena Phomsouvanh, (808) 768-8052, lena.phomsouvanh@honolulu.gov 650 South King Street, 7th Floor, Honolulu, HI 96813
Applicant	Cove Campbell Kobayashi LLC; 1288 Ala Moana Blvd., Suite 201, Honolulu, HI 96814 Matthew Pennaz, (808) 524-1508, mpennaz@kobayashi-group.com
Consultant	G70; 111 S. King Street, Suite 170, Honolulu, HI 96813 Tracy Camuso, (808) 523-5866, thecovekoolina@g70.design
Status	Statutory 45-day public review and comment period starts. Comments are due by June 24, 2024. Please send comments to the approving agency/accepting authority at thecovekoolina@g70.design

The Applicant, Cove Campbell Kobayashi LLC, proposes to redevelop the approximately 10.85-acre property located in the Ko Olina resort area of Kapolei, O'ahu. This will be the first major improvement of the property in over 25 years. The Project includes the replacement of dated structures and existing programming at the site with a new performing arts venue. The lū'au show will continue to be the focal point of the property. Improvements will also include ancillary uses, such as programming, restaurants, and retail, to create an authentic Hawaiian community gathering place that honors and reflects the history, culture, and connection to place.

O'AHU EAs/EISs (CONTINUED)

HPD Communication Facilities Upgrade at Kapa'a Reservoir--Final EA (FONSI)

HRS §343-5(a) Triggers	(1) Propose the use of state or county lands or the use of state or county funds (2) Propose any use within any land classified as a conservation district
District(s)	Ko'olaupoko
TMK(s)	(1) 4-2-017:016
Permit(s)	Conservation District Use Permit, Building Permit
Proposing/ Determining Agency	City and County of Honolulu, Department of Design and Construction Clyde Higa, (808) 768-8424, clyde.higa@honolulu.gov 650 South King Street, 11th Floor, Honolulu, HI 96813
Consultant	AGY LLC; 615 Pi'ikoi Street Suite 1806, Honolulu, HI 96814 Aolani Yamasato-Gragas, (808) 447-9849, aolani_y@yahoo.com
Status	Finding of No Significant Impact (FONSI) determination

The City and County of Honolulu Department of Design and Construction (DDC), Department of Information Technology (DIT), and Honolulu Police Department (HPD), intend to upgrade the public safety radio communication system at the Board of Water Supply (BWS) Kapa'a Reservoir parcel in Kāne'ohe, O'ahu. The existing communication facility, integral to Honolulu's emergency communications network, serves state, federal, and local public safety agencies. The facility prohibits public or commercial use. The project aims to replace one microwave truss tower with an 80-foot monopole tower able to withstand Category IV hurricanes, install a sidewalk, replace propane tanks with a single diesel tank, modify the building's interior, upgrade the generator, and upgrade the building and all critical appurtenances to withstand Category IV hurricanes. The proposed project involves approximately 305 square feet of improvements.

Hawaii Fueling Facilities Corporation Sand Island Facilities Upgrade Project--Final EA (FONSI)

HRS §343-5(a) Trigger	(1) Propose the use of state or county lands or the use of state or county funds
District(s)	Honolulu
TMK(s)	(1) 1-2-025:020 & 021
Permit(s)	Special Management Area Major Permit, grading and building permits
Approving Agency	City and County of Honolulu, Department of Planning and Permitting Steve H. Tagawa, (808) 768-8024, stagawa@honolulu.gov 650 South King Street, Honolulu, HI 96813
Applicant	Hawaii Fueling Facility Corporation; 3201 Aolele Street, Honolulu, HI 96819 Jason Maga, (808) 833-3291, Jason.maga@signatureflight.com
Consultant	Burns & McDonnell; 833 Bishop Street, Suite 2150, Honolulu, HI 96813 Jeremy Jewell, (816) 601-4919, jjewell@burnsmcd.com
Status	Finding of No Significant Impact (FONSI) determination

The EPA-mandated upgrade to the secondary spill containment and storm water management system is for the Applicant's jet fuel storage facility at 6 Sand Island Access Road. The 8.4-acre facility, initially built in the 1960s, consists of 16 aboveground steel storage tanks, with a total capacity of 45 million gallons, is the sole supply of jet fuel for the Daniel K. Inouye International Airport. Jet fuel is transported to this facility via pipelines from the refinery in Kalaeloa (formerly Campbell Industrial Park). The Project involves soil excavation, new asphalt pavement & spray-on coating of exposed areas, 31 collection inlets, 4 lift stations with sump pumps and an above-ground oil-water separator. The site is on State-owned DOT land, which triggers the preparation of an EA per Chapter 343. The FONSI determination allows the SMA application to be accepted for processing by the Department of Planning and Permitting, with decision-making by the Honolulu City Council.

Maui EAs/EISs

Relocation of DOE Maui District Mowers Facility and Community School for Adults--Draft EA (AFNSI)

HRS §343-5(a) Trigger	(1) Propose the use of state or county lands or the use of state or county funds
District(s)	Wailuku
TMK(s)	(2) 3-8-007:098
Permit(s)	HRS Chapter 6E, NPDES General Permit, County Grading Permit, Community Noise Permit, Building Permit, Roadway Permit, Water Use Permit, Sewage Connection
Proposing/ Determining Agency	State of Hawai'i, Department of Education Jenny Ho, (808) 784-5122, jenny.ho@k12.hi.us Facilities Development Branch, P.O. Box 2360, Honolulu, HI 96804
Consultant	Bowers and Kubota Consulting, Inc.; 2153 North King Street, Suite 200, Honolulu, HI 96819 Matthew Fernandez, (808) 836-7787, mfernandez@bowersandkubota.com
Status	Statutory 30-day public review and comment period starts. Comments are due by June 7, 2024. Please click on title link above to read the document, then send comments to the proposing/determining agency at mfernandez@bowersandkubota.com

The State of Hawai'i, Department of Education, Facilities Development Branch (DOE) is proposing to relocate and develop two new buildings on an undeveloped area within a larger State-owned property that is used by Maui High School. The project area would utilize approximately 2.2-acres of the 6.5-acres of the school property's undeveloped space.

The proposed DOE buildings are to be a new one-story building and parking lot for the Maui District Mowers Facility, and a new one-story building and parking lot for the McKinley School for Adults Maui Campus program. The Proposed Action will also involve constructing one new driveway to connect the new facilities to West Papa Avenue, landscaping, installation of fencing around the project site, and provide electrical, telecommunications, water, sewer, and drainage utilities and infrastructure to service the proposed facilities.

Moloka'i EAs/EISs

Replacement/Demolition of the Kaluako'i Wastewater Treatment Plant--Draft EA (AFNSI)

HRS §343-5(a) Trigger	(9)(A) Propose any wastewater treatment unit, except an individual wastewater system or a wastewater treatment unit serving fewer than fifty single-family dwellings or the equivalent
District(s)	Moloka'i
TMK(s)	(2) 5-1-003-008 (por.) and 024 (por.)
Permit(s)	Various (see document)
Approving Agency	County of Maui, Department of Planning on behalf of Moloka'i Planning Commission Sybil Lopez, (808) 270-7735, Sybil.Lopez@co.maui.hi.us 2200 Main Street, One Main Plaza, Suite 315, Wailuku, HI 96793
Applicant	Mosco, Inc.; P.O. Box 259, Maunaloa, HI 96770 Todd Svetin, (808) 552-2444, TSvetin@molokairanch.com
Consultant	Munekiyo Hiraga; 305 High Street, Suite 104, Wailuku, HI 96793 Mark Alexander Roy, (808) 244-2015, planning@munekiyohiraga.com
Status	Statutory 30-day public review and comment period starts. Comments are due by June 7, 2024. Please click on title link above to read the document, then send comments to the approving agency and copy the applicant and the consultant.

The proposed project consists of the construction of a new replacement Wastewater Treatment Plan (WWTP) and the demolition of the existing Kaluako'i WWTP as mandated by the State Department of Health. Once the replacement WWTP is operational, the existing Kaluako'i WWTP will be removed. The replacement WWTP will be designed with a treatment capacity of 102,000 Gallons Per Day (GPD) to service the community, a reduction of 58,000 GPD from the WWTP's original (160,000 GPD) capacity.

Hawai'i EAs/EISs

Waikoloa Public Library--Final EA (FONSI)

HRS §343-5(a) Trigger	(1) Propose the use of state or county lands or the use of state or county funds
District(s)	South Kohala
TMK(s)	(3) 6-8-041:020
Permit(s)	Chapter 343, HRS Compliance; Dust Control Plan; Noise Permit (if necessary); National Pollutant Discharge Elimination System (NPDES) construction site stormwater discharge permit; Americans with Disabilities Act (ADA) Compliance; Section 6E, HRS Review; Grading, Grubbing, and Stockpiling Permits; Building Permit (electrical, plumbing, civil); Certificate of Occupancy; and Plan Approval
Proposing/ Determining Agency	State of Hawai'i, Department of Accounting and General Services Brian Isa, (808) 586-0484, brian.s.isa@hawaii.gov 1151 Punchbowl Street, Room 430, Honolulu, HI 96810
Consultant	PBR HAWAII; 1001 Bishop Street, ASB Tower, Suite 650, Honolulu, HI 96813 Bradley Furuya, (808) 954-6348, bfuruya@pbrhawaii.com
Status	Finding of No Significant Impact (FONSI) determination

The proposed Project includes a new, approximately 12,000 square foot public library, approximately 3,000 square foot Early Learning Center (ELC), 71-stall surface parking lot, and complimentary landscaping. The proposed library includes shelving for a minimum of 50,000 books, private meeting rooms, a program room, a work room, support space, and a librarian's office. The ELC, connected to the library, will have two classrooms, each capable of accommodating roughly 20 students.

Previously Published Documents Open for Comment

Status: The comment period for these projects began previously. Please click on the links below to read a document, then send comments to the relevant agency and copy any relevant applicant and/or consultant identified in the submission form that follows the initial agency letter.

Comments Due May 8, 2024

Hawai'i

Hilo Medical Center New Administrative Services Building--Draft EA (AFNSI)

Maui

Honokōwai Water System Improvements--Draft EA (AFNSI)

O'ahu

Waimea Valley Economic Resiliency Project--Draft EA (AFNSI)

Comments Due May 23, 2024

Hawai'i

Hakalau Stream Bridge Rehabilitation--Draft EA (AFNSI)

Maui

Ledcor South Maui Properties and Improvements--Republished Draft EIS **and** scoping meeting audio

Please send comments to the approving agency/accepting authority at http://www.ledcorsouthmauipermitting.com.

Comments Due June 7, 2024

Hawai'i

Army Training Land Retention at Pōhakuloa Training Area--2nd Draft EIS Vol I, II, III, **and** scoping meeting audio

Maui

Air Force Maui Optical and Supercomputing (AMOS) Site Small Telescope Advanced Research Facility--EISPN

Lists of Exemption Notices

Pursuant to HAR § 11-200.1-17, State and county agencies that have determined specific actions to be exempt from the requirement to prepare an EA are required to submit a listing of such exemptions made during the previous month. Following are Lists of Exemption Notices submitted by various agencies for April 2024; contact the identified agency contact on each list for additional information about any specific exemption:

State of Hawai'i
Department of Accounting and General Services
Department of Education
Department of Land and Natural Resources

County of Hawai'i
Office of Housing and Community Development

County of Maui
Department of Public Works

City and County of Honolulu
Department of Transportation Services

Coastal Zone Management Notices

Federal Consistency Reviews

The following federal actions are being reviewed for consistency with the enforceable policies of the Hawai'i Coastal Zone Management (CZM) Program, including the CZM objectives and policies in Hawai'i Revised Statutes, Chapter 205A. Federal consistency, pursuant to Section 307 of the Coastal Zone Management Act of 1972 (CZMA), as amended, generally requires that federal actions, within and outside of the coastal zone, which have reasonably foreseeable effects on any coastal use (land or water) or natural resource of the coastal zone be consistent with the enforceable policies of a state's federally approved coastal management program. Federal actions include federal agency activities, federal license or permit activities, and federal financial assistance activities. This public notice is being provided in accordance with § 306(d)(14) of the CZMA, and federal regulations at 15 CFR § 930.2, § 930.42, and § 930.61. General information about federal consistency is available at the Hawai'i CZM Program web site, or call (808) 587-2878.

For specific information or questions about an action listed below, contact the CZM staff person identified for each action. The CZM Program is required to adhere to federal review deadlines, therefore, comments must be received by the date specified. Comments may be submitted by mail or electronic mail, to the addresses below.

Mail: Office of Planning and Sustainable Development
Department of Business, Economic Development and Tourism
P.O. Box 2359, Honolulu, HI 96804

Email: Debra.L.Mendes@hawaii.gov

County DPW Wilder Road Culvert Replacement Project

Proposed Action: Replace the existing drainage structure and eliminate the deteriorated conditions to ensure that the drainage system continues to convey the design storm water drainage flows from the surrounding area at South Wilder Road, in Kaūmana Ahupu'a, Hilo, Hawai'i. The project involves the demolition of approximately 180 linear feet of existing dual, 96-inch diameter corrugated metal pipe culverts that pass under South Wilder Road, including demolition of above-ground road and walkway improvements, and replacement with two 8'x8' reinforced concrete box culverts and headwalls; restoration of approximately 82 linear feet of eroded protection in the downstream channel bottom with new grouted rubble pavement and cutoff wall; and reconstruction of road pavement, concrete walkway, guardrails and appurtenances.

Location: Kaūmana Stream at South Wilder Road, Hilo, Island of Hawi'i
TMK(s): (3)2-5-045:999, (3)2-5-005:157 and (3)2-5-045:001, (3)2-5-005:158 and 159
Applicant: County of Hawai'i, Department of Public Works
Federal Action: Federal Permit
Federal Agency: U.S. Army Corps of Engineers
CZM Contact: Debra Mendes, (808) 587-2840, Debra.L.Mendes@hawaii.gov
Comments Due: May 22, 2024

Coastal Zone Management Notices (continued)

Special Management Area (SMA) Minor Permits

The SMA Minor permits below have been approved (HRS § 205A-30). For more information, contact the relevant county/state planning agency: Honolulu [(808) 768-8015]; Hawai'i [East (808) 961-8288], [West (808) 323-4770]; Kaua'i [(808) 241-4050]; Maui [(808) 270-7735]; Kaka'ako or Kalaeloa Community Development District [(808) 587-2846]

Location (TMK)	Description (File No.)	Applicant/Agent
Hawai'i: North Kohala District (5-3-007:047)	Establish Community Farm and Related Uses (PL-SMM-2024-000060)	Hale Ipu Kukui LLC
Kaua'i: Hanalei (5-5-001:042 Unit 1)	After-the-Fact Construction of a storage shed (SM(M)-2024-15)	Anthony Sutton
Maui: Kīhei (3-9-009:021)	Earhart Apartment Alteration. Enclose existing covered lanai and convert to living space (SM22024-00018)	Michelle Cockett
O'ahu: Kāne'ohe (4-6-001:009)	After-the-Fact Alterations of Three Single-Family Dwellings (2024/SMA-27)	Richard and Noreen Van Horn
O'ahu: Mokulē'ia (6-8-006:006) Parcel 6	Tang Ohana Unit Addition (2024/SMA-22)	Gordon Tang Family Trust

Shoreline Notices

Applications for Shoreline Certification

The shoreline certification applications below are available for review and comment at the Department of Land and Natural Resources offices on Kaua'i, Hawai'i, Maui, and Honolulu, 1151 Punchbowl Street, Room 220 (HRS § 205A-42 and HAR § 13-222-12). **Maps and photos of each application file can be viewed here.** All comments shall be submitted in writing to the State Land Surveyor, 1151 Punchbowl Street, Room 210, Honolulu, HI 96813 and postmarked no later than 15 calendar days from the date of this public notice of the application. For more information, contact Rebecca Anderson at rebecca.l.anderson@hawaii.gov

File No.	Location	TMK	Applicant	Owner
MA-825	4933 Uakea Road, Maui 96713	(2) 1-4-005:019	Kevin J. Clarke	Hana Aku LLC
MA-826	2780 Keka'a Drive, Maui 96761	(2) 4-4-008:007	Reed M. Ariyoshi	Royal Lahaina Owner LP

Proposed Shoreline Certifications and Rejections

The shoreline notices below have been proposed for certification or rejection by the Department of Land and Natural Resources (HRS § 205A-42 and HAR § 13-222-26). Any person or agency who wants to appeal shall file a notice of appeal in writing with DLNR no later than 20 calendar days from the date of this public notice. Send the appeal to the Board of Land and Natural Resources, 1151 Punchbowl Street, Room 220, Honolulu, Hawai'i 96813.

File No.	Status	Location	TMK	Applicant	Owner
OA-2051	Proposed	608 Kaimalino Place, O'ahu 96734	(1) 4-4-039:023	Ross K. Tanaka	Stuart Family Trust
OA-2052	Proposed	61-821 Papailoa Road, O'ahu 96712	(1) 6-1-004:097	Ross K. Tanaka	John D. and Marie-Niege H. S. Whittington
OA-2055	Proposed	55-119 and 55-113 Kamehameha Highway, O'ahu 967	(1) 5-5-001:013 & 056	Benjamin E. K. Guieb	Devin J. Moncur
OA-2090	Proposed	Kaluanui Stream Bridge, Kamehameha Highway, O'ahu 9677	(1) 5-3-009:047	ControlPoint Surveying, Inc.	City & County of Honolulu
OA-2098	Proposed	58-207 H Kamehameha Highway, O'ahu 9672	(1) 5-8-001:021	Leaps & Boundaries, Inc.	Edward Weldon & Katherine Weldon
MA-819	Proposed	111 Aleiki Place, Maui 96779	(2) 2-6-012:072	Action Survey LLC	111 Aleiki Place LLC
HA-644	Proposed	12-7235 Moana Kai Pali Street, Hawai'i 96778	(3) 1-2-030:012	Daniel Berg c/o dlb & Associates, LLC	Equity Trust Co. fbo Mike Stehle IRA and Lisa Stehle-Doggett
HA-645	Proposed	45-5034 Nanaina Kai Road, Hawai'i 96727	(3) 4-5-002:016 & 080	L. Edward Pare	Stephen & Cheryl Winter, Trustees

Federal Notices

As a courtesy, listed below are some relevant entries from the Federal Register published since the last issue of *The Environmental Notice*. For more information, click on the title link, also available at www.federalregister.gov.

Notice: Western Pacific Fishery Management Council; Public Meetings (published by the National Oceanic and Atmospheric Administration on 04/29/2024

The Western Pacific Fishery Management Council (Council) will hold meetings of its Archipelagic Plan Team (APT) and Pelagic Plan Team (PPT) to discuss fishery management issues and develop recommendations for future management of fisheries in the Western Pacific Region. The APT will meet on Monday and Tuesday, May 13-14, 2024, (HST). The APT will meet jointly with the PPT on Wednesday, May 15, 2024, HST. The PPT will meet on Thursday and Friday, May 16-17, 2024, HST. The meetings will be a hybrid format (web conference and in person) For specific details, times and agendas, click on the title link above.

Notice: Endangered Species; Receipt of Recovery Permit Applications (published by the Fish and Wildlife Service on 04/29/2024)

The U.S. Fish and Wildlife Service has received applications for permits to conduct activities intended to enhance the propagation and survival of various endangered bird, sea turtle and plant species in Hawaii under the Endangered Species Act. We invite the public and local, State, Tribal, and Federal agencies to comment on these applications. Before issuing the requested permits, we will take into consideration any information that we receive during the public comment period that ends on May 29, 2024. For additional information, please click on the title link above.

Proposed Rule: International Fisheries; Pacific Tuna Fisheries; Safe Handling and Release Practices for Sharks on Longline Vessels and Revision to Vessel Monitoring System Requirements in the Eastern Pacific Ocean (published by the National Oceanic and Atmospheric Administration on 04/25/2024

NMFS is proposing regulations under the Tuna Conventions Act of 1950, as amended, to implement Resolutions C-23-07 (Conservation Measures for the Protection and Sustainable Management of Sharks) and C-23-11 (On the Establishment of a Vessel Monitoring System) adopted by the Inter-American Tropical Tuna Commission (IATTC) at its meeting in August 2023 in Victoria, Canada. This proposed rule would implement provisions of these Resolutions and would require U.S. longline vessels fishing for tuna or tuna-like species in the eastern Pacific Ocean (EPO) that have incidental shark catch to release sharks by leaving them in the water and cutting the branchline so that less than 1 meter remains on each animal. The proposed rule would also require large vessels fishing for tuna or tuna-like species in the EPO to make manual reports every six hours in the event of a malfunctioning vessel monitoring system (VMS) unit. This action is necessary for the United States to satisfy its obligations as a member of the IATTC. Comments on the proposed rule and supporting documents must be submitted in writing by May 28, 2024. For additional information, please click on the title link above.

Notice: Permanent Advisory Committee To Advise the U.S. Commissioners to the Western and Central Pacific Fisheries Commission; Meeting Announcement (published by the National Oceanic and Atmospheric Administration on 04/26/2024)

NMFS announces a public meeting of the Permanent Advisory Committee (PAC) to advise the U.S. Commissioners to the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC) via web conference on May 13, 2024, from 10 a.m. to 1 p.m. HST. Click on the title link to this entry for supplementary information about this meeting.

Notice: Changes in Flood Hazard Determinations (published by the Federal Emergency Management Agency on 04/22/2024)

This notice lists communities (including the County of Maui) where the addition or modification of Base Flood Elevations (BFEs), base flood depths, Special Flood Hazard Area (SFHA) boundaries or zone designations, or the regulatory floodway (hereinafter referred to as flood hazard determinations), as shown on the Flood Insurance Rate Maps (FIRMs), and where applicable, in the supporting Flood Insurance Study (FIS) reports, prepared by the Federal Emergency Management Agency (FEMA) for each community, is appropriate because of new scientific or technical data. The FIRM, and where applicable, portions of the FIS report, have been revised to reflect these flood hazard determinations through issuance of a Letter of Map Revision (LOMR), in accordance with Federal Regulations. For further and supplemetary information, please click on the title link above.

Glossary of Terms and Definitions

Agency Actions

Projects or programs processed by any department, office, board, or commission of the state or county government which is part of the executive branch of that government per HRS 343-2.

Applicant Actions

Projects or programs proposed by any person who, pursuant to statute, ordinance, or rule, requests approval for a proposed action per HRS 343-2.

Draft Environmental Assessment

When an Agency or Applicant proposes an action that triggers HRS 343, an Environmental Assessment shall be prepared at the earliest practicable time to determine whether the action's environmental impact will be significant, and thus whether an environmental impact statement shall be required per HRS 343-5(b) for Agency actions and HRS 343-5(e), for Applicant actions. For actions for which the processing or approving agency anticipates a Finding of No Significant Impact (AFNSI), a Draft EA (DEA) shall be made available for public review and comment for 30 days and public notice is published in this periodic bulletin.

Final Environmental Assessment and Finding of No Significant Impact

The action's proponent shall respond in writing to comments on a DEA received during the 30-day review period and prepare a Final EA (FEA) that includes those responses to determine whether an environmental impact statement shall be required. If there are no significant impacts, then the Agency will issue a Finding of No Significant Impact (FONSI). An Environmental Impact Statement (EIS) will not be required and the project has cleared HRS 343 requirements. The public has 30 days from the notice of a FONSI in this bulletin to challenge the FONSI in the Environmental Court and seek a ruling to require the preparation of an EIS.

Final Environmental Assessment and Environmental Impact Statement Preparation Notice

An EIS shall be required if the Agency finds that the proposed action may have a significant effect on the environment. The Agency shall file notice of such determination with OPSD called an EIS Preparation Notice (EISPN) along with the succeeding Final EA. After the notice of the FEA-EISPN is published in this bulletin, the public has 30 days to request to become a consulted party and to make written comments. The public (including the Applicant) has 60 days from the notice of the EISPN in this bulletin to ask a court to not require the preparation of an EIS.

Act 172-2012, Direct-to-EIS, Environmental Impact Statement Preparation Notice (with no EA)

Act 172 in 2012 amended HRS 343 by providing for an agency to bypass the preparation of an environmental assessment for various actions that in the experience of the agency would clearly require the preparation of an EIS. The agency must submit its determination that an EIS is required for an action (Act 172-2012, EISPN) with a completed publication form detailing the specifics of the action. This starts a 30-day scoping period in which

HEPA

While technically there is no 'Hawai'i Environmental Policy Act,' HRS 343 is often referred to by this term.

Act 312-2012, Secondary Actions in the Highway or Public Right Of Way

Act 312-2012, amended HRS 343, by adding a new section (HRS 343-5.5, entitled "Exemption to applicability of chapter"). HEPA allows for a statutory exemption for "secondary actions" (those that involve infrastructure in the highway or public right-of-way) provided that the permit or approval of the related "primary action" (those outside of the highway or public right-of-way and on private property) is not subject to discretionary consent and further provided that the applicant for the primary action submits documentation from the appropriate agency confirming that no future need for removal approvals are required. Aid to understanding this is to visualize residential driveway improvements in the public right-of-way, versus, retail outlet driveway improvements in the public right-of-way.

Draft Environmental Impact Statement

After receiving the comments on the EISPN, the Agency or Applicant must prepare a Draft Environmental Impact Statement (DEIS). The content requirements of the DEIS shall contain an explanation of the environmental consequences of the proposed action including the direct, indirect and cumulative impacts and their mitigation measures. The public has 45 days from the first publication date in this bulletin to comment on a DEIS.

Final Environmental Impact Statement

After considering all public comments filed during the DEIS stage, the Agency or Applicant must prepare a Final EIS (FEIS). The FEIS must respond in a point-by-point manner to all comments from the draft and must be included in the FEIS. For Applicant projects, the Approving Agency is the Accepting Authority and must make a determination within 30 days or the FEIS is deemed accepted as a matter of law. For an Agency project, the Governor or the Mayor (or their designated representative) is the Accepting Authority, and unlike Applicant actions, there is no time limit on the accepting authority reviewing the FEIS. Only after the FEIS is accepted may the project be implemented.

Acceptability

The Accepting Authority must be satisfied that the FEIS meets three criteria (process, content, response to comments) to accept it. Whether the FEIS is accepted or not accepted, notice of the Acceptance Determination is published in this bulletin. The public has 60 days from publication to legally challenge the acceptance of a FEIS. For both Applicant and Agency actions, the Applicant or the proposing Agency can prepare a Revised DEIS after a non-acceptance determination.

Maui sunset Photo by Thomas Hawk

National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires federal projects to prepare a Federal EA or EIS. In many ways it is similar to Hawai'i's law. Some projects require both a State and Federal EIS and the public comment procedure should be coordinated. Upon request by a federal agency, OPSD publishes NEPA notices in this bulletin to help keep the public informed of important federal actions.

Conservation District

Proposed uses of land in the State Conservation District require a Conservation District Use Application (CDUA). These applications are reviewed and approved/denied by the Department or Board of Land and Natural Resources. Members of the public may intervene in the permit process. This bulletin will include EAs & EISs for actions proposed within the Conservation District.

Special Management Area and Shoreline Setback Area

The Special Management Area (SMA) is along the coastline of all islands; development in this area is generally regulated by HRS 205A and county ordinance. A portion of the SMA that is addressed by HRS 343 is the Shoreline Area, which includes land between the State-certified shoreline and the county-determined shoreline setback line. This bulletin will include EAs & EISs for actions proposed within the Shoreline Setback Area. Some projects going through the SMA permit process on O'ahu are also required to go through a new environmental review process that mirrors HRS 343; these 'ROH Chapter 25' EAs/EISs are included in this bulletin.

Shoreline Certifications

State law requires that Hawai'i's shorelines be surveyed and certified when necessary to clearly establish the shoreline's exact from the certified shoreline. The public may participate in the process to help assure accurate regulatory boundaries. Private landowners often common to have their shoreline certified by the State surveyor prior to construction. This bulletin publishes notice from the Department of Land and Natural Resources of shoreline certification applications and final certifications or rejections.

Environmental Advisory Council

The Environmental Advisory Council is a 15-member citizen board appointed by the Governor. They serve as a liaison between the Director of OPSD and the general public concerning ecology and environmental quality. Agendas of their regular meetings are posted on the Internet and the public is invited to attend.

Agency Exemption Lists

Government agencies may keep a list describing the minor activities they regularly perform that are exempt from the environmental review process. These lists and any amendments shall be submitted to the Council for review and concurrence (HAR 11-200.1-16). This bulletin will publish an agency's draft exemption list for public comment prior to Council decision making, as well as notice of the Council's decision on the list.

Endangered Species

This bulletin is required by HRS 343-3(c), to publish notice of public comment periods or public hearings for Habitat Conservation Plans (HCP), Safe Harbor Agreements (SHA), or Incidental Take Licenses (ITL) under the federal Endangered Species Act, as well as availability for public inspection of a proposed HCP or SHA, or a proposed ITL (as a part of an HCP or SHA).

Navy Region Hawaii
May 8 at 6:03 PM ·

The Navy and NASA invite you to participate. The Navy and NASA are jointly preparing an Environmental Impact Statement (EIS) for proposed continued use of State of Hawai'i lands for the Navy's Pacific Missile Range Facility (PMRF) and NASA's Kōke'e Park Geophysical Observatory (KPGO), through potential updated real estate agreements. The Navy and NASA are initiating a public scoping period to receive comments on the scope of the EIS. The scoping meetings will also serve as an opportunity to receive public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and Hawai'i Revised Statutes Section 6E-42. Attend any of the public scoping meetings on Kaua'i listed below to talk story, learn more, and submit written or oral comments. Submit comments by June 17, 2024. Your voice is important to this planning process.

Meeting Times: 5 to 8 p.m., with Navy and NASA presentation from 6 to 6:30 p.m.:

Tuesday, June 4, 2024
Kaua'i Veterans Center
3215 Kaua'i Veterans Memorial Hwy, Līhu'e

Wednesday, June 5, 2024
Kekaha Neighborhood Center
8130 Elepaio Rd, Kekaha

Thursday, June 6, 2024
Sheraton Kaua'i Coconut Beach Resort
650 Aleka Loop, Kapa'a

In addition to the scoping meetings, the public may submit comments in any of the following ways:
• In person at a public scoping meeting
• Through the project website at PMRF-KPGO-EIS.com
• By email to info@PMRF-KPGO-EIS.com
• By mail, postmarked by June 17, 2024, to the following address:
Naval Facilities Engineering Systems Command, Hawai'i
Environmental OPHEV2
Attn: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
400 Marshall Road, Building X-11
Pearl Harbor, HI 96860

Visit PMRF-KPGO-EIS.com to learn more.

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Navy Region Hawaii
@NavRegHawaii

Follow

Navy & NASA invite you to participate in the Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement. Attend public meetings June 4-6, and submit comments by June 17, 2024. Visit PMRF-KPGO-EIS.com to learn more.

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Pacific Missile Range Facility
May 8 at 11:00 AM ·

The Navy and NASA invite you to participate.

The Navy and NASA are jointly preparing an Environmental Impact Statement (EIS) for proposed continued use of State of Hawai'i lands for the Navy's Pacific Missile Range Facility (PMRF) and NASA's Kōke'e Park Geophysical Observatory (KPGO), through potential updated real estate agreements. The Navy and NASA are initiating a public scoping period to receive comments on the scope of the EIS. The scoping meetings will also serve as an opportunity to receive public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and Hawai'i Revised Statutes Section 6E-42. Attend any of the public scoping meetings on Kaua'i listed below to talk story, learn more, and submit written or oral comments. Submit comments by June 17, 2024. Your voice is important to this planning process.

Meeting Times: 5 to 8 p.m., with Navy and NASA presentation from 6 to 6:30 p.m.:

Tuesday, June 4, 2024
Kaua'i Veterans Center
3215 Kaua'i Veterans Memorial Hwy, Līhu'e

Wednesday, June 5, 2024
Kekaha Neighborhood Center
8130 Elepaio Rd, Kekaha

Thursday, June 6, 2024
Sheraton Kaua'i Coconut Beach Resort
650 Aleka Loop, Kapa'a

In addition to the scoping meetings, the public may submit comments in any of the following ways:

- In person at a public scoping meeting
- Through the project website at PMRF-KPGO-EIS.com
- By email to info@PMRF-KPGO-EIS.com
- By mail, postmarked by June 17, 2024, to the following address:

Naval Facilities Engineering Systems Command, Hawai'i
Environmental OPHEV2
Attn: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
400 Marshall Road, Building X-11
Pearl Harbor, HI 96860

Visit https://pmrf-kpgo-eis.com/ to learn more.

PMRF-KPGO-EIS.COM
PMRF & KPGO EIS
Welcome to the project website for the Pacific Missile Range Facility and Kōke'e Park Geophysi...

7 5 shares

Like Comment Share

An official website of the United States government Here's how you know

MEDIA RELEASE: THE U.S. NAVY AND NASA JOINTLY PREPARE AN ENVIRONMENTAL IMPACT STATEMENT FOR CONTINUED USE OF STATE LANDS THROUGH PROPOSED REAL ESTATE AGREEMENTS WITH THE STATE OF HAWAI‘ I

08 May 2024

FROM COMMANDER, NAVY REGION HAWAII PUBLIC AFFAIRS

The U.S. Department of the Navy and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) and welcome the community's input in the environmental planning process. The public's participation in this initial phase of the environmental planning process is important to ensuring community concerns are identified and addressed in the environmental analysis.

Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Welcome to the project website for the Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Aloha and Welcome

The U.S. Navy and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts of proposed real estate agreements with the State of Hawaiʻi for the Pacific Missile Range Facility (PMRF) and the Kōkeʻe Park Geophysical Observatory (KPGO). The Navy and NASA invite the public to participate in the environmental planning process.

This project website provides the latest information on the EIS. Please review this site for:

- information on the status and schedule of the EIS
- documents and references available for review
- opportunities for public involvement
- methods to submit comments during the designated public comment periods

This website will be updated throughout the project. Please check back often for updates.

Public Scoping Period

Privacy - Terms

Public involvement is an integral part of the environmental planning process. The public has an important role in providing input during this process to help the Navy and NASA make more informed decisions about the proposed real estate action.

The Navy and NASA are initiating a public scoping period to receive comments on the scope of the EIS. The public can participate in the environmental planning process by providing input on the proposed real estate action including potential alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS.

The public scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and Hawai'i Revised Statutes Section 6E-42.

To submit a public comment, please click here to access the Comment Form **(https://pmrf-kpgo-eis.com/comment-form/)** .

To add your name to the mailing list to receive notifications about the project, please click here to access the Mailing List Form **(https://pmrf-kpgo-eis.com/mailing-list/)** .

How to Submit Scoping Comments

The Navy and NASA welcome your scoping comments. Comments should be related to the proposed real estate action including potential alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS.

The public may submit comments in any of the following ways:

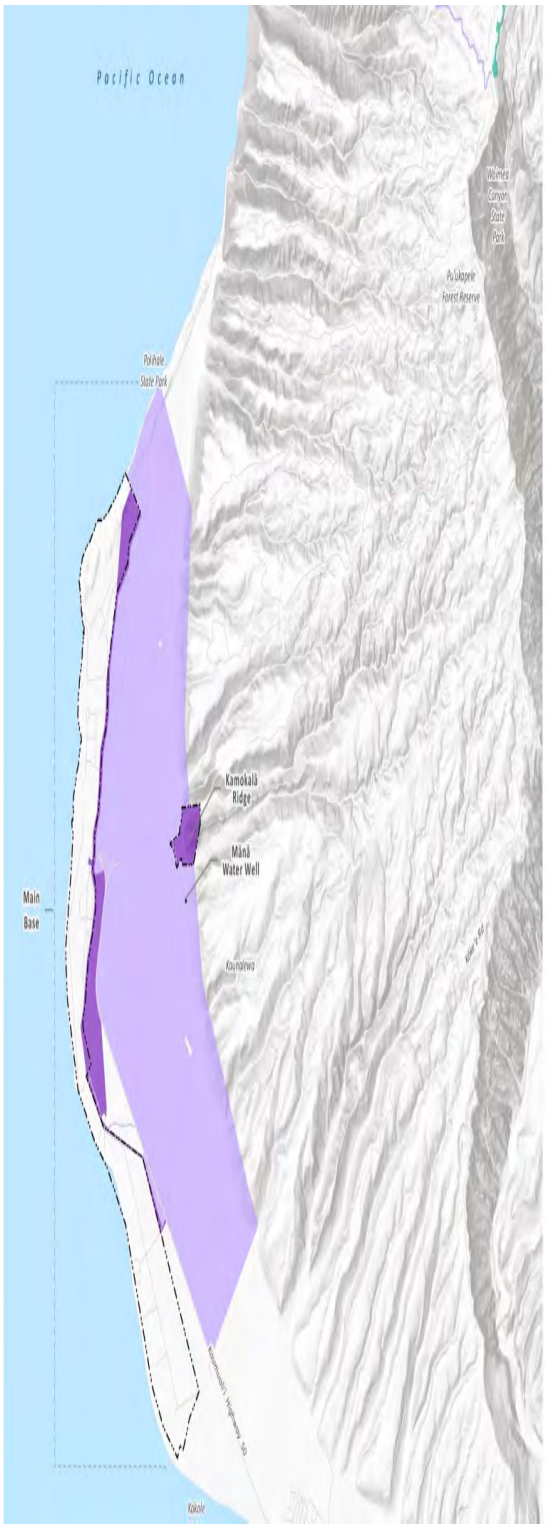
- In person at a public scoping meeting, where comments will be accepted orally and in writing
- In writing via the online Comment Form **(https://pmrf-kpgo-eis.com/comment-form/)**
- In writing via email to info@PMRF-KPGO-EIS.com **(mailto:info@pmrf-kpgo-eis.com)**
- In writing via postal mail, postmarked by June 17, 2024 to the following address:
  Naval Facilities Engineering Systems Command, Hawai'i
  Environmental OPHEV2
  Attn: PMRF and KPGO RE EIS Project Manager,
  Ms. Kerry Wells
  400 Marshall Road, Building X-11
  Pearl Harbor, HI 96860

Public Scoping Meetings

The Navy and NASA will host public scoping meetings at three locations on Kaua'i. The public is encouraged to attend any of the public scoping meetings to talk story, learn more, and submit written or oral comments.

Tuesday, June 4, 2024 Kaua'i Veterans Center	**Meeting Times: 5 to 8 p.m.** **Agenda:**

3215 Kauaʻi Veterans Memorial Hwy, Līhuʻe **Wednesday, June 5, 2024** Kekaha Neighborhood Center 8130 Elepaio Rd, Kekaha **Thursday, June 6, 2024** Sheraton Kauaʻi Coconut Beach Resort 650 Aleka Loop, Kapaʻa	• **5 to 8 p.m.** Information stations – meet the projec team, talk story, and ask questions. Visit the comments station to provide a written or oral comment. • **6 to 6:30 p.m.** Project presentation by Navy and NASA.



Proposed Action

The Navy proposes to maintain long-term Department of Defense use of 8,348 acres of State of Hawai‘i lands on Kaua‘i for operational continuity and sustainment of the military readiness mission. NASA proposes to maintain long-term use of 23 acres of State of Hawai‘i land on Kaua‘i for continued operations of Kōke‘e Park Geophysical Observatory.

Click here to learn more.
[(/environmental-planning/proposed-action/)](/environmental-planning/proposed-action/)

Get Involved

The Navy and NASA are initiating a public scoping period to receive public comments on topics to be considered in the development of the Environmental Impact Statement. Attend any of the upcoming public scoping meetings to talk story, learn more, and submit written or oral comments.

The scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and Hawai‘i Revised Statutes Section 6E-42.

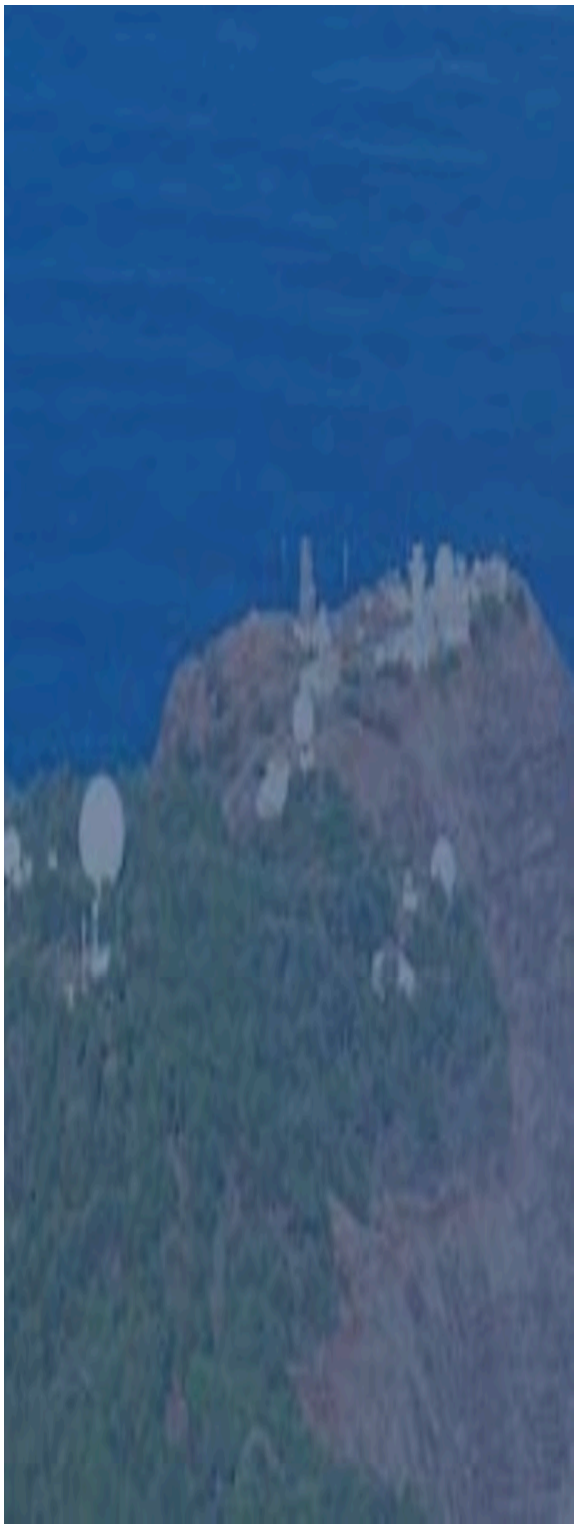
Click here to learn more.
(/public-involvement/)

Environmental Planning Process

The Navy and NASA are preparing an Environmental Impact Statement in accordance with the requirements of the National Environmental Policy Act (NEPA) and Hawai‘i Revised Statutes (HRS) Chapter 343 and Hawai‘i Administrative Rules (HAR) Chapter 11-200.1, collectively referred to as the Hawai‘i Environmental Policy Act (HEPA).

Click here to learn more.

(/environmental-planning/environmental-review-process/)



FAQs

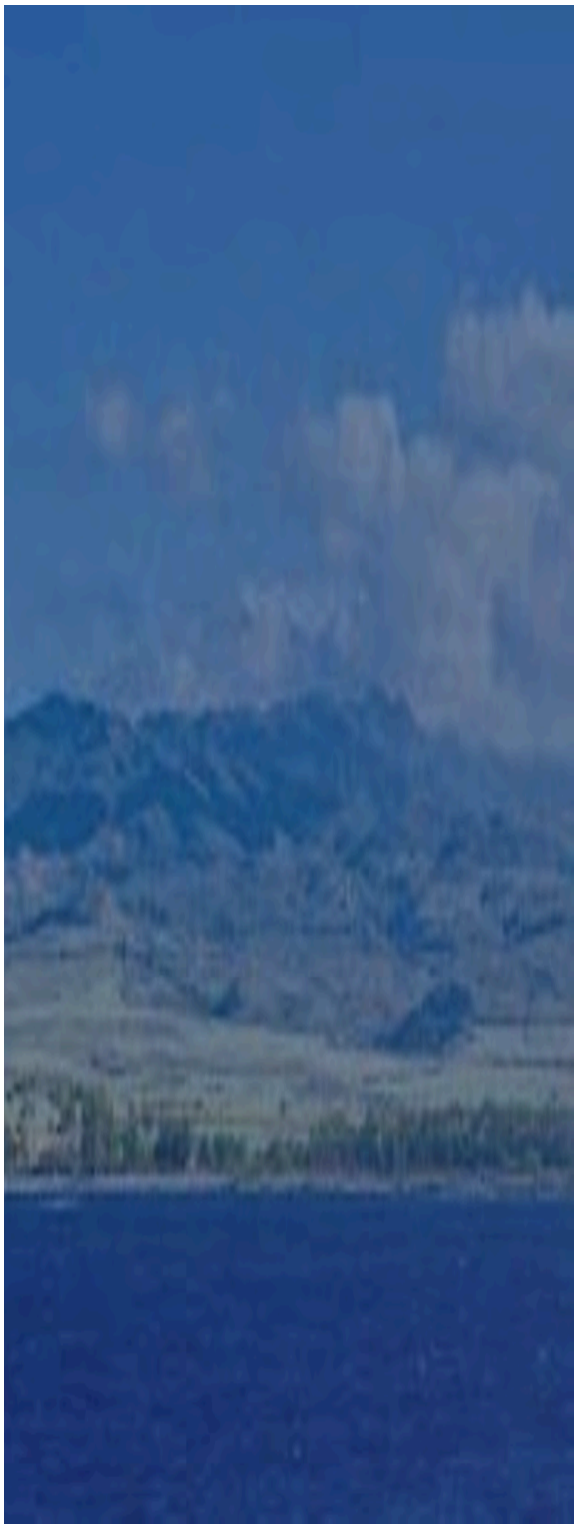
Click here for responses to common questions.

(/faqs/)

Documents

Find documents and informational materials related to the project.

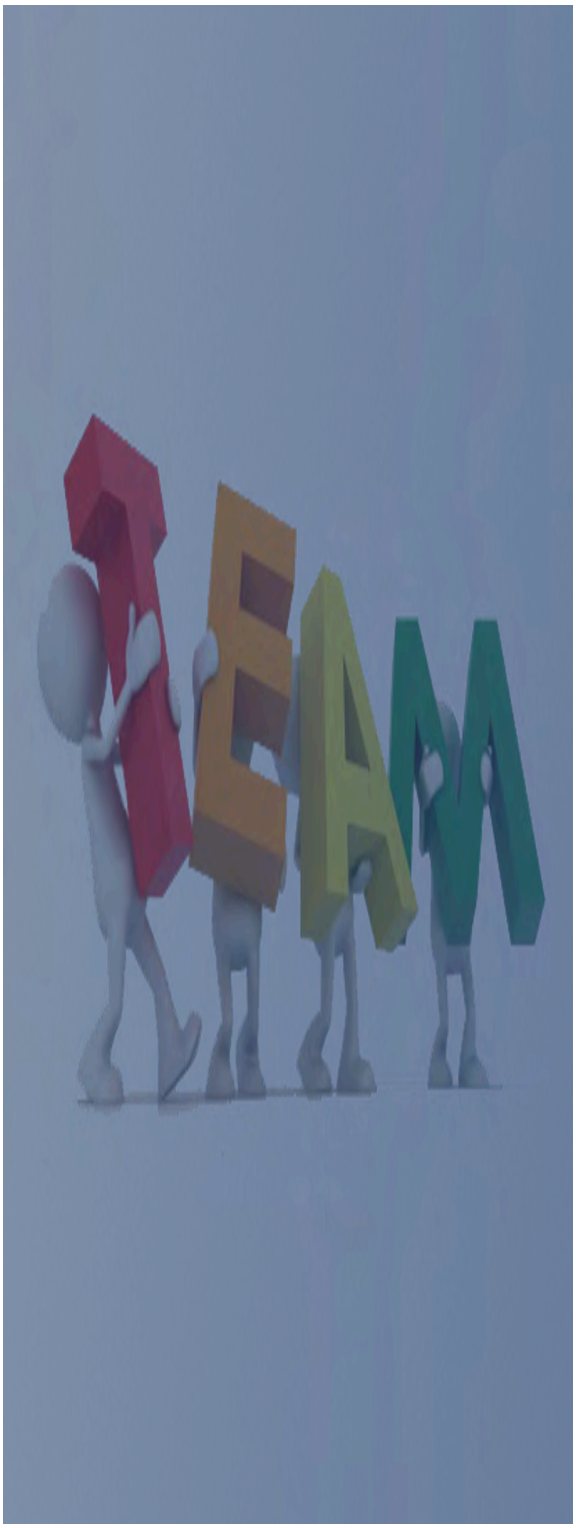
(/documents/)



Contact Us

Have a question? Click here to contact the project team.

(/contact-us/)



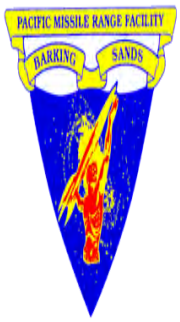
Project Team

Click Here

(/members-area/)

Please revisit this website as the content will be updated frequently.

This website is compliant with Section 508 of the Rehabilitation Act. This allows assistive technology to be used to obtain the available information from the website. Due to the nature of graphics, figures, tables, and images occurring in the website, accessibility is limited to a descriptive title for each item.



© 2024 Privacy Policy (/privacy-policy/) Section 508 (https://www.compliance.af.mil/Resources/Section-508-Compliance/)

Attachment I

E Pane Mai Ka Nonoi O Nohili

Answering the requests of Nohili

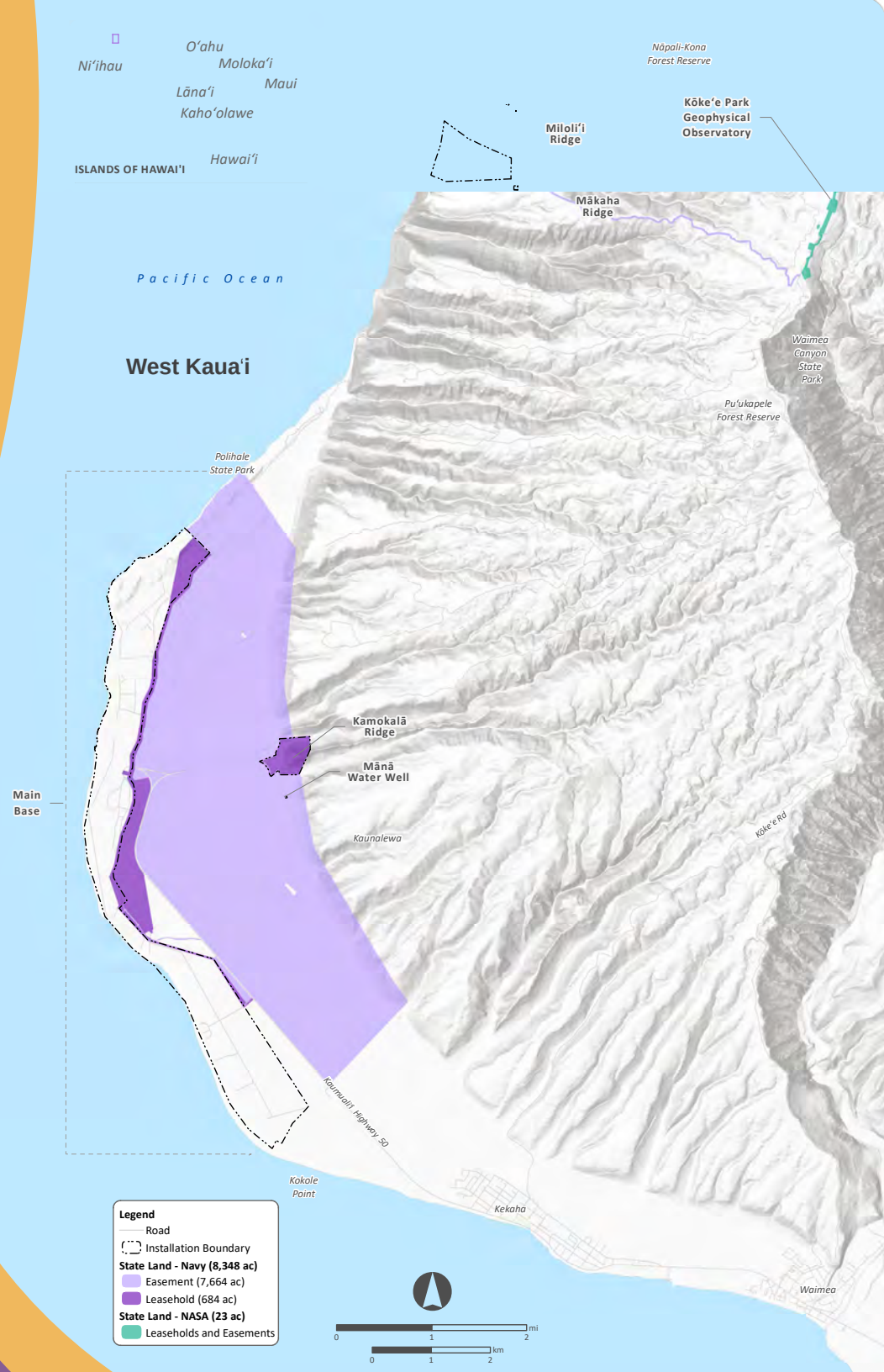
U.S. NAVY PACIFIC MISSILE RANGE FACILITY AND NASA

KŌKE'E PARK GEOPHYSICAL OBSERVATORY REAL ESTATE ENVIRONMENTAL IMPACT STATEMENT

The Navy and NASA invite you to participate in the environmental planning process and submit comments.

The U.S. Department of the Navy (Navy) and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts of proposed real estate agreements with the State of Hawai'i for the Pacific Missile Range Facility (PMRF) and the Kōke'e Park Geophysical Observatory (KPGO). The Navy and NASA are initiating a public scoping period to receive comments on the scope of the EIS. The scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and Hawai'i Revised Statutes Section 6E-42.

The Navy proposes to maintain long-term Department of Defense use of 8,348 acres of State of Hawai'i lands on Kaua'i for operational continuity and sustainment of the military readiness mission. The Navy operates on 410 acres of the total acres leased from the State. The majority of the leased and easement areas remain intentionally undeveloped as they are used as an encroachment buffer and security for the facility's mission. NASA proposes to maintain long-term use of 23 acres of State of Hawai'i land on Kaua'i for continued operations of KPGO. The Proposed Action is needed because existing real estate agreements for these State lands are set to expire between 2027 and 2030.



The Navy and NASA will host public scoping meetings at three locations on Kaua‘i. Attend any of the public scoping meetings to talk story, learn more, and submit written or oral comments. Your voice is important to this planning process.

Meetings will be held from 5 to 8 p.m. HST at the following locations:

Public Scoping Meetings:

Tuesday, June 4, 2024
Kaua‘i Veterans Center
3215 Kaua‘i Veterans Memorial Hwy, Līhu‘e

Wednesday, June 5, 2024
Kekaha Neighborhood Center
8130 Elepaio Rd., Kekaha

Thursday, June 6, 2024
Sheraton Kaua‘i Coconut Beach Resort
650 Aleka Loop, Kapa‘a

Agenda:

5 to 8 p.m.
Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment.

6 to 6:30 p.m.
Project presentation by Navy and NASA.

For language assistance or special accommodations, contact the PMRF Public Affairs Officer at (808) 335-4740 or PMRFPublicAffairs@us.navy.mil.
Requests for language assistance or special accommodations should be made at least seven days prior to the public meeting.

For more information, visit PMRF-KPGO-EIS.com

Submit Comments in Person, Online, or by Mail

Submit comments by *June 17, 2024*.
The public may submit comments in any of the following ways:

- In person at a public scoping meeting
- Through the project website at PMRF-KPGO-EIS.com
- By email to info@PMRF-KPGO-EIS.com
- By mail, postmarked by *June 17, 2024* to the following address:

  Naval Facilities Engineering Systems Command, Hawai‘i
  Environmental OPHEV2
  Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
  400 Marshall Road, Building X-11
  Pearl Harbor, HI 96860

The Navy and NASA propose to evaluate potential environmental impacts to the following resource areas. The public is invited to provide input on these and other resources that should be considered in the EIS.

Social Environment

- Archaeological and historic resources
- Cultural practices
- Visual resources
- Public health and safety
- Land use
- Socioeconomics
- Environmental justice

Physical Environment

- Air quality and greenhouse gases
- Water resources

Built Environment

- Utilities
- Transportation
- Hazardous materials and wastes

Biological Environment

- Biological resources

Preserving the long-term Department of Defense and NASA use of these State lands is critical for military readiness, continuation of ongoing military training and testing, and maintaining data collection efforts of global and local significance.

It also ensures the continued conservation management by the Navy and NASA of natural and cultural resources on these lands.

May 2024

Attachment J

Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Welcome to the project website for the Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Aloha and Welcome

The U.S. Navy and the National Aeronautics and Space Administration (NASA) are jointly

Public Scoping Meetings

Proposed Action and Preliminary Alternatives

Pacific Missile Range Facility and Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement

Proposed Action

The Navy proposes to maintain long-term Department of Defense use of the 8,348 acres of State of Hawai'i lands on Kaua'i for operational continuity and sustainment of the military readiness mission. NASA proposes to maintain long-term use of the 23 acres of leaseholds and easements on Kaua'i for continued operation of Kōke'e Park Geophysical Observatory (KPGO). The Navy and NASA existing real estate agreements for State lands were established in 1964 and 1965 and are set to expire between 2027 and 2030.

Alternative 1: Succeeding Current Real Estate Agreements.

Under this alternative, the Navy and NASA would apply to the Department of Land and Natural Resources for new long-term real estate agreements in the same manner, similar duration, and for the same uses as the current leases and easements. The Navy's agreements would include 684 acres of land leased exclusively by the Navy and 7,664 acres of easements. NASA's agreements would include 16 acres of land leased exclusively by NASA, 7 acres of easement lands, and would continue its Use Permit with the Navy. This alternative would not change any use or maintenance of existing infrastructure and would not involve construction, renovation, or demolition of facilities.

Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds.

Under this alternative, the Navy and NASA would pursue fee simple acquisition of 700 acres (684 acres for Navy use and 16 acres for NASA use) of leaseholds, and otherwise obtain use of the remaining acreage as described in Alternative 1. The new Navy fee simple land of 684 acres would include 392 acres of land at the Main Base, 89 acres at Kamokalā Ridge, 0.29 acre at the Mānā Water Well, 0.015 acre at Miloli'i Ridge, 203 acres at Mākaha Ridge, and the NASA fee simple land would include 16 acres at KPGO. This acreage would be transferred from ownership by the State of Hawai'i to the United States. This alternative would not change any use or maintenance of existing infrastructure and would not involve construction, renovation, or demolition of facilities.

Alternative 3: No Action Alternative.

Environmental Planning

PROPOSED ACTION
ENVIRONMENTAL REVIEW PROCESS

Conservation & Community

Pacific Missile Range Facility and Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement

The Navy at PMRF takes great pride in its role as caretakers of the cultural and natural resources entrusted to it.

The Navy believes it is the responsibility of all personnel, all commands, and all contractors to help protect Hawai'i's environment. The Navy strives to comply with environmental requirements and protect and preserve natural and cultural resources with which it is entrusted.

Over its 65-year history at PMRF, the Navy has established many successful stewardship programs. Conservation management of natural and cultural resources is a priority for both stewardship and mission readiness. This includes activities such as protecting the endangered Hawaiian monk seal (*Neomonachus schauinslandi*), green sea turtle (*Chelonia mydas*), protected birds to include the Nene Hawaiian goose, wetlands, precontact archaeological sites, iwi kūpuna (ancestral remains), and historic buildings and structures. The Navy also protects natural and cultural resources, including native Hawaiian sacred resources.

PMRF's awareness of the importance of Native Hawaiian cultural values is embodied in PMRF's slogan: ***E Pane Mai Ka Nonoi O Nohili – Answering the Requests of Nohili.***

The table below (Table 1) lists Navy funded and managed natural and cultural programs on State lands.

Table 1 Navy Programs on State Lands

Program	*Description*
	Mitigation for the effects of sea level rise on agricultural land on the Mānā Plain by: • creating an open floodable space to reduce the quantity and improve the quality of stormwater runoff discharged from agricultural drainage ditches into the nearshore

Public Involvement

Pacific Missile Range Facility and Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement

The Navy and NASA value and welcome input from the community, as well as the chance to share, communicate, and inform the community about the Environmental Impact Statement and the need for the real estate agreements.

Public Scoping Meetings

The Navy and NASA hosted public scoping meetings at three locations on Kaua'i. The public was encouraged to attend any of the public scoping meetings to talk story, learn more, and submit written or oral comments. The public scoping meetings were held on the dates below.

Tuesday, June 4, 2024 Kaua'i Veterans Center 3215 Kaua'i Veterans Memorial Hwy, Līhu'e **Wednesday, June 5, 2024** Kekaha Neighborhood Center 8130 Elepaio Rd, Kekaha **Thursday, June 6, 2024** Sheraton Kaua'i Coconut Beach Resort 650 Aleka Loop, Kapa'a	**Meeting Times: 5 to 8 p.m.** **Agenda:** • **5 to 8 p.m.** Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment. • **6 to 6:30 p.m.** Project presentation by Navy and NASA.

Attachment K

U.S. Navy Pacific Missile Range Facility and NASA Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Public Scoping Fact Sheet

Public Scoping Meeting Schedule

Attend any of the three public scoping meetings to talk story, learn more, and submit comments. Your voice is important to this planning process.

Tuesday, June 4, 2024	Kauaʻi Veterans Center 3215 Kauaʻi Veterans Memorial Hwy, Līhuʻe	• 5 to 8 p.m. Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment. • 6 to 6:30 p.m. Project presentation by Navy and NASA.
Wednesday, June 5, 2024	Kekaha Neighborhood Center 8130 Elepaio Road, Kekaha	
Thursday, June 6, 2024	Sheraton Kauaʻi Coconut Beach Resort 650 Aleka Loop, Kapaʻa	5 to 8 p.m. HST

Please Check In!

Scoping is the public's opportunity to provide comments to help the Navy and NASA focus their analysis. Please visit the project website at PMRF-KPGO-EIS.com

Welcome

The U.S. Navy (Navy) and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts of proposed real estate agreements with the State of Hawai`i for the Pacific Missile Range Facility (PMRF) and the Kōke`e Park Geophysical Observatory (KPGO). The Navy and NASA invite you to participate in this environmental planning process.

What are the Navy and NASA Proposing?

The Navy currently leases or holds easements for approximately 8,348 acres of State of Hawai`i land primarily for passive encroachment buffer as well as for mission readiness, access, and utilities for PMRF on Kaua`i. The Navy proposes to maintain long-term Department of Defense use of the 8,348 acres of State of Hawai`i lands on Kaua`i for operational continuity and sustainment of the military readiness mission.

The Navy operates on 410 acres of the total acres leased from the State of Hawai`i. The remaining acres are used as buffer zones, conservation areas, infrastructure, and access corridors.

NASA currently leases or holds easements for 23 acres of State of Hawai`i land for operations of KPGO. NASA has issued a Use Permit to the Navy for use of portions of KPGO to conduct PMRF mission support with radar, telemetry, and communications services.

NASA operates KPGO to collect geodetic data about the Earth's shape, orientation in space, and gravity. This data supports modern navigation technology such as the Global Positioning System (GPS) that is used every day in a wide variety of devices, from handheld smartphones to satellites. In addition, this data is used for scientific studies, spacecraft navigation, and the geolocation of Earth observations.

NASA proposes to maintain long-term use of the 23 acres of leased lands and easements for continued operation of KPGO. The Proposed Action is needed because existing real estate agreements for these State lands are set to expire between 2027 and 2030.

On Kaua`i, the Navy is the largest high-tech employer and third largest overall employer. Most of the 900 personnel at PMRF are civilians, including many from the local community. PMRF contributes approximately $150 million annually in salary, contract goods, and services to the local economy.

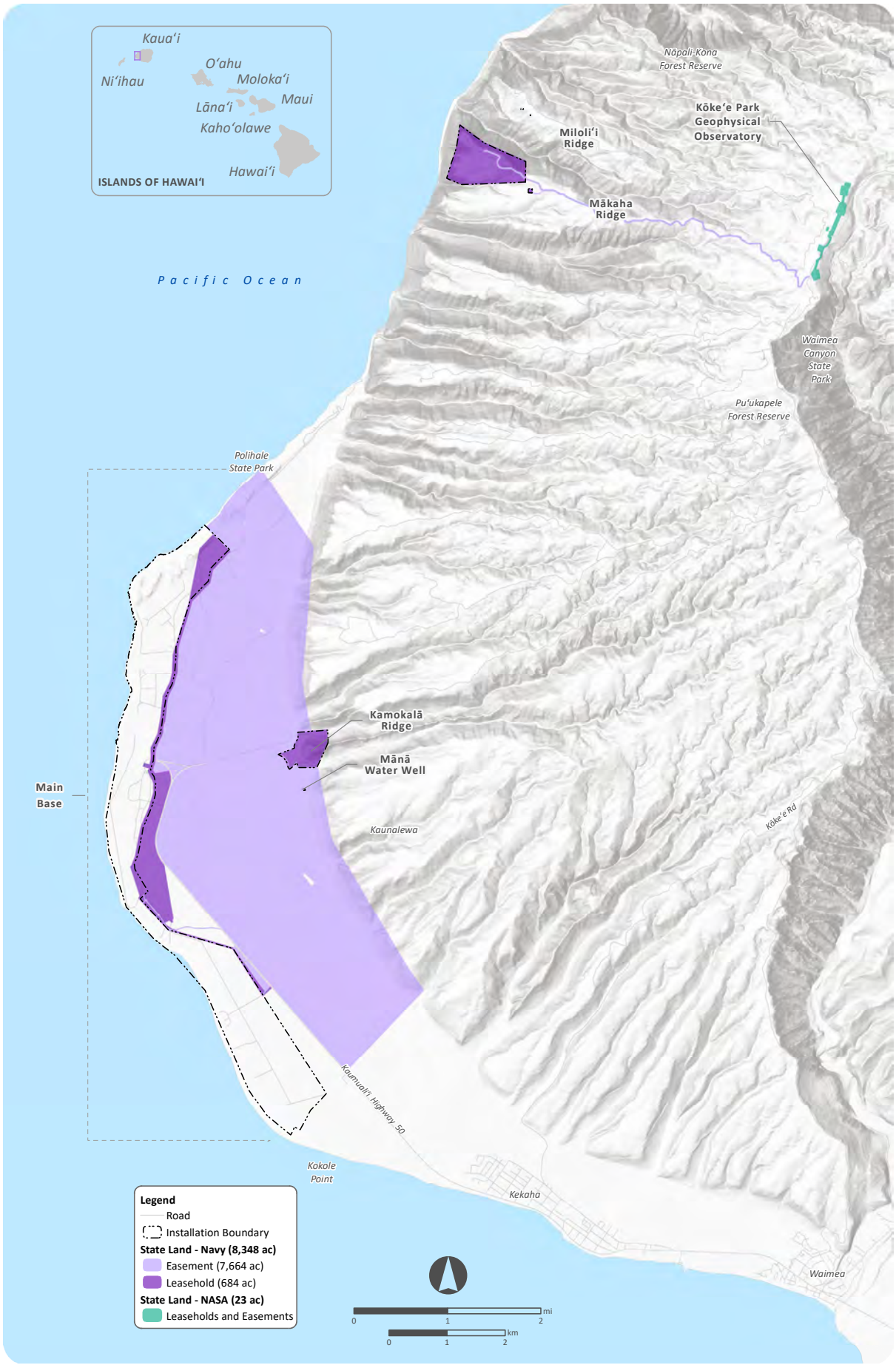


Figure 1. Project Map

Action Alternatives

Alternative 1: Succeeding Current Real Estate Agreements.

Under this alternative, the Navy and NASA would apply to the Department of Land and Natural Resources for new long-term real estate agreements in the same manner, similar duration, and for the same uses as the current leases and easements. The Navy's agreements would include 684 acres of land leased exclusively by the Navy and 7,664 acres of easements. NASA's agreements would include 16 acres of land leased exclusively by NASA, 7 acres of easement lands, and would continue its Use Permit with the Navy. This alternative would not change any use or maintenance of existing infrastructure and would not involve construction, renovation, or demolition of facilities.

Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds.

Under this alternative, the Navy and NASA would pursue fee simple acquisition of 700 acres (684 acres for Navy use and 16 acres for NASA use) of leaseholds, and otherwise obtain use of the remaining acreage as described in Alternative 1. The new Navy fee simple land of 684 acres would include 392 acres of land at the Main Base, 89 acres at Kamokalā Ridge, 0.29 acre at the Mānā Water Well, 0.015 acre at Miloli`i Ridge, 203 acres at Mākaha Ridge, and the NASA fee simple land would include 16 acres at KPGO. This acreage would be transferred from ownership by the State of Hawai`i to the United States. This alternative would not change any use or maintenance of existing infrastructure and would not involve construction, renovation, or demolition of facilities.

Alternative 3: No Action Alternative.

Under the No Action Alternative, the Navy and NASA would not seek any real estate agreements for the State lands on Kaua`i after expiration of the leases and easements between 2027 to 2030. The current real estate agreements for 8,348 acres with the Navy and 23 acres with NASA would expire. All existing infrastructure would be removed, or abandoned in place, from Navy and NASA leased and easement lands.

Preliminary Environmental Resources to be Studied

The Navy and NASA propose to evaluate potential environmental impacts for each of the alternatives on the following resource areas. The public is invited to provide input on these and other resources that should be considered in the EIS.

Social Environment

- Archaeological and historic resources
- Cultural practices
- Visual resources
- Public health and safety
- Land use
- Socioeconomics
- Environmental justice

Physical Environment

- Air quality and greenhouse gases
- Water resources

Biological Environment

- Biological resources

Built Environment

- Utilities
- Transportation
- Hazardous materials and wastes

PMRF honors ancestral Native Hawaiians in summer solstice event.

Sea turtle on beach at PMRF.

Nohili Dunes.

Waiokapua Bay, at PMRF.

Hawai'i's state bird, the nēnē, or Hawaiian goose.

Solar panels at PMRF.

About the Navy Pacific Missile Range Facility and NASA Kōkeʻe Park Geophysical Observatory

Pacific Missile Range Facility

PMRF is the world's largest instrumented multi-domain training and testing facility. What makes PMRF unique is its ability to simultaneously support surface, subsurface, air, and space operations. For portions of PMRF, the Navy has lease agreements with the State of Hawai`i for 8,348 acres, comprised of 684 acres of leaseholds and 7,664 acres of easements. The Navy operates on 410 acres of the total acres leased from the State. The majority of the leased and easement areas remain intentionally undeveloped as they are used as an encroachment buffer and security for the facility's mission. For more information, visit https://cnrh.cnic.navy.mil/Installations/PMRF-Barking-Sands/

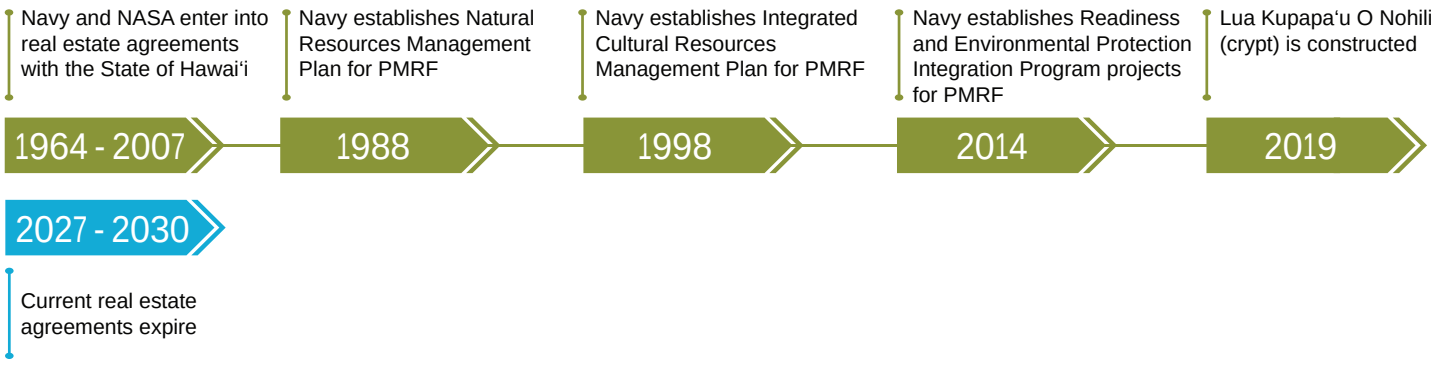
PMRF engages and actively participates with the community. Personnel who work at PMRF take great pride in their role as caretakers of the cultural and natural resources they are entrusted with. As the third largest employer on Kaua`i, many of the personnel are from the community.

Kōkeʻe Park Geophysical Observatory

NASA's Kōkeʻe Park Geophysical Observatory (KPGO) is located on a remote ridge within Kōkeʻe State Park. NASA operates the observatory to collect geodetic data that contributes to daily measurements of the Earth's orientation in space and rotation. This data is used for scientific studies and a wide variety of positioning and navigation applications. For more information, visit https://space-geodesy.nasa.gov/NSGN/sites/KPGO/KPGO.html

Preserving the long-term Department of Defense and NASA use of these State lands is critical for military readiness, continuation of ongoing military training and testing, and maintaining data collection efforts of global and local significance. It also ensures the continued conservation management by the Navy and NASA of natural and cultural resources on these lands.

PMRF and KPGO Timeline



What is the Space Geodesy Project at KPGO?

The Space Geodesy Project (SGP) maintains a global network of space geodetic observing instruments. The network is comprised of sites around the world that use four primary observation techniques:

- Very Long Baseline Interferometry (VLBI)
- Satellite Laser Ranging
- Doppler Orbitography by Radiopositioning Integrated on Satellite (DORIS)
- Global Navigation Satellite System (GNSS)

The International Terrestrial Reference Frame (ITRF) is determined by the observations made from the instruments listed above and is the foundation for virtually all Earth observations and georeferenced data used by society. This data is fundamental for:

- Positioning and navigation in space/air and on land/sea
- Tracking sea level changes
- Tsunami early warning systems
- Volcano deformation measurements
- Predicting flood patterns
- Studying glacier dynamics

What is KPGO?

The Kōke`e Park Geophysical Observatory (KPGO) is one of the core sites for NASA's SGP. The mission of KPGO is to collect geodetic data to support the geolocation of Earth observation from both land and space as well as scientific investigations of the Earth's surface and interior.

Why is KPGO Important?

NASA and the scientific community use the data collected by KPGO to study ecosystems, water cycles, geological hazards, sea-level change, crustal-dynamics, and many other Earth science topics. Many of these applications rely on the long history and continuity of the geodetic data collected from the current KPGO location.

Why Kōke`e State Park?

KPGO is in Kōke`e State Park at an elevation of 3,600 feet near the Waimea Canyon, isolated from radio broadcasts that would interfere with the sensitive measurements made by the VLBI system. The location on the island of Kaua`i is also critical for tying the Hawaiian Islands into the ITRF that contributes towards improving positioning and navigation accuracy on and around Hawai`i.

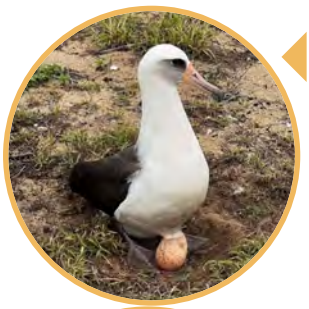
Stewardship and Care of the Land

Personnel who work at PMRF take great pride in their role as caretakers of the cultural and natural resources they are entrusted with.

E Pane Mai Ka Nonoi O Nohili

Answering the requests of Nohili

NATURAL RESOURCES CONSERVATION THROUGH PARTNERSHIPS



Conservation of Laysan albatross through translocation program.

Conservation of green sea turtles and their nests.

Conservation of sensitive species at Honopū Valley.

CULTURAL RESOURCES PRESERVATION

The Lua Kupapa'u O Nohili (crypt) preserves and honors iwi kūpuna (ancestral remains) found on PMRF.

Mānā Town Japanese cemetery from the sugar plantation days.

COMMUNITY SERVICE

Local scientists and students take part in natural resource surveys.

PMRF celebrates with the community at Kekaha Family Fun Day.

PMRF hosts the community at Earth Day events.

CLEAN ENERGY AND RESILIENCY THROUGH RENEWABLE ENERGY PROJECTS

Solar facility and battery energy storage system at PMRF.

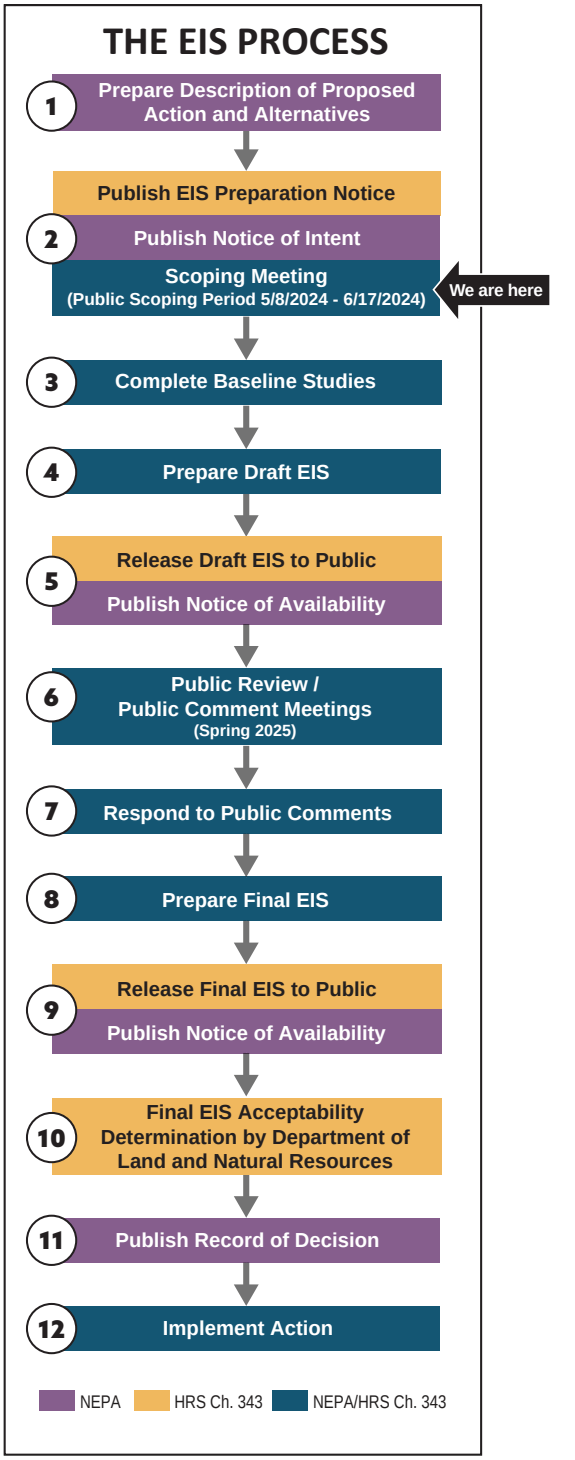
In 2023, the Department of Defense Readiness and Environmental Protection Integration (REPI) program awarded $5.29 million to natural resource conservation projects on Kaua'i. Approximately $26.7 million was awarded for all of Hawai'i.

NEPA/HEPA/Historic Preservation Process and Community Involvement

The Navy and NASA are jointly preparing the EIS pursuant to the National Environmental Policy Act (NEPA). The EIS will also be used by the Hawai`i Department of Land and Natural Resources under Hawai`i Revised Statutes (HRS) Chapter 343 and Hawai`i Administrative Rules Chapter 11-200.1, collectively referred to as the Hawai`i Environmental Policy Act (HEPA), in its decision making as to whether and what type of real estate agreement it may grant the Navy and NASA.

The EIS Process diagram (at right) illustrates the stages of public involvement in the NEPA and HEPA environmental processes. The public involvement processes for NEPA and HEPA for this EIS are running concurrently to meet the requirements for both state and federal laws and regulations.

The NEPA/HEPA scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act (NHPA) and HRS Section 6E-42.



Community Involvement

The Navy and NASA are initiating a public scoping process to receive comments on the scope of the EIS. Members of the public are encouraged to participate in the environmental planning process by providing input on the proposed real estate action including potential alternatives, environmental or cultural concerns, information the public would like the Navy and NASA to know, and any other information the public would like to see addressed in the EIS, and the project's potential to affect historic properties pursuant to Section 106 of the NHPA and HRS Section 6E-42.

The Navy and NASA are proud contributing members of the local community. The Navy and NASA value and welcome input from the community, as well as the chance to share, communicate, and inform the community about the EIS and the need for the real estate agreements.

Opportunities for formal public participation in the EIS process occur during two stages:

1. During the scoping period, following publication of the Notice of Intent (NOI) and the Environmental Impact Statement Preparation Notice (EISPN).
2. During the comment period following publication of the Draft EIS.

What is Scoping?

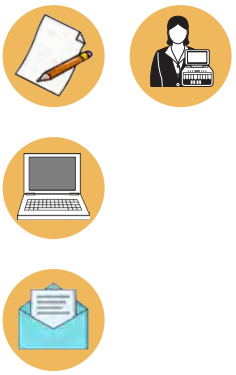
Scoping occurs at the beginning of the NEPA/HEPA process to help the Navy and NASA understand community-specific concerns regarding the Proposed Action and the planned analysis. Scoping encourages the participation of other federal, state, and local agencies, Native Hawaiian Organizations, environmental, cultural, and other groups, and the general public. Scoping helps determine what should be studied in this EIS including the alternatives and resources to be analyzed.

How to Submit Comments

Submit Comments in Person, Online, or by Mail.

Submit comments by ***June 17, 2024***. The Navy and NASA encourage the public to attend a public scoping meeting and to visit the project website to learn more.

The public may submit comments in any of the following ways:



- In person at a public scoping meeting
- Through the project website at **PMRF-KPGO-EIS.com**
- By email to **info@PMRF-KPGO-EIS.com**
- By mail, **postmarked by *June 17, 2024*** to the following address:

  Naval Facilities Engineering Systems Command, Hawai`i
  Environmental OPHEV2
  Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
  400 Marshall Road, Building X-11
  Pearl Harbor, HI 96860

For language assistance or special accommodations, contact the PMRF Public Affairs Officer, at (808) 335-4740 or PMRFPublicAffairs@us.navy.mil.

Notes:

We appreciate your time and interest.

For more information visit the project website at PMRF-KPGO-EIS.com

Attachment L

E Pane Mai Ka Nonoí O Nohíli

Answering the requests of Nohili

U.S. Navy Pacific Missile Range Facility and NASA Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Aloha and Welcome

Your participation is important to this planning process

PMRF-KPGO-EIS.com

Why We Are Here Tonight

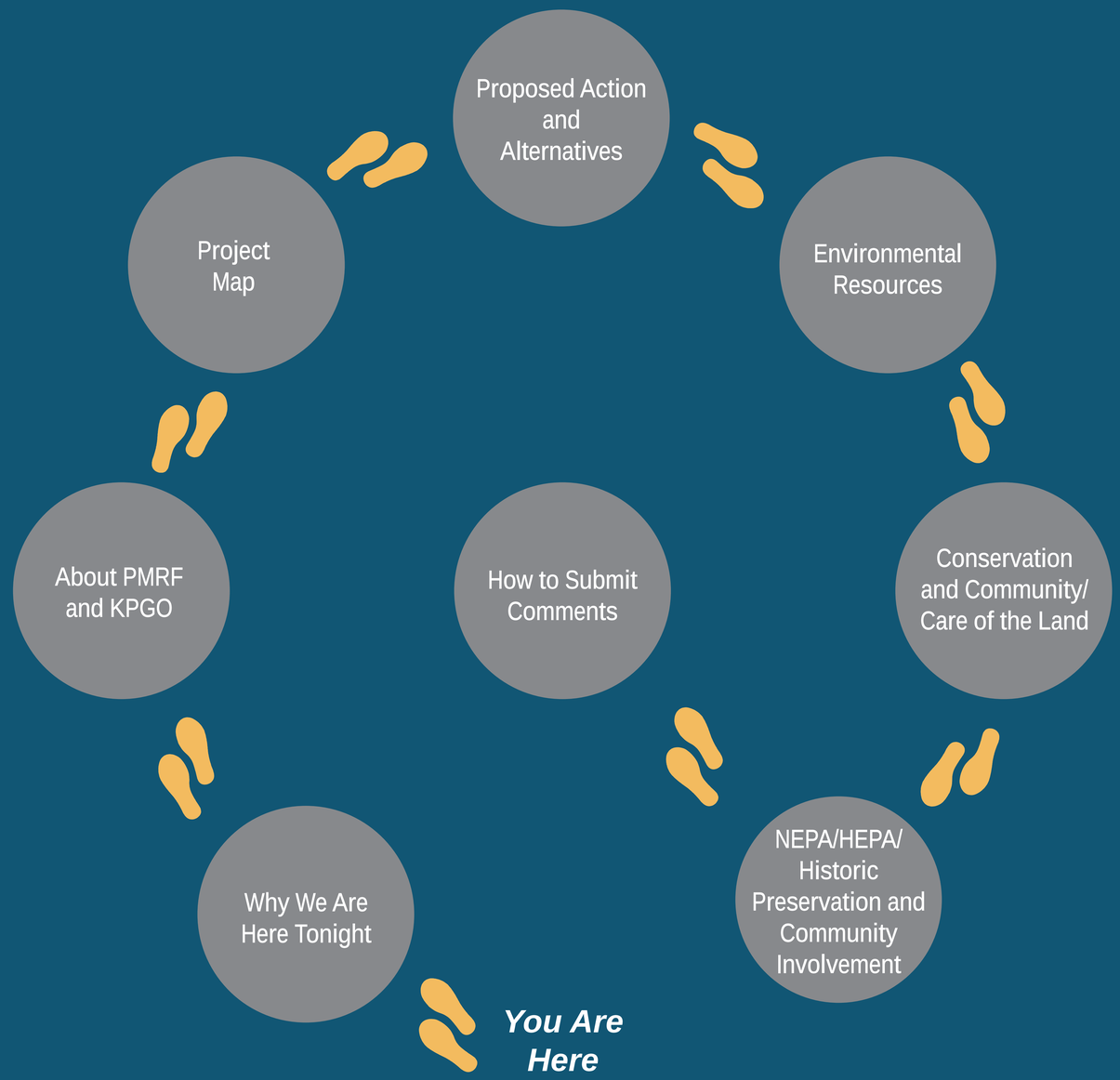
- The Navy and NASA will evaluate the potential environmental impacts of proposed real estate agreements with the State of Hawai‘i, Department of Land and Natural Resources for the Pacific Missile Range Facility and Kōke‘e Park Geophysical Observatory.

- The scoping meetings will also serve as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act and Hawai‘i Revised Statutes Section 6E-42.

- This is the beginning of the environmental planning process.

- The Navy and NASA invite you to participate and to provide your comments.

- Your comments can help the Navy and NASA evaluate potential environmental impacts.



About the Navy Pacific Missile Range Facility (PMRF)

PMRF is the world's largest instrumented multi-domain training and testing facility. What makes PMRF unique is its ability to simultaneously support surface, subsurface, air, and space operations.

Personnel at PMRF engage and actively participate with the community.

On Kaua'i, the Navy is the largest high-tech employer and third largest overall employer. Most of the 900 personnel at PMRF are civilians, including many from the local community. PMRF contributes approximately $150 million annually in salary, contract goods, and services to the local economy.

PMRF and KPGO Timeline

- **1964 - 2007** — Navy and NASA enter into real estate agreements with the State of Hawai'i
- **1988** — Navy establishes Natural Resources Management Plan for PMRF
- **1998** — Navy establishes Integrated Cultural Resources Management Plan for PMRF
- **2014** — Navy establishes Readiness and Environmental Protection Integration Program projects for PMRF
- **2019** — Lua Kupapa'u O Nohili (crypt) is constructed
- **2027 - 2030** — Current real estate agreements expire

About the Kōke‘e Park Geophysical Observatory (KPGO)

The Kōke‘e Park Geophysical Observatory (KPGO) is located on a remote ridge within Kōke‘e State Park in the western portion of Kaua‘i.

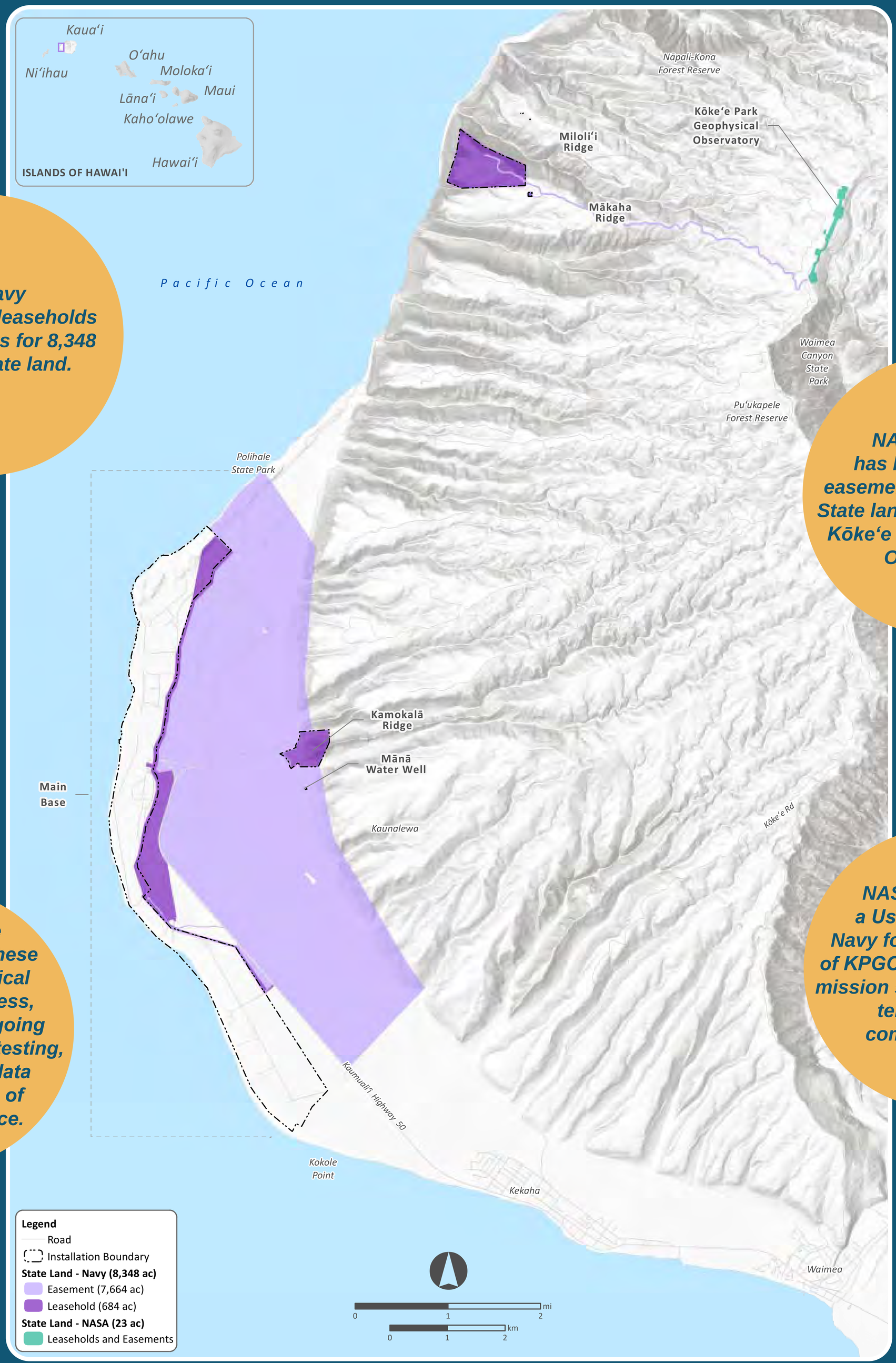
NASA operates KPGO to collect geodetic data about the Earth’s shape, orientation in space, and gravity. This data supports modern navigation technology such as the Global Positioning System (GPS) that is used every day in a wide variety of devices, from handheld smartphones to satellites. This data is also used for scientific studies, spacecraft navigation, and the geolocation of Earth observations.

Continued operations at KPGO would ensure that data-related operations of global and local significance can continue, allowing multiple agencies’ missions to persist without interruption.

NASA has issued a Use Permit to the Navy for use of portions of KPGO to conduct PMRF mission support with radar, telemetry, and communications services.

NASA’s lease began in 1965 when KPGO was part of the NASA Manned Space Flight Network. Since that time, KPGO has supported many NASA and external projects and has hosted a variety of equipment; it is a highly flexible and crucial geodetic site.

NASA’s Space Geodesy Project maintains a global network of space geodetic observing instruments. The network is comprised of sites around the world that use four primary observation techniques.



The Navy currently has leaseholds and easements for 8,348 acres of State land.

NASA currently has leaseholds and easements for 23 acres of State land for operations at Kōke‘e Park Geophysical Observatory.

Preserving the long-term use of these State lands is critical for military readiness, continuation of ongoing military training and testing, and maintaining data collection efforts of global significance.

NASA has issued a Use Permit to the Navy for use of portions of KPGO to conduct PMRF mission support with radar, telemetry, and communications services.

Current Land Agreements – West Kaua‘i

PROPOSED ACTION

- The Navy proposes to maintain long-term Department of Defense use of 8,348 acres of State lands on Kauaʻi for operational continuity and sustainment of the military readiness mission.
- The 8,348 acres is comprised of:
  - 684 acres of leaseholds
  - 7,664 acres of easements
- NASA proposes to maintain long-term use of 23 acres of leased lands and easements on Kauaʻi for continued operation of Kōkeʻe Park Geophysical Observatory (KPGO).

The Navy and NASA existing real estate agreements for State lands were established in 1964 and 1965 and are expiring between 2027 and 2030.

The Navy operates on 410 acres of the total acres leased from the State of Hawaiʻi. The remaining acres are used as buffer zones, conservation areas, infrastructure, and access corridors.

ALTERNATIVES

- **Alternative 1: Succeeding Current Real Estate Agreements.** The Navy and NASA would apply to the State of Hawaiʻi Department of Land and Natural Resources for new long-term real estate agreements in the same manner, similar duration, and for the same uses as the current leases and easements.
- **Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds.** The Navy and NASA would pursue fee simple acquisition of 700 acres (684—Navy, 16—NASA) of leaseholds, and otherwise obtain use of the remaining acreage as described in Alternative 1.
- **Alternative 3: No Action Alternative.** The Navy and NASA would not seek any real estate agreements for the State lands on Kauaʻi after expiration of the leases and easements between 2027 to 2030.

The Navy and NASA propose to evaluate the potential environmental impacts of each of these alternatives in the Environmental Impact Statement.

ENVIRONMENTAL RESOURCES

The Navy and NASA propose to evaluate potential environmental impacts for each of the alternatives on the following resource areas. The public is invited to provide input on these and other resources that should be considered in the Environmental Impact Statement.

Social Environment

- Archaeological and historic resources
- Cultural practices
- Visual resources
- Public health and safety
- Land use
- Socioeconomics
- Environmental justice

Physical Environment

- Air quality and greenhouse gases
- Water resources

Biological Environment

- Biological resources

Built Environment

- Utilities
- Transportation
- Hazardous materials and wastes

Waiokapua Bay, at PMRF

Sea turtle on beach at PMRF

Laysan albatross at PMRF

PMRF hosts Hālau Hula at Nohili Dunes

Nohili Dunes

Hawai‘i’s state bird, the nēnē, or Hawaiian goose

Sea turtle hatchling

CONSERVATION AND COMMUNITY

Stewardship and Care of the Land

Personnel who work at the Pacific Missile Range Facility (PMRF) take great pride in their role as caretakers of the cultural and natural resources they are entrusted with.

CULTURAL RESOURCES PRESERVATION

The Lua Kupapaʻu O Nohili (crypt) preserves and honors iwi kūpuna (ancestral remains) found on PMRF

Mānā Town Japanese cemetery from the sugar plantation days

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E Pane Mai Ka Nonoí O Nohíli

Answering the requests of Nohili

U.S. Navy Pacific Missile Range Facility and NASA Kōkeʻe Park Geophysical Observatory Real Estate EIS

PMRF-KPGO-EIS.com

NEPA/HEPA/Historic Preservation Process and Community Involvement

WE WANT TO HEAR FROM YOU

The National Environmental Policy Act (NEPA); Section 106 of the National Historic Preservation Act (NHPA); Hawai‘i Revised Statutes (HRS) Chapter 343 and Hawai‘i Administrative Rules (HAR) Chapter 11-200.1, collectively referred to as the Hawai‘i Environmental Policy Act (HEPA); and HRS Section 6E-42 require federal agencies and the State of Hawai‘i Department of Land and Natural Resources, respectively, to:

- Consider the environmental impacts of proposed projects.
- Consider the potential effects of their actions on historic properties and look for ways to avoid, minimize, or mitigate them.
- Get early public input on resources and alternatives to be evaluated.

COMMUNITY INVOLVEMENT

Opportunities for formal public participation in the EIS process occur during two stages:

1. During the scoping period, following publication of the Notice of Intent (NOI) and the Environmental Impact Statement Preparation Notice (EISPN).
2. During the public comment period following publication of the Draft EIS.

The Navy and NASA value and welcome your input.

THE EIS PROCESS

1. Prepare Description of Proposed Action and Alternatives
2. Publish EIS Preparation Notice / Publish Notice of Intent
   Scoping Meeting (Public Scoping Period 5/8/2024 - 6/17/2024) ← We are here
3. Complete Baseline Studies
4. Prepare Draft EIS
5. Release Draft EIS to Public / Publish Notice of Availability
6. Public Review / Public Comment Meetings (Spring 2025)
7. Respond to Public Comments
8. Prepare Final EIS
9. Release Final EIS to Public / Publish Notice of Availability
10. Final EIS Acceptability Determination by Department of Land and Natural Resources
11. Publish Record of Decision
12. Implement Action

NEPA | HRS Ch. 343 | NEPA/HRS Ch. 343

Public participation helps the Navy, NASA, and Department of Land and Natural Resources make informed decisions.

Thank you for your participation.

How to Submit Comments

Submit Comments in Person, Online, or by Mail

Submit comments by ***June 17, 2024***. The public may submit comments in any of the following ways:

- In person at a public scoping meeting
- Through the project website at **PMRF-KPGO-EIS.com**
- By email to **info@PMRF-KPGO-EIS.com**
- By mail, postmarked by ***June 17, 2024*** to the following address:

Naval Facilities Engineering Systems Command, Hawai‘i
Environmental OPHEV2
Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
400 Marshall Road, Building X-11
Pearl Harbor, HI 96860

For language assistance or special accommodations, ask a representative at today’s meeting, or contact the PMRF Public Affairs Officer, at (808) 335-4740, or PMRFPublicAffairs@us.navy.mil.

Attachment M

U.S. Navy Pacific Missile Range Facility and NASA Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Public Scoping Fact Sheet

Public Scoping Meeting Schedule

Attend any of the three public scoping meetings to talk story, learn more, and submit comments. Your voice is important to this planning process.

Tuesday, June 4, 2024	Kauaʻi Veterans Center 3215 Kauaʻi Veterans Memorial Hwy, Līhuʻe	• 5 to 8 p.m. Information stations – meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment. • 6 to 6:30 p.m. Project presentation by Navy and NASA.
Wednesday, June 5, 2024	Kekaha Neighborhood Center 8130 Elepaio Road, Kekaha	
Thursday, June 6, 2024	Sheraton Kauaʻi Coconut Beach Resort 650 Aleka Loop, Kapaʻa	5 to 8 p.m. HST

Please Check In!

Scoping is the public's opportunity to provide comments to help the Navy and NASA focus their analysis. Please visit the project website at PMRF-KPGO-EIS.com

Welcome

The U.S. Navy (Navy) and the National Aeronautics and Space Administration (NASA) are jointly preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts of proposed real estate agreements with the State of Hawai`i for the Pacific Missile Range Facility (PMRF) and the Kōke`e Park Geophysical Observatory (KPGO). The Navy and NASA invite you to participate in this environmental planning process.

What are the Navy and NASA Proposing?

The Navy currently leases or holds easements for approximately 8,348 acres of State of Hawai`i land primarily for passive encroachment buffer as well as for mission readiness, access, and utilities for PMRF on Kaua`i. The Navy proposes to maintain long-term Department of Defense use of the 8,348 acres of State of Hawai`i lands on Kaua`i for operational continuity and sustainment of the military readiness mission.

The Navy operates on 410 acres of the total acres leased from the State of Hawai`i. The remaining acres are used as buffer zones, conservation areas, infrastructure, and access corridors.

NASA currently leases or holds easements for 23 acres of State of Hawai`i land for operations of KPGO. NASA has issued a Use Permit to the Navy for use of portions of KPGO to conduct PMRF mission support with radar, telemetry, and communications services.

NASA operates KPGO to collect geodetic data about the Earth's shape, orientation in space, and gravity. This data supports modern navigation technology such as the Global Positioning System (GPS) that is used every day in a wide variety of devices, from handheld smartphones to satellites. In addition, this data is used for scientific studies, spacecraft navigation, and the geolocation of Earth observations.

NASA proposes to maintain long-term use of the 23 acres of leased lands and easements for continued operation of KPGO. The Proposed Action is needed because existing real estate agreements for these State lands are set to expire between 2027 and 2030.

On Kaua`i, the Navy is the largest high-tech employer and third largest overall employer. Most of the 900 personnel at PMRF are civilians, including many from the local community. PMRF contributes approximately $150 million annually in salary, contract goods, and services to the local economy.

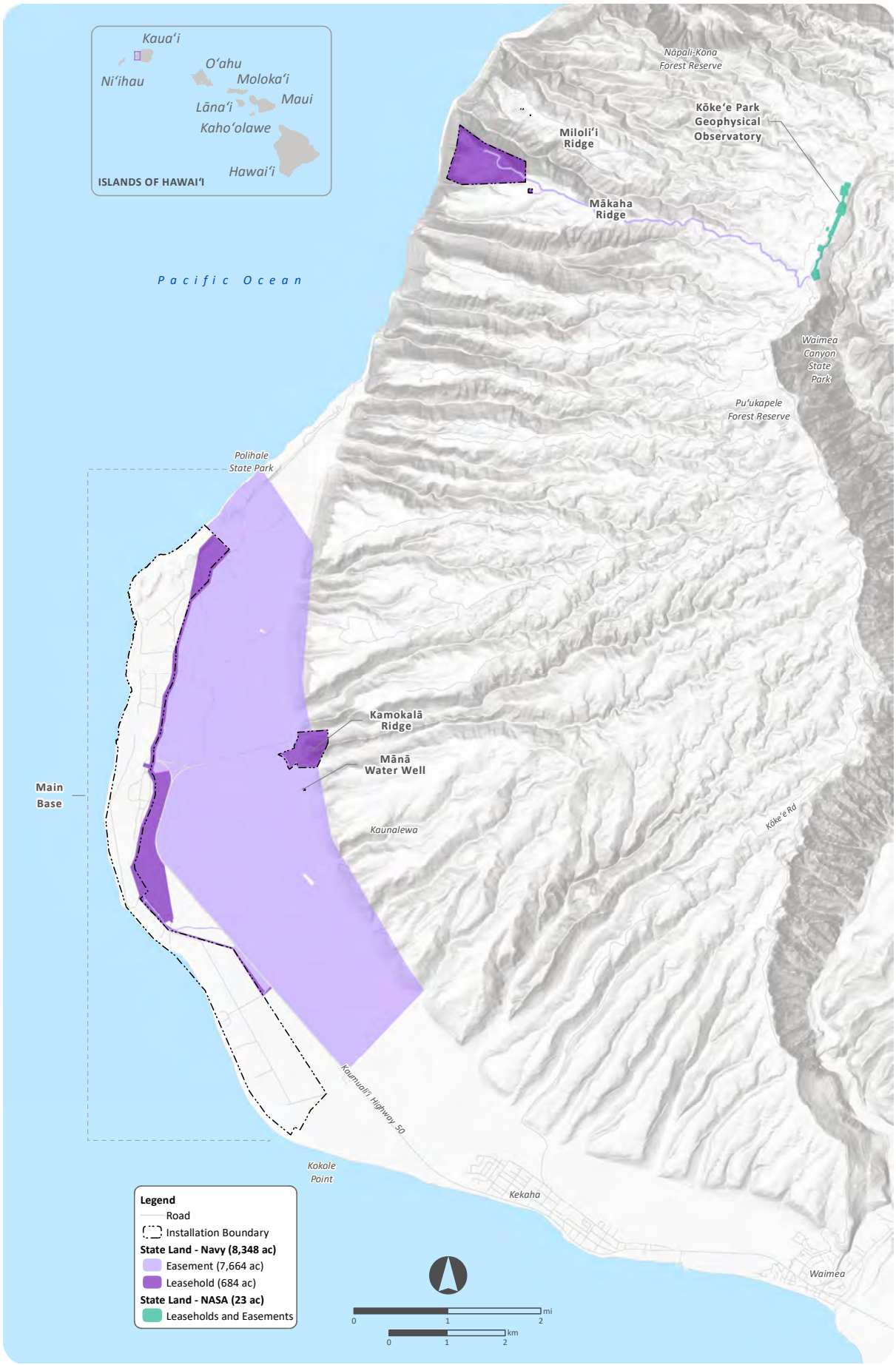


Figure 1. Project Map

Action Alternatives

Alternative 1: Succeeding Current Real Estate Agreements.

Under this alternative, the Navy and NASA would apply to the Department of Land and Natural Resources for new long-term real estate agreements in the same manner, similar duration, and for the same uses as the current leases and easements. The Navy's agreements would include 684 acres of land leased exclusively by the Navy and 7,664 acres of easements. NASA's agreements would include 16 acres of land leased exclusively by NASA, 7 acres of easement lands, and would continue its Use Permit with the Navy. This alternative would not change any use or maintenance of existing infrastructure and would not involve construction, renovation, or demolition of facilities.

Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds.

Under this alternative, the Navy and NASA would pursue fee simple acquisition of 700 acres (684 acres for Navy use and 16 acres for NASA use) of leaseholds, and otherwise obtain use of the remaining acreage as described in Alternative 1. The new Navy fee simple land of 684 acres would include 392 acres of land at the Main Base, 89 acres at Kamokalā Ridge, 0.29 acre at the Mānā Water Well, 0.015 acre at Miloli`i Ridge, 203 acres at Mākaha Ridge, and the NASA fee simple land would include 16 acres at KPGO. This acreage would be transferred from ownership by the State of Hawai`i to the United States. This alternative would not change any use or maintenance of existing infrastructure and would not involve construction, renovation, or demolition of facilities.

Alternative 3: No Action Alternative.

Under the No Action Alternative, the Navy and NASA would not seek any real estate agreements for the State lands on Kaua`i after expiration of the leases and easements between 2027 to 2030. The current real estate agreements for 8,348 acres with the Navy and 23 acres with NASA would expire. All existing infrastructure would be removed, or abandoned in place, from Navy and NASA leased and easement lands.

Preliminary Environmental Resources to be Studied

The Navy and NASA propose to evaluate potential environmental impacts for each of the alternatives on the following resource areas. The public is invited to provide input on these and other resources that should be considered in the EIS.

Social Environment

- Archaeological and historic resources
- Cultural practices
- Visual resources
- Public health and safety
- Land use
- Socioeconomics
- Environmental justice

Physical Environment

- Air quality and greenhouse gases
- Water resources

Biological Environment

- Biological resources

Built Environment

- Utilities
- Transportation
- Hazardous materials and wastes

PMRF honors ancestral Native Hawaiians in summer solstice event.

Sea turtle on beach at PMRF.

Nohili Dunes.

Waiokapua Bay, at PMRF.

Hawai'i's state bird, the nēnē, or Hawaiian goose.

Solar panels at PMRF.

About the Navy Pacific Missile Range Facility and NASA Kōkeʻe Park Geophysical Observatory

Pacific Missile Range Facility

PMRF is the world's largest instrumented multi-domain training and testing facility. What makes PMRF unique is its ability to simultaneously support surface, subsurface, air, and space operations. For portions of PMRF, the Navy has lease agreements with the State of Hawai`i for 8,348 acres, comprised of 684 acres of leaseholds and 7,664 acres of easements. The Navy operates on 410 acres of the total acres leased from the State. The majority of the leased and easement areas remain intentionally undeveloped as they are used as an encroachment buffer and security for the facility's mission. For more information, visit https://cnrh.cnic.navy.mil/Installations/PMRF-Barking-Sands/

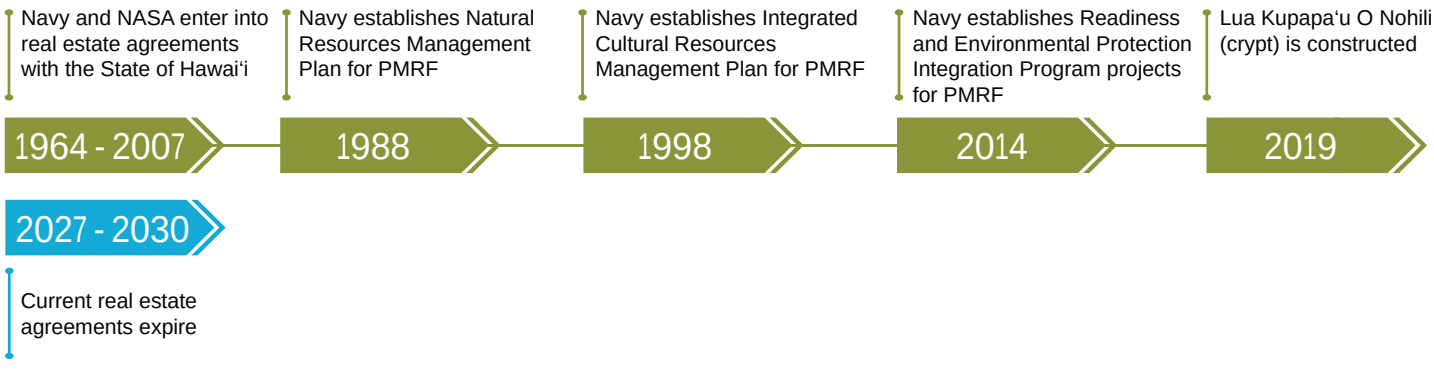
PMRF engages and actively participates with the community. Personnel who work at PMRF take great pride in their role as caretakers of the cultural and natural resources they are entrusted with. As the third largest employer on Kaua`i, many of the personnel are from the community.

Kōkeʻe Park Geophysical Observatory

NASA's Kōkeʻe Park Geophysical Observatory (KPGO) is located on a remote ridge within Kōkeʻe State Park. NASA operates the observatory to collect geodetic data that contributes to daily measurements of the Earth's orientation in space and rotation. This data is used for scientific studies and a wide variety of positioning and navigation applications. For more information, visit https://space-geodesy.nasa.gov/NSGN/sites/KPGO/KPGO.html

Preserving the long-term Department of Defense and NASA use of these State lands is critical for military readiness, continuation of ongoing military training and testing, and maintaining data collection efforts of global and local significance. It also ensures the continued conservation management by the Navy and NASA of natural and cultural resources on these lands.

PMRF and KPGO Timeline



What is the Space Geodesy Project at KPGO?

The Space Geodesy Project (SGP) maintains a global network of space geodetic observing instruments. The network is comprised of sites around the world that use four primary observation techniques:

- Very Long Baseline Interferometry (VLBI)
- Satellite Laser Ranging
- Doppler Orbitography by Radiopositioning Integrated on Satellite (DORIS)
- Global Navigation Satellite System (GNSS)

The International Terrestrial Reference Frame (ITRF) is determined by the observations made from the instruments listed above and is the foundation for virtually all Earth observations and georeferenced data used by society. This data is fundamental for:

- Positioning and navigation in space/air and on land/sea
- Tracking sea level changes
- Tsunami early warning systems
- Volcano deformation measurements
- Predicting flood patterns
- Studying glacier dynamics

What is KPGO?

The Kōke`e Park Geophysical Observatory (KPGO) is one of the core sites for NASA's SGP. The mission of KPGO is to collect geodetic data to support the geolocation of Earth observation from both land and space as well as scientific investigations of the Earth's surface and interior.

Why is KPGO Important?

NASA and the scientific community use the data collected by KPGO to study ecosystems, water cycles, geological hazards, sea-level change, crustal-dynamics, and many other Earth science topics. Many of these applications rely on the long history and continuity of the geodetic data collected from the current KPGO location.

Why Kōke`e State Park?

KPGO is in Kōke`e State Park at an elevation of 3,600 feet near the Waimea Canyon, isolated from radio broadcasts that would interfere with the sensitive measurements made by the VLBI system. The location on the island of Kaua`i is also critical for tying the Hawaiian Islands into the ITRF that contributes towards improving positioning and navigation accuracy on and around Hawai`i.

Stewardship and Care of the Land

Personnel who work at PMRF take great pride in their role as caretakers of the cultural and natural resources they are entrusted with.

E Pane Mai Ka Nonoi O Nohili

Answering the requests of Nohili

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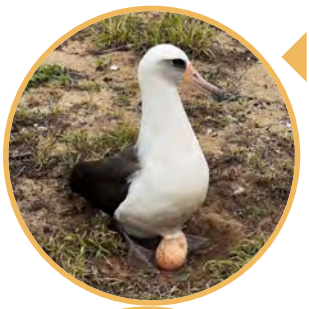

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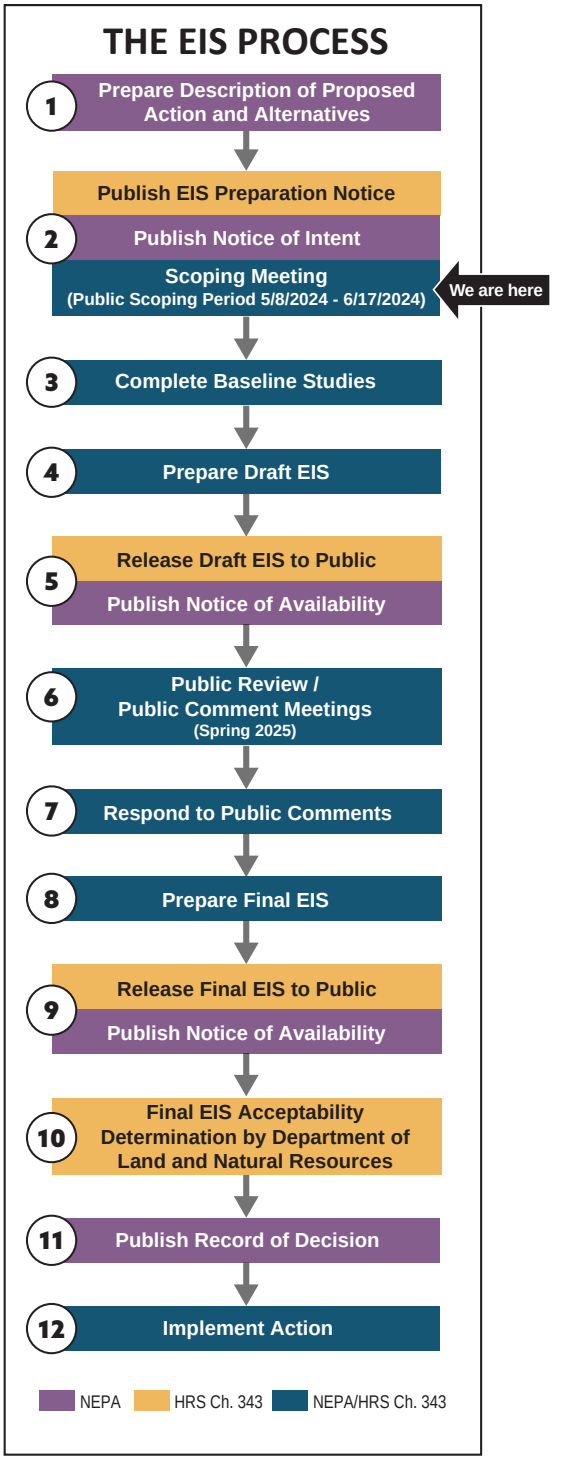

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2. During the comment period following publication of the Draft EIS.

What is Scoping?

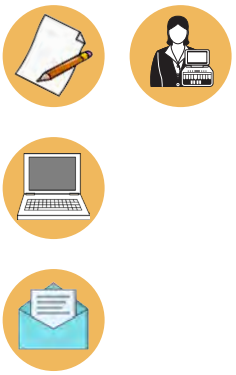
Scoping occurs at the beginning of the NEPA/HEPA process to help the Navy and NASA understand community-specific concerns regarding the Proposed Action and the planned analysis. Scoping encourages the participation of other federal, state, and local agencies, Native Hawaiian Organizations, environmental, cultural, and other groups, and the general public. Scoping helps determine what should be studied in this EIS including the alternatives and resources to be analyzed.

How to Submit Comments

Submit Comments in Person, Online, or by Mail.

Submit comments by ***June 17, 2024***. The Navy and NASA encourage the public to attend a public scoping meeting and to visit the project website to learn more.

The public may submit comments in any of the following ways:



- In person at a public scoping meeting
- Through the project website at **PMRF-KPGO-EIS.com**
- By email to **info@PMRF-KPGO-EIS.com**
- By mail, **postmarked by *June 17, 2024*** to the following address:

  Naval Facilities Engineering Systems Command, Hawai`i
  Environmental OPHEV2
  Attention: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
  400 Marshall Road, Building X-11
  Pearl Harbor, HI 96860

For language assistance or special accommodations, contact the PMRF Public Affairs Officer, at (808) 335-4740 or PMRFPublicAffairs@us.navy.mil.

Notes:

We appreciate your time and interest.

For more information visit the project website at PMRF-KPGO-EIS.com

Public Scoping Meeting Comment Form

Date: _____

Please submit comments for the scoping process by June 17, 2024. The Navy and NASA encourage the public to speak to project representatives available at tonight's meeting and to visit the website for project updates. The public may submit comments in any of the following ways:

- In person at a public scoping meeting
- Through the project website at **PMRF-KPGO-EIS.com**
- By email to **info@PMRF-KPGO-EIS.com**
- By mail, postmarked by June 17, 2024 (see address below)

** Please Print Clearly ** Additional Space is Provided on Back **

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Please provide your mailing address to receive future notifications about the project.

1. Name:_____
2. Organization/Affiliation (if applicable): _____
3. Mailing Address:_____

In the event the contents of specific comments are incorporated into the environmental review analysis, released in whole or in part in response to a Freedom of Information Act request, or otherwise disclosed to the public, the Navy and NASA will include the name of the individual or entity submitting the comment, but will not publish or otherwise disclose other potentially-identifying information such as home addresses, e-mail addresses, or telephone numbers.

Please turn in this form at a public scoping meeting, submit online at PMRF KPGO EIS.com, send by email to info@PMRF KPGO EIS.com or mail to:

Naval Facilities Engineering Systems Command, Hawai'i, Environmental OPHEV2
Attn: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
400 Marshall Road, Building X 11
Pearl Harbor, HI 96860

** Please Print Clearly **

YOUR INPUT MATTERS

Visit PMRF-KPGO-EIS.com

Scan QR code for project website

Public Scoping Meeting Comment Form

Date: _____

Please submit comments for the scoping process by June 17, 2024. The Navy and NASA encourage the public to speak to project representatives available at tonight's meeting and to visit the website for project updates. The public may submit comments in any of the following ways:

- In person at a public scoping meeting
- Through the project website at **PMRF-KPGO-EIS.com**
- By email to **info@PMRF-KPGO-EIS.com**
- By mail, postmarked by June 17, 2024 (see address below)

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Please provide your mailing address to receive future notifications about the project.

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In the event the contents of specific comments are incorporated into the environmental review analysis, released in whole or in part in response to a Freedom of Information Act request, or otherwise disclosed to the public, the Navy and NASA will include the name of the individual or entity submitting the comment, but will not publish or otherwise disclose other potentially-identifying information such as home addresses, e-mail addresses, or telephone numbers.

Please turn in this form at a public scoping meeting, submit online at PMRF KPGO EIS.com, send by email to info@PMRF KPGO EIS.com or mail to:

Naval Facilities Engineering Systems Command, Hawai'i, Environmental OPHEV2
Attn: PMRF and KPGO RE EIS Project Manager, Ms. Kerry Wells
400 Marshall Road, Building X 11
Pearl Harbor, HI 96860

** Please Print Clearly **

YOUR INPUT MATTERS

Visit PMRF-KPGO-EIS.com

Scan QR code for project website

ORAL COMMENT FORM

Please provide this form to the court reporter.

Meeting Location

- ☐ Līhuʻe, HI
- ☐ Kekaha, HI
- ☐ Kapaʻa, HI

Please provide the following information. Please print clearly.

Note: Your address, phone number, and email address will not be made public.

First and Last Name: _____

Organization representing (if any): _____

Address: _____

Phone: _____

Email: _____

ORAL COMMENT FORM

Please provide this form to the court reporter.

Meeting Location

- ☐ Līhuʻe, HI
- ☐ Kekaha, HI
- ☐ Kapaʻa, HI

Please provide the following information. Please print clearly.

Note: Your address, phone number, and email address will not be made public.

First and Last Name: _____

Organization representing (if any): _____

Address: _____

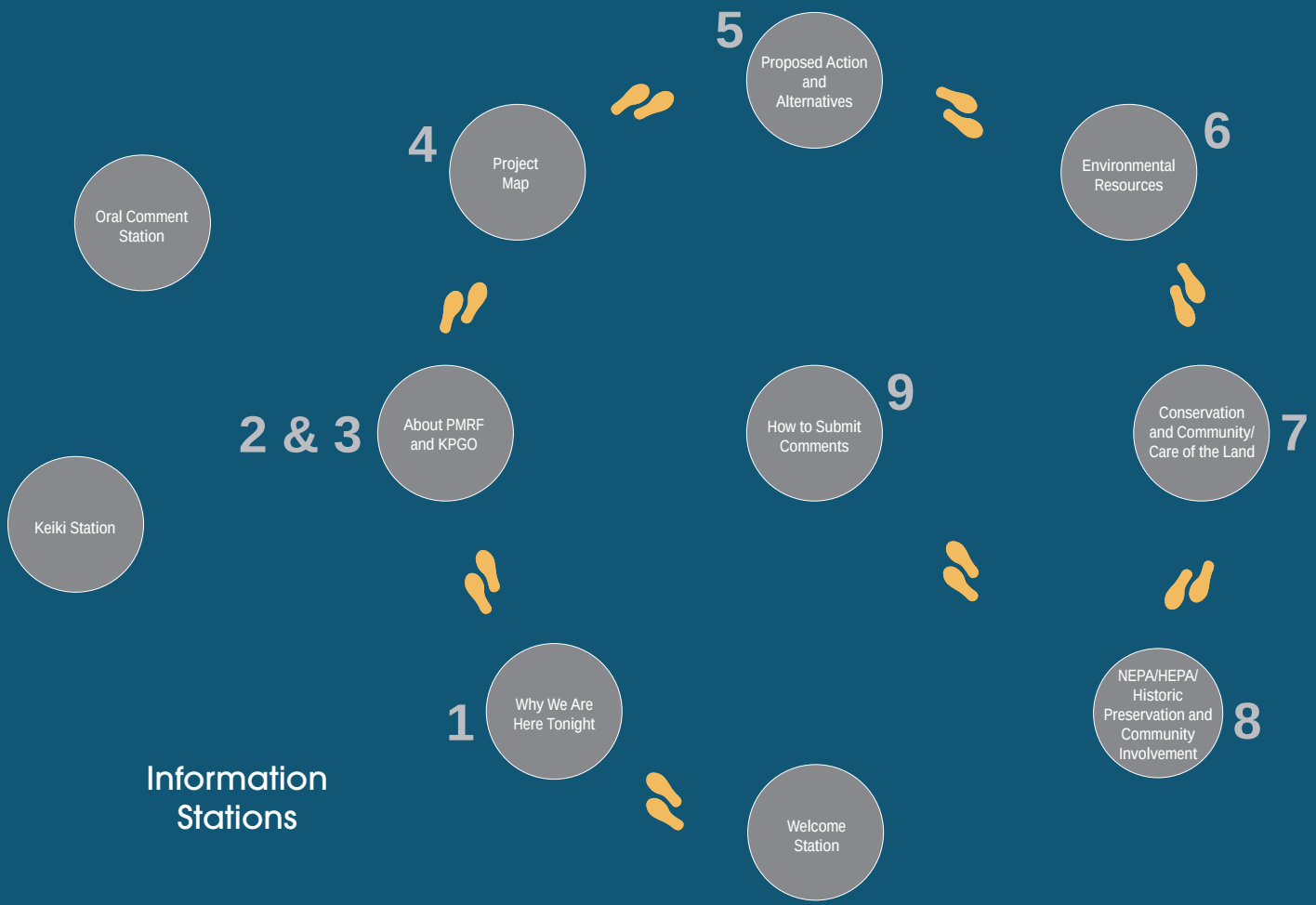
Phone: _____

Email: _____

U.S. Navy Pacific Missile Range Facility and NASA Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Aloha and Welcome

Mahalo for joining us this evening. Please visit the information stations to meet the project team, talk story, and ask questions. Visit the comments station to provide a written or oral comment.



Information Stations

PMRF-KPGO-EIS.com

Attachment N

E Pane Mai Ka Nonoi O Nohili

Answering the requests of Nohili

U.S. Navy Pacific Missile Range Facility and NASA Kōke'e Park Geophysical Observatory Real Estate Environmental Impact Statement

Aloha and Welcome

Your participation is important to this planning process

PMRF-KPGO-EIS.com

E Pane Mai Ka Nonoi O Nohili
Answering the requests of Nohili

2024 Public Scoping Meetings for the U.S. Navy Pacific Missile Range Facility and NASA Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

June 4 - Kauaʻi Veterans Center, Līhuʻe

June 5 - Kekaha Neighborhood Center, Kekaha

June 6 - Sheraton Kauaʻi Coconut Beach Resort, Kapaʻa

Scan QR code for project website

PMRF-KPGO-EIS.com

Public Scoping Meeting Agenda

- Meet & Greet at Poster Stations
- Project Presentation
- Return to Poster Stations

Purpose of Today's Meeting

- This is the beginning of the environmental review process.
- The Navy and NASA invite you to participate and to provide your comments.
- Your comments can help the Navy and NASA evaluate potential environmental impacts.
- This is also an opportunity to provide input on potential effects to historic properties.

About the Pacific Missile Range Facility (PMRF)

- PMRF is the world's largest instrumented multi-domain training and testing facility.
- It is unique because it can simultaneously support surface, subsurface, air, and space operations.
- PMRF brings about $150 million annually to Kaua'i County.
  - Approximately 1,000 personnel
  - Largest high-tech employer on Kaua'i
  - Third largest overall employer on Kaua'i
- Personnel at PMRF engage and actively participate with the community.

Conservation and Community

Stewardship and Care of the Land

Personnel who work at PMRF take great pride in their role as caretakers of the cultural and natural resources they are entrusted with.

- Natural Resources Conservation through Partnerships
- Clean Energy and Resiliency through Renewable Energy Projects
- Cultural Resources Preservation
- Community Service

About the Kōke‘e Park Geophysical Observatory (KPGO)

- KPGO is located on a remote ridge in Kōke‘e State Park.
- NASA operates KPGO to collect data about the Earth’s shape, orientation in space, and gravity.
- Navy uses KPGO to conduct PMRF mission support with radar, telemetry, and communications services.
- The data collected at KPGO is of global and local importance.

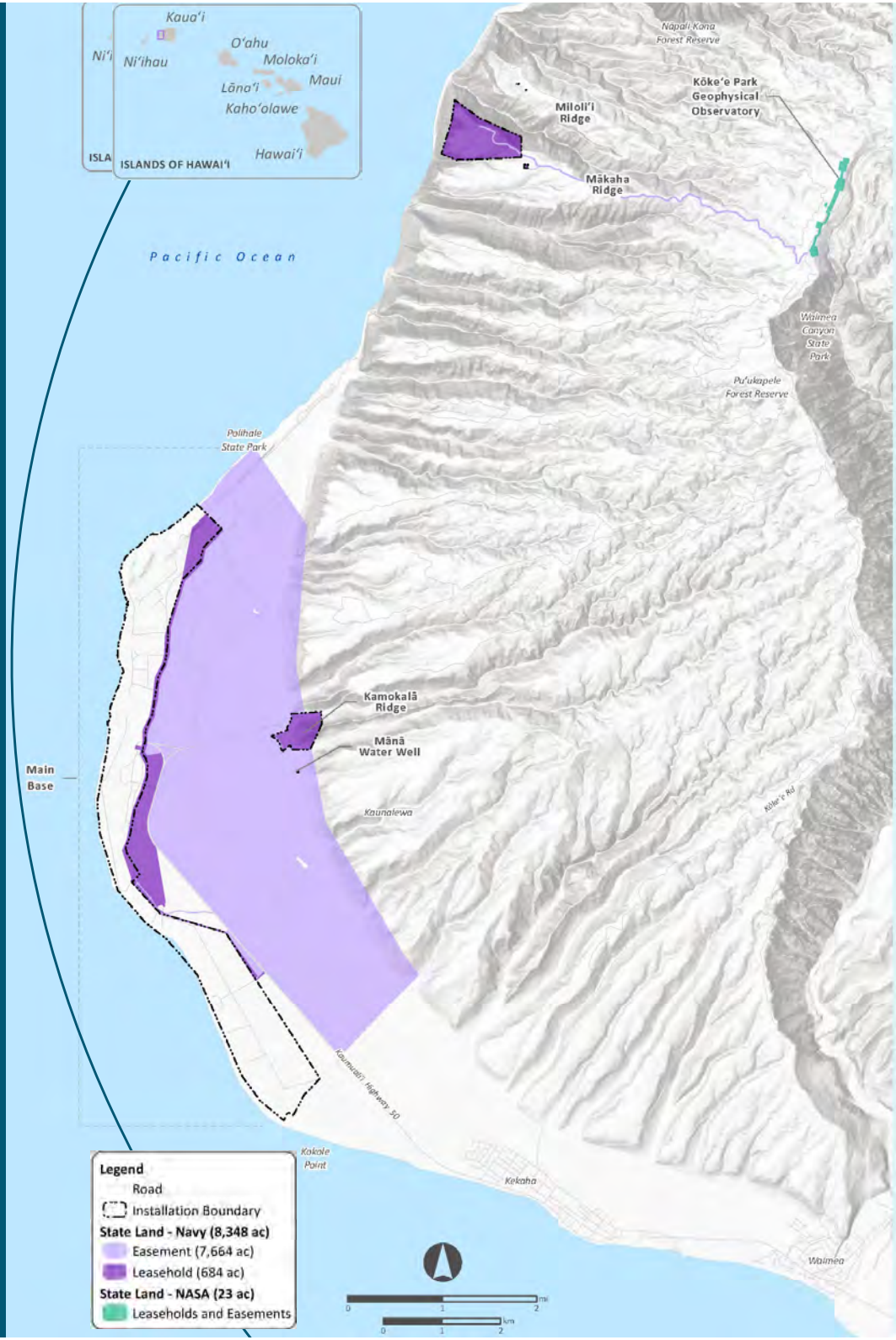
Current Land Management West Kaua‘i

Kōke‘e Park Geophysical Observatory

- NASA has 16 acres of leaseholds and 7 acres of easements for operation of KPGO.
- NASA issued a Use Permit to the Navy for portions of KPGO.

West Kaua‘i

- Navy has 684 acres of leaseholds and 7,664 acres of easements for portions of PMRF.
- The Navy operates on 410 acres of the total 8,348 acres leased.



Proposed Action

- Navy and NASA real estate agreements are set to expire between 2027 and 2030.
- Navy proposes to maintain long-term Department of Defense use of 8,348 acres of State lands on Kaua‘i for operational continuity and sustainment of the military readiness mission.
- NASA proposes to maintain long-term use of the 23 acres of leaseholds and easements for continued operation of KPGO.

Preliminary Alternatives

The Navy and NASA propose to evaluate the potential environmental impacts of each of the alternatives.

Alternative 1: Succeeding Current Real Estate Agreements

- Navy and NASA would apply to the Department of Land and Natural Resources for new long-term real estate agreements in the same manner, similar duration, and for the same uses as the current leases and easements.

Preliminary Alternatives

Alternative 2: Fee Simple Acquisition of Current Real Estate Agreements for Leaseholds

- Navy would pursue fee simple acquisition of the 684 acres at fair market value and obtain succeeding easements for the remaining acres currently held.
- NASA would pursue fee simple acquisition of the 16 acres of leaseholds at fair market value and obtain succeeding easements for the remaining 7 acres currently held.

Alternative 3: No Action Alternative

- Navy and NASA would not seek any real estate agreements for the State lands after expiration.

Environmental Resources

Social Environment

- Archaeological and historic resources
- Cultural practices
- Visual resources
- Public health and safety
- Land use
- Socioeconomics
- Environmental justice

Physical Environment

- Air quality and greenhouse gases
- Water resources

Biological Environment

- Biological resources

Built Environment

- Utilities
- Transportation
- Hazardous materials and wastes

The public is invited to provide input on these and other resources that should be considered in the Environmental Impact Statement.

THE EIS PROCESS

1. Prepare Description of Proposed Action and Alternatives
2. Publish EIS Preparation Notice
   Publish Notice of Intent
   Scoping Meeting
   (Public Scoping Period 5/8/2024 - 6/17/2024) ← We are here
3. Complete Baseline Studies
4. Prepare Draft EIS
5. Release Draft EIS to Public
   Publish Notice of Availability
6. Public Review / Public Comment Meetings
   (Spring 2025)
7. Respond to Public Comments
8. Prepare Final EIS
9. Release Final EIS to Public
   Publish Notice of Availability
10. Final EIS Acceptability Determination by Department of Land and Natural Resources
11. Publish Record of Decision
12. Implement Action

NEPA | HRS Ch. 343 | NEPA/HRS Ch. 343

PMRF-KPGO-EIS.com

How to Submit Comments

- In person at a public scoping meeting
- Online at: **PMRF-KPGO-EIS.com**
- Via email to: **info@PMRF-KPGO-EIS.com**
- Mail written comments to:
  Naval Facilities Engineering Systems Command, Hawai‘i
  Environmental OPHEV2
  Attn: PMRF and KPGO RE EIS Project Manager,
  Ms. Kerry Wells
  400 Marshall Road, Building X-11
  Pearl Harbor, HI 96860
- **PMRF Public Affairs Officer:** (808) 335-4740, or PMRFPublicAffairs@us.navy.mil

Submit comments by June 17, 2024

Scan QR code for project website

Scoping Meeting Schedule

Tuesday, June 4, 2024 (5 to 8 p.m.)
Kauaʻi Veterans Center
3215 Kaua'i Veterans Memorial Hwy, Līhuʻe

Wednesday, June 5, 2024 (5 to 8 p.m.)
Kekaha Neighborhood Center
8130 Elepaio Road, Kekaha

Thursday, June 6, 2024 (5 to 8 p.m.)
Sheraton Kauaʻi Coconut Beach Resort
650 Aleka Loop, Kapaʻa

Scan QR code for project website

PMRF-KPGO-EIS.com

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Draft EIS Comment Summary Report

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DRAFT ENVIRONMENTAL IMPACT STATEMENT COMMENT SUMMARY REPORT

Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate

Environmental Impact Statement

December 2025

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Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory
Real Estate Draft Environmental Impact Statement
Comment Summary Report

This report summarizes public comments received during the comment period for the United States (U.S) Department of the Navy (Navy) and the National Aeronautics and Space Administration (NASA) *Pacific Missile Range Facility (PMRF) and Kōkeʻe Park Geophysical Observatory (KPGO) Real Estate Environmental Impact Statement (EIS)*. The Proposed Action analyzed in the Draft EIS is for the Navy to retain 8,172 acres of state lands on Kauaʻi, Hawaiʻi, for operational continuity and sustainment, in support of continued military training, testing, and facility operations at PMRF. NASA proposes to retain 23 acres of state lands on Kauaʻi, Hawaiʻi, in support of continued operations including measurements of the Earth's rotation and local land motion at KPGO.

The public comment period for the National Environmental Policy Act (NEPA) started on June 20, 2025, with the publication of the Notice of Availability (NOA) in the *Federal Register,* and for the Hawai'i Revised Statues (HRS) Chapter 343 (commonly known as the "Hawai'i Environmental Policy Act [HEPA]") on June 23, 2025, with the publication of the Draft EIS in *The Environmental Notice*. The public comment period ended on August 7, 2025. The purpose of public involvement and outreach during the comment phase was to invite the public, elected officials, government agencies, nongovernmental organizations, Native Hawaiian Organizations, and all interested stakeholders to review and comment on the Draft EIS in accordance with NEPA and HEPA. As part of the public comment period, the Navy and NASA solicited feedback on the Draft EIS which included the proposed real estate action, potential impacts of the alternatives, environmental and/or cultural concerns, and sought information the public would like the Navy and NASA to know and any other information the public would like to see addressed in the Final EIS. The comment period also served as an opportunity to obtain public input concerning potential effects to historic properties pursuant to Section 106 of the National Historic Preservation Act (NHPA) and HRS Section 6E-8.

During the public comment period, the Navy and NASA hosted public meetings at three locations on Kauaʻi. Each meeting included a live online broadcast and public comment opportunity to submit written or oral comments (both in person and/or online).

The Navy and NASA recognize the importance of public engagement and have made significant efforts to encourage public participation during development of the EIS. These efforts exceed those required by NEPA and HEPA in order to ensure the broadest effort to notify, inform, and engage the public during the Draft EIS public comment period.

Outreach efforts included the following:

- A 48-day comment period (NEPA) and 45-day comment period (HEPA);
- Multiple, consecutive newspaper advertisements and social media postings;
- Stakeholder informational presentations held during the public comment period;
- Regularly scheduled informational presentations with Department of Land and Natural Resources (DLNR) Land Division;
- Notification letters, postcard mailers, and flyers;

- Publication of materials on the project website (https://www.pmrf-kpgo-eis.com/) and PMRF websites (https://pmrfkauai.com/; https://cnrh.cnic.navy.mil/Installations/PMRF-Barking-Sands/); and
- Three locations on Kaua‘i were selected for public meetings with geographic convenience for the general public; additionally, each meeting included a live online broadcast to ensure participants from other locations could give their testimony.

Summary of Activities

A. PUBLIC OUTREACH INFORMATION

Project Website

The Navy and NASA established a website at the initiation of the scoping process on May 8, 2024, to provide the public with project information. The website has remained active throughout the EIS process. The website serves as a repository of information and includes notices, maps, the public scoping meeting presentation, public meeting information, public comment information, posters and fact sheets, and other project information. Other highlights of the website include information on the environmental planning process, PMRF conservation and community activities, responses to frequently asked questions (FAQs), and contact forms for the public to reach out to the EIS team and to subscribe to receive future notifications. During the public comment period, the public could submit comments via the website using the online comment form.

The project website for the Navy and NASA is https://www.pmrf-kpgo-eis.com and the address is included on all public notifications and informational materials. Fact sheets and a link to the project website can be found at NASA’s Space Geodesy Project (SGP) website https://space-geodesy.nasa.gov, on the PMRF installation website at https://cnrh.cnic.navy.mil/Installations/PMRF-Barking-Sands/, and on PMRF’s “One Kaua‘i” website https://pmrfkauai.com. As described in the Draft EIS, the PMRF One Kaua‘i website and quarterly newsletter were developed as part of the Enhanced Engagements, and are detailed in Enhanced Engagement-4 in the Draft EIS.

Selected screen captures of the websites and One Kaua‘i quarterly newsletter are found in Attachment A.

Stakeholder Informational Presentations

Monthly informational presentations with the Navy, NASA, and DLNR Land Division started on May 28, 2024, and continue to occur on the last Tuesday of every month. Other stakeholder informational engagements include:

- Aha Moku Council representatives on June 23, 2025, and August 28, 2025;
- Board of Land and Natural Resources (BLNR)/DLNR leadership on July 8, 2025;
- Governor’s staff on July 8, 2025;
- Media interview with Catherine Cruz of Hawai‘i Public Radio on July 14, 2025;
- Lieutenant Governor and others on July 23, 2025;
- Office of Hawaiian Affairs (OHA) on July 24, 2025;
- House of Representatives on July 28, 2025 (including the following: Representative Nadine Nakamura, Speaker; Representative Linda Ichiyama, Vice Speaker; Representative Dee Morikawa; Representative Luke Evslin; Representative Chris Todd, FIN; Representative Della Au

Belatti, PBS; Representative Mark Hashem, WAL; Representative Nicole Lowen, EEP; Representative David Tarnas, JHA; and Representative Cory Chun, AGR);
- Media interview with Larry Graff of KKCR radio on July 28, 2025;
- Kaua'i County Council (1 to 2 councilmembers at a time) on August 6 and 7, 2025;
- Hawai'i Senate leadership on August 18, 2025;
- Governor's staff and the Military and Community Relations Office (MACRO) visit to PMRF on August 21, 2025; and
- Department of Hawaiian Homelands on September 22, 2025.

Presentations included information about the Navy and NASA missions at PMRF and KPGO, respectively; the summary of the Draft EIS, including the Proposed Action and alternatives and the effects analysis; its purpose and need; the NEPA, HEPA, and Section 106 processes; consultations and coordination; resources affected; public involvement opportunities; and Navy and NASA natural resource management activities.

B. PUBLIC NOTIFICATION

The Navy and NASA prepared materials to notify the public about the availability of the Draft EIS for public review and comment. These materials provided project information, a summary of the Draft EIS analysis, and public involvement opportunities.

Federal Register Notice and The Environmental Notice

The Navy and NASA published the NOA for the Draft EIS in the *Federal Register* on June 20, 2025, and in the State of Hawai'i, Office of Planning and Sustainable Development-Environmental Review Program semi-monthly publication, *The Environmental Notice*, on June 23, 2025. The *Federal Register* notice is found in Attachment B, and *The Environmental Notice* publication is found in Attachment C.

Newspaper Advertisements

The Navy and NASA placed display advertisements in four local and regional newspapers in Hawai'i beginning June 20, 2025, to coincide with publication of the NOA in the *Federal Register*. The newspapers ran the advertisements for three consecutive days, including on Sunday if the publication schedule allowed. As the public meetings approached, the advertisements were also repeated.

Table 1 shows the newspapers and corresponding publication dates for each advertisement. The newspaper advertisements are found in Attachment D.

Table 1 Newspaper Publications for the Notice of Availability of the Draft Environmental Impact Statement

Newspaper	Newspaper Coverage	Publication Frequency	Publication Dates
The Honolulu-Star Advertiser	Hawaiian Islands	Daily; except Saturday	Friday, June 20, 2025 Sunday, June 22, 2025 Monday, June 23, 2025 Friday, July 11, 2025 Sunday, July 13, 2025 Monday, July 14, 2025

Newspaper	Newspaper Coverage	Publication Frequency	Publication Dates
The Garden Island	Kauaʻi	Daily; except Sunday	Friday, June 20, 2025 Saturday, June 21, 2025 Monday, June 23, 2025 Friday, July 11, 2025 Saturday, July 12, 2025 Monday, July 14, 2025
MidWeek Kauaʻi	Kauaʻi	Wednesdays	Wednesday, June 25, 2025 Wednesday, July 2, 2025 Wednesday, July 9, 2025 Wednesday, July 16, 2025
Ka Wai Ola News	Hawaiian Islands	Monthly	July 2025 edition

Stakeholder Notification Letters

The Navy and NASA mailed notification letters on June 18, 2025, via first-class mail, to 207 stakeholders comprising elected officials (local, state, federal), government agencies (local, state, federal), environmental organizations and other non-governmental organizations (local, regional, national, government programs), Native Hawaiian Organizations and cultural centers, and participants in the Cultural Impact Assessment (see Appendix F of the Final EIS). The Navy and NASA offered stakeholders an informational presentation upon request and provided a point of contact should they have questions. A copy of the stakeholder letter is found in Attachment E.

Postcard Mailer

The Navy and NASA mailed notification postcards on June 18, 2025, via first-class mail, to 154 stakeholders, including the following: agencies and environmental organizations; Native Hawaiian Organizations; schools, colleges, and universities; small business associations, economic development/tourism organizations, and recreational and real estate interests; fishing and diving interests; community planning groups and civic organizations; boating, yacht clubs, and marinas; libraries; and other interested individuals and groups. A copy of the postcard is found in Attachment F.

Mailing List

The Navy and NASA developed a mailing list for the stakeholder letter and postcard from the project Strategic Communications Plan, Hawaii-California Training and Testing EIS/Overseas EIS project mailing list, One Kauaʻi project mailing list, and Navy and NASA stakeholder lists for Kauaʻi. The Navy and NASA updated the list to add individuals who requested to be added to the mailing list, including those who participated in the scoping process, and those that requested to join the mailing list through the project's website (https://pmrf-kpgo-eis.com/mailing-list/). The mailing list is provided in Attachment G.

News Release and Media Distribution

The Public Affairs Officers (PAOs) for Commander Navy Region Hawaii, PMRF, and NASA distributed a news release on June 20, 2025, to local, regional, and national media. The news release provided a description of the Proposed Action, its purpose and need, a list of environmental resources analyzed, project website address, and information about consultation under Section 106 of the NHPA and HRS Section 6E-8.

The news release also provided information on the public comment period for the Draft EIS including relevant dates, information on the public meetings, and instructions on how to submit public comments.

The news release also provided contact information for media questions. The news release is found in Attachment H.

Social Media Posts

The Navy and NASA began social media posts on June 20, 2025, and continued through the end of the 48-day (NEPA) and 45-day (HEPA) public comment period. Commander Navy Region Hawaii and PMRF posted to their social media accounts, including Navy Region Hawaii's Facebook and X pages and PMRF's Facebook page. NASA posted to their social media accounts, including KPGO and SGP pages. The Navy and NASA used social media to raise awareness of the NOA and Draft EIS, public meetings, and public comment period. Social media posts are found in Attachment I.

Flyer

The Navy and NASA disseminated a flyer to notify community members about the Draft EIS, public meetings, and public comment period. PMRF representatives distributed the flyer to their community contacts via email and in-person events and meetings. This flyer is included in Attachment J.

C. PUBLIC MEETINGS

The Navy and NASA initiated the public comment period on June 20, 2025, (NEPA) and June 23, 2025, (HEPA) to receive comments on the Draft EIS. The Navy and NASA encouraged members of the public to participate in the environmental planning process by providing input on the proposed real estate action including alternatives and the environmental analysis, environmental or cultural concerns, information the public would like the Navy and NASA to know, any information the public would like to see addressed in the Final EIS, and the project's potential to affect historic properties pursuant to Section 106 of the NHPA and HRS Section 6E-8.

The Navy and NASA held public meetings from July 15, 2025 through July 17, 2025 at three locations on Kauaʻi selected with geographic convenience for the general public; additionally, each meeting included a live online broadcast to ensure participants from other locations could give their testimonies. All meetings occurred from 5 to 8 p.m., Hawaiʻi Standard Time (HST). Table 2 provides the meeting dates, locations, and agenda as advertised.

Table 2 Public Meeting Dates and Locations

Date	Location	Time and Agenda
Tuesday, July 15, 2025	Kauaʻi Veterans Center 3215 Kauaʻi Veterans Memorial Hwy, Līhuʻe, 96766	**Meeting Times:** 5 to 8 p.m. HST **Agenda:** • **5 to 6 p.m.** Information stations – meet the project team, talk story, and ask questions. Visit the comment station to write a comment or sign up to make an oral comment. • **6 to 6:30 p.m.** Project presentation by Navy and NASA. • **6:30 to 8 p.m.** Oral comments from the public in person and online.
Wednesday, July 16, 2025	Kekaha Neighborhood Center 8130 Elepaio Rd., Kekaha, 96752	
Thursday, July 17, 2025	Sheraton Kauaʻi Coconut Beach Resort, Makai Ballroom 650 Aleka Loop, Kapaʻa, 96746	

Meeting Format

Each public meeting was a 3-hour event which included information poster stations in an open house format, a project presentation, and an opportunity for the public to provide oral comments to a panel of EIS, Navy, and NASA representatives.

The Navy and NASA organized information stations by topic and arranged them around the room, enabling the public to meet project team members and ask questions. A project team member staffed the live broadcast on Zoom Webinar, which also opened at 5 p.m., to answer logistical questions online. The Zoom Webinar presented online attendees with a slideshow of the information station posters until the meeting presentation began at 6 p.m. The Navy and NASA posted a link to the Zoom Webinar on the project website prior to the meetings. The posters may be viewed on the project website at https://pmrf-kpgo-eis.com/documents/.

The presentation portion opened with cultural protocol led by a Hawaiian cultural practitioner. Navy and NASA leadership and EIS project team members provided the project presentation. The presentation covered the project's purpose and need, description of the Proposed Action and alternatives, highlights of the environmental analysis and enhanced management measures (renamed to enhanced engagement in the Final EIS), overview of the NEPA/HEPA environmental review process, Draft EIS public involvement opportunities, and information about PMRF and KPGO including natural resource management and cultural stewardship.

After the presentation, Navy and NASA leadership and EIS project team members opened the oral comment session, and both in person and online oral comments were received from 6:30 to 8 p.m. A facilitator moderated the oral comments and broadcasted the comment session live for an online public comment opportunity. All oral comments, both in person and online, were audio recorded in accordance with HEPA requirements, and a stenographer also recorded the comments verbatim. The Navy and NASA asked commenters to keep their comments to 3 minutes to ensure all commenters had an opportunity to speak. Following the oral comment period as time permitted, the Navy and NASA invited attendees to return to the poster stations to continue conversations with Navy, NASA, and EIS project team members.

The public meetings also included refreshments and a children's activity station with coloring books and other activities to allow visiting parents to focus on the project information. An American Sign Language interpreter and Hawaiian interpreters (and other languages) were available upon request with 7-day notice. Security personnel were also present during the meetings. The Navy and NASA recorded the Zoom Webinar for the purpose of recording oral comments for the record.

The station topics are listed below. Subject matter experts staffed each station.

- Welcome/Sign-In Table
- Why We Are Here Tonight
- About PMRF and About KPGO
- Project Map
- Proposed Action and Alternatives
- Environmental Resources Studied in the Draft EIS
- Summary of Potential Effects
- Alternatives Screening Process

- Conservation and Community/Care of the Land
- NEPA/HEPA/Section 106 Community Involvement
- How to Submit Comments
- Comments Table/Written Comments

Copies of the posters and other handouts (comment form, oral comment sign up form) produced for the public meetings are found in Attachments K and L. A copy of the presentation slides is found in Attachment M. A copy of the meeting handout is found in Attachment N. Additionally, this information is available to the public under the "Documents" tab on the website, https://www.pmrf-kpgo-eis.com/.

D. SUMMARY OF DRAFT EIS PUBLIC COMMENTS

This section is intended to summarize the comments identified during the Draft EIS public comment period; it is not meant to identify all comments or to respond to comments. A formal response to public comments will be included in the Final EIS.

The Navy and NASA received 177 comments during the public comment period. The EIS project team reviewed each comment and categorized them by specific resource areas or topics. One comment may be relevant to multiple resource areas or topics. All comments were compiled, logged, and distributed to the EIS project team and appropriate subject matter experts for review and response. The EIS project team discussed the impact, significance, and relevance of the comments in preparation of the Final EIS. All comments submitted during the public comment period will become part of the public record and will be considered in preparing the Final EIS.

Table 3 shows the method of submittal and comment count.

Table 3 Method of Submittal and Count of Public Comments

Method of Submittal	Count
Project website online comment form	55
Email	63
Postal mail	5
In writing at the public meetings	6
Orally at the public meetings	48
Total	**177**

Table 4 includes a summary of Draft EIS public comments as a brief overview of the issues and concerns expressed during this EIS comment period.

Table 4 Summary of Draft EIS Comments

Resource Area/Topic	Comment
Proposed Action and Alternatives	• The Proposed Action should include impacts from Navy activities on fee simple lands. • The Proposed Action should include impacts identified in the Land-based Training and Testing EA and the Hawaii-California Training and Testing EIS as they relate to activities performed on leasehold and easement lands. • The ROI should include testing and training performed offshore. • Concerns about effects from military presence and training around the Hawaiian Islands, which commenters consider sensitive environments.

Resource Area/Topic	Comment
	• Concerns about impacts from Navy activities at PMRF and from agricultural activities to the local environment and public health. • Request for military training to be conducted away from the Hawaiian Islands, which commenters consider sacred lands. • Concerns about increasing development and infrastructure and associated impacts. • The Proposed Action has no benefit to the Kaua‘i community. • Increased detail regarding the No Action Alternative including a request for robust description of restoration following the end of the lease, and concern about infrastructure that could be abandoned in place under the terms of the current leases. • Request easement lands transition to community-led agricultural lands. • Request for alternatives to include a shorter-term lease (26 or 30 years). • All impacts from past projects that were identified should be considered for analysis in the Final EIS if those impacts are ongoing. • Integrate applicable nature-based project elements into the Project design. • As part of the new agreements, request Navy and NASA provide additional community resources including services and infrastructure. • Explain facilities on Ni‘ihau and their relationship to the Proposed Action. • Recognition that under Alternative 2, public access would decrease and State oversight would be diminished. • Request to expand discussion on long-term lease/easement duration. • Request that nautical boundaries and additional maps be included in the Final EIS. • Concern that the No Action Alternative does not contain enough detail. • Concern that the Navy is increasing testing and training activities. • Concern that impacts to marine life and groundwater were not analyzed. • Request to include all permits and licenses to be applied for under the Proposed Action. • Request to include impacts to State land use districts and zoning regulations under Alternative 2. • Concern that the No Action Alternative impacts are one-sided. • Opposition to all three alternatives. • Request to add additional sections to the EIS to analyze other resources. • Request for clarification on distribution of funds under the Proposed Action. • The No Action Alternative did not provide enough information on clean-up/restoration of State lands in the event of a lease expiration. • The No Action Alternative should not preclude the continuation of military funding for conservation and natural resources. • Support for the military’s presence and activities. • Support for the Proposed Action. • Support for the No Action Alternative. • Concerns about combining the analysis of Navy and NASA Proposed Actions. • Support for only NASA’s continued presence.
Air Quality and Greenhouse Gases	• Consider electric buses, bikes, and charging stations for use by the Navy at PMRF and other renewable energy technologies for improved base sustainability. • Requirements for air pollution control permit and consideration for dust and airborne pollutants. • Concern regarding military production of greenhouse gases.
Biological Resources	• Concern about impacts on coastal lands, wetlands, and biological life that frequent wetlands.

Resource Area/Topic	Comment
	• Concern about effects to endangered, native, and endemic species, including marine species. • Effects of noise, light pollution, and chemical byproducts to biological resources. • Concern about ecosystem-scale effects from military activities. • Concern about impacts from invasive species, particularly the Coconut Rhinoceros Beetle. • EIS should consider specific forest restoration and plant management techniques. • Request to improve hunting access for invasive ungulate removal. • Request to incorporate more robust discussion on wildland fire risk. • Request for more information on the management of native plant and animal species including terrestrial invertebrates/insects and use of insecticides. • Concern with avian botulism in the oxidation ponds adjacent to PMRF Main Base. • Request to incorporate robust analysis of species outlined for authorized take, minimization, and mitigation actions for federally listed plant and animal, species specific recommendations, improvements to species management, and increased coordination with State regulatory agencies. • Recommend the Navy explore alternative methods to prioritize bird conservation and monitoring at PMRF. • Request that more content from the Integrated Natural Resources Management Plan be included in the main body of the EIS. • Concern about marine mammal "takes." • Concern about insufficient climate change and sea level rise analysis. • Concern about biosecurity plans for various invasive species found within the ROI. • Support for PMRF's ecological stewardship. • Recognition that no significant environmental concerns were identified in the analysis. • Frustration with Navy and NASA land stewardship. • Support for the Navy and NASA land stewardship. • Special status species plants at KPGO, such as the kōpiko and others, were not fully analyzed in either the surveys or in the main body of the biological report. Concern that mitigation measures for the kōpiko were also not fully discussed in the EIS. • Request data on Hawaiian picture fly surveys at KPGO including surveyor credentials.
Cultural Practices/Archaeological and Historic Properties/NHPA Section 106 Process/HRS 6E Process	• Concern about Native Hawaiian's cultural attachment to the land and stress that their lands were wrongly taken. • The EIS should discuss mental and emotional health impacts, sense of loss and injustice, in addition to impacts to other resources, and identify mitigation. • Request for the Navy to consult with Native Hawaiian Organizations, homestead communities, and Native Hawaiian Niʻihau beneficiaries. • Concern about impacts to culturally sensitive sites and activities, including impacts from noise. • More indigenous ecological knowledge and history should have been incorporated. • Concern about access for cultural practices and gathering rights at PMRF. • Concern about restoration of culturally sensitive plants and animals. • Concern about sufficiency of Ka Paʻakai analysis, the Archaeological Inventory Survey, and associated mitigation measures. • Consultation with the State Aha Moku and various lineal descendent representatives was insufficient. • Request clarification on determination of significance for specific cultural sites at PMRF that are considered eligible under the National Register of Historic Places.

Resource Area/Topic	Comment
	• Request to include summary of Navy's current compliance with 6E-8 and any previous State Historic Preservation Division determinations. • Recommendation that the EIS comply with all applicable laws and rules including the 1997 Guidelines for Assessing Cultural Impacts. • Nohili Dune restoration should be incorporated into the No Action Alternative. • Concern that consultation with indigenous communities was not sufficient and is purely symbolic. • Revise specific historical terminology used in the EIS, particularly the term "ceded." • Request for historical land titles and baseline cultural studies. • Request to analyze impacts to cultural practices on Niʻihau and Kaʻula islands. • Request for a specific Archaeological survey of Kaʻula Island. • Support for the Navy's cultural stewardship of the land at PMRF, including preservation of iwi kupuna. • Appreciation for the robust cultural resource analysis and commitments made to Native Hawaiian communities for access for cultural practices as discussed in the EIS.
Cumulative Effects	• Include a description of environmental conditions prior to military use. • Final EIS should include cumulative impacts from Navy land use since commencement of current lease. • There are too many cumulative impacts to the project. • Concern about impacts from RIMPAC activities. • Concern about inadequate cumulative impact analysis regarding contamination and development. • Positive feedback on the Navy's community engagement including blood drives, highway trash cleanups, collaboration with Kauaʻi Community College, and leadership training and sponsorship. • Support for the Navy's relationship with residents of Niʻihau. • Support for the Navy's relationship building with Kauaʻi County government, Waimea High School, and other community organizations.
EIS Process	• Question regarding posted public meeting times. • Concern that the EIS does not meet certain HEPA- or NEPA-related legal requirements. • Recommend all concerns raised by the community be incorporated into the Final EIS. • Request for PMRF staff to participate in media engagement. • Concern that the EIS is incomplete and/or insufficient. • Concern that the EIS is too lengthy. • Request to incorporate more information into the body of the EIS instead of directing the reader to the appendices. • Request to receive receipt of comments. • Request to receive a printed copy of the EIS. • Recognition that recommendations provided in scoping comments were fully adopted in the Draft EIS. • Recognition of community participation in public meetings conducted for the Draft EIS. • Concern about different interests and obligations of the federal government (Navy and NASA) and the State of Hawaiʻi (DLNR) regarding decisions about public trust lands and fiduciary responsibilities under all three alternatives.

Resource Area/Topic	Comment
Hazardous Materials and Waste	• Concern about fuel and other hazardous material presence and conditions at PMRF in the water adjacent to Barking Sands, and on leasehold, easement, and fee simple lands. • Request for third-party verification for hazardous material testing and reporting. • Concern about PFAS at PMRF and request for investigation, sampling, and public notification and monitoring. • Concern about contamination of lands on other DoD installations which have limited access and certain recreational activities. • Concern about pesticide use and request for disclosure of pesticide management plans, including pesticide use in areas adjacent to PMRF Main Base. • Requirements for construction activities that could involve asbestos and lead-containing materials. • Request for disclosure of pollutant spill reports and management plans. • Concern about Navy clean-up after lease expiration. • Request for risk assessment and soil and groundwater testing near fuel storage tanks and missile launch areas. • Appreciation that PMRF cleans up after activities. • Ensure that the Final EIS discusses a plan to remove all cesspools in the ROI in compliance with Hawai‘i State Department of Health standards. • Request that rubbish piles from Navy and NASA activities be removed prior to lease retention.
Land Use and Access	• Concern about ongoing effects from the presence of the military on Kaua‘i. • General requests to return the land to Kanaka Maoli and concern about Kanaka Maoli sovereignty. • Request for increased access to the beach for water sports (i.e., surfing and kayaking), hiking, and camping from Kekaha Beach to Polihale. • Request for increased access for hunting, foraging, or fishing. • Request formalization of an updated, non-conditional access plan without the ability to revoke. • Request for an expanded discussion on access and an access management plan. • Request that an access agreement be incorporated into lease agreements. • Recommend land be used for affordable housing and suggest the Navy implement housing mitigation strategies. • Recognition of community events hosted by PMRF that are open to the public. • Question regarding accuracy of permitting history for PMRF and KPGO. • Question/concern regarding existing use within the Conservation District, non-conforming use, and historical records of use within those areas. • Request that no hazardous materials be stored on Conservation District lands. • Request to utilize tax map keys in the EIS. • Request for information on the change in acreage and tax map keys from the EISPN to the Draft EIS. • Support for the continuation of the easements to preserve agricultural land. • Recognition that PMRF helps preserve open space and agricultural land on the easement lands adjacent to Main Base. • Request to formalize and expand existing use agreements for helicopter operations and updates to infrastructure on State lands adjacent to Navy- and NASA-use lands.
Ocean ROW	• Proposed Action should include the 12-square mile Ocean ROW lease in the area of analysis. • Concern about the Navy’s use of the Ocean ROW after lease expiration.

Resource Area/Topic	Comment
	• Concern about what materials and instrumentation are currently present and utilized in the Ocean ROW and their potential impacts to marine species.
Ongoing Effects	• Noting the Navy's actions impact marine resources from underwater testing and training, including the use of sonar. • Address pollution from runoff at PMRF. • Request the impact of existing improvements to infrastructure on Mākaha and Miloliʻi Ridges be analyzed. • Explain the right of transit along the shoreline adjacent to Barking Sands pursuant to HRS Chapter 115.
Other	• Concern about how the military is perceived to treat Native Hawaiians and the Hawaiian Islands. • Concern about testing carried out at PMRF and its relation to global militarization and effects on other countries. • Recommendation for the Navy to visit various historical and art exhibits within the State. • Concern about military activities on/at Kahoolawe, Pōhakuloa, Niʻihau, in the Kaulakahi Channel, Kawailoa-Poamoho Training Areas, Puʻunua Firing Range, Kapilina Beach Homes, Kawailoa–Poamoho, Kahuku, Molokini, and the Makua Military Reservation. • Concern about activities on military bases on Oʻahu and the scale of those activities, including amount of equipment and frequency of training activities. • Concern about cultural and environmental impacts to Kaʻula island from military testing activities and recommendations for restoration. • Concern about impacts associated with Red Hill. • Request to receive access to database used to create figures in the EIS. • Comments regarding other NEPA documents analyzing impacts at PMRF. • Concern regarding foreign governments and the role of SpaceX in Hawaiʻi. • Ethical concerns over operations conducted by the Sandia Corporation, which owns Kauai Test Facility. • Frustration with redacted portions of the EIS. • The DoD should participate in more community health-related programs on Kauaʻi and Oʻahu. • Request information on structures located on Ground Hazard Areas. • The EIS does not consider environmental injustices. • Request disclosure of underground, coastal, and aerial operations, including classified contracts and missile data. • Request for disclosure of any State inspections on the leasehold and easement lands. • Consider need for permanent infrastructure considering the pace of developing technologies (use of drones, cyber warfare) and recommend use of alternative non-explosive training methods.
Public Health and Safety	• Concern about impacts from agricultural activities on the easements. • Concern about unexploded ordnance and for timeline and plan for removal. • Concern about electromagnetic radiation effects on people, wildlife, and weather and request for disclosure for radiation mitigation plans and third-party oversight. • Concern about wildfire and the risk of wildfire associated with missile launches. • Concern about noise impacts to the public. • Questions regarding missile launch locations, weapons systems, and missile landing areas.

Resource Area/Topic	Comment
	• General concern for risks to human health and health impacts from certain contaminants used in propellants. • Request that more detail on fuel storage tanks, both on leasehold and fee simple lands, be incorporated into the EIS. • Concern about specific aircraft operations. • Request for more information on infrastructure associated with the Kamokalā Magazines. • Include discussion on safety of PMRF staff or nearby communities due to risk of increasing negative foreign relations. • Request for more information on public notification timeline during missile launches. • Request to disclose all PMRF environmental and public health plans. • Support for the Navy's activities that result in an increased feeling of safety. • Support for the Navy's collaboration with and augmentation of the Kaua'i County Fire Department for fire/emergency support. • Support for the Navy's invasive species management for wildfire prevention. • Support for Navy infrastructure at Mākaha Ridge supporting Hawaii Air National Guard and Federal Aviation Administration operations. • Recognition of services provided by PMRF during Hurricanes Iniki and Iwa. • Recognition of services and electricity provided by PMRF during wildfires in Kamuakani to maintain power to critical infrastructure in the area. • Recognition of firefighting services (helicopter water drops) provided by PMRF to the community. • Recognition that no significant public health and safety risks were identified in the analysis. • Recognition that PMRF contractors comply with all applicable federal and state regulations while conducting operations on both fee simple and leasehold and easement lands. • Feeling that the efforts that PMRF contractors take to be environmentally compliant is not appreciated. • Lease retention fees should be higher than what is anticipated under the Proposed Action. • Questions about monitoring equipment at PMRF and KPGO.
Real Estate Agreements	• Request for a list of reports for all site inspections conducted by DLNR. • Lease agreements should include commitment to assist with Kekaha landfill closure and all associated cleanup. • Lease agreements should include environmental restoration as part of lease renewal. • Request that the "Unresolved Issues" section of the EIS be expanded to include more detail on land disposition under a new real estate agreement. • Lease renewal should include dedicated fee to support environmental stewardship and a market-based fee for utilities. • Request to consolidate leases under the Proposed Action. • Request for more information regarding the fair market value of the land and how the funding would be distributed. • Recommend that PMRF utilize the Kaua'i Emergency Management Agency system to inform the public about PMRF environmental stewardship and investment in infrastructure and community programs. • Concern about NASA's legal authority to provide a use permit to the Navy.

Resource Area/Topic	Comment
Socioeconomics	• Concern about the low cost of the current leases and easements (only $1 for the Navy). • Support for the employment opportunities provided by PMRF. • Questioning the legitimacy of claims regarding the positive economic impact that PMRF has on the island of Kaua'i. • Request to see a detailed breakdown of spending at PMRF. • Concern regarding general DoD funding and uses. • Noting belief that reparations are owed to Native Hawaiians. • Request that PMRF staff invest in the local economy. • Support for the socioeconomic benefit of the Navy and NASA to Kaua'i.
Transportation	• Concern about the volume and speed of traffic in Kekaha due to PMRF operations. • Address mitigation for habitat fragmentation due to road infrastructure.
Utilities	• Support for the Navy's investment in clean energy in collaboration with the Kaua'i Island Utility Cooperative. • Request the wastewater treatment plants should be upgraded to EPA standards. • Noting that well and pump systems are not accurately depicted.
Water Resources	• Concern that the discussion regarding erosion at Mākaha Ridge and associated impacts to water quality is incomplete and should be expanded to include impacts from Navy-use structures and impervious surfaces. • Discuss how current groundwater pumping at PMRF and other water-related projects discussed in the EIS will affect the greater Mānā Plain, and if updating the practices would increase resilience. • Suggest allowing ADC lands to return to wetland state due to potential sea level rise, including cessation of pumping activities in the ROI and in the greater Mānā Plain. • Concern about cumulative impacts to water quality on fee simple, leasehold, and easement lands as well as water use on properties adjacent to PMRF Main Base. • Concern about impacts to groundwater and potable water from Navy activities. • Recommend more collaboration with other agencies for water management in the Mānā Plain. • Concern that the aquifers within the ROI were not properly analyzed. • Groundwater, streams, and Mānā Plain outfalls should be tested by a third-party regularly and results should be shared publicly. • The Final EIS should include more information on the Kawai'ele Pump Station Maintenance and Open Floodable Space projects. • Request that the USACE final determination on the proposed wetland area adjacent to PMRF Main Base be included in the Final EIS. • Request that PMRF disclose historic or current pollutant contributions to the Mānā Plain ditch and outfall system. • Research alternative methods for flood mitigation in the Mānā Plain. • Concern about impacts to water resources in the Mānā Plain, including aquifers and muliwai systems, due to Navy activities and infrastructure at PMRF. • Address impacts to nearshore waters, such as runoff and drainage, should be expanded in the EIS. • Request for more historical and pumping information on the Mānā Well. • Address requirements for environmental compliance and regulatory requirements for projects which may impact State waters (i.e., permits, National Pollutant Discharge Elimination System permit, best management practices, water quality certifications).

Resource Area/Topic	Comment
	• Concern regarding septic water systems on beach cottages on fee simple land and runoff. • Utilize Best Management Practices during construction activities to minimize impacts to water quality in the ROI.

Legend: ADC = Agribusiness Development Corporation; DLNR = Department of Land and Natural Resources; DoD = Department of Defense; EIS = Environmental Impact Statement; EISPN = Environmental Impact Statement Preparation Notice; EPA = United States Environmental Protection Agency; HRS = Hawaii Revised Statute; KPGO = Kōkeʻe Park Geophysical Observatory; NASA = National Aeronautics and Space Administration; NHPA = National Historic Preservation Act; PFAS = Per- and polyfluoroalkyl substances; PMRF = Pacific Missile Range Facility; RIMPAC = Rim of the Pacific; ROI = Region of Influence; ROW = right-of-way; USACE = United States Army Corps of Engineers

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Appendix K

Natural Resource Surveys and Relevant Biological Opinions

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PMRF Flora Survey Report

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Final

Vegetation Survey Report at Pacific Missile Range Facility in Support of Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Kauaʻi, Hawaiʻi

Prepared for:

Department of the Navy
Naval Facilities Engineering Systems Command, Pacific
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Prepared under: Contract N62742-18-D-1802, Task Order N6274222F0206

January 2024

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Final
Vegetation Survey Report in Support of
Pacific Missile Range Facility and Kōkeʻe Park
Geophysical Observatory Real Estate
Kauaʻi, Hawaiʻi

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ACRONYMS AND ABBREVIATIONS

DLNR	Department of Land and Natural Resources
DON	Department of the Navy
EIS	Environmental Impact Statement
ESA	Endangered Species Act
GIS	geographic information system
GPS	global positioning system
INRMP	Integrated Natural Resources Management Plan
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Systems Command
NEPA	National Environmental Policy Act
PMRF	Pacific Missile Range Facility
SOW	Statement of Work
USFWS	United States Fish and Wildlife Service

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CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

This vegetation survey report details the results of vegetation mapping and plant surveys at Pacific Missile Range Facility (PMRF) in support of the proposed PMRF and Kōkeʻe Park Geophysical Observatory (KPGO) Real Estate Environmental Impact Statement (EIS). The United States (U.S.) Department of the Navy (Navy) and National Aeronautics and Space Administration (NASA), in coordination with the Hawaiʻi Department of Land and Natural Resources (DLNR), are preparing an EIS which evaluates the potential environmental consequences of the Navy's and NASA's proposal to retain the use of approximately 8,348 acres and 23 acres, respectively, in support of the Navy's continued and ongoing operational continuity and sustainment at PMRF and NASA's continued operations at KPGO. The Navy's 8,348 acres are a part of the larger PMRF installation which includes the entire instrumented range on land and ocean areas that support surface, subsurface, air, and space operations.

Between 1964 and 2007, the Navy and NASA began leasing property from the DLNR-owned land primarily for passive encroachment buffer as well as for mission operations, access, and utilities at the following five general locations: Main Base (also referred to as Barking Sands), Kamokalā Ridge, Mānā Water Well, Miloliʻi Ridge, and Mākaha Ridge. The easement areas provide safety buffer zones for training and testing missions and prevent incompatible development. The existing Navy and NASA real estate agreements with the DLNR are set to expire between 2027 and 2030.

Under the direction of Naval Facilities Engineering Systems Command (NAVFAC), and in accordance with the 19 July 2022 Statement of Work (SOW) for Task Order N6274222F0206, Stantec GS Inc. ("Stantec") performed vegetation surveys within identified survey area components of the PMRF and KPGO real estate study area in Kauaʻi, Hawaiʻi (Figure 1-1). Survey results will be used for future project planning; development of potential avoidance and minimization measures; National Environmental Policy Act analysis; Chapter 343, Hawaiʻi Revised Statutes (commonly referred to as HEPA) and Hawaiʻi Administrative Rules Section 11.200-1 analysis; and/or potential Endangered Species Act (ESA) section 7 consultation.

A work plan and desktop analysis were prepared in August 2023 to inform what vegetation resources may exist in the survey area, and also outlined the proposed methodology, data management, reporting, scheduling, and personnel roles during the prescribed fieldwork (NAVFAC Pacific, 2023a). This field report summarizes the vegetation surveys that occurred in October 2023.

1.2 PURPOSE AND OBJECTIVE OF THE SURVEY

The purpose of the vegetation surveys was to document special status plant species (those having either federal or state protective status) presence, map plant community/land cover types, and document invasive plant species within the survey area at PMRF. The primary objective of the vegetation surveys was to identify what terrestrial vegetation resources exist within the survey area to support any environmental evaluations and consultations potentially required by laws, regulations, or policies.

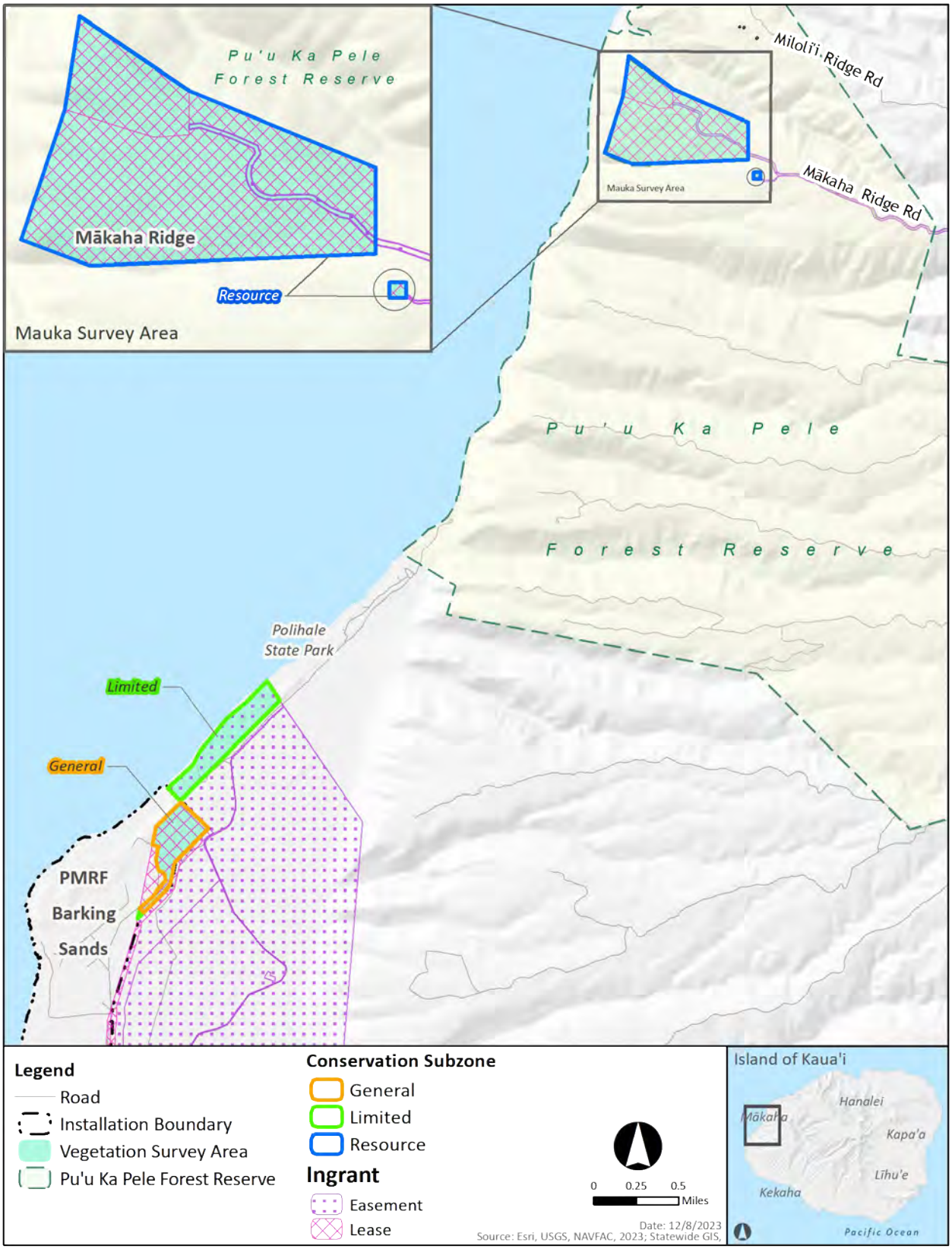

Figure 1-1 PMRF General Location Map

1.3 SURVEY AREA

The identified vegetation survey area was approximately 306 acres. The vegetation survey area includes the following three areas:

1) Approximately 167.1 acres around the Mākaha Ridge Tracking Station (Resource Conservation Subzone on Figure 1-1)
2) Approximately 69.6 acres along the coastal areas at PMRF, within Polihale State Park (Limited Conservation Subzone on Figure 1-1)
3) Approximately 69.6 acres approximately 800 feet inland at PMRF (General Conservation Subzone on Figure 1-1)

Elevations at the Mākaha Ridge Tracking Station range from approximately 860 to 1,880 feet above sea level, and elevations at the coastal areas range from approximately 20 to 80 feet above sea level. The Mākaha Ridge survey area is located within the Division of Forestry and Wildlife Pu‘u Ka Pele Forest Reserve.

1.4 SURVEY SCHEDULE AND PERSONNEL

Surveys were conducted on five consecutive days from 8 October to 12 October 2023. Survey start/end times and weather descriptions for each survey day are included in Table 1-1.

Table 1-1 Survey Dates, Times, and Weather Conditions

Survey Date[a]	*Start Time*	*End Time*	*Weather Conditions*
8 October 2023	8:30 a.m.	4:30 p.m.	Clear, no wind, no rain, mid-80s (°F)
9 October 2023	8:00 a.m.	4:00 p.m.	Clear, little wind, no rain, mid-80s (°F)
10 October 2023	8:00 a.m.	4:30 p.m.	Clear, little wind, no rain, mid-80s (°F)
11 October 2023	8:30 a.m.	4:00 p.m.	Clear, little wind, no rain, mid-80s (°F)
12 October 2023	8:30 a.m.	2:00 p.m.	Clear, little wind, no rain, mid-80s (°F)

Note: [a]Survey date and time noted in Hawaii Standard Time.
Legend: °F = degree Fahrenheit.

The team members involved in performing the project tasks are listed in Table 1-2 along with their project-specific roles. The field survey personnel consisted of Michele Lefebvre, Taylor Marsh, and Jessica Hawkins.

Table 1-2 Vegetation Survey Team Personnel

Role	*Name*
Project Manager	Ben Berridge
Biologist	Michele Lefebvre
Biologist	Taylor Marsh
Biologist	Jessica Hawkins
Senior Biologist/Review	Clint Scheuerman
Senior Biologist/Review	John Lowenthal
GIS Specialist	Christine Chaplin

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CHAPTER 2
VEGETATION DESKTOP ANALYSIS

2.1 EXISTING DATA IN THE VEGETATION SURVEY AREA

The following existing data was reviewed to determine the potential habitat in the vegetation survey area and potential for special status species:

1) Soil data (Natural Resources Conservation Service, 2023).
2) Previous biological survey results, including previously mapped vegetation communities at PMRF (NAVFAC Pacific, 2010, 2021, 2023b).
3) DLNR plant species of greatest conservation need identified in the State Wildlife Action Plan (DLNR, 2015, 2023).
4) United States Fish and Wildlife Service (USFWS) federally listed species habitat and occurrences (USFWS, 2023).

2.2 SPECIAL STATUS PLANT SPECIES HABITAT REVIEW

Table 2-1 provides a list of special status plant species identified during review of the existing data as well as known habitat and whether potential habitat for the species occurs in the vegetation survey area.

Table 2-1 Special Status Plant Species with Potential to Occur in the Vegetation Survey Areas

Scientific Name	*Common Name*	*Federal Status*	*Known Habitat and Occurrences*	*Potential to Occur in the Vegetation Survey Area*
Species at the Coastal Survey Area				
Panicum niihauense	Lau‘ehu	Endangered	This perennial bunchgrass is currently only known to occur on Kaua‘i. Habitat includes dry coastal areas including calcareous sand dunes and rocky knolls. The last known population is located on State-owned land at Polihale State Park (NAVFAC Pacific, 2010).	The survey area along the coast overlaps with known critical habitat for this species. The northern portion of the survey area is located within Polihale State Park, which is where the last known population was recorded; therefore, potential habitat is considered present in the vegetation survey area.
Sesbania tomentosa	‘Ohai	Endangered	This shrub to small tree is known to occur on O‘ahu, Moloka‘i, Maui, Kaua‘i, Kaho‘olawe, and Hawai‘i. Habitat includes dry forests, often coastal and less often inland. It is found on calcareous beaches and sand dunes, rocky ridges and slopes, deep red soil, and on soil pockets on lava (NAVFAC Pacific, 2010).	The vegetation survey area along the coast overlaps with known critical habitat for this species.
Species at the Mākaha Ridge Survey Area				
Lobelia niihauensis	Ni‘ihau lobelia	Endangered	This prostrate branched shrub is known to occur on Kaua‘i and O‘ahu in mesic forest and dry cliffs. Six individuals of this species were located during a 2019 unmanned aerial vehicle survey at the Mākaha Ridge facility (Nyberg, 2019). Occupied habitat for this species is located on the cliffs west of the vegetation survey area.	Although no cliff habitat will be surveyed in the vegetation survey area at Mākaha Ridge, potential habitat could occur in mesic forest in this area.

Scientific Name	***Common Name***	***Federal Status***	***Known Habitat and Occurrences***	***Potential to Occur in the Vegetation Survey Area***
Peucedanum sandwicense	Makou	Threatened	On Kauaʻi, this sprawling herb occurs on cliff habitats in mixed shrub coastal drill cliff communities or diverse mesic forest. Six individuals of this species were located during a 2019 unmanned aerial vehicle survey at the Mākaha Ridge facility (Nyberg, 2019). Occupied habitat for this species is located on the cliffs north of the vegetation survey area.	Although no cliff habitat will be surveyed in the vegetation survey area at Mākaha Ridge, potential habitat could occur in mesic forest in this area.
Schiedea apokremnos	Maʻoliʻoli	Endangered	This low, branching perennial shrub occurs in the crevices of nearly vertical coastal cliffs. There were 152 individuals of this species located during a 2019 unmanned aerial vehicle survey at the Mākaha Ridge facility (Nyberg, 2019). Occupied habitat for this species is located on the cliffs north of the vegetation survey area.	Since no vertical cliff habitat will be surveyed, this species is not expected to be found in the Mākaha Ridge vegetation survey area.
Wilkesia hobdyi	Dwarf iliʻau	Endangered	This shrub is a Kauaʻi endemic known to occur on coastal cliffs, dry cliffs, or very dry ridges from 500 to 1,500 feet. Only 10 populations with a total of 759–809 individuals are thought to exist in the northwestern region of Kauaʻi. Around the Mākaha Ridge Tracking Station, 11 colonies were documented, totaling 214 individuals. The Mākaha Ridge Tracking Station populations range in size from 1 individual to 50 individuals. The plants are found on the denser, harder rock outcrops with nearly vertical faces and out of reach of the goats that frequent the area (NAVFAC Pacific, 2010). In 2019, 3,635 individuals were located during an unmanned aerial vehicle survey at the Mākaha Ridge facility (Nyberg, 2019). Occupied habitat for this species is located on the cliffs north and west of the vegetation survey area.	According to the PMRF INRMP (NAVFAC Pacific, 2023c), there are known populations on the northern boundary of the Mākaha Ridge survey area and just south of the survey area and, therefore, potential habitat is considered present in the survey area.
Spermolepis hawaiiensis	None	Endangered	On Kauaʻi, this ephemeral, annual herb is known to occur in ʻohia (*Metrosideros polymorpha*) forest and aʻaliʻi (*Dodonaea viscosa*) lowland dry shrubland mesic cliffs at elevations between 184 and 2,377 feet. Two significant colonies grow on north facing, precipitous slopes around the Mākaha Ridge Tracking Station and represent approximately 700 individuals (NAVFAC Pacific, 2010).	According to the PMRF INRMP (NAVFAC Pacific, 2023c), there are known populations just south of the Mākaha Ridge survey area and, therefore, potential habitat is considered present within the survey area.

Legend: INRMP = Integrated Natural Resources Management Plan; NAVFAC = Naval Facilities Engineering Systems Command; PMRF = Pacific Missile Range Facility.

2.3 INVASIVE PLANT SPECIES

Although PMRF employs a number of management actions to prevent introduction and control the spread of invasive vegetation species, a number of invasive and/or noxious species have been identified for control by PMRF Environmental and Navy Natural Resources staff. These species include long-thorn kiawe (*Prosopis juliflora*), kiawe (*Prosopis pallida*), koa haole (*Leucaena leucocephala*), and buffelgrass (*Cenchrus ciliaris*) (NAVFAC Pacific, 2010).

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CHAPTER 3
SURVEY METHODOLOGY

3.1 TERRESTRIAL SURVEY METHODS

Vegetation surveys were conducted by two to three terrestrial biologists in the areas shown on Figure 1-1 using the provided geographic information system (GIS) boundaries for the survey area. Surveyors walked in relative parallel fashion through the survey area while carrying a portable global positioning system (GPS) unit with a tracking application that continuously tracked the movements of the surveyors, as depicted by the survey tracks in Figures 3-1 and 3-2. Vegetation survey tracks are representative of one surveyor's GPS tracks. The other surveyors were generally 30 to 45 feet away depending on localized conditions and vegetation density. Surveyors did not traverse where steep topography prevented safe access and minimized traversing in dense vegetation due to the lack of suitable habitat for species listed in Table 2-1.

Personnel surveyed all habitat types and conducted a presence/absence pedestrian survey for all potentially occurring special status plant species with an emphasis on the species listed in Table 2-1. At Mākaha Ridge, in portions of the survey area that consisted of open, eroded areas or very dense understory vegetation consisting of lantana (*Lantana camara*), surveyors walked meandering survey paths to ensure full visual coverage. Likewise, surveyors walked meandering paths in portions of the coastal survey area that were dominated by koa haole and kiawe communities, where there was full visual coverage in the dune areas, and where large piles of debris northeast of the base consisting of barbed wire, concrete, and asphalt occurred. In all cases, the surveyors had visual coverage of the survey area.

Vegetation and land cover types were mapped on physical maps (with an aerial background) and later digitized, using waypoint data that was collected in the field to identify boundaries (ecotones) between communities. Special status plant species observations were also recorded during these surveys.

Where special status plant species were identified, surveyors mapped the location(s) of species and collected baseline data with the portable GPS unit (refer to Section 3.3 for the types of data collected). For individual plants of interest observed, a single point was collected on the GPS to map the location of the individual.

During the course of the surveys, surveyors collected representative photographs of special status plants and plant communities. A photographic record of the surveys is provided in Appendix A. In addition, surveyors identified all plant species encountered to the lowest taxonomic level, given parts of the plants observed at the time of the survey. A complete list of plant species observed is included in Appendix B.

3.2 SURVEY EQUIPMENT AND STANDARDS

The survey team was equipped with one portable/handheld Eos Arrow 100 GPS unit with sub-meter level mapping accuracy (Eos 2023). Following surveys, data were downloaded each day. Field survey personnel were equipped with proper clothing, personal protective equipment, and binoculars.

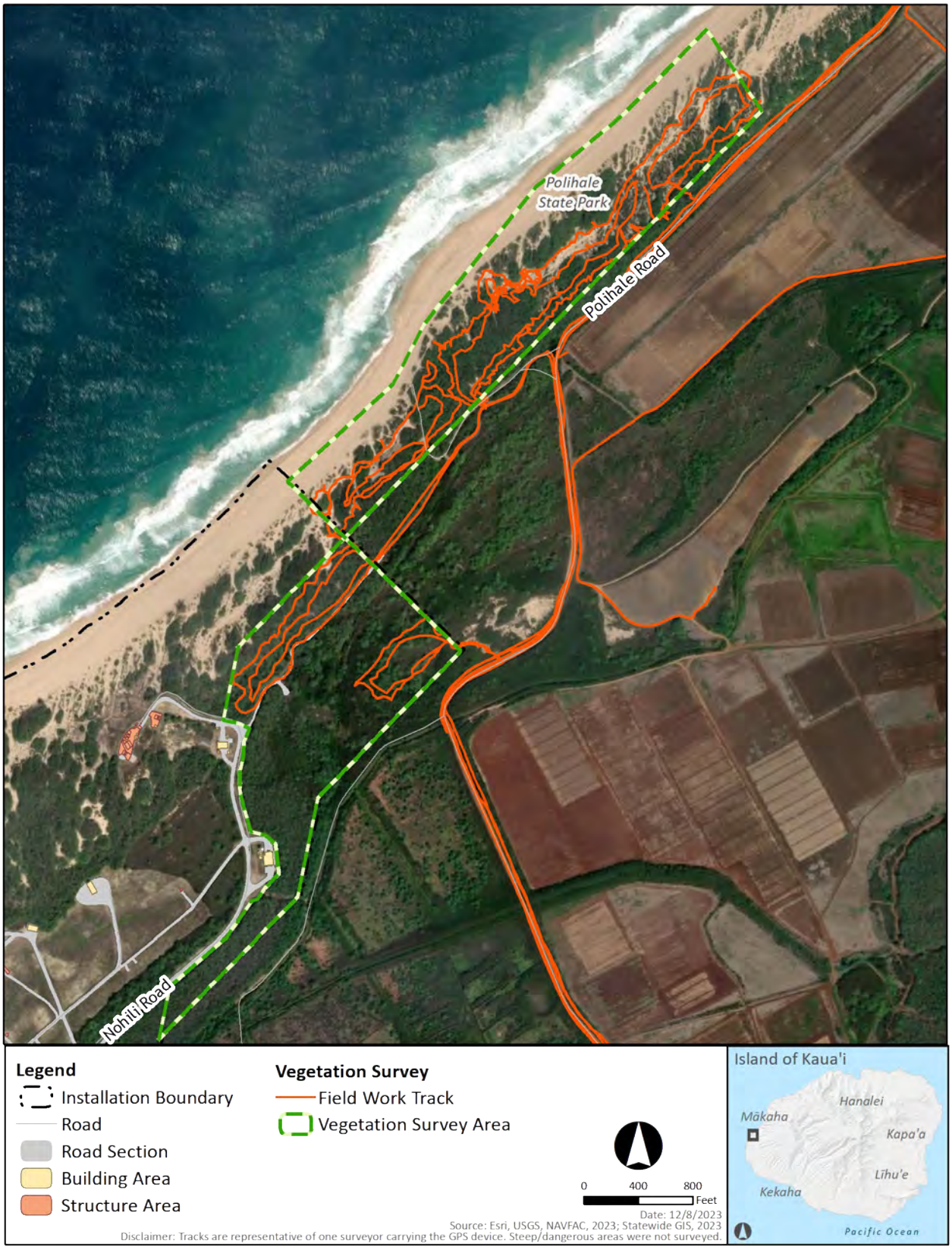

Figure 3-1 Survey Tracks at Coastal and Inland Areas of PMRF

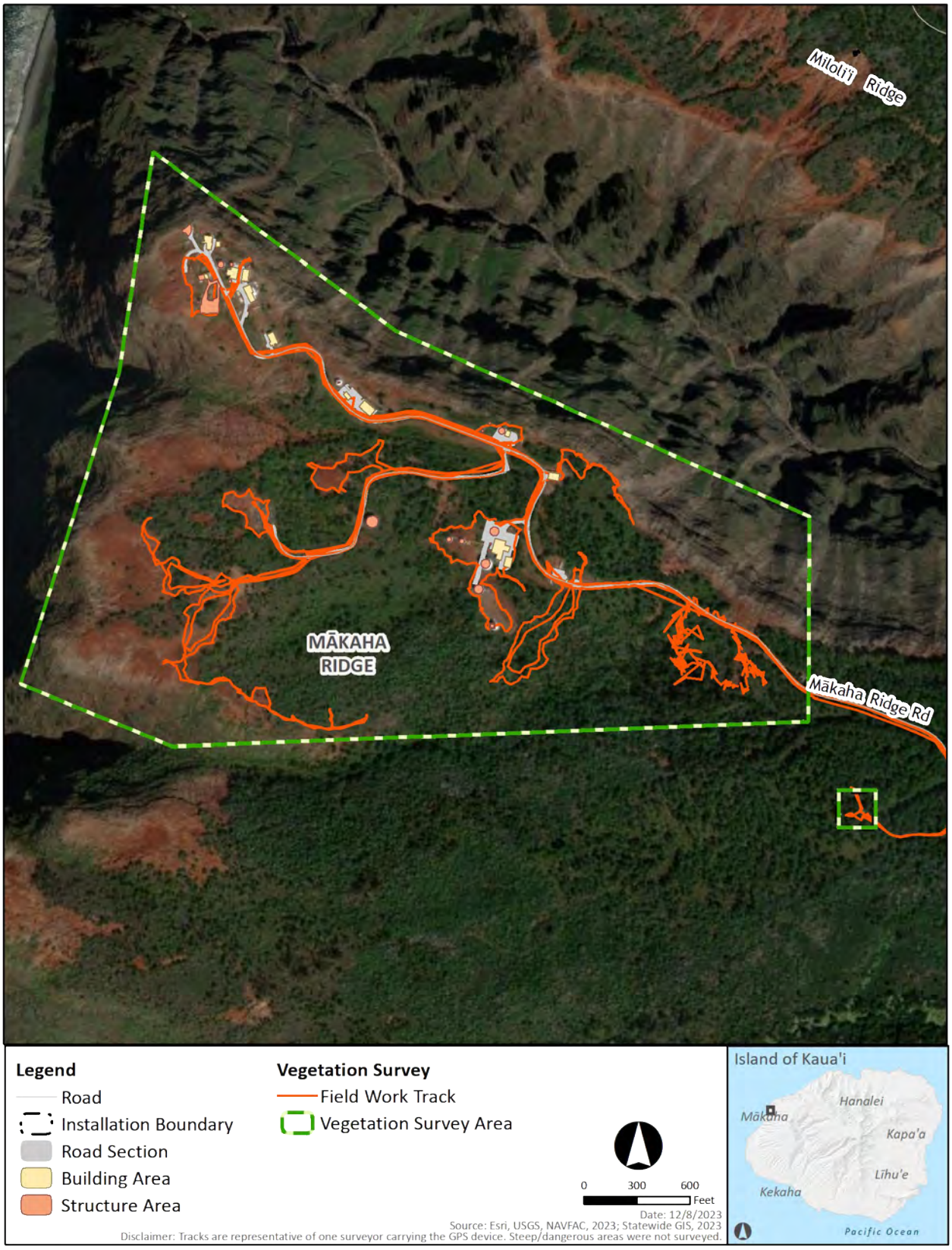

Figure 3-2 Survey Tracks at Mākaha Ridge

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CHAPTER 4
SURVEY RESULTS

Results of the vegetation surveys are summarized in Tables 4-1 through 4-3 and are depicted in Figures 4-1 through 4-3. Appendix A contains a photographic record of the survey area. Appendix B contains a complete list of plant species observed during the surveys. All GIS survey data collected in the field have been provided to NAVFAC Pacific as a part of this deliverable.

4.1 SPECIAL STATUS PLANT SPECIES

Table 4-1 details the survey data collected for the special status plant species that were observed and mapped. In total, four individual *Panicum niihauense* (lau‘ehu) were observed and mapped. These individuals are shown on Photos 22 through 26 in Appendix A. A discussion is provided in Section 5.

Table 4-1 Special Status Plant Species Observed

Scientific Name	*Common Name*	*Federal Status*	*Mapped Individuals*	*Life Stage/Condition/Notes*
Panicum niihauense	Lau‘ehu	Endangered	4	Observed in two locations approximately 15 feet apart. First location with one mature senesced individual (with flowers) and one living mature individual (with flowers). Second location with two immature living individuals (no flowers).

Although the coastal portion of the survey area is located within critical habitat for ‘ohai **(***Sesbania tomentosa*), no individuals were detected. In the same dune area where the *Panicum niihauense* individuals were located, outplanting tags for ‘ohai were also located (Photos 16 and 17, Appendix A); however, no individuals were located during the survey.

4.2 VEGETATION AND LAND COVER TYPES

Plant community and land cover mapping of the vegetation survey area was conducted concurrently during special status plant species surveys. Surveyors visually assessed all portions of the survey area and mapped existing plant community and land cover locations and boundaries.

Based on the observations during field surveys, vegetation communities at the coastal survey area matched those communities mapped in the 2010 Integrated Natural Resources Management Plan (INRMP) while vegetation communities at Mākaha Ridge Survey Area more closely matched communities mapped in the 2023 Draft INRMP (NAVFAC, 2021, 2023c).

Tables 4-2 and 4-3 provide the acreage of each vegetation and land cover type documented in both survey areas (Figures 4-2 and 4-3).

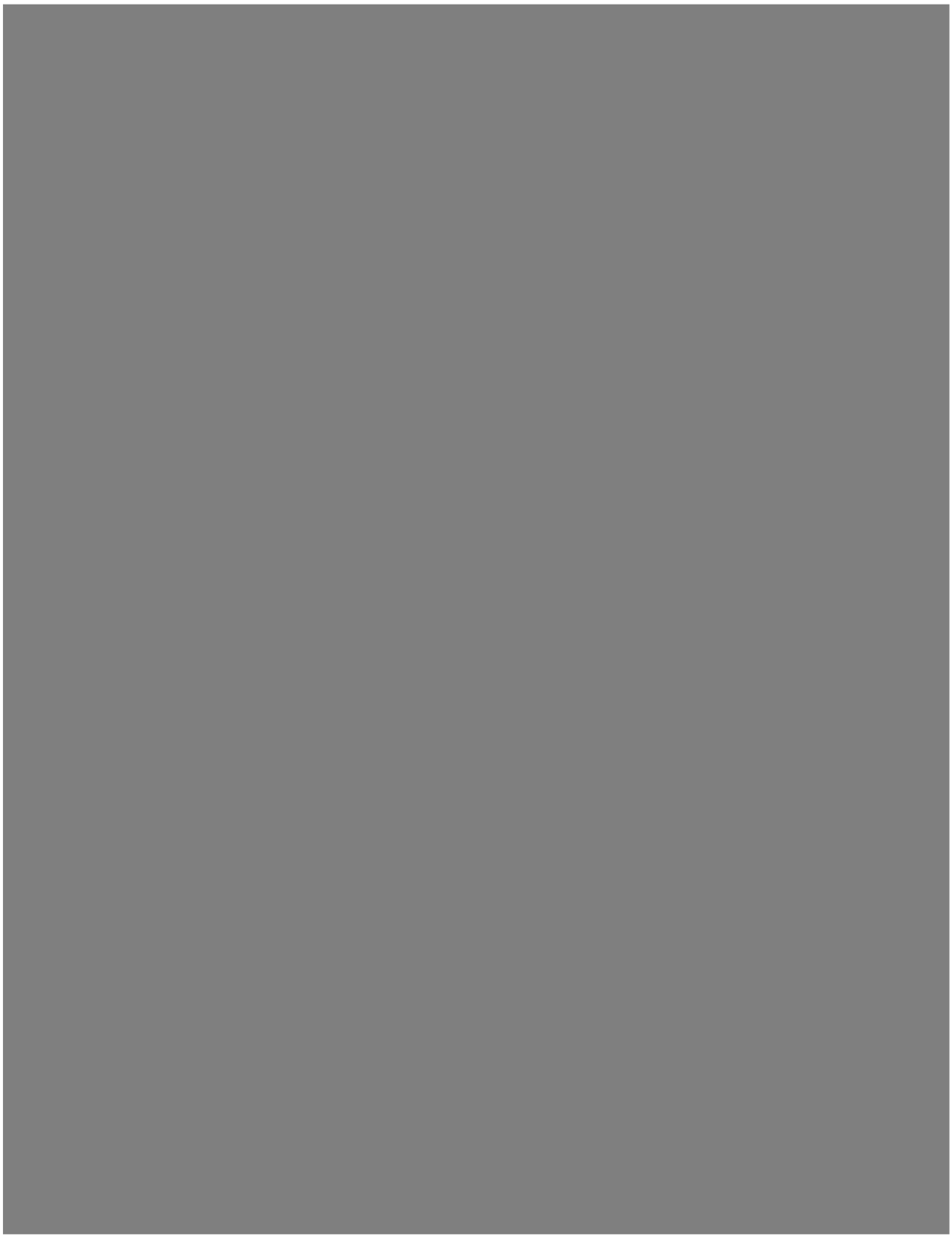

Figure 4-1 Coastal and Inland PMRF Survey Area Vegetation Communities

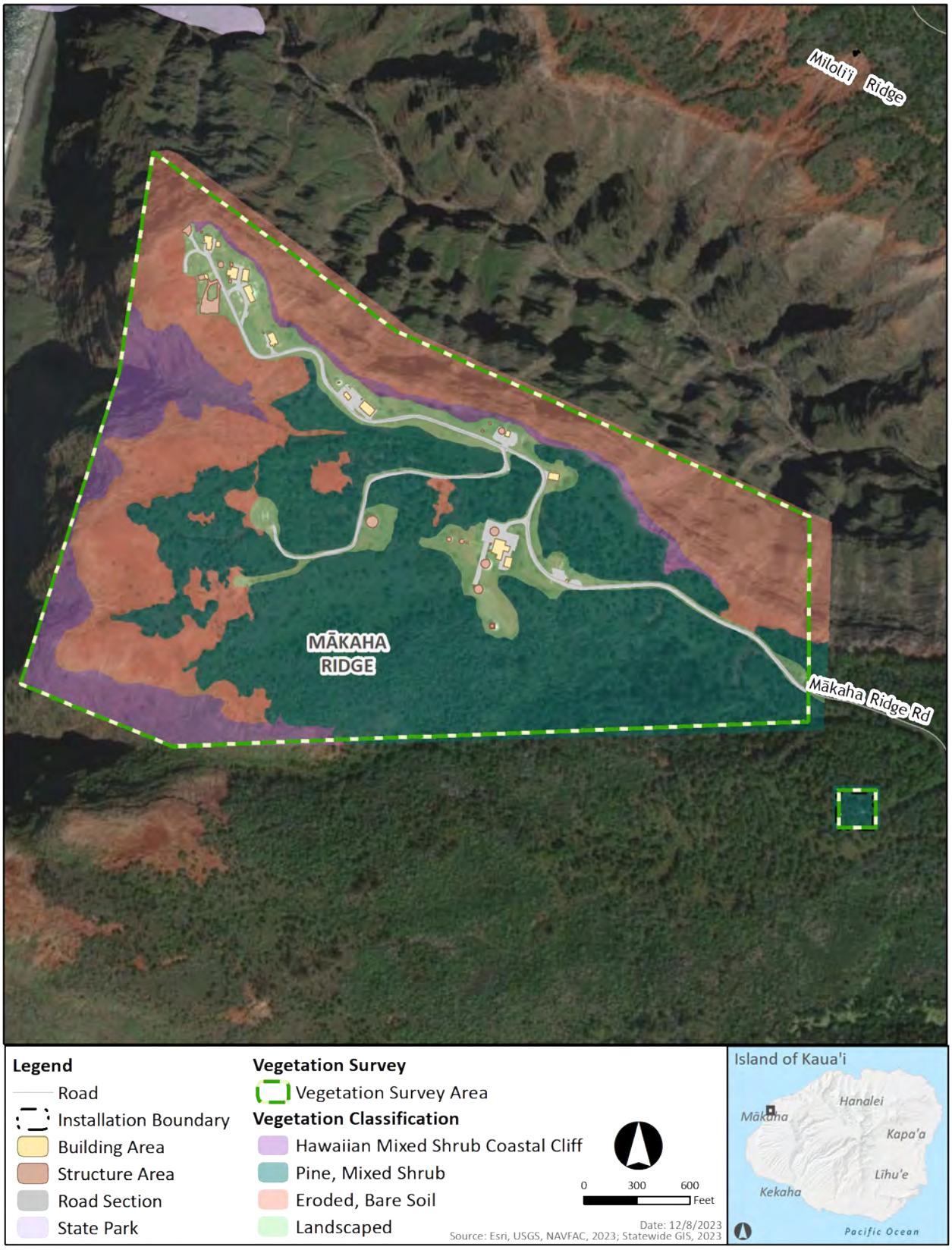

Figure 4-2 Mākaha Ridge Survey Area Vegetation Communities

Table 4-2 Vegetation and Land Cover in the Coastal Survey Area

Vegetation and Land Cover Type	*Acres*
Kiawe	14.7
Kiawe-koa haole scrub	62.3
Pōhinahina-naupaka dune	16.5
Agricultural	14.0
Wetland vegetation with koa haole	2.3
Dunes[1]	13.3
Roadways	1.9
Total	**125.0**

Note: [1]Dunes devoid of vegetation.

Table 4-3 Vegetation and Land Cover in the Mākaha Ridge Survey Area

Vegetation and Land Cover Type	*Acres*
Pine, mixed shrub	97.2
Hawaiian mixed shrub coastal cliff	23.0
Landscaped	23.8
Eroded, bare soil	64.2
Total	**208.2**

Eleven vegetation and land cover types were documented in the survey area: kiawe; kiawe-koa haole scrub; pōhinahina-naupaka dune; agricultural; wetland vegetation with koa haole; dunes; roadways; pine, mixed shrub; Hawaiian mixed shrub coastal cliff; landscaped; and eroded, bare soil. Descriptions of the pertinent vegetation and land cover types and their characteristic species are provided in Sections 4.2.1 and 4.2.2. Plant community descriptions are based on those provided in the 2023 Draft INRMP (NAVFAC Pacific, 2023c), and updated per the in-field observations made by surveyors. A list of all plant species encountered is included in Appendix B.

4.2.1 Coastal and Inland PMRF Survey Areas

The following vegetation communities and land cover types were documented in the coastal survey area (Figure 4-1).

4.2.1.1 Kiawe

Kiawe (*Prosipis pallida*)-dominated forest is present just inland of the native dune ecosystems and stretches along the entire PMRF coastline. Much of the kiawe thickets, which are found in monotypic patches, contain little to no understory vegetation, due to the thick, sprawling, and shading habit of the kiawe trees. This vegetation type grows on soils as well as sand and is dominant in the inland dunes.

4.2.1.2 Kiawe and Koa Haole

Kiawe and koa haole are the most abundant and dominant canopy species in the dry, disturbed, lowland habitats of coastal PMRF and peripheral areas. They are found in about equal numbers throughout the base. The tallest and densest area of this vegetation type occurs behind the Nohili Point sand dunes between Nohili Road and the agricultural fields in the northern portion of the base. Non-native guinea grass (*Megathyrsus maximus*) is also abundant and grows 2 to 3 feet (0.6 to 1 meters) tall in this area. Much of the kiawe/koa haole-dominated vegetation contained little understory vegetation, due to the dense cover and lack of sunlight underneath the canopy. However, lantana shrubs form dense 5 to 7 feet (1.5 to 2 meters) thickets between the trees, and ʻaliʻi (*Dononaea viscosa*) patches are abundant among the thick kiawe/koa haole canopy. Other abundant groundcover plants include ʻilieʻe (*Plumbago zeylanica*), lion's ear (*Leonotis nepitifolia*), golden crownbeard (*Verbesina encelioides*), dodder (*Cassytha filiformis*), and tall comb hyptis (*Hyptis pectina*).

4.2.1.3 Pōhinahina-Naupaka Dune

The seaward facing slopes of the large dunes at Nohili Point contain mostly native coastal dune vegetation, which is dominated by pōhinahina (*Vitex rotundifolia*) and naupaka (*Scaevola taccada*). Low mats of pōhinahina form over the dunes interspersed with low thickets of naupaka. ʻAkoko (*Euphorbia celastroides*) is also locally abundant in the area of the launch pads and individuals also exist intermittently along the dunes. ʻAkiʻaki grass (*Sporobolus virginicus*), beach morning glory (*Ipomoea pes-caprae*), and hunakai (*Ipomoea imperati*) are also widespread and abundant in this habitat. Inland of the pōhinahina-naupaka dune vegetation is dense kiawe-koa haole scrub, and some kiawe and koa haole scrub are scattered throughout the native dune vegetation.

4.2.1.4 Agricultural

The agricultural area is located in between the dirt road and the irrigation ditch. This area contains mostly koa haole canopy with understory thickets of lantana and guinea grass. Other abundant vegetation in this area is sourbush (*Pluchea carolinensis*), and java plum (*Syzigium cummini*). There are a number of native species, including aʻaliʻi (*Dodonaea viscosa*) and ʻilima (*Sida falax*), that mostly exist in sandy/sunny openings in the canopy.

4.2.1.5 Wetland Vegetation with Koa Haole

This community was found along the edge of a drainage in the survey area. Non-native vegetation such as shoreline sea purslane (*Sesuvium portulacastrum*) and *Pluchea* spp. border the outskirts of this elongated "wetland" area. Atop the berm of the "wetland" are non-native canopy species including koa haole and kiawe trees. The drainage eventually leads to the ocean at Barking Sands.

4.2.2 Mākaha Ridge Survey Area

The following vegetation communities and land cover types were documented at Mākaha Ridge Survey Area (Figure 4-2).

4.2.2.1 Pine, Mixed Shrub

Non-native pine canopy and mixed understory scrub vegetation typically includes slash pine (*Pinus elliottii*), lantana shrubs, eucalyptus (*Eucalyptus* spp.), and silk oak (*Grevillea robusta*) trees. Portions of these areas either contain grasses such as guinea grass, tufted beardgrass (*Schizachyrium condensatum*), or bushy bluestem (*Andropogon glomeratus*), or contain exposed soil with unanchored small and large boulders that have been highly disturbed by goats. This forested vegetation type includes a significant amount of native canopy and native understory plant life, including large patches of koa (*Acacia koa*), alaheʻe (*Psydrax odorata*), aʻaliʻi, and pūkiawe (*Leptecophylla tameiameiae*), which dominates the vegetation in some of these upland forested Mākaha Ridge Survey Areas.

4.2.2.2 Landscaped Vegetation

Other than in the immediate vicinity of buildings and recent landscape improvements, very little of the survey area is landscaped. Most of the landscaped area vegetation is Bermuda grass (*Cynodon dactylon*), which has been planted and maintained. Plantings of red hibiscus (*Hibiscus* sp.), aloe (*Aloe* sp.), guava (*Psidium guajava*), and mango (*Mangifera indica*) were present and maintained near buildings. It should also be noted that around the buildings and maintained areas, invasive weeds were present, and this is possibly due to the introduction of these weeds from heavy equipment, earth moving, and/or human foot traffic.

4.2.2.3 Hawaiian Mixed Shrub Coastal Cliff

Cliff vegetation is primarily composed of native mixed shrub species and sparsely vegetated/bare dirt areas. A small percentage of the cliff vegetation contains non-native vegetation as well. Most of the vegetation is either on severely eroded ridgetop or scattered in small patches along the cliff face, ledges, or long, narrow terraces. Low-growing (2 to 4 feet [0.6 to 1 meter]) shrubs of naio (*Myoporum sandwicense*) are the most abundant plant species populating the cliff zones, along with tufted beardgrass (*Schizachryrium condensatum*).

The dry cliff community faces several threats. One threat is habitat degradation by feral goats. Several state and federally listed plants are found on dry cliff communities as these extreme slopes provide protection from feral goats. The other threats are competition with non-native plants and reduced reproductive vigor of rare species due to the limited number of remaining individuals.

4.2.2.4 Eroded, Bare Soil

Ruderal vegetation occurs in the disturbed and unmaintained areas. Various grasses and weedy, often annual herbaceous species, compose the majority of this vegetation type. Large, barren, eroded sites are located along and adjacent to the oceanside fence line and adjacent to most of the buildings and other facilities. The majority of the vegetation in these areas is low-growing naio, non-native grasses, and lantana. Plant restoration work is occurring on a few oceanside/bare ground areas to prevent erosion. These areas appear to be recently planted with vetiver grass (*Chrysopogon zizanioides*).

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CHAPTER 5
DISCUSSION

This section provides details on the special status species observed and mapped during the terrestrial surveys. Specific coordinates of all mapped points for species locations were provided to the Navy via a GIS package.

5.1 *PANICUM NIIHAUENSE*

Panicum niihauense **(**lauʻehu) is a federally endangered short-lived perennial bunchgrass in the Poaceae that currently only occurs on Kauaʻi, but was also known historically from Niʻihau. It is known to occur in dry coastal habitats in calcareous sand dunes and rocky knolls (Appendix A, Photo 2). Threats to the species include invasive plant species (koa haole and kiawe), loss of habitat from climate change, and off-road vehicles.

The portion of the survey area along the coast overlaps with known critical habitat for this species. Occupied habitat included sand dunes with rocky knolls, and vegetation was dominated by kiawe and koa haole, with naupaka and buffelgrass also present. The survey located four individuals located in two adjacent locations in an area with multiple outplanting tags for ʻohai and *Panicum niihauense*. All four individuals located during the survey had been previously tagged and were found in groups of two. One group, located in a slightly more open area adjacent to koa haole and buffelgrass, included one mature senesced individual with flowers (Appendix A, Photos 22 and 23) and one mature living individual with flowers (Appendix A, Photo 24). The second group was located approximately 15 feet from the first location in a more densely vegetated area, adjacent to the edge of a kiawe patch with koa haole, and included two immature living individuals with no flowers (Appendix A, Photos 25 and 26).

As described in the USFWS's last 5-year review for *Panicum niihauense* prepared in 2015, the total population included six individuals known to occur in the wild and 17 outplanted individuals (USFWS, 2015). There are currently 19 different collections of *Panicum niihauense* from Polihale in the National Tropical Botanical Garden's seed bank, additional seeds are at the Lyon Arboretum, and several plants are cultivated in gardens and nurseries. The review describes outplantings within a fenced exclosure at Nualolo Kai in 2013, 11 individuals outplanted in 2014, and over 300 plants have been planted at Lawai Kai.

Navy Region Hawaii's 2010 INRMP provides management actions and goals for protecting *Panicum niihauense* habitat within PMRF. The Navy monitors the area and has restrictions on use, directing personnel to avoid sensitive dune vegetation. Planned projects (depending on funding) include invasive plant control and removal (kiawe), buffelgrass, and koa haole. PMRF is in the planning stages of establishing a plant nursery to propagate native plants for landscaping and habitat restoration.

5.2 INVASIVE SPECIES

Invasive species are identified as such in Appendix B. Invasive plants dominate the two areas surveyed, as is well documented in the 2010 INRMP and 2023 Draft INRMP. Lantana forms dense thickets at Mākaha Ridge, outcompeting the native understory species. Additionally, the kiawe-koa haole scrub varies from dense forests along the inland portion of the coastal survey area and low, windswept thickets along the oceanfront. Of note, golden crownbeard was located at the Polihale survey area and is considered extremely invasive and detrimental to native habitats and may warrant special attention for management.

5.3 SURVEY NOTES AND RECOMMENDATIONS

Large, rusted barbed wire piles under dead kiawe were located along with infrastructure debris (including concrete slabs and asphalt) (Appendix A, Photos 6 and 7).

An ancestral Hawaiian site marked as "Wahi kupuna" with burial sites was located approximately 0.25 mile southwest of the monkeypod tree that marks a turn from the main Polihale Road to a side road that runs from the edge of the State land to Main Base.

To minimize impacts to *Panicum niihauense* and ʻohai critical habitat at Polihale, the Navy should continue to implement INRMP management actions and goals.

CHAPTER 6
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Appendix A
Survey Photographic Record

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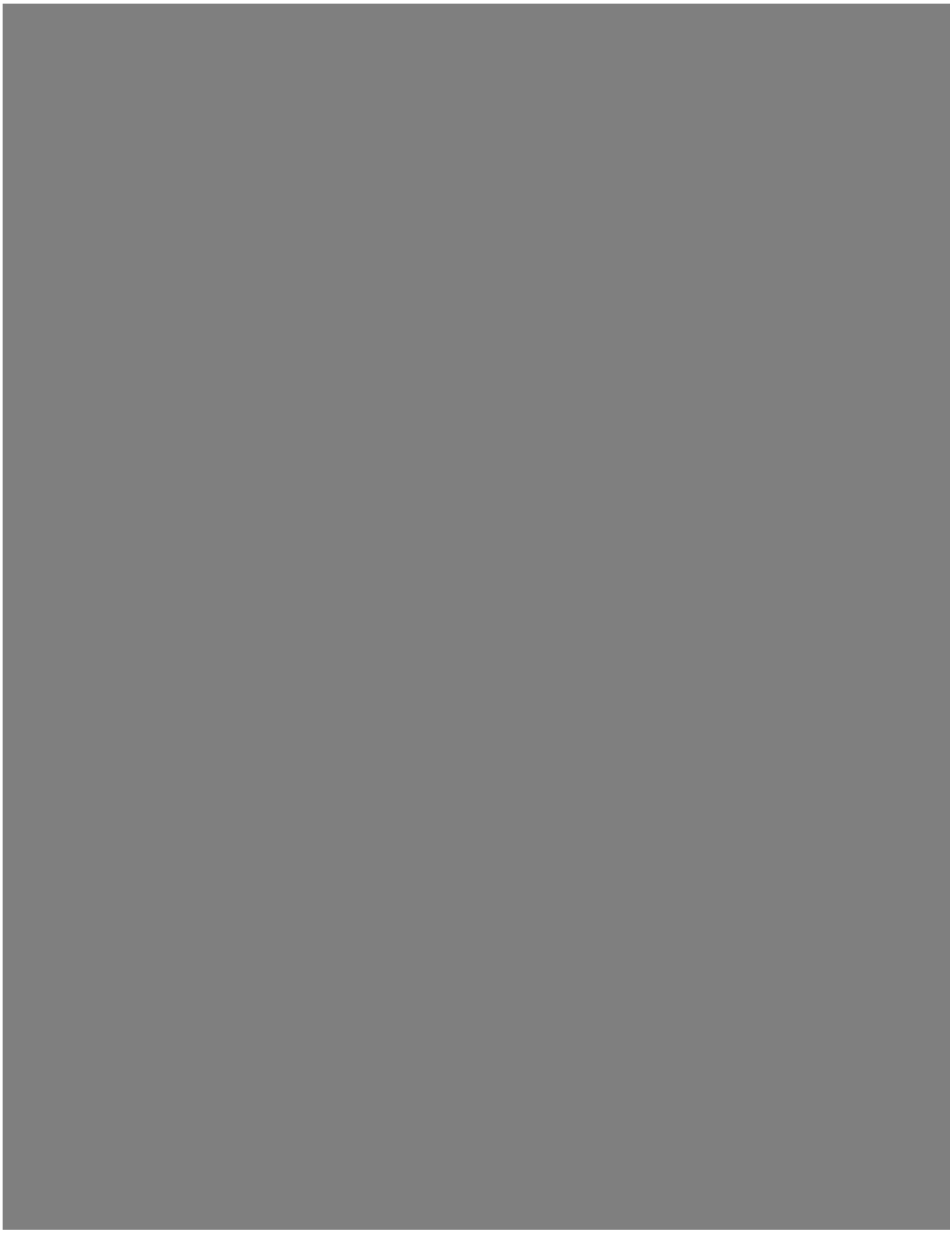

Figure A. Photograph Locations

Photo 1. Sand dunes with mixed vegetation of koa haole (*Leucaena leucocephala)*, pōhinahina (*Vitex rotundifolia*), and naio (*Myoporum sandwicense*) on Barking Sands Beach. The ocean is located behind the sand dune.

Photo 2. Sand dunes at Barking Sands Beach. Sparse patches of beach naupaka (*Scaevola taccada*) and pōhinahina in front of dense kiawe thickets.

Photo 3. Low mats of pōhinahina draped over sand dunes at Barking Sands Beach.

Photo 4. Kiawe (*Prosopis pallida*) scrub forest consisting of large dead branches of kiawe, living kiawe trees, and dead grassy understory at Barking Sands.

Photo 5. Sparsely populated kiawe-koa haole scrub in dry forested area near Barking Sands.

Photo 6. Piles of old infrastructure debris, consisting of concrete slabs, discovered in kiawe-koa haole forest near Barking Sands.

Photo 7. Rusted barbed wire piles under dead kiawe vegetation at Barking Sands.

Photo 8. Pine tree (*Pinus elliottii*) overstory with lantana and grassy understory at Mākaha Ridge.

Photo 9. Pine tree canopy towering over mixed shrub understory at Mākaha Ridge.

Photo 10. Roadway at Barking Sands alongside dry kiawe-koa haole scrubland.

Photo 11. Roadway shaded by tall pine trees at Mākaha Ridge.

Photo 12. Mixed shrub coastal cliff vegetation at Mākaha Ridge.

Photo 13. Mixed shrub coastal cliff vegetation consisting of naio at Mākaha Ridge.

Photo 14. Safety fenceline on Mākaha Ridge with mixed shrub vegetation.

Photo 15. Eroded, bare soil atop Mākaha Ridge.

Photo 16. Plantings associated with erosion control, consisting of grassy clumps on eroded, bare soil at Mākaha Ridge.

Photo 17. "Wetland" vegetation community along drainage with koa haole, *Pluchea* sp., and other mixed non-native scrub at Barking Sands.

Photo 18. Landscaped red hibiscus (*Hibiscus* sp.) bushes alongside roadside at Mākaha Ridge.

Photo 19. Landscaped foxtail agave (*Agave attenuata*) plants along roadside at Mākaha Ridge.

Photo 20. One ʻohai (*Sesbania tomentosa*) outplanting tag found at Barking Sands. Living ʻohai plants were not observed.

Photo 21. Several ʻohai outplanting tags found at Barking Sands. Living ʻohai plants were not observed.

Photo 22. Close-up of mature senesced lauʻehu (*Panicum niihauense*) plant with plant tag discovered in sand dunes at Barking Sands.

Photo 23. Mature senesced lau‘ehu (*Panicum niihauense*) plant in sand dunes at Barking Sands.

Photo 24. Mature lau‘ehu plant discovered in sand dunes at Barking Sands.

Photo 25. Immature lau‘ehu plant discovered next to another immature lau‘ehu in sand dunes at Barking Sands.

Photo 26. Immature lau‘ehu plant discovered next to another immature lau‘ehu in sand dunes at Barking Sands.

Photo 27. Agricultural area with dead grassy understory and sparsely populated koa haole canopy.

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Appendix B
Complete List of Plant Species Observations

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Family	***Scientific Name***	***Common Name***	***Hawaiian Name***	***Location***	***Origin/Status***	***Vegetation Type***
Malvaceae	*Abutilon grandifolium*	Hairy abutilon	mao	Barking Sands	Intro	K,R
Amaranthaceae	*Amaranthus spinosus*	Spiny amaranth	pakai kuku	Barking Sands	Intro	R
Poaceae	*Andropogon virginicus**	Broomsedge		Barking Sands	Intro	BG
Apocynaceae	*Asclepias physocarpa**	Balloon plant		Barking Sands	Intro	K
Acanthaceae	*Barleria cristata*	Philippine violet		Barking Sands	Intro	
Lauraceae	*Cassytha filiformis*	Dodder	kauna‘oa pehu	Barking Sands	Intro	K,PND,S
Poaceae	*Cenchrus ciliaris*	Buffelgrass		Barking Sands	Intro	
Poaceae	*Chloris barbata*	Swollen fingergrass	mau‘u lei	Barking Sands	Intro	K, KH
Cyperaceae	*Cyperus alternifolius**	Umbrella papyrus	‘ahu‘awa haole	Barking Sands	Intro	K, KH
Sapindaceae	*Dodonaea viscosa*		a`ali`i	Barking Sands	Intro	K,A,PND,S,D
Euphorbiaceae	*Euphorbia celastroides*		‘akoko	Barking Sands	End	PND
Boraginaceae	*Heliotropium procumbens var. depressum*	Fourspike heliotrope		Barking Sands	Intro	R
Lamiaceae	*Hyptis pectinata*	Comb hyptis		Barking Sands	Intro	D,R
Fabaceae	*Indigofera suffruticosa*	Indigo	‘inikō	Barking Sands	Intro	
Convolvulaceae	*Ipomoea pes-caprae*	Beach morning glory	pohuehue	Barking Sands	Ind	PND,S,R
Verbenaceae	*Lantana camara*	Lantana	lākana	Barking Sands	Intro	K,A,R
Lamiaceae	*Leonotis nepetifolia*	Lion's ear		Barking Sands	Intro	K,A,R
Fabaceae	*Leucaena leucocephala*		koa haole	Barking Sands	Intro	
Poaceae	*Megathyrsus maximus*	Guinea grass		Barking Sands	Intro	K, KH
Poaceae	*Melinis minutiflora*	Molasses grass		Barking Sands	Intro	K, KH
Cucurbitaceae	*Momordica charantia*	Bitter melon		Barking Sands	Intro	K,A
Fabaceae	*Prosopis pallida*		kiawe	Barking Sands	Intro	K, PND
Poaceae	*Panicum niihauense*	Niihau panicgrass	lau'ehu	Barking Sands	FE, SE	S
Poaceae	*Paspalum conjugatum*	Hilo grass	mau'u hilo	Barking Sands	Intro	K, KH
Arecaceae	*Phoenix sp.*	Date plam		Barking Sands	Intro	K,S
Asteraceae	*Pluchea carolinensis*	Sourbush		Barking Sands	Intro	K,PND,D,R
Asteraceae	*Pluchea fosbergii*	Pluchea hybrid		Barking Sands	Intro	R
Asteraceae	*Pluchea indica*	Indian fleabane		Barking Sands	Intro	K,A,S,D,R
Plumbaginaceae	*Plumbago zeylanica**		‘ilie'e	Barking Sands	Ind	
Euphorbiaceae	*Ricinus communis*	Castor bean		Barking Sands	Intro	K,R
Petiveriaceae	*Rivina humilis*	Coral berry		Barking Sands	Intro	K
Aizoaceae	*Sesuvium portulacastrum*	Shoreline seapurslane		Barking Sands	Intro	
Goodneiaceae	*Scaevola taccada*		beach naupaka, naupaka kahakai	Barking Sands	Ind	A,PND,S,D,R
Anacardiaceae	*Schinus terebinthifolius*	Christmas berry		Barking Sands	Intro, Inv	A
Pinaceae	*Setaria verticillata*	Bristly foxtail	mau'u pilipili	Barking Sands	Intro	

Family	*Scientific Name*	*Common Name*	*Hawaiian Name*	*Location*	*Origin/Status*	*Vegetation Type*
Malvaceae	*Sida rhombifolia*	Sida, Cuban jute		Barking Sands	Intro	R
Solanaceae	*Solanum americanum*	Glossy nightshade	popolo	Barking Sands	Ind	K,A
Asteraceae	*Sonchus oleraceus*	Sow thistle	pualele	Barking Sands	Intro	A,PND,S,R
Poaceae	*Sporobolus virginicus*	Beach dropseed	ʻakiʻaki	Barking Sands	Ind	
Verbenaceae	*Stachytarpheta jamaicensis*	Jamaican vervian	ōwī	Barking Sands	Intro	D,R
Myrtaceae	*Syzygium cumini*	Java plum		Barking Sands	Intro	D,R
Malvaceae	*Triumfetta semitriloba**	Sacramento bur		Barking Sands	Intro	
Asteraceae	*Verbesina encelioides*	Golden crownbeard		Barking Sands	Intro, Inv	K,A,PND,S,D,R
Lamiaceae	*Vitex rotundifolia*	Beach vitex	pōhinahina	Barking Sands	Ind	A,PND,S
Sterculiaceae	*Waltheria indica*		uhaloa	Barking Sands	Ind	K,A,PND,S,R
Fabaceae	*Acacia confusa*	Formosa koa		Mākaha Ridge	Ind	
Fabaceae	*Acacia koa*		koa	Mākaha Ridge	End	PPMS
Pteridaceae	*Adiantum hispidulum*	Five-finger maiden hair		Mākaha Ridge	Intro	
Agavaceae	*Agave attenuata**	Agave		Mākaha Ridge	Intro	
Asteraceae	*Ageratina riparia*	Spreading mist flower	hāmākua pāmakani	Mākaha Ridge	Intro	
Asphodeaceae	*Aloe sp.**	Aloe		Mākaha Ridge	Intro	
Poaceae	*Andropogon glomeratus*	Bushy bluestem		Mākaha Ridge	Intro	
Araucariaceae	*Araucaria columnaris**	Cook pine		Mākaha Ridge	Intro	
Blechnaceae	*Blechnum appendiculatum*	Palm fern		Mākaha Ridge	Intro	C
Fabaceae	*Canavalia hawaiiensis**		ʻāwikiwiki	Mākaha Ridge	End	
Cyperaceae	*Carex wahuensis*	O'ahu sedge		Mākaha Ridge	End	PPMS
Fabaceae	*Chamaecrista nictitans var. glabrata*	Partridge pea	laukī	Mākaha Ridge	Intro	PPMS,R, C
Thelypteridaceae	*Cyclosorus parasiticus*	Parasitic maiden fern		Mākaha Ridge	Intro	C
Poaceae	*Chrysopogon zizanioides**	Vetiver grass		Mākaha Ridge	Intro	
Asteraceae	*Cirsium vulgare*	Bull thistle	pua kala	Mākaha Ridge	Intro	C,PPMS,R
Menispermaceae	*Cocculus orbiculatus*		huehue, hue	Mākaha Ridge	Ind	PPMS
Asteraceae	*Conyza bonariensis*	Hairy horseweed	lani wela	Mākaha Ridge	Intro	C,R
Apiaceae	*Cyclospermum leptophyllum**	Fir-leaved celery		Mākaha Ridge	Intro	
Poaceae	*Cynodon dactylon*	Bermuda grass	mānienie	Mākaha Ridge	Intro	R
Fabaceae	*Desmanthus pernambucanus*	Slender mimosa		Mākaha Ridge	Intro	C
Fabaceae	*Desmodium incanum*	Spanish clover	kaʻimi	Mākaha Ridge	Intro	PPMS,R
Liliaceae	*Dianella sandwicensis*		ʻukiʻuki, ʻuki	Mākaha Ridge	Ind	PPMS
Sapindaceae	*Dodonaea viscosa*		aʻaliʻi	Mākaha Ridge	Intro	C,PPMS,R
Amaranthaceae	*Dysphania pumilo**	Clammy goosefoot		Mākaha Ridge	Intro	
Asteraceae	*Elephantopus mollis**	Elephant's foot		Mākaha Ridge	Intro	

Family	*Scientific Name*	*Common Name*	*Hawaiian Name*	*Location*	*Origin/Status*	*Vegetation Type*
Asteraceae	*Emilia sonchifolia* var. javanica	Lilac tasselflower		Mākaha Ridge	Intro	R
Asteraceae	*Erigeron karvinskianus*	Daisy fleabane		Mākaha Ridge	Intro	R
Myrtaceae	*Eucalyptus* spp.	Eucalyptus		Mākaha Ridge	Intro	PPMS
Euphorbiaceae	*Euphorbia hirta*	Hairy spurge, Garden spurge	koko kahiki	Mākaha Ridge	Intro	C
Proteaceae	*Grevillea robusta*	Silky oak		Mākaha Ridge	Intro	C,PPMS
Malvaceae	*Hibiscus sp.**	Red hibiscus			Intro	L
Lamiaceae	*Hyptis pectinata**	Comb hyptis			Intro	
Fabaceae	*Indigofera suffruticosa*	Upright indigo	inikō	Mākaha Ridge	Intro	C,R
Crassulaceae	*Kalanchoe pinnata**	Air plant		Mākaha Ridge	Intro	
Verbenaceae	*Lantana camara*	Lantana	lākana	Mākaha Ridge	Intro	C,PPMS,R
Epacridaceae	*Leptecophylla tameiameiae*		pūkiawe, ʻaʻaliʻi mahu	Mākaha Ridge	Ind	C
Fabaceae	*Leucaena leucocephala*	Lead tree, False koa	koa haole	Mākaha Ridge	Intro	R
Malvaceae	*Malvastrum coromandelianum**	False mallow		Mākaha Ridge	Inro	
Anacardiaceae	*Mangifera indica **	Mango	manako, meneke	Mākaha Ridge	Intro	
Poaceae	*Megathyrsus maximus*	Guinea grass		Mākaha Ridge	Intro, Inv	C
Meliaceae	*Melia azedarach*	Chinaberry		Mākaha Ridge	Intro	PPMS
Poaceae	*Melinis minutiflora*	Molasses grass		Mākaha Ridge	Intro	C,PPMS,R
Poaceae	*Melinis repens*	Natal redtop		Mākaha Ridge	Intro	C,PPMS,R
Fabaceae	*Mimosa pudica var. unijuga*	Sensitive plant, Sleeping grass	pua hilahila	Mākaha Ridge	Intro	R
Cucurbitaceae	*Momordica charantia*	Bitter melon		Mākaha Ridge	Intro	C
Myricaceae	*Morella faya**	Fire tree		Mākaha Ridge	Intro, Inv	
Myoporaceae	*Myoporum sandwicense*	Bastard or false sandalwood	naio	Mākaha Ridge	End	C,PPMS
Nephrolepidaceae	*Nephrolepis brownii*	Hairy swordfern		Mākaha Ridge	Intro	PPMS
Oleaceae	*Olea europaea*	Olive, African olive	ʻoliwa	Mākaha Ridge	Intro	PPMS, C
Poaceae	*Oplismenus hirtellus*	Basketgrass, Bamboo grass	honohono kukui	Mākaha Ridge	Intro	PPMS
Cactaceae	*Opuntia ficus-indica*	Prickly pear cactus	pānini, pāpipi	Mākaha Ridge	Intro	C
Oxalidaceae	*Oxalis corniculata*	Yellow wood sorrel	ʻihi ʻai, ʻihi ʻawa	Mākaha Ridge	Intro	C,PPMS,R
Oxalidaceae	*Oxalis debilis*	Pink wood sorrel	ʻihi pehu	Mākaha Ridge	Intro	C
Asteraceae	*Parthenium hysterophorus**	False ragweed, Santa Maria		Mākaha Ridge	Intro	

Family	***Scientific Name***	***Common Name***	***Hawaiian Name***	***Location***	***Origin/Status***	***Vegetation Type***
Lauraceae	*Persea amaericana**	Avocado		Mākaha Ridge	Intro	
Arecaceae	*Phoenix sp.*	Date palm		Mākaha Ridge	Intro	C
Pinaceae	*Pinus elliottii*	Slash pine		Mākaha Ridge	Intro	C
Pteridaceae	*Pityrogramma austroamericana**	Gold dust fern		Mākaha Ridge	Intro	
Plantaginaceae	*Plantago lanceolata*	Narrow-leaved plantain		Mākaha Ridge	Intro	C
Plantaginaceae	*Plantago major*	Broad-leaved plantain	laukahi	Mākaha Ridge	Intro	C,R
Asteraceae	*Pluchea carolinensis*	Sourbush		Mākaha Ridge	Intro	R
Plumbaginaceae	*Plumbago auriculata**	Cape plumbago, Leadwort		Mākaha Ridge	Intro	
Polygalaceae	*Polygala paniculata**	Milkwort, Rootbeer plant		Mākaha Ridge	Intro	
Myrtaceae	*Psidium cattleianum*	Strawberry guava	waiawi ʻulaʻula	Mākaha Ridge	Intro, Inv	PPMS
Myrtaceae	*Psidium cattleianum* var. *littorale*	Strawberry guava	waiawi	Mākaha Ridge	Intro, Inv	PPMS
Myrtaceae	*Psidium guajava*	Common guava	kuawa, kuawa keʻokeʻo	Mākaha Ridge	Intro	PPMS
Rubiaceae	*Psydrax odorata*		alaheʻe, ʻheʻe, walaheʻe	Mākaha Ridge	Ind	C,PPMS
Euphorbiaceae	*Ricinus communis*	Castor bean		Mākaha Ridge	Intro	R
Lamiaceae	*Salvia rosmarinus**	Rosemary		Mākaha Ridge	Intro	
Goodeniaceae	*Scaevola gaudichaudii*	Ridgetop naupaka	naupaka kuahiwi	Mākaha Ridge	End	PPMS
Poaceae	*Schizachyrium condensatum*	Tufted beardgrass, Little bluestem		Mākaha Ridge	Intro	C,PPMS
Poaceae	*Setaria parviflora*	yellow foxtail	mauʻu kaleponi	Mākaha Ridge	Intro	PPMS,R,C
Malvaceae	*Sida fallax*		ʻilima	Mākaha Ridge	Ind	PPMS
Malvaceae	*Sida spinosa**	Prickly sida		Mākaha Ridge	Intro	
Solanaceae	*Solanum americanum*	Glossy nightshade	popolo	Mākaha Ridge	Ind	R
Asteraceae	*Sonchus oleraceus*	Sow thistle	pualele	Mākaha Ridge	Intro	C
Rubiaceae	*Spermacoce assurgens*	Buttonweed		Mākaha Ridge	Intro	R
Asteraceae	*Sphagneticola trilobata*	Wedelia		Mākaha Ridge	Intro	PPMS,R
Poaceae	*Sporobolus indicus*	Smutgrass		Mākaha Ridge	Intro	R, C
Verbenaceae	*Stachytarpheta jamaicensis*	Jamaican vervian	ōwī, oi	Mākaha Ridge	Intro	D,R
Myrtaceae	*Syzygium cumini*	Java plum		Mākaha Ridge	Intro	C

Family	*Scientific Name*	*Common Name*	*Hawaiian Name*	*Location*	*Origin/Status*	*Vegetation Type*
Tiliaceae	*Triumfetta semitriloba**	Sacramento bur		Mākaha Ridge	End	
Sterculiaceae	*Waltheria indica*		uhaloa	Mākaha Ridge	Ind	C,PPMS,R

Key for species:
* new species observation record.

Key for origin/status:
End=Endemic; FE=Federally Endangered; Intro=Introduced; Ind=Indigenous; Inv=Invasive; SE=State Endangered

Key for vegetation type:
K= Kiawe-Koa Haole Scrub; A= A`ali`i Scrub; PND= Pōhinahina-Naupaka Dune; S= Strand; D= Drainage/Wetlands; C= cliff; PPMS= Planted Pine/Mixed shrub; R=Ruderal

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CABI Compendium, https://www.cabidigitallibrary.org
Hawaii Ecosystems at Risk, Pacific Island Ecosystems at Risk, Hawaiian Ecosystems at Risk project (HEAR)

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PMRF Fauna Survey Report

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Final

Terrestrial Fauna Survey Report at Pacific Missile Range Facility in Support of Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Kauaʻi, Hawaiʻi

Prepared for:

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Final

Terrestrial Fauna Survey Report at Pacific Missile Range Facility in Support of Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement Kauaʻi, Hawaiʻi

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ACRONYMS AND ABBREVIATIONS

DLNR	Department of Land and Natural Resources
DON	Department of the Navy
EIS	Environmental Impact Statement
ESA	Endangered Species Act
GIS	geographic information system
GPS	global positioning system
KPGO	Kōkeʻe Park Geophysical Observatory
MBTA	Migratory Bird Treaty Act
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Systems Command
Navy	United States Department of the Navy
PMRF	Pacific Missile Range Facility
SOW	Statement of Work
U.S.	United States

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CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

This report details the results of two surveys for terrestrial wildlife species at Pacific Missile Range Facility (PMRF) in support of the proposed PMRF and Kōkeʻe Park Geophysical Observatory (KPGO) Real Estate Environmental Impact Statement (EIS). The United States (U.S.) Department of the Navy (Navy) and National Aeronautics and Space Administration (NASA), in coordination with the Hawaiʻi Department of Land and Natural Resources (DLNR), are preparing an EIS which evaluates the potential environmental consequences of the Navy's and NASA's proposal to retain the use of approximately 8,348 acres and 23 acres, respectively, in support of the Navy's continued and ongoing operational continuity and sustainment at PMRF and NASA's continued operations at KPGO. The Navy's 8,348 acres are a part of the larger PMRF installation which includes the entire instrumented range on land and ocean areas that support surface, subsurface, air, and space operations.

Between 1964 and 2007, the Navy and NASA began leasing property from the DLNR-owned land primarily for passive encroachment buffer as well as for mission operations, access, and utilities at the following five general locations: Main Base (also referred to as Barking Sands), Kamokalā Ridge, Mānā Water Well, Miloliʻi Ridge, and Mākaha Ridge. The easement areas provide safety buffer zones for training and testing missions and prevent incompatible development. The existing Navy and NASA real estate agreements with the DLNR are set to expire between 2027 and 2030.

Under the direction of Naval Facilities Engineering Systems Command (NAVFAC), and in accordance with the 19 July 2022 Statement of Work (SOW) for Task Order N6274222F0206, Stantec GS Inc. ("Stantec") performed terrestrial fauna surveys within identified survey area components of the PMRF and KPGO real estate study area in Kauaʻi, Hawaiʻi (Figure 1-1). Survey results will be used for future project planning; development of potential avoidance and minimization measures; National Environmental Policy Act analysis; Chapter 343, Hawaiʻi Revised Statutes (commonly referred to as HEPA) and Hawaiʻi Administrative Rules Section 11.200-1 analysis; and/or potential Endangered Species Act (ESA) section 7 consultation.

A work plan and desktop analysis were prepared in August 2023 to inform what terrestrial resources may exist in the survey area, and also outlined the proposed methodology, data management, reporting, scheduling, and personnel roles during the prescribed fieldwork (NAVFAC Pacific, 2023). This field report summarizes the terrestrial fauna surveys that occurred in October 2023 and April 2024.

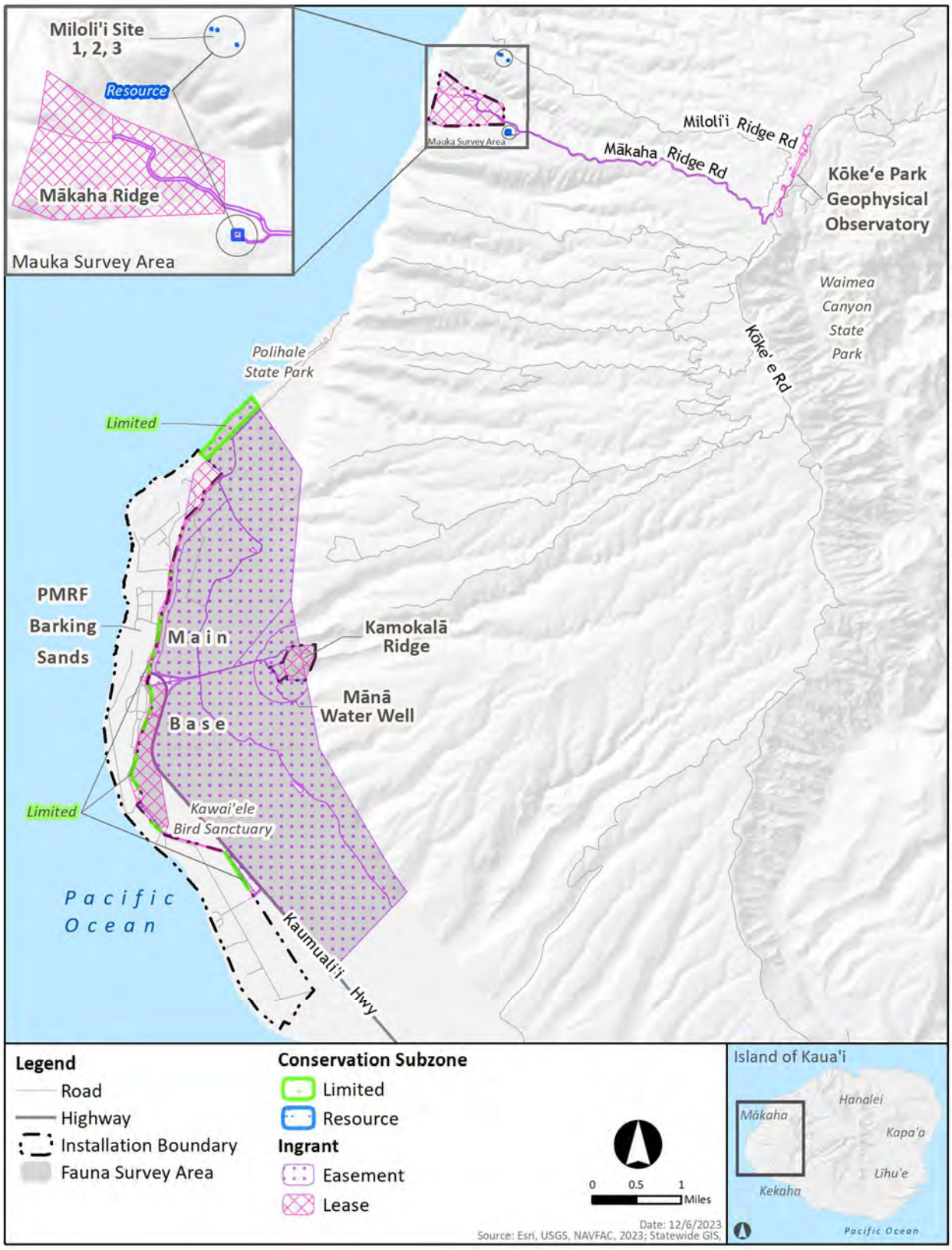

Figure 1-1 PMRF Fauna Survey Area Location Map

1.2 PURPOSE AND OBJECTIVE OF THE SURVEY

The purpose of the terrestrial fauna surveys was to document wildlife presence within the terrestrial survey area at PMRF (see Figure 1-1), as well as document the general suitability of habitat for wildlife within the survey area. Primary species of concern during the surveys included special status wildlife species (federally or state-listed species), bird species protected under the Migratory Bird Treaty Act (MBTA), and invasive and/or pest species. The primary objective of the terrestrial fauna surveys was to identify what terrestrial fauna resources exist within the survey area to support any environmental evaluations and consultations potentially required by laws, regulations, or policies.

1.3 SURVEY AREA

The identified survey area for terrestrial fauna was approximately 5,708 acres, predominately occurring on the coastal areas within the Mānā Plain (see Figure 1-1). 'Mauka' survey areas (those areas toward higher elevation) of 1.0 acre and 600 square feet were surveyed on Mākaha Ridge and Miloli'i Ridge, respectively (see Figure 1-1).

1.4 POTENTIALLY OCCURRING SPECIAL STATUS WILDLIFE SPECIES

A total of 14 federally and state-listed species are known to or have the potential to occur within PMRF and are presented in Table 1-1. PMRF and adjacent areas are largely non-native habitats; therefore, it was not expected that all species in Table 1-1 would or have the potential to occur in the terrestrial survey area.

Table 1-1 Special Status Wildlife Species Known to Occur or with Potential to Occur in the Survey Area

Scientific Name	*Common Name*	*Hawaiian Name*	*Regulatory Status*	*Habitat*
Birds				
Anas wyvilliana[1]	Hawaiian duck	Koloa moali	FE, SE	Common in a variety of natural and artificial wetland habitats
Fulica alai	Hawaiian coot	'Alae ke'oke'o	FE, SE	Common in a variety of natural and artificial wetland habitats
Gallinula galeata sandvicensis	Hawaiian gallinule	'Alae 'ula	FE, SE	Common in a variety of natural and artificial wetland habitats
Himantopus mexicanus knudseni	Hawaiian stilt	'Ae'o	FE, SE	Common in a variety of natural and artificial wetland habitats
Branta sandvicensis	Hawaiian goose	Nēnē	FT, SE	Variety of habitats such as coastal dunes and grasslands, shrubland, and shrubland-woodland interfaces
Hydrobates castro	Band-rumped storm petrel	'Akē 'Akē	FE, SE	Colonies are in steep valleys vegetated with shrubs and grasses
Pterodroma sandwichensis	Hawaiian petrel	'Ua'u	FE, SE	Colonies occur in lower elevation forests dominated by native 'ōhi'a trees

Scientific Name	*Common Name*	*Hawaiian Name*	*Regulatory Status*	*Habitat*
Puffinus newelli	Newell's shearwater	ʻAʻo	FT, ST	Most colonies occur on steep, densely vegetated mountains and also nest on sparsely vegetated coastal cliffs along west Kauaʻi
Phoebastria albatrus	Short-tailed albatross	Makalena	FE, SE	Small numbers of birds nest on outer Hawaiian islands and atolls and rarely visit Kauaʻi
Vestiaria coccinea	Scarlet Hawaiian honeycreeper	ʻIʻiwi	FT, ST	Mesic and wet native forest, above 1,250 meters
Mammals				
Lasiurus cinereus semotus[2]	Hawaiian hoary bat	ʻōpeʻapeʻa	FE, SE	Occurring in a variety of landscapes, present throughout Hawaiʻi
Neomonachus schauinslandi	Hawaiian monk seal	Īlio holo i ka uaua	FE, SE	Occurring on beaches at Polihale, common throughout Hawaiʻi
Reptiles				
Chelonia mydas	Green sea turtle	Honu	FT, ST	Occurring on beaches at Polihale for both resting (hauling out) and nesting, common throughout Hawaiʻi
Invertebrates				
Drosophila musaphilia	Hawaiian picture-wing fly	-	FE, SE	*Acacia koa* forest within regions of Kōkeʻe State Park
Hylaeus spp.[3]	Hawaiian yellow-faced bee	Nalo meli maoli	FE, SE	Occurring on beaches in proximity to native coastal vegetation

Notes: [1]Hawaiian ducks are known to hybridize with mallards and such hybrids are difficult to distinguish in the field.
[2]Hawaiian hoary bats were surveyed for in a separate survey event and findings are addressed in a separate report.
[3]Not all species within the *Hylaeus* genus are ESA-listed species.
Selections for Listing Status Column include: FE = federal endangered, FT = federally threatened, SE = state endangered, ST = state threatened.
Source: DLNR, 2015; United States Fish and Wildlife Service, 2023.

1.5 SURVEY SCHEDULE AND PERSONNEL

Surveys were conducted over 7 days from 4–12 October 2023 (Field Survey Event 1) and again over 5 days from 1–5 April 2024 (Field Survey Event 2). Survey start/end times and weather descriptions for each survey day are included in Table 1-2. The team members involved in performing the project tasks are listed in Table 1-3 along with their project-specific roles. The survey personnel consisted of Hannah Hubanks, Clint Scheuerman, John Lowenthal, Jessica Hawkins, and Josh De Guzman.

Table 1-2 Survey Dates, Times, and Weather Conditions

Survey Date[a]	*Start Time*	*End Time*	*Weather Conditions*
Field Survey Event 1			
4 October 2023	1:00 p.m.	3:00 p.m.	Clear, little wind, no rain, mid-80s (°F)
6 October 2023	10:30 a.m.	2:00 p.m.	Cloudy, light drizzle, mid-80s (°F)
8 October 2023	8:00 a.m.	4:00 p.m.	Clear, little wind, no rain, mid-80s (°F)
9 October 2023	8:00 a.m.	4:00 p.m.	Clear, little wind, no rain, mid-80s (°F)
10 October 2023	8:00 a.m.	4:00 p.m.	Clear, little wind, no rain, mid-80s (°F)
11 October 2023	8:00 a.m.	4:00 p.m.	Clear, little wind, no rain, mid-80s (°F)
12 October 2023	8:00 a.m.	4:00 p.m.	Clear, little wind, no rain, mid-80s (°F)
Field Survey Event 2			
1 April 2024	9:30 a.m.	5:00 p.m.	Partly cloudy, little wind, no rain, mid-80s (°F)
2 April 2024	7:30 a.m.	5:00 p.m.	Partly cloudy, little wind, no rain, mid-80s (°F)
3 April 2024	7:30 a.m.	5:00 p.m.	Partly cloudy, little wind, no rain, mid-80s (°F)
4 April 2024	7:30 a.m.	5:00 p.m.	Partly cloudy, little wind, no rain, mid-80s (°F)
5 April 2024	7:30 a.m.	11:30 a.m.	Partly cloudy, little wind, no rain, mid-80s (°F)

Note: [a]Survey date noted in Hawai‘i Standard Time.
Legend: °F = degree Fahrenheit.

Table 1-3 Survey Personnel

Role	*Name*
Project Manager	Ben Berridge
Senior Biologist	Clint Scheuerman
Senior Biologist	John Lowenthal
Biologist, Primary Site Health and Safety Coordinator	Hannah Hubanks
Biologist	Jessica Hawkins
Biologist	Josh De Guzman
Geographic Information System Specialist	Christine Chaplin

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CHAPTER 2
SURVEY METHODOLOGY

2.1 TERRESTRIAL SURVEY METHODS

Terrestrial biologists surveyed the entire survey area using the geographic information system (GIS) boundaries in Figure 1-1. One surveyor carried a portable Global Positioning System (GPS) unit with a tracking application to continuously track the movements of the surveyors, as depicted by the survey tracks in Figure 2-1. Surveys were completed by conducting point count surveys at established point count locations for all potentially occurring special status wildlife species. Surveyors also documented any occurrences of MBTA species and invasive or pest species at each observation point.

Based on the desktop analysis findings, the fauna survey area was divided into six zones based on terrain, vegetative cover, and potential habitat for wildlife (Table 2-1) (NAVFAC Pacific, 2023). Observation points within each zone were selected within the fauna survey area at regions anticipated to capture the most representative biological resources present, and based on accessibility (NAVFAC Pacific, 2023). Details of survey methods for each zone are also described in Table 2-1. The field survey personnel recorded incidental observations and conducted point count surveys for a minimum of 10 minutes at observation points within the survey area (79 observation points [including four incidental points] during Field Survey Event 1; 75 observation points during Field Survey Event 2) (Figure 2-1). While most observation points were utilized to assess wildlife occurrence in the immediate vicinity, certain observation points functioned as vantage points to view inaccessible regions within the survey area (such as the steep cliffs within Zone 1).

When stationary or walking for point count observations, surveyors used binoculars to scan for presence of wildlife. While driving through the survey area to reach various observation points and conduct the habitat assessment, the passenger surveyors scanned for presence of wildlife and notified the driver of any occurrences of special status wildlife. If special status wildlife was observed while driving, surveyors pulled the car off the road, stopped, and recorded the observation. The area at each observation point and along roads covered an approximate 100–200-meter radius from the surveyor's position; however, many points and roadways were surrounded by thick vegetation which obstructed views. To effectively survey such areas with obstructed views, surveyors adjusted viewing stance and direction to obtain the most efficient coverage of the survey area. The location and number of observed wildlife were recorded at the time of the observation. Locations of special status wildlife species were mapped using a portable GPS unit. At each observation point, the total number of wildlife individuals were recorded.

2.2 SURVEY EQUIPMENT AND STANDARDS

The surveyor team was equipped with one portable/handheld Eos Arrow 100 GPS unit with sub-meter level mapping accuracy (Eos, 2023) for Field Survey Event 1 and used mobile devices equipped with ArcGIS Field Maps for Field Survey Event 2. Following surveys, data were downloaded, backed up, and viewed to ensure data completeness prior to survey completion. Field survey personnel were equipped with proper clothing, personal protective equipment, and binoculars.

Table 2-1 Fauna Survey Zones within the Survey Area

Zone	*Description*	*Survey Method*
1	At approximately 40 to 700 feet elevation, Zone 1 includes land mauka of the Mānā Plain. In this zone, topography quickly steepens, vegetation becomes less dense, and consists of mostly unmanaged, non-native shrubland vegetation with some exposed soil and occasional steep cliff terrain. Wildlife consists mostly of invasive species such as pigs (*Sus scrofa*) and goats (*Capra hircus*); however, seabirds such as the white-tailed tropicbirds (*Phaethon lepturus*) may occur.	Observation points were selected based on known accessibility, visibility, and their representation of the zone characteristics, with focus on areas which may contain habitat features for special status wildlife species. Special attention was focused on binocular searches for wildlife on the steep terrain that cannot be reached by surveyors, where vantage points existed. Locations of observation points within Zone 1 are indicated on Figure 2-1.
2	Zone 2 includes floodable and water-retaining regions on the Mānā Plain such as mud flats and shallow ponds, as well as agricultural irrigation ditches and canals. Vegetation is dominated by invasive, non-native plants following agricultural disturbance, such as guinea grass (*Megathyrsus maximus*), kiawe (*Prosopis pallida*), and koa haole (*Leucaena leucocephala*). Wildlife consists of both native and non-native species with high potential for Hawaiian waterbirds which have been previously observed (NAVFAC Pacific, 2023).	Observation points were selected based on known accessibility, visibility, as well as surveyor knowledge of wildlife use of the area, with focus on areas probable to contain sufficient conditions for Hawaiian waterbirds. Locations of observation points within Zone 2 are indicated on Figure 2-1.
3	Zone 3 contains unmanaged, non-native vegetation within agricultural land, and is dominated by koa haole and kiawe shrubland. Various areas exist adjacent to agricultural irrigation ditches, which provide habitat for wildlife. Wildlife consists of mostly non-native and invasive species, with some habitat for special status wildlife species near irrigation ditches and canals.	Observation points were selected based on their known accessibility, visibility, and representation of the zone characteristics, with focus on areas which may contain habitat features for special status wildlife species. Zone 3 also includes broad coverage incidental surveying between observation points, conducted by vehicle along accessible agricultural roads at speeds no greater than 10 mph. Locations of observation points within Zone 3 are indicated on Figure 2-1.
4	Zone 4 consists of managed agricultural land, which may include actively cultivated or fallow fields. Perimeters of fields offer some habitat for wildlife, and presence of irrigation ditches offer moderate potential for special status wildlife species (e.g., Hawaiian waterbirds) to occur in the area.	Observation points were selected based on their known accessibility, visibility, and representation of the zone characteristics, with focus on areas which may contain habitat features for special status wildlife species. Zone 4 also included broad coverage incidental surveying between observation points, conducted by vehicle along accessible agricultural roads at speeds no greater than 10 mph. Locations of observation points within Zone 4 are indicated on Figure 2-1.
5	At elevations of approximately 1,770 to 1,980 feet, Zone 5 is a small mauka survey region on Mākaha and Miloli‘i Ridges. Vegetation is moderately to sparsely present consisting of mixed Hawaiian shrubs with some potential habitat for birds. On the steep cliffs adjacent to the survey areas, habitat for federally-listed and MBTA seabirds has been documented.	As all four mauka survey areas are small (200 feet maximum width on Mākaha Ridge, and 20 feet maximum width on Miloli‘i Ridge), the selected observation points visually covered all potential habitats within and near to the zone. Locations of observation points within Zone 5 are indicated on Figure 2-1.

Zone	***Description***	***Survey Method***
6	Zone 6 occurs within Polihale State Park and contains coastal dunes dominated by non-native shrubs and grasses and native cover such as naupaka (*Scaevola sencea*). Wildlife may include seabirds, green sea turtle (*Chelonia mydas*), Hawaiian monk seal (*Neomonachus schauinslandi*), and Hawaiian yellow-faced bee *(Hylaeus* spp.*).*	As driving through this zone is limited due to sandy terrain, surveyors included broad coverage incidental surveying by walking to each observation point and surrounding areas. The observation points were selected based on known accessibility, visibility, and their representation of the zone characteristics, with focus on areas which may contain habitat features for special status wildlife species. Locations of observation points within Zone 6 are indicated on Figure 2-1.

Legend: MBTA = Migratory Bird Treaty Act; mph = miles per hour.

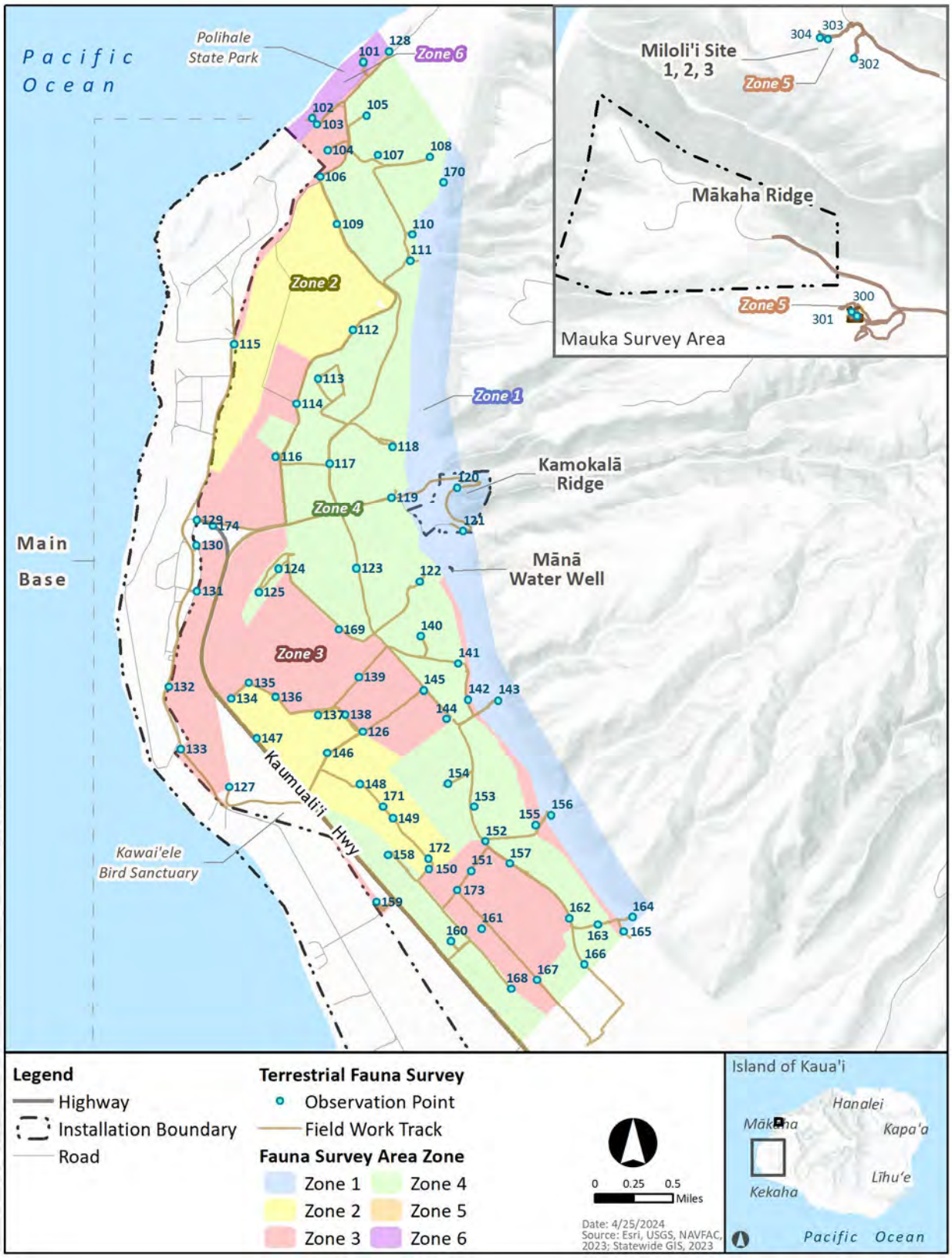

Figure 2-1 Survey Tracks

2.3 DATA COLLECTED

2.3.1 Special Status Wildlife Species

At each established point count observation location, when and where special status wildlife species, MBTA species, or general wildlife species were detected, the field survey personnel documented the following on a GPS unit:

1. Species name(s) and numbers of individuals.
2. GPS location.
    a. Location points were generally collected at the established point count observation locations and all species detected were noted as occurring at that point.
    b. For observations made from a vantage point for an inaccessible region in the survey area, approximate distance and direction from observation point were recorded.
3. Life stage (e.g., adult, juvenile, etc.) (if discernible in the field).
4. Condition (e.g., dead, poor, fair, good, etc.) (if discernible in the field).

Representative photos of wildlife observed during the surveys are provided in Appendix A.

2.3.2 Habitat Assessment

At each observation point, the field survey personnel documented the following:

1. Dominant plant species of the immediate surrounding environment
2. Presence/absence of water features (e.g., wetland, irrigation ditch, or canal)
3. Presence/absence of agricultural activity

Representative photos of habitat taken during the surveys are provided in Appendix A.

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CHAPTER 3
SURVEY RESULTS

Results of the terrestrial fauna surveys are summarized in Tables 3-1 and 3-2 and are depicted in Figures 3-1 through 3-8 (Field Survey Event 1 in Figures 3-1 through 3-4; Field Survey Event 2 in Figures 3-5 through 3-8). Appendix A contains a photographic record of the survey area, and Appendix B contains a complete data matrix for GIS species data collected during the surveys. All GIS survey data collected in the field have been provided to NAVFAC Pacific as a part of this deliverable.

3.1 SPECIAL STATUS WILDLIFE SPECIES

Table 3-1 details the survey data collected for the special status wildlife species that were observed and mapped. While the surveys could not eliminate the potential of recounting individuals from day to day or between observation points, efforts were made to reduce such repeat counts of wildlife at neighboring observation points by observing wildlife directions of travel to and from each point. Additionally, survey observation point count locations were generally distanced well enough away from each other to reduce the likelihood of recounting individuals. In total during Field Survey Event 1, 39 Hawaiian ducks (*Anas wyvilliana*) and/or Hawaiian duck/mallard hybrids, 24 Hawaiian coots (*Fulica alai*), 16 Hawaiian gallinules (*Gallinula galeata sandvicensis*), 27 Hawaiian stilts (*Himantopus mexicanus knudseni*), and 126 Hawaiian geese or nēnē *(Branta sandvicensis*) were observed and mapped. Two Hawaiian yellow-faced bees (*Hylaeus* spp.) were observed; however, species-level identification could not be obtained to confirm if the observation was an ESA-listed species (both listed and non-listed species occur within the genus). In total during Field Survey Event 2, 66 Hawaiian ducks and/or Hawaiian duck/mallard hybrids, 35 Hawaiian coots, 27 Hawaiian gallinules, 86 Hawaiian stilts, and 225 Hawaiian geese were observed and mapped.

Table 3-2 summarizes the survey data collected for species protected under the MBTA that were observed and mapped. Fourteen species of birds protected under the MBTA were documented in the survey area during the surveys, performing a variety of activities such as flying, foraging, and loafing (Table 3-2). Discussions of mapped individuals of special status and other wildlife species are provided in Chapter 4.

Table 3-1 Special Status Wildlife Species Observed

Scientific Name	*Common Name*	*ESA or SOH-Listed Status*	*Number of Individuals: Event 1*	*Life Stage/Condition/Notes: Event 1*	*Number of Individuals: Event 2*	*Life Stage/Condition/Notes: Event 2*
Anas wyvilliana[1]	Hawaiian duck	FE, SE	39	Adults observed foraging, flying, and loafing, mostly within wetland habitats	66	Adults observed foraging, flying, and loafing, mostly within wetland habitats
Fulica alai	Hawaiian coot	FE, SE	24	Adults observed foraging, flying, and loafing, mostly within wetland habitats	35	Adults observed foraging, flying, and loafing, mostly within wetland habitats
Gallinula galeata sandvicensis	Hawaiian gallinule	FE, SE	16	Adults observed foraging, flying, and loafing, mostly within wetland habitats	27	Adults and juveniles observed foraging, flying, and loafing, mostly within wetland habitats
Himantopus mexicanus knudseni	Hawaiian stilt	FE, SE	27	Adults observed foraging, flying, and loafing, mostly within wetland habitats	86	Adults observed foraging, flying, loafing, and nesting, mostly within wetland habitats
Branta sandvicensis	Hawaiian goose	FT, SE	126	Adults observed foraging, flying, and loafing, mostly within wetland habitats	225	Adults and goslings observed foraging, flying, and loafing, mostly within wetland habitats and in manicured grass areas
Hylaeus spp.[2]	Hawaiian yellow-faced bee	N/A	2	Individuals observed pollinating native coastal vegetation	0	N/A

Note: [1]Hawaiian ducks are known to hybridize with mallards and such hybrids are difficult to distinguish in the field.
[2]*Hylaeus* genus was observed; however, species identification could not be obtained to confirm if the observation was an ESA-listed species.

Legend: ESA = Endangered Species Act; FE = federal endangered; FT = federally threatened; N/A = not applicable; SE = state endangered; SOH = State of Hawai‘i.

Table 3-2 Migratory Bird Treaty Act Species Observed

Scientific Name	***Common Name***	***Number of Individuals: Event 1***	***Life Stage/Condition/Notes: Event 1***	***Number of Individuals: Event 2***	***Life Stage/Condition/Notes: Event 2***
Bubulcus ibis	Cattle egret	472	Healthy adult individuals, observed foraging	309	Healthy adult individuals, observed foraging
Pluvialis fulva	Pacific golden plover	18	Healthy adult individuals, observed foraging and in flight	19	Healthy adult individuals, observed foraging and in flight
Tringa incana	Wandering tattler	2	Healthy adult individuals, observed foraging in wetland habitat	0	N/A
Fregata minor	Great frigatebird	4	Adult individuals, observed in flight above agricultural land	0	N/A
Nycticorax nycticorax	Black-crowned night heron	39	Healthy adult individuals, observed foraging and in flight	34	Healthy adult and juvenile individuals, observed foraging and in flight
Cardinalis cardinalis	Northern cardinal	12	Healthy adult individuals, observed foraging, in flight, and perched	56	Healthy adult individuals, observed foraging, in flight, and perched
Haemorhous mexicanus	House finch	46	Healthy adult individuals, observed foraging, in flight, and perched	11	Healthy adult individuals, observed foraging, in flight, and perched
Phaethon lepturus	White-tailed tropic bird	5	Adults observed in flight	4	Adults observed in flight
Mimus polyglottos	Northern mockingbird	11	Healthy adult individuals, observed foraging, in flight, and perched	2	Healthy adult individuals, observed while perched
Asio flammeus sandwichensis[1]	Hawaiian Short-eared owl	5	Adults observed flying, perched, and hunting in open grassy or agricultural regions	2	Adults observed flying and hunting in above agricultural regions
Tyto alba	Barn owl	1	Deceased adult, observed on the shoulder of an unpaved road	0	N/A
Plegadis chihi	White-faced ibis	0	N/A	1	Healthy nonbreeding/immature individual observed foraging in wetland habitat
Calidris alba	Sanderling	0	N/A	1	Healthy adult observed foraging in wetland habitat
Arenaria interpres	Ruddy turnstone	0	N/A	1	Healthy adult observed foraging in streambank habitat

Note: [1]Hawaiian short-eared owl is State-Listed as Endangered on the island of ʻOahu. On the island of Kauaʻi, the species only has MBTA status.
Legend: N/A = not applicable.

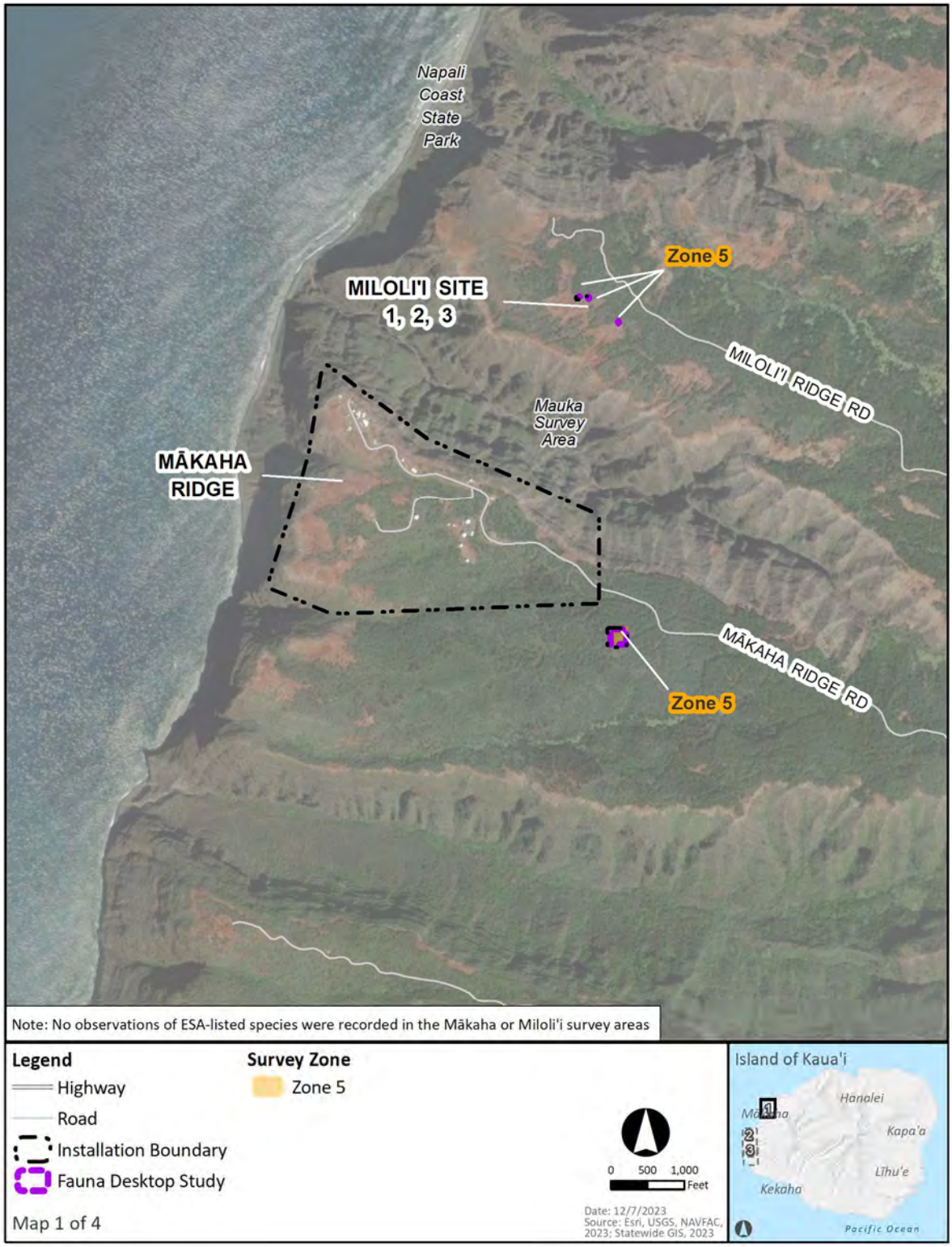

Figure 3-1 ESA-Listed Species Observations within the Fauna Survey Area during Field Survey Event 1 – Mauka

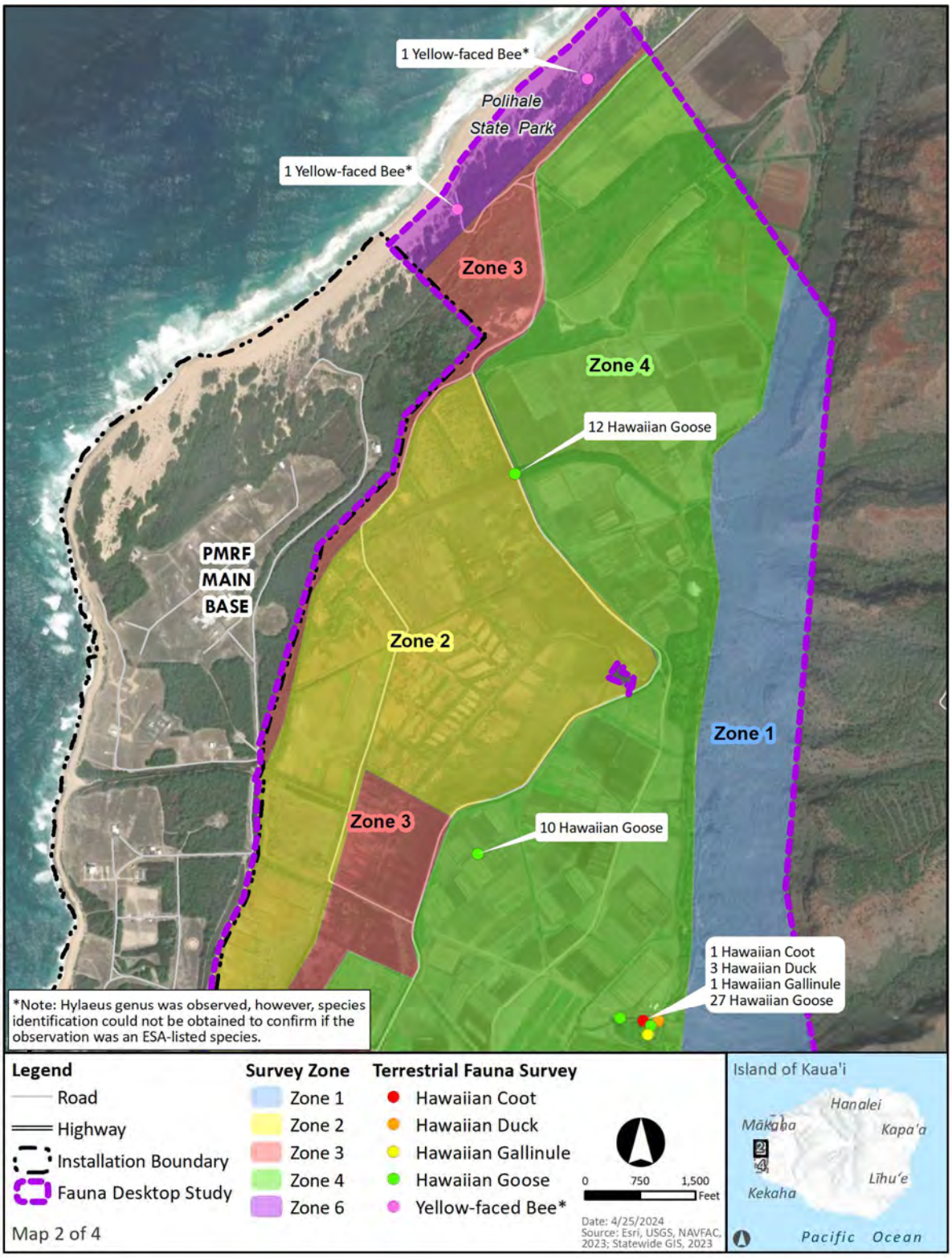

Figure 3-2 ESA-Listed Species Observations within the Fauna Survey Area during Field Survey Event 1 – North

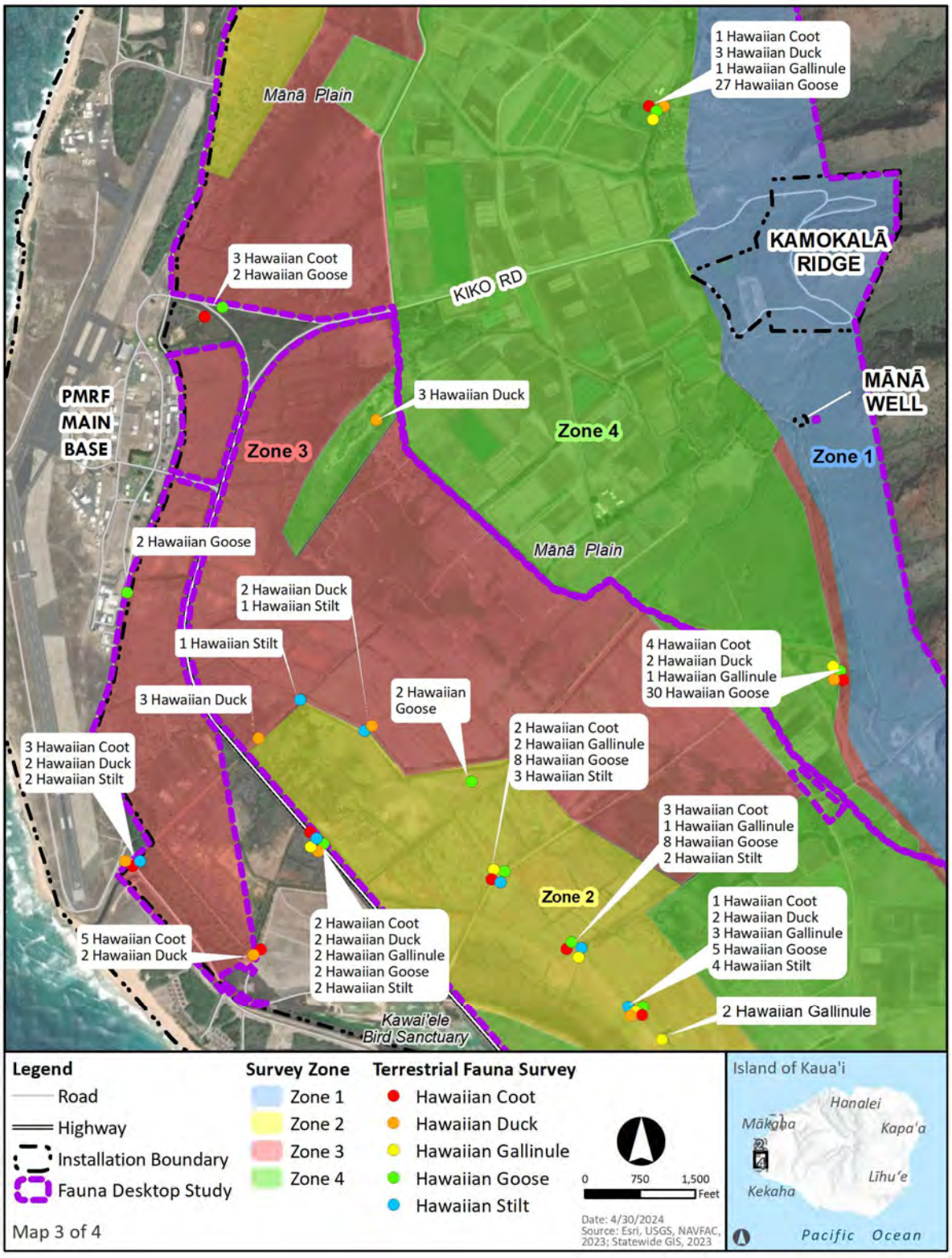

Figure 3-3 ESA-Listed Species Observations within the Fauna Survey Area during Field Survey Event 1 – Central

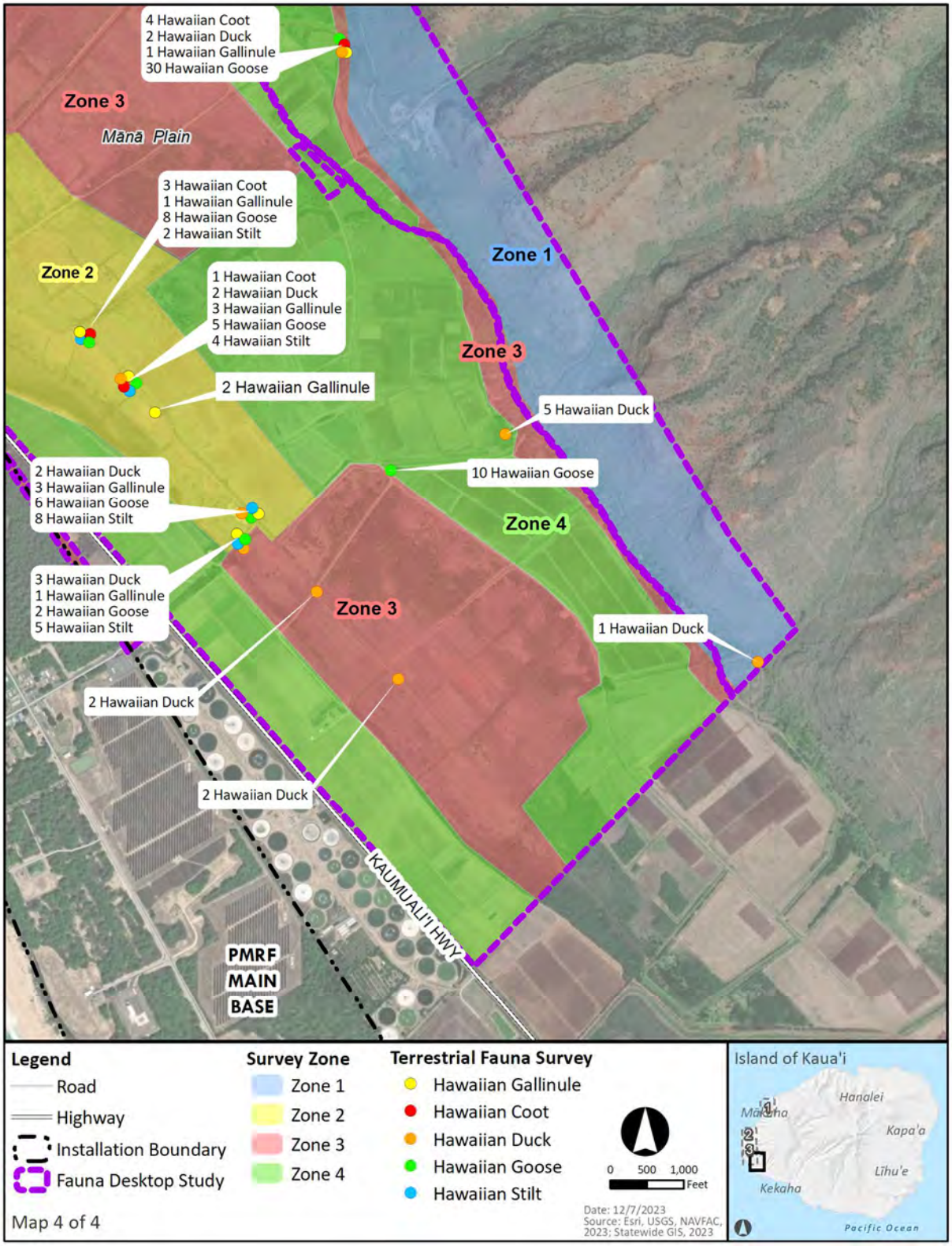

Figure 3-4 ESA-Listed Species Observations within the Fauna Survey Area during Field Survey Event 1 – South

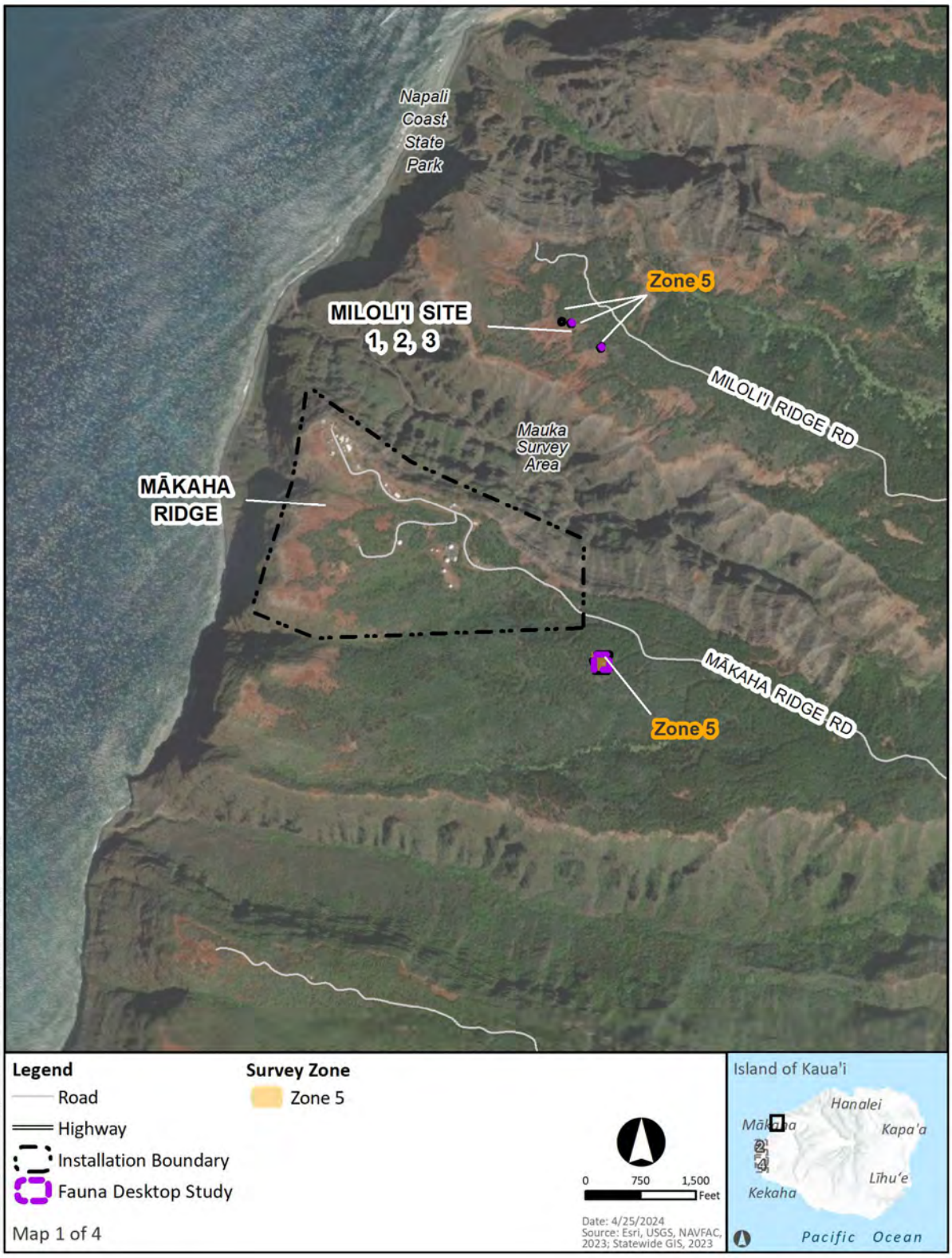

Figure 3-5 ESA-Listed Species Observations within the Fauna Survey Area during Field Survey Event 2 – Mauka

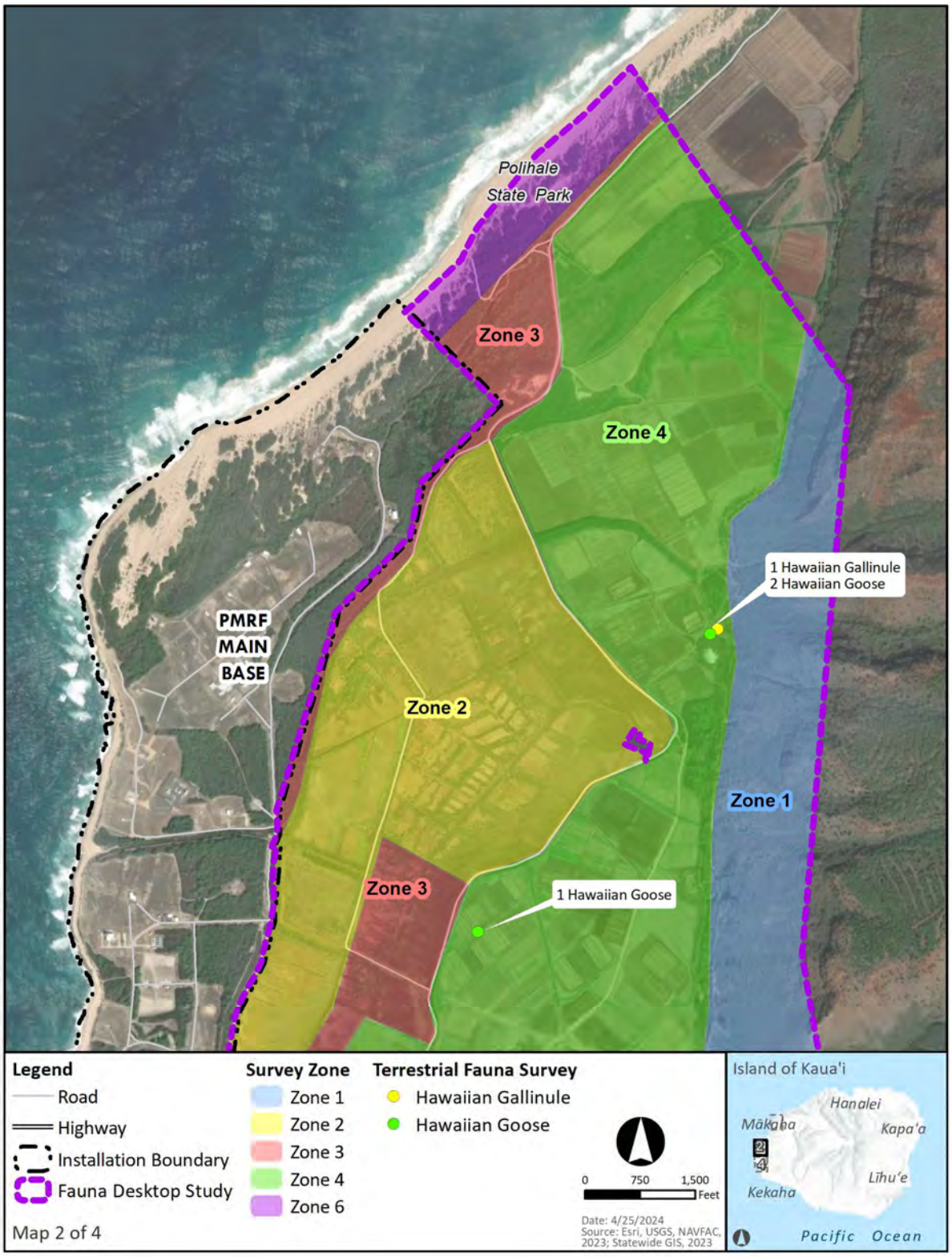

Figure 3-6 ESA-Listed Species Observations within the Fauna Survey Area during Field Survey Event 2 – North

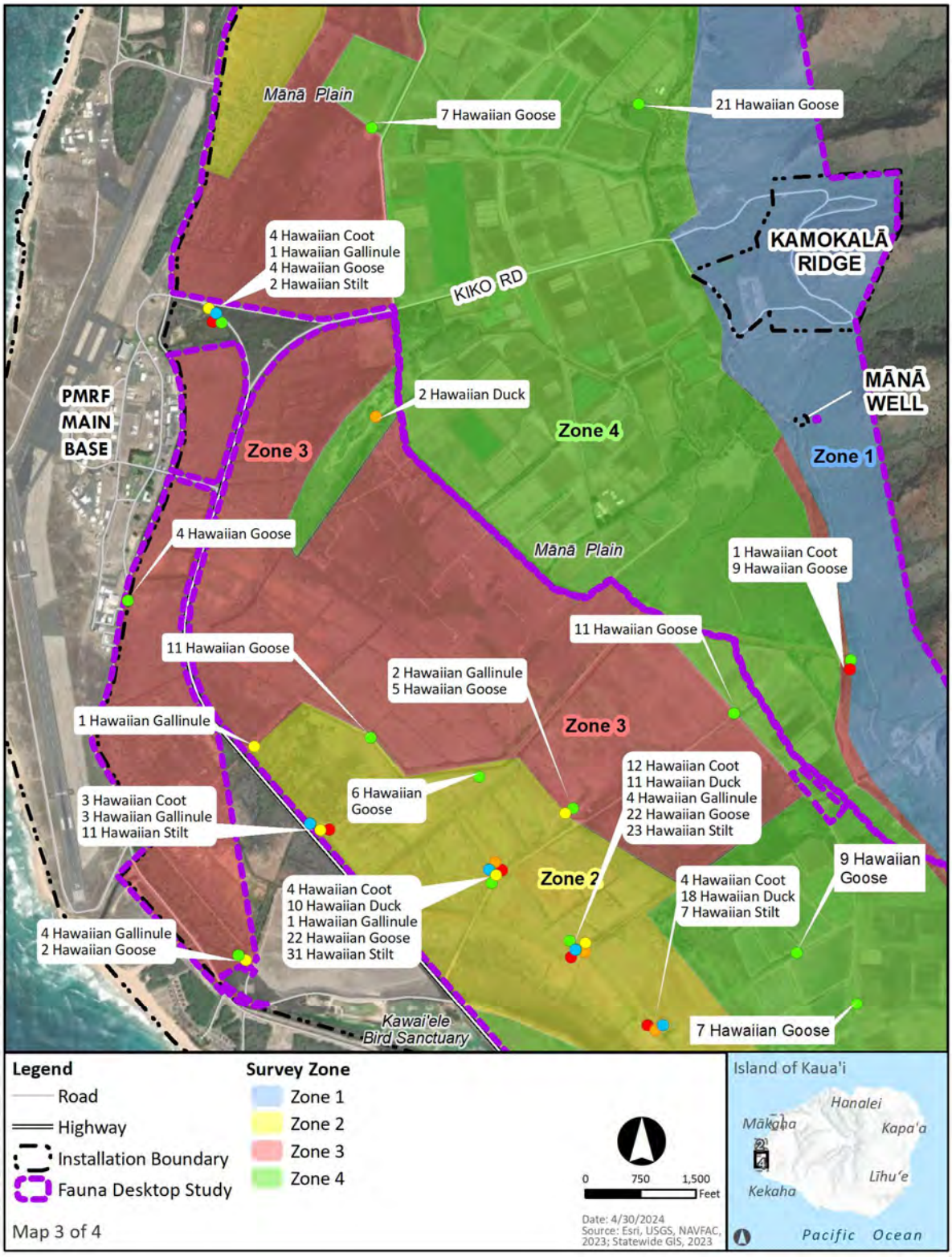

Figure 3-7 ESA-Listed Species Observations within the Fauna Survey Area during Field Survey Event 2 – Central

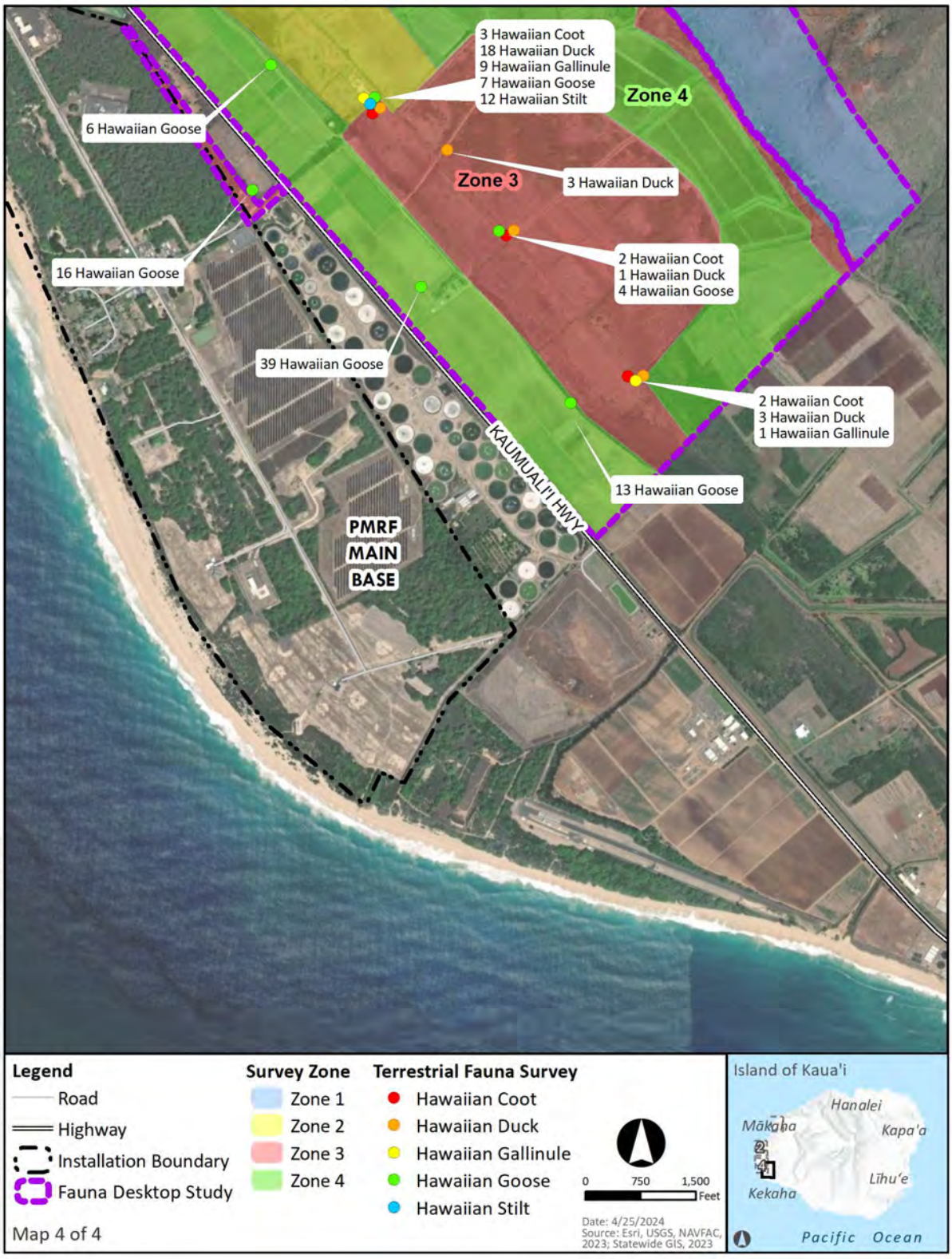

Figure 3-8 ESA-Listed Species Observations within the Fauna Survey Area during Field Survey Event 2 – South

3.2 OTHER WILDLIFE SPECIES OBSERVED

Common bird species were observed throughout the survey area performing a variety of activities such as flying, foraging, and resting/perching. Common bird species observed included zebra dove (*Geopelia striata*), house sparrow (*Passer domesticus*), spotted dove (*Spilopelia chinensis*), warbling white-eye (*Zosterops japonicus*), common myna (*Acridotheres tristis*), java sparrow (*Padda oryzivora*), common waxbill (*Estrilda astrild*), scaly-breasted munia (*Lonchura punctulate*), chestnut munia (*Lonchura atricapilla*), African silverbill (*Euodice cantans*), red-crested cardinal (*Paroaria coronate*), rose-ringed parakeet (*Psittacula krameria*), red junglefowl (*Gallus gallus*), and rock pigeon (*Columba livia*). Less frequent observations of the white-rumped shama (*Copsychus malabaricus*), saffron finch *(Sicalis flaveola*), ring-necked pheasant (*Phasianus colchicus*), black francolin (*Francolinus francolinus*), Erckel's francolin (*Pternistis erckelii*), and grey francolin (*Ortygornis pondicerianus*) were documented.

Mammals observed in the survey area included black-tailed deer (*Odocoileus hemionus hemionus),* donkey (*Equus asinus*), feral cat (*Felis catus*), feral goat (*Capra hircus*), feral pig (*Sus scrofa*), and cow (*Bos taurus*). Cane toad (*Rhinella marina*), alive and deceased, were also prevalent across the survey area. A single occurrence of an individual moth skink (*Lipinia noctua*) was documented in the survey area. The complete list of species observations is provided in Appendix C and total counts of each species collected during the surveys are documented in Appendix B.

3.3 HABITAT ASSESSMENT

The suitability of potential wildlife habitat in the fauna survey area was conducted concurrently during fauna species surveys. Utilizing road networks within the survey area, surveyors visually assessed all portions of the survey area for wildlife habitat, and survey personnel documented the dominant plant community and land cover at each observation point. Additionally, any notable vegetation was recorded as well as any high disturbance or prevalence of invasive plant species.

Overall, the survey area is highly disturbed and dominated by non-native and invasive plant species, with a system of agricultural irrigation canals throughout and some wetland and flooded regions. Summaries of the habitat suitability within each of the six survey zones, including characteristic plant species, and notable habitat containing desirable special status wildlife species habitat are described below. Characteristic photos of each zone are presented in Appendix A.

3.3.1 Zone 1

Zone 1 is characterized by steep topography with minimal to no vegetation along ridgelines and is dominated by mixed kiawe (*Prosopis pallida*) and koa haole (*Leucaena leucocephala*) scrub at lower elevations where vegetation is present. These vegetated areas additionally included fast-growing weedy species such as guinea grass (*Megathyrsus maximus*). The portion of Zone 1 within the Kamokalā Ridge installation is dominated by koa haole scrub with the addition of native wiliwili (*Erythrina sandwicensis*) trees throughout. Some suitable habitat for white-tailed tropicbirds (*Phaethon lepturus*) exists within Zone 1. Agricultural lands occur at the base of the steep cliffs along the majority of this zone.

3.3.2 Zone 2

Zone 2 is characterized by open floodable land and water-retaining regions such as mud flats and shallow ponds, as well as agricultural irrigation ditches. Areas containing wetlands are dominated by sea purslane (*Sesuvium portulacastrum*) as well as camphorweed *(Pluchea indica*) around perimeters. Regions of Zone 2 containing irrigation ditches were dominated by kiawe-koa haole scrub and fast-growing non-native plants

along the banks and adjacent to the water including species such as java plum (*Syzygium cumini*). Suitable habitat for Hawaiian duck, Hawaiian coot, Hawaiian gallinule, Hawaiian stilt, and nēnē (referred to as the Hawaiian waterbirds) exists throughout Zone 2 (see Figures 3-2 through 3-8).

3.3.3 Zone 3

Zone 3 is dominated by non-native vegetation adjacent to agricultural land, primarily kiawe-koa haole scrub and an understory of guinea grass. Generally, this zone provides minimal habitat for special status wildlife species; however, some regions within Zone 3 occur adjacent to agricultural irrigation ditches which provide habitat for Hawaiian waterbirds.

3.3.4 Zone 4

Zone 4 consists primarily of managed agricultural land, including both actively cultivated and fallow fields. Crops observed include papaya (*Carica papaya*), mango (*Mangifera indica*), kale (*Brassica oleracea var acephala*), corn (*Zea mays*), and taro (*Colocasia esculenta*). Conservation cover is prevalent in fallow fields throughout this zone, dominated by volunteer grasses and occasionally, sunn hemp (*Crotalaria juncea*). Vegetation within windbreaks and along field borders includes kiawe-koa haole scrub, monkeypod (*Samanea saman*), castor bean (*Ricinus communis*), guinea grass, and variegated hau (*Hibiscus tiliaceus*). Golden crownbeard (*Verbesina encelioides*) was observed in some fallow fields. Open fields offer suitable foraging habitat for the pueo and a variety of birds including cattle egret (*Bubulcus ibis*) and many passerine bird species. Perimeters of fields that occur adjacent to irrigation ditches offer some suitable habitat for Hawaiian waterbirds.

3.3.5 Zone 5

The mauka survey regions within Zone 5 are characterized by slash pine (*Pinus elliottii*) canopy, and an understory dominated by lantana (*Lantana camara*), as well as presence of silky oak (*Grevillea robusta*), strawberry guava (*Psidium cattleianum*), ʻaʻaliʻi (*Dodonea viscosa*), and tufted beardgrass (*Schizachyrium condensatum*). Minimal suitable habitat for special status wildlife exists within the boundaries of the survey area in Zone 5; however, some suitable habitat for the white-tailed tropicbird exists along steep cliff terrain adjacent to the survey area (approximately 1,000 feet south of observation points 302–304).

3.3.6 Zone 6

Zone 6 is characterized by coastal dunes dominated by native and non-native shrubs and grasses. Plants observed include beach naupaka (*Scaevola taccada*), pohinahina (*Vitex rotundifolia*), and naio (*Myoporum sandwicense*). On the south side of the dunes, kiawe-koa haole scrub dominates the landscape with minimal understory. The coastal dunes provide suitable habitat for Hawaiian yellow-faced bee (see Figure 3-2). North of the dunes within Zone 6, the beaches provide suitable habitat for green sea turtle (*Chelonia mydas*), Hawaiian monk seal (*Neomonachus schauinslandi*), and seabirds.

3.4 NOTABLE HABITAT

At observation points 118, 126, 133, 141, 146, 147, 148, 149, 150, 171, 172, and 174, considerable habitat was observed to be suitable and highly utilized by Hawaiian waterbirds and MBTA species. Wetlands, mud flats, and reservoir water in these locations provide sufficient habitat for such species (see Appendix A).

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CHAPTER 4
DISCUSSION

This section provides details on the special status wildlife and invasive species observed and mapped during the terrestrial surveys. Specific coordinates of all mapped points for species locations are provided in Appendix B.

4.1 FEDERALLY-LISTED HAWAIIAN WATERBIRDS

Prior to its drainage and conversion to agricultural lands during the early 1900s, approximately 1,700 acres of permanent, semi-permanent, and seasonal wetlands were present on the Mānā Plain which hosted considerable habitat for Hawaiian waterbirds (Department of the Navy [DON], 2023). A total of 232 Hawaiian waterbirds (all adults) were observed throughout the Mānā Plain during Field Survey Event 1, and a total of 439 (including 17 juveniles) during Field Survey Event 2, favoring regions that still contain wetlands and mud flats, as well as irrigation canals (see Table 3-1).

Most commonly, the Hawaiian waterbirds were documented while the birds were foraging in wetland habitats. Notably, four Hawaiian stilts were observed on their nests with unhatched eggs at observation points 148 and 149. The juvenile Hawaiian gallinule and Hawaiian coot observations were all nearly mature, while the non-adult Hawaiian geese were chicks with no mature feathers (see Appendix A).

4.2 HAWAIIAN YELLOW-FACED BEE

Two individual Hawaiian yellow-faced bees were documented in separate locations along the coastal dunes in the survey area during Field Survey Event 1, both were visiting native plants at the time of the observations (pohinahina) (see Figure 3-2). Seven species within the genus are federally-listed as endangered; 56 additional non-listed species exist, some of which also occur in coastal regions. While a limited number of species have the potential to occur in the survey area, there is potential for both listed and non-listed species. As such, species-level identification could not be obtained to confirm if the observations were ESA-listed species. Previous data regarding the bee's presence at Polihale documented five species of *Hylaeus* (Magnacca, 2007). No observations were made of the genus during Field Survey Event 2.

4.3 MIGRATORY BIRD TREATY ACT PROTECTED SPECIES

Fourteen species of birds protected under the MBTA were observed performing a variety of activities such as flying, foraging, and resting within the survey area (see Table 3-2). All individuals appeared healthy, and all were adults apart from two observations of juvenile black-crowned night heron. Suitable habitat exists for a variety of migratory birds throughout the survey area (see Appendix B). Most of the MBTA bird species observed during surveys are considered ubiquitous in Hawai‘i. A few species are considered less common in the area and are described in greater detail below.

A total of nine white-tailed tropic birds were observed flying: in the mauka survey area (between the cliffs of Mākaha and Miloli‘i Ridges), over the Mānā Plain (along the cliffs), as well as above Kamokalā Ridge (mauka side). Individual great frigatebirds were documented at four locations flying over the Mānā Plain.

Single individuals of white-faced ibis (*Plegadis chihi*), sanderling *(Calidris alba*), and ruddy turnstone (*Arenaria interpres*), as well as two wandering tattlers *(Tringa incana*), were observed in wetland habitats (see Table 3-2). Notably, the white-faced ibis is considered a rare sighting in Hawai‘i, but may be observed

in circumstances where individuals are blown off course during migration, where they rest and/or forage in suitable habitats before continuing on their migration.

The Hawaiian short-eared owl or pueo (*Asio flammeus sandwichensis*) is only State-listed as endangered on the island of O‘ahu, but is protected under the MBTA on the island of Kaua‘i. Suitable foraging habitat exists throughout the survey area for the pueo. A total of seven adult individuals were documented, five of which were observed in flight and actively foraging on fallow agricultural fields. The other two individuals were observed perched in trees, adjacent to unmanaged agricultural lands. The pueo is commonly observed at Barking Sands although no confirmed instances of breeding on the base have been recorded (DON, 2023).

4.4 INVASIVE SPECIES

A variety of non-native and/or invasive wildlife species were observed throughout the survey area; predominantly black-tailed deer, feral goat, feral pig, barn owl, and cane toad. Non-native predators are the primary invasive animal management issue at PMRF (DON, 2023). Feral cats, pigs, cattle egrets, and barn owls can depredate the adults or young of ESA- and MBTA-listed species. Barn owls also likely displace the native owl species, the pueo (DON, 2023). While cattle egret is an MBTA species, they predate on native bird eggs and are considered an invasive species in Hawai‘i and are under a control order at PMRF. Golden crownbeard *(Verbesina encelioides*) was observed, and due to the toxic properties produced by the plant, cattle who graze on this plant can become lethargic or incur fatalities. Rose-ringed parakeets were observed in abundance during Field Survey Event 2, which were not observed during Field Survey Event 1. No observations of presence or sign of mongoose (*Herpestes javanicus*), coqui frog (*Eleutherodactylus coqui*), little fire ant (*Eleutherodactylus coqui*), or coconut rhinoceros beetle (*Oryctes rhinoceros*) were made during the fauna survey, although coconut rhinoceros beetle traps were observed in various locations throughout the survey area.

CHAPTER 5
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Appendix A
Survey Photographic Record

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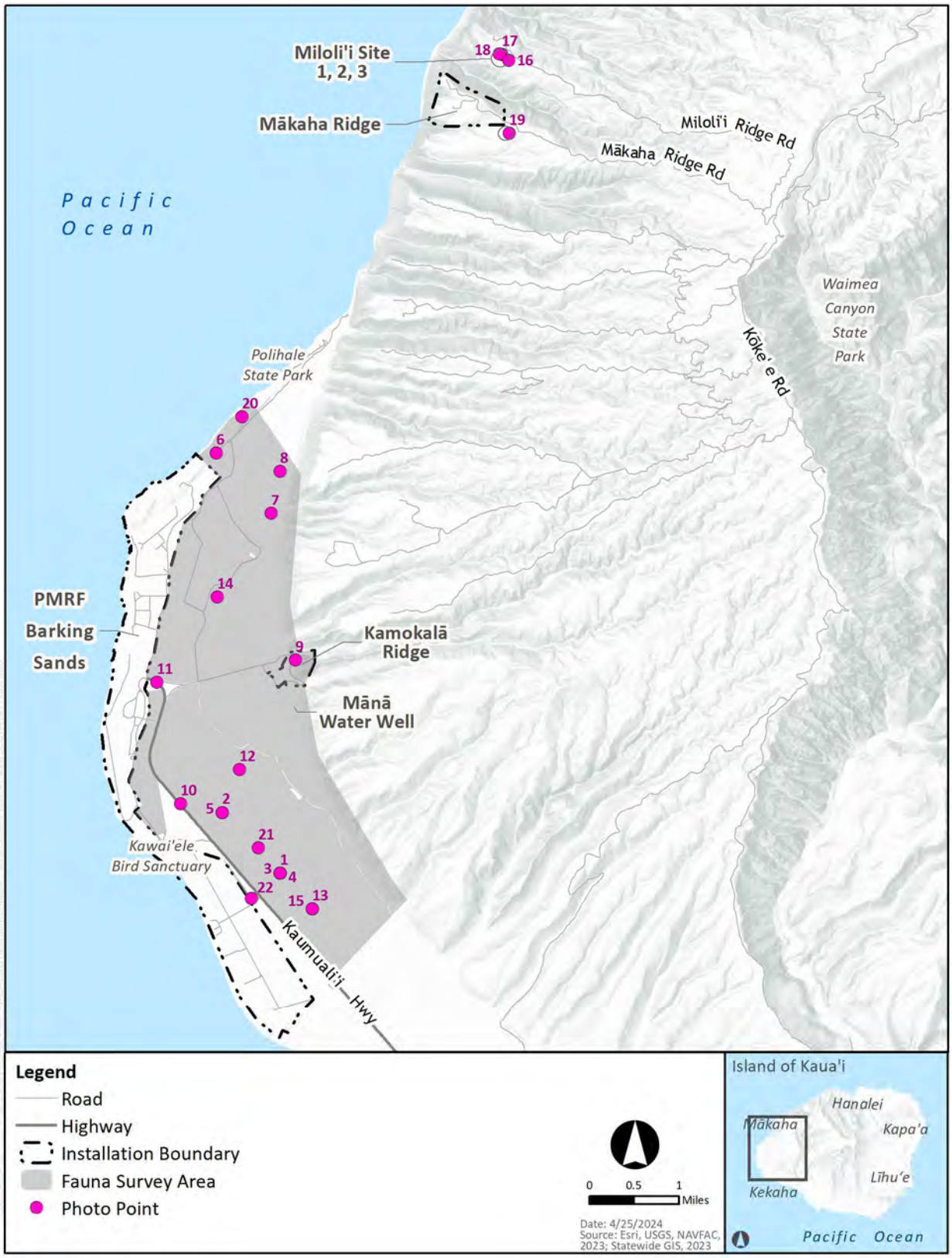

Figure A Photograph Locations

Photo 1. Hawaiian goose (*Branta sandvicensis*), Hawaiian coot (*Fulica alai*), and Hawaiian stilt (*Himantopus mexicanus knudseni*) foraging at mudflats on the Mānā Plain (Observation Point 172).

Photo 2. Hawaiian gallinule (*Gallinula galeata sandvicensis*) foraging along irrigation canals on the Mānā Plain (Observation Point 146).

Photo 3. Hawaiian coot and Hawaiian stilt foraging in an irrigation canal on the Mānā Plain (Observation Point 172).

Photo 4. Hawaiian stilt foraging in mudflats on the Mānā Plain (Observation Point 172).

Photo 5. Black-crowned night heron (*Nycticorax nycticorax*) perched along an irrigation canal on the Mānā Plain (Observation Point 146).

Photo 6. Hawaiian short-eared owl (*Asio flammeus sandwichensis*) perched in koa haole (*Leucaena leucocephala*) trees near agricultural fields (Observation Point 103).

Photo 7. Land cover representative of Zone 1, including steep topography with minimum vegetation on steep slopes. Guinea grass (*Megathyrsus maximus*), lion's ear (*Leonotis nepetifolia*) and koa haole predominately occur in the lower elevation regions of Zone 2 (Observation Point 110).

Photo 8. Land cover representative of Zone 1, including steep topography and minimum vegetation on slopes. Active and fallow agricultural lands occur at the base of the cliffs (Observation Point 108).

Photo 9. Land cover representative of Kamokalā Ridge within Zone 1, including wiliwili (*Erythrina sandwicensis*), koa haole, and non-native dry grasses (Observation Point 120).

Photo 10. Land cover representative of Zone 2, including flooded mudflat and vegetative scrub including camphorweed (*Pluchea indica*), mixed kiawe (*Prosopis pallida*), and koa haole scrub (Observation Point 147).

Photo 11. Land cover representative of Zone 2, including sea purslane (*Sesuvium portulacastrum*), guinea grass, and camphorweed (Observation Point 174).

Photo 12. Land cover representative of Zone 3, including unmanaged vegetation such as umbrella sedge (*Cyperus alternifolius*), koa haole, and guinea grass (Observation Point 139).

Photo 13. Land cover representative of Zone 3, containing some irrigation canals throughout surrounded by unmanaged vegetation such as koa haole, shoreline sea purslane (*Sesuvium portulacastrum*), and camphorweed (Observation Point 161)

Photo 14. Land cover representative of Zone 4, including large flocks of cattle egret (*Bubulcus ibis*) foraging in tilled soil. Fields of fallow land contain non-native grasses and vegetative scrub (Observation Point 113).

Photo 15. Land cover representative of Zone 4, including non-native scrubland and grasses, koa haole, and guinea grass within and surrounding acres of active and fallow agricultural lands (Observation Point 161).

Photo 16. Land cover representative of Zone 5, including bare, rocky soil, tufted beardgrass (*Schizachyrium condensatum*), and slash pine (*Pinus elliottii*) canopy (Observation Point 302).

Photo 17. Land cover representative of Zone 5, including tufted beardgrass and slash pine (Observation Point 303).

Photo 18. Land cover representative of Zone 5, including tufted beardgrass, a‘ali‘i (*Dodonaea viscosa*), and slash pine canopy (Observation Point 304).

Photo 19. Land cover representative of Zone 5, including lantana understory and slash pine canopy (Observation Point 300).

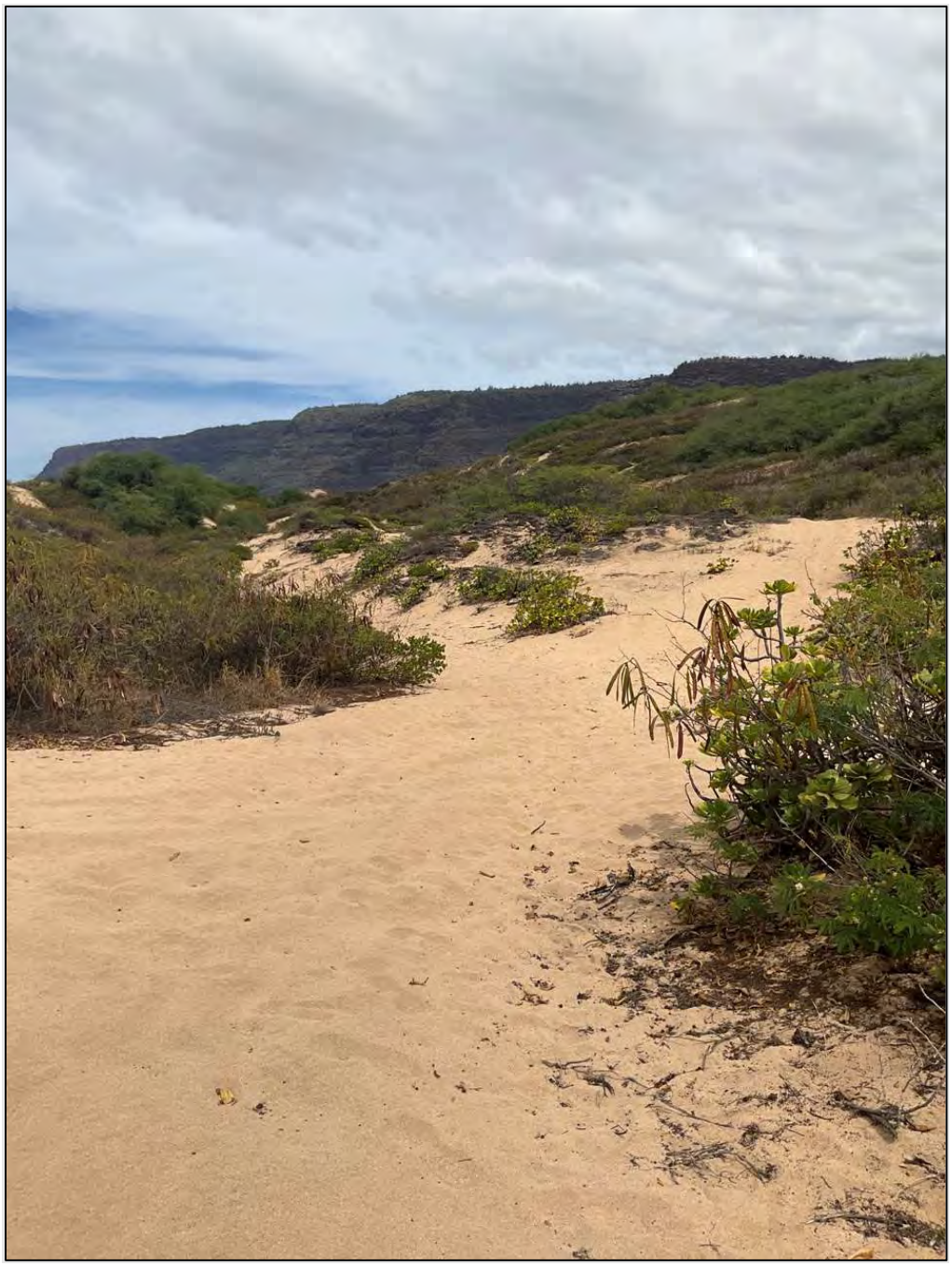

Photo 20. Land cover representative of Zone 6, including koa haole, beach naupaka (*Scaevola taccada*), koa haole, and kiawe on rolling sand dunes at Polihale Beach (Observation Point 101).

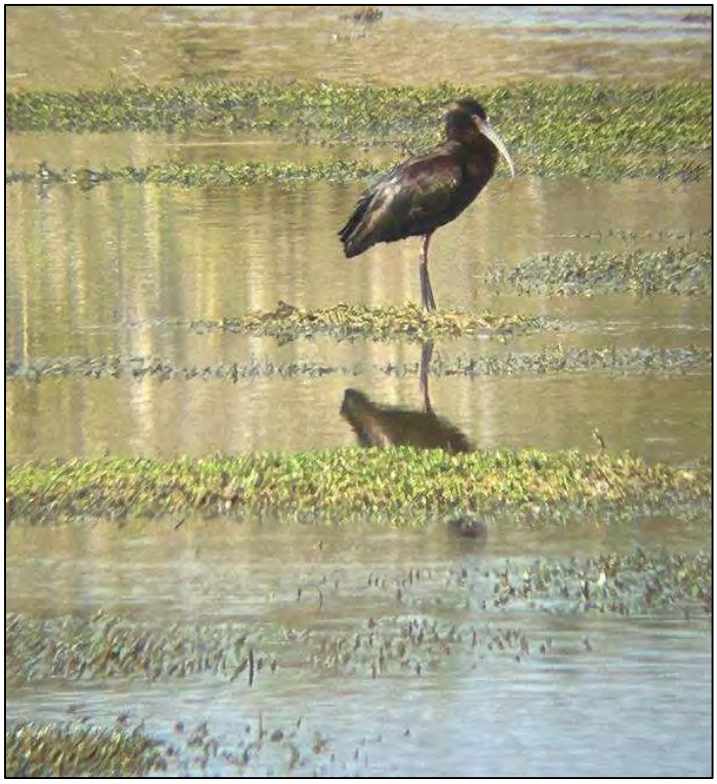

Photo 21. A nonbreeding white-faced ibis foraging in wetland habitat on the Mānā Plain (Observation Point 149).

Photo 22. Nēnē goslings near the PMRF entrance gates (Observation Point 159).

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Appendix B
Survey Summary Data Matrix

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Table B-1. Field Survey Event 1 Data Matrix

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*[1]	*Longitude*
101	Hawaiian Yellow-faced Bee	*Hylaeus* sp.	Good	Adult	1	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	No	Redacted	Redacted
101	White-rumped Shama	*Copsychus malabaricus*	Good	Adult	3	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	No	22.079905	-159.763668
101	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	1	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	Yes	22.079905	-159.763668
101	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	No	22.079905	-159.763668
102	Hawaiian Yellow-faced Bee	*Hylaeus* sp.	Good	Adult	1	NA	NA	Sand dunes, koa haole and kiawe low scrubland	No	Redacted	Redacted
102	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Sand dunes, koa haole and kiawe low scrubland	Yes	22.074666	-159.768765
103	Feral Cat	*Felis catus*	Good	Adult	3	NA	NA	Koa haole and kiawe forest, dirt/sand road	No	22.074023	-159.768142
103	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, dirt/sand road	No	22.074023	-159.768142
103	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, dirt/sand road	No	22.074023	-159.768142
103	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, dirt/sand road	Yes	22.074023	-159.768142
103	Barn Owl	*Tyto alba*	Deceased	Adult	1	NA	NA	Koa haole and kiawe forest, dirt/sand road	No	22.073974	-159.767907
104	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Koa haole dominated scrubland	No	22.071713	-159.767163
104	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Koa haole dominated scrubland	No	22.071713	-159.767163
104	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	1	NA	NA	Koa haole dominated scrubland	Yes	22.071713	-159.767163
104	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Koa haole dominated scrubland	No	22.071713	-159.767163
105	Common Myna	*Acridotheres tristis*	Good	Adult	3	NA	NA	Active fallow agricultural land	No	22.075101	-159.763184
105	Zebra Dove	*Geopelia striata*	Good	Adult	70	NA	NA	Active fallow agricultural land	No	22.075101	-159.763184
105	Warbling White-eye	*Zosterops japonicus*	Good	Adult	4	NA	NA	Active fallow agricultural land	No	22.075101	-159.763184
105	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	4	NA	NA	Active fallow agricultural land	Yes	22.075101	-159.763184
105	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	5	NA	NA	Active fallow agricultural land	No	22.075101	-159.763184

[1] This report has been redacted to prevent disclosure of information about the location of special status species.

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
105	House Finch	*Haemorhous mexicanus*	Good	Adult	8	NA	NA	Active fallow agricultural land	Yes	22.075101	-159.763184
106	Warbling White-eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Irrigation canal, kiawe and koa haole scrub	No	22.068686	-159.767794
106	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Irrigation canal, kiawe and koa haole scrub	No	22.068686	-159.767794
106	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Irrigation canal, kiawe and koa haole scrub	Yes	22.068686	-159.767794
107	Warbling White-eye	*Zosterops japonicus*	Good	Adult	1	NA	NA	Active fallow agricultural land	No	22.071403	-159.761955
108	Common Waxbill	*Estrilda astrild*	Good	Adult	2	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.071096	-159.756946
108	Spotted Dove	*Spilopelia chinensis*	Good	Adult	4	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.071096	-159.756946
108	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	Yes	22.071096	-159.756946
108	Feral Goat	*Capra hircus*	Good	Adult	2	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.071096	-159.756946
109	Warbling White-eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	No	22.064991	-159.766104
109	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	No	22.064991	-159.766104
109	White-rumped Shama	*Copsychus malabaricus*	Good	Adult	1	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	No	22.064991	-159.766104
109	Spotted Dove	*Spilopelia chinensis*	Good	Adult	4	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	No	22.064991	-159.766104
109	Great Frigatebird	*Fregata minor*	Good	Adult	1	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	Yes	22.064991	-159.766104
109	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	12	Threatened	Endangered	Kiawe and koa haole, dry ditch, side drainage with water	Yes	Redacted	Redacted
110	Common Waxbill	*Estrilda astrild*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.064191	-159.758532
110	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.064191	-159.758532
110	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.064191	-159.758532
110	White-tailed Tropicbird	*Phaethon lepturus*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	Yes	22.064191	-159.758532
110	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.064191	-159.758532
110	Feral Goat	*Capra hircus*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.064191	-159.758532
111	Grey Francolin	*Ortygornis pondicerianus*	Good	Adult	3	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.061575	-159.758805

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
111	Feral Goat	*Capra hircus*	Good	Adult	1	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.061575	-159.758805
111	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.061575	-159.758805
111	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	1	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	Yes	22.061575	-159.758805
111	Common Waxbill	*Estrilda astrild*	Good	Adult	5	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.061575	-159.758805
111	Spotted Dove	*Spilopelia chinensis*	Good	Adult	4	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.061575	-159.758805
111	Zebra Dove	*Geopelia striata*	Good	Adult	10	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.061575	-159.758805
111	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	3	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.061575	-159.758805
112	Cattle Egret	*Bubulcus ibis*	Good	Adult	4	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	Yes	22.055048	-159.764327
112	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	No	22.055048	-159.764327
112	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	No	22.055048	-159.764327
112	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	Yes	22.055048	-159.764327
112	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	No	22.055048	-159.764327
113	Common Waxbill	*Estrilda astrild*	Good	Adult	12	NA	NA	Actively cultivated agricultural land, fallow	No	22.050582	-159.767817
113	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	10	Threatened	Endangered	Actively cultivated agricultural land, fallow	Yes	Redacted	Redacted
113	Rock Pigeon	*Columba livia*	Good	Adult	4	NA	NA	Actively cultivated agricultural land, fallow	No	22.050582	-159.767817
113	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	3	NA	NA	Actively cultivated agricultural land, fallow	Yes	22.050582	-159.767817
113	Cattle Egret	*Bubulcus ibis*	Good	Adult	300	NA	NA	Actively cultivated agricultural land, fallow	Yes	22.050582	-159.767817
113	Hawaiian Short-eared Owl	*Asio flammeus sandwichensis*	Good	Adult	3	NA	NA	Actively cultivated agricultural land, fallow	Yes	Redacted	Redacted
113	Zebra Dove	*Geopelia striata*	Good	Adult	10	NA	NA	Actively cultivated agricultural land, fallow	No	22.050582	-159.767817
113	Common Myna	*Acridotheres tristis*	Good	Adult	9	NA	NA	Actively cultivated agricultural land, fallow	No	22.050582	-159.767817
114	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	2	NA	NA	Kiawe koa haole scrub, dry, no path or access	Yes	22.048318	-159.770356
114	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	Yes	22.048318	-159.770356

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*[1]	*Longitude*
114	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.048318	-159.770356
114	Warbling White-eye	*Zosterops japonicus*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.048318	-159.770356
114	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.048318	-159.770356
114	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	Yes	22.048318	-159.770356
114	Java Sparrow	*Padda oryzivora*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.048318	-159.770356
114	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	Yes	22.048318	-159.770356
114	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.048318	-159.770356
115	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	6	NA	NA	Dry canal, papyrus weed, koa haole scrub	No	22.053836	-159.776477
115	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	2	NA	NA	Dry canal, papyrus weed, koa haole scrub	Yes	22.053836	-159.776477
115	Warbling White-eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Dry canal, papyrus weed, koa haole scrub	No	22.053836	-159.776477
115	Zebra Dove	*Geopelia striata*	Good	Adult	10	NA	NA	Dry canal, papyrus weed, koa haole scrub	No	22.053836	-159.776477
115	African Silverbill	*Euodice cantans*	Good	Adult	1	NA	NA	Dry canal, papyrus weed, koa haole scrub	No	22.053836	-159.776477
116	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Agricultural fallow field	No	22.043526	-159.772066
116	African Silverbill	*Euodice cantans*	Good	Adult	2	NA	NA	Agricultural fallow field	No	22.043526	-159.772066
116	Warbling White-eye	*Zosterops japonicus*	Good	Adult	4	NA	NA	Agricultural fallow field	No	22.043526	-159.772066
116	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Agricultural fallow field	No	22.043526	-159.772066
116	Scaly-breasted Munia	*Lonchura punctulata*	Good	Adult	5	NA	NA	Agricultural fallow field	No	22.043526	-159.772066
117	Cattle Egret	*Bubulcus ibis*	Good	Adult	10	NA	NA	Agricultural fields	Yes	22.042918	-159.766887
117	Spotted Dove	*Spilopelia chinensis*	Good	Adult	5	NA	NA	Agricultural fields	No	22.042918	-159.766887
117	Chestnut Munia	*Lonchura atricapilla*	Good	Adult	4	NA	NA	Agricultural fields	No	22.042918	-159.766887
118	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	4	Threatened	Endangered	Reservoir, surrounded by koa haole/kiawe scrub	Yes	Redacted	Redacted
118	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	3	Endangered	Endangered	Reservoir, surrounded by koa haole/kiawe scrub	Yes	Redacted	Redacted
118	Hawaiian Coot	*Fulica alai*	Good	Adult	1	Endangered	Endangered	Reservoir, surrounded by koa haole/kiawe scrub	Yes	Redacted	Redacted

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
118	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	23	Threatened	Endangered	Reservoir, surrounded by koa haole/kiawe scrub	Yes	Redacted	Redacted
118	Spotted Dove	*Spilopelia chinensis*	Good	Adult	4	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	No	22.044356	-159.760537
118	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	Yes	22.044356	-159.760537
118	Common Myna	*Acridotheres tristis*	Good	Adult	4	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	No	22.044356	-159.760537
118	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	1	Endangered	Endangered	Reservoir, surrounded by koa haole/kiawe scrub	Yes	Redacted	Redacted
118	Hawaiian Short-eared Owl	*Asio flammeus sandwichensis*	Good	Adult	1	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	Yes	Redacted	Redacted
119	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.039792	-159.760346
119	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	1	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	Yes	22.039792	-159.760346
119	African Silverbill	*Euodice cantans*	Good	Adult	5	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.039792	-159.760346
119	Common Myna	*Acridotheres tristis*	Good	Adult	6	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.039792	-159.760346
119	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.039792	-159.760346
119	Feral Pig	*Sus scrofa*	Good	Adult	1	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.039792	-159.760346
119	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	Yes	22.039792	-159.760346
119	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	3	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.039792	-159.760346
119	Red Junglefowl	*Gallus gallus*	Good	Adult	3	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.039792	-159.760346
119	Grey Francolin	*Ortygornis pondicerianus*	Good	Adult	1	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.039792	-159.760346
119	House Sparrow	*Passer domesticus*	Good	Adult	1	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.039792	-159.760346
120	Warbling White-eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Wiliwili trees, steep rock habitat, koa haole scrubland	No	22.040406	-159.754166
120	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Wiliwili trees, steep rock habitat, koa haole scrubland	No	22.040406	-159.754166
120	White-rumped Shama	*Copsychus malabaricus*	Good	Adult	2	NA	NA	Wiliwili trees, steep rock habitat, koa haole scrubland	No	22.040406	-159.754166
121	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Koa haole scrubland	No	22.037038	-159.754687
121	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Koa haole scrubland	Yes	22.037038	-159.754687
122	Great Frigatebird	*Fregata minor*	Good	Adult	1	NA	NA	Dry reservoir	Yes	22.031914	-159.757611
122	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Dry reservoir	No	22.031914	-159.757611

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*[1]	*Longitude*
123	Cattle Egret	*Bubulcus ibis*	Good	Adult	6	NA	NA	Agricultural field	Yes	22.033104	-159.763953
123	Spotted Dove	*Spilopelia chinensis*	Good	Adult	6	NA	NA	Agricultural field	No	22.033104	-159.763953
123	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Agricultural field	No	22.033104	-159.763953
124	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	2	NA	NA	Sand quarry, ponded water with scrub vegetation	Yes	22.032901	-159.771757
124	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.032901	-159.771757
124	Cattle Egret	*Bubulcus ibis*	Good	Adult	7	NA	NA	Sand quarry, ponded water with scrub vegetation	Yes	22.032901	-159.771757
124	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	3	Endangered	Endangered	Sand quarry, ponded water with scrub vegetation	Yes	Redacted	Redacted
124	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.032901	-159.771757
124	Chestnut Munia	*Lonchura atricapilla*	Good	Adult	1	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.032901	-159.771757
124	African Silverbill	*Euodice cantans*	Good	Adult	16	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.032901	-159.771757
125	Scaly-breasted Munia	*Lonchura punctulata*	Good	Adult	4	NA	NA	Unmanaged open grass/koa haole kiawe scrub land adjacent to sand pit	No	22.030747	-159.773771
125	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Unmanaged open grass/koa haole kiawe scrub land adjacent to sand pit	No	22.030747	-159.773771
125	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Unmanaged open grass/koa haole kiawe scrub land adjacent to sand pit	No	22.030747	-159.773771
126	Warbling White-eye	*Zosterops japonicus*	Good	Adult	11	NA	NA	Fallow agricultural kiawe, koa haole scrub	No	22.017754	-159.76354
126	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Fallow agricultural kiawe, koa haole scrub	Yes	22.017754	-159.76354
126	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Fallow agricultural kiawe, koa haole scrub	No	22.017754	-159.76354
126	Rock Pigeon	*Columba livia*	Good	Adult	4	NA	NA	Fallow agricultural kiawe, koa haole scrub	No	22.017754	-159.76354
127	Hawaiian Coot	*Fulica alai*	Good	Adult	5	Endangered	Endangered	Irrigation canal, kiawe/koa haole scrub	Yes	Redacted	Redacted
127	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Irrigation canal, kiawe/koa haole scrub	Yes	Redacted	Redacted
127	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	1	NA	NA	Irrigation canal, kiawe/koa haole scrub	Yes	22.012654	-159.776645
127	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Irrigation canal, kiawe/koa haole scrub	No	22.012654	-159.776645
128	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Koa haole and kiawe forest, sand dune slope	No	22.080443	-159.761107
128	Moth Skink	*Lipinia noctua*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, sand dune slope	No	22.080443	-159.761107
128	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Koa haole and kiawe forest, sand dune slope	No	22.080443	-159.761107

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
128	White-rumped Shama	*Copsychus malabaricus*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, sand dune slope	No	22.080443	-159.761107
129	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	1	NA	NA	Irrigation canal, kiawe/koa haole scrub	Yes	22.037341	-159.779977
129	Warbling White-eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Irrigation canal, kiawe/koa haole scrub	No	22.037341	-159.779977
130	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	2	NA	NA	Koa haole and kiawe scrub along irrigation canal	Yes	22.035223	-159.780203
130	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Koa haole and kiawe scrub along irrigation canal	Yes	22.035223	-159.780203
130	House Sparrow	*Passer domesticus*	Good	Adult	3	NA	NA	Koa haole and kiawe scrub along irrigation canal	No	22.035223	-159.780203
130	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Koa haole and kiawe scrub along irrigation canal	No	22.035223	-159.780203
131	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Irrigation canal, koa haole scrub on banks	No	22.030548	-159.780079
131	Warbling White-eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Irrigation canal, koa haole scrub on banks	No	22.030548	-159.780079
132	African Silverbill	*Euodice cantans*	Good	Adult	2	NA	NA	Irrigation canal, koa haole scrub on banks	No	22.025876	-159.781842
132	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	1	NA	NA	Irrigation canal, koa haole scrub on banks	Yes	22.025876	-159.781842
132	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	2	Threatened	Endangered	Irrigation canal, koa haole scrub on banks	Yes	Redacted	Redacted
132	Warbling White-eye	*Zosterops japonicus*	Good	Adult	1	NA	NA	Irrigation canal, koa haole scrub on banks	No	22.025876	-159.781842
133	Hawaiian Short-eared Owl	*Asio flammeus sandwichensis*	Good	Adult	1	NA	NA	Mowed grass and kiawe-koa haole	Yes	Redacted	Redacted
133	Chestnut Munia	*Lonchura atricapilla*	Good	Adult	5	NA	NA	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	No	22.016005	-159.781408
133	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	4	NA	NA	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	Yes	22.016005	-159.781408
133	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	3	NA	NA	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	Yes	22.016005	-159.781408
133	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	No	22.016005	-159.781408

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*[1]	*Longitude*
133	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	No	22.016005	-159.781408
133	Hawaiian Coot	*Fulica alai*	Good	Adult	3	Endangered	Endangered	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	Yes	Redacted	Redacted
133	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	Yes	22.016005	-159.781408
133	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	4	NA	NA	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	No	22.016005	-159.781408
133	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	Yes	Redacted	Redacted
133	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	1	Endangered	Endangered	Maintained turf near airfield, with irrigation canal containing stagnant water. Koa haole and kiawe scrub adjacent to point	Yes	Redacted	Redacted
134	Grey Francolin	*Ortygornis pondicerianus*	Good	Adult	2	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.020817	-159.776396
134	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.020817	-159.776396
134	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Kiawe and koa haole scrub, irrigation canal	Yes	22.020817	-159.776396
134	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	3	Endangered	Endangered	Kiawe and koa haole scrub, irrigation canal	Yes	Redacted	Redacted
134	African Silverbill	*Euodice cantans*	Good	Adult	4	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.020817	-159.776396
135	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	3	NA	NA	Kiawe and koa haole scrub, irrigation canal	Yes	22.022254	-159.774708
135	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	1	Endangered	Endangered	Kiawe and koa haole scrub, irrigation canal	Yes	Redacted	Redacted
135	Warbling White-eye	*Zosterops japonicus*	Good	Adult	6	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.022254	-159.774708
135	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.022254	-159.774708
136	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Kiawe and koa haole scrub, irrigation canal	Yes	22.021109	-159.772135

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
136	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	1	Endangered	Endangered	Kiawe and koa haole scrub, irrigation canal	Yes	Redacted	Redacted
136	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Kiawe and koa haole scrub, irrigation canal	Yes	Redacted	Redacted
136	African Silverbill	*Euodice cantans*	Good	Adult	3	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.021109	-159.772135
137	Donkey	*Equus asinus*	Good	Adult	1	NA	NA	Fallow field, unmanaged land	No	22.019384	-159.767604
137	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	2	Threatened	Endangered	Fallow field, unmanaged land	Yes	Redacted	Redacted
137	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Fallow field, unmanaged land	Yes	22.019384	-159.767604
137	Warbling White-eye	*Zosterops japonicus*	Good	Adult	4	NA	NA	Fallow field, unmanaged land	No	22.019384	-159.767604
137	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Fallow field, unmanaged land	Yes	22.019384	-159.767604
138	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Kiawe and koa haole scrub	No	22.019104	-159.765084
138	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Kiawe and koa haole scrub	No	22.019104	-159.765084
138	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Kiawe and koa haole scrub	No	22.019104	-159.765084
139	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Kiawe, koa haole scrub, irrigation canal	No	22.022656	-159.763783
140	Warbling White-eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Kiawe scrub, guinea grass	No	22.026696	-159.757563
140	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Kiawe scrub, guinea grass	No	22.026696	-159.757563
141	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	30	Threatened	Endangered	Reservoir	Yes	Redacted	Redacted
141	Hawaiian Coot	*Fulica alai*	Good	Adult	4	Endangered	Endangered	Reservoir	Yes	Redacted	Redacted
141	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	1	Endangered	Endangered	Reservoir	Yes	Redacted	Redacted
141	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Reservoir	Yes	22.023442	-159.753029
141	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Reservoir	Yes	Redacted	Redacted
141	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Reservoir	Yes	22.023442	-159.753029
142	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Scrub grassland, koa haole and kiawe scrub	No	22.020896	-159.752939
142	Common Myna	*Acridotheres tristis*	Good	Adult	5	NA	NA	Scrub grassland, koa haole and kiawe scrub	No	22.020896	-159.752939
142	Warbling White-eye	*Zosterops japonicus*	Good	Adult	6	NA	NA	Scrub grassland, koa haole and kiawe scrub	No	22.020896	-159.752939
142	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Scrub grassland, koa haole and kiawe scrub	No	22.020896	-159.752939

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
142	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Scrub grassland, koa haole and kiawe scrub	Yes	22.020896	-159.752939
143	Feral Goat	*Capra hircus*	Good	Adult	11	NA	NA	Koa haole scrub land	No	22.020937	-159.750121
143	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Koa haole scrub land	No	22.020937	-159.750121
143	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Koa haole scrub land	Yes	22.020937	-159.750121
143	Warbling White-eye	*Zosterops japonicus*	Good	Adult	6	NA	NA	Koa haole scrub land	No	22.020937	-159.750121
144	Warbling White-eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Kiawe scrub, guinea grass	No	22.019041	-159.754934
144	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Kiawe scrub, guinea grass	No	22.019041	-159.754934
145	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Fallow agricultural field	Yes	22.021861	-159.757327
145	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Fallow agricultural field	No	22.021861	-159.757327
145	Spotted Dove	*Spilopelia chinensis*	Good	Adult	4	NA	NA	Fallow agricultural field	No	22.021861	-159.757327
145	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Fallow agricultural field	No	22.021861	-159.757327
145	Warbling White-eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Fallow agricultural field	No	22.021861	-159.757327
146	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	8	Threatened	Endangered	Unleased land, fallow field, irrigation canal	Yes	Redacted	Redacted
146	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	2	Endangered	Endangered	Unleased land, fallow field, irrigation canal	Yes	Redacted	Redacted
146	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	1	NA	NA	Unleased land, fallow field, irrigation canal	Yes	22.015688	-159.766786
146	Spotted Dove	*Spilopelia chinensis*	Good	Adult	7	NA	NA	Unleased land, fallow field, irrigation canal	No	22.015688	-159.766786
146	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Unleased land, fallow field, irrigation canal	Yes	22.015688	-159.766786
146	Hawaiian Coot	*Fulica alai*	Good	Adult	2	Endangered	Endangered	Unleased land, fallow field, irrigation canal	Yes	Redacted	Redacted
146	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	3	Endangered	Endangered	Unleased land, fallow field, irrigation canal	Yes	Redacted	Redacted
147	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	2	Threatened	Endangered	Water present, open mudflats, wetlands scrub, koa haole	Yes	Redacted	Redacted
147	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Water present, open mudflats, wetlands scrub, koa haole	Yes	Redacted	Redacted
147	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	Yes	22.017072	-159.774013
147	Hawaiian Coot	*Fulica alai*	Good	Adult	2	Endangered	Endangered	Water present, open mudflats, wetlands scrub, koa haole	Yes	Redacted	Redacted
147	Common Waxbill	*Estrilda astrild*	Good	Adult	6	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	No	22.017072	-159.774013

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
147	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	2	Endangered	Endangered	Water present, open mudflats, wetlands scrub, koa haole	Yes	Redacted	Redacted
147	Rock Pigeon	*Columba livia*	Good	Adult	1	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	No	22.017072	-159.774013
147	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	No	22.017072	-159.774013
147	Zebra Dove	*Geopelia striata*	Good	Adult	10	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	No	22.017072	-159.774013
147	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	No	22.017072	-159.774013
147	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	2	Endangered	Endangered	Water present, open mudflats, wetlands scrub, koa haole	Yes	Redacted	Redacted
148	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	2	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
148	Cattle Egret	*Bubulcus ibis*	Good	Adult	4	NA	NA	Flooded land	Yes	22.01287	-159.763573
148	Hawaiian Coot	*Fulica alai*	Good	Adult	3	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
148	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Flooded land	Yes	22.01287	-159.763573
148	Rock Pigeon	*Columba livia*	Good	Adult	18	NA	NA	Flooded land	No	22.01287	-159.763573
148	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	8	Threatened	Endangered	Flooded land	Yes	Redacted	Redacted
148	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	1	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
148	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Flooded land	Yes	22.01287	-159.763573
149	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	1	NA	NA	Flooded land	Yes	22.009594	-159.760129
149	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	2	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
149	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Flooded land	Yes	22.009594	-159.760129
149	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Flooded land	Yes	22.009594	-159.760129
150	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	1	Endangered	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
150	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	3	Endangered	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
150	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	5	Endangered	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
150	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Irrigation canal, unleased land	No	22.005098	-159.756795
150	House Finch	*Haemorhous mexicanus*	Good	Adult	3	NA	NA	Irrigation canal, unleased land	Yes	22.005098	-159.756795

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
150	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	2	Threatened	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
151	Cane Toad	*Rhinella marina*	Good	Adult	4	NA	NA	Guinea grass and koa haole	No	22.005052	-159.752451
151	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Guinea grass and koa haole	Yes	22.005052	-159.752451
151	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Guinea grass and koa haole	No	22.005052	-159.752451
151	House Finch	*Haemorhous mexicanus*	Good	Adult	6	NA	NA	Guinea grass and koa haole	Yes	22.005052	-159.752451
151	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Guinea grass and koa haole	No	22.005052	-159.752451
151	Black Francolin	*Francolinus francolinus*	Good	Adult	3	NA	NA	Guinea grass and koa haole	No	22.005052	-159.752451
151	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Guinea grass and koa haole	No	22.005052	-159.752451
152	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Agricultural field	Yes	22.007936	-159.75139
152	Black Francolin	*Francolinus francolinus*	Good	Adult	3	NA	NA	Agricultural field	No	22.007936	-159.75139
152	Java Sparrow	*Padda oryzivora*	Good	Adult	3	NA	NA	Agricultural field	No	22.007936	-159.75139
152	Common Myna	*Acridotheres tristis*	Good	Adult	6	NA	NA	Agricultural field	No	22.007936	-159.75139
152	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	10	Threatened	Endangered	Agricultural field	Yes	Redacted	Redacted
152	Zebra Dove	*Geopelia striata*	Good	Adult	8	NA	NA	Agricultural field	No	22.007936	-159.75139
152	Rock Pigeon	*Columba livia*	Good	Adult	21	NA	NA	Agricultural field	No	22.007936	-159.75139
152	Warbling White-eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Agricultural field	No	22.007936	-159.75139
153	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Fallow field	Yes	22.010985	-159.752318
153	House Finch	*Haemorhous mexicanus*	Good	Adult	12	NA	NA	Fallow field	Yes	22.010985	-159.752318
153	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Fallow field	No	22.010985	-159.752318
153	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Fallow field	No	22.010985	-159.752318
154	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Fallow field, uncultivated, guinea grass	No	22.012963	-159.754787
154	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Fallow field, uncultivated, guinea grass	Yes	22.012963	-159.754787
154	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Fallow field, uncultivated, guinea grass	No	22.012963	-159.754787
155	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	5	Endangered	Endangered	Reservoir, guinea grass, monkey pod	Yes	Redacted	Redacted
155	Common Myna	*Acridotheres tristis*	Good	Adult	12	NA	NA	Reservoir, guinea grass, monkey pod	No	22.008833	-159.745956
155	Warbling White-eye	*Zosterops japonicus*	Good	Adult	4	NA	NA	Reservoir, guinea grass, monkey pod	No	22.008833	-159.745956
155	Zebra Dove	*Geopelia striata*	Good	Adult	7	NA	NA	Reservoir, guinea grass, monkey pod	No	22.008833	-159.745956

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
156	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Koa haole, kiawe, guinea grass scrub	No	22.01007	-159.744501
156	Common Waxbill	*Estrilda astrild*	Good	Adult	2	NA	NA	Koa haole, kiawe, guinea grass scrub	No	22.01007	-159.744501
156	Warbling White-eye	*Zosterops japonicus*	Good	Adult	1	NA	NA	Koa haole, kiawe, guinea grass scrub	No	22.01007	-159.744501
157	Java Sparrow	*Padda oryzivora*	Good	Adult	12	NA	NA	Guinea grass and koa haole	No	22.005785	-159.748661
157	Cattle Egret	*Bubulcus ibis*	Good	Adult	4	NA	NA	Guinea grass and koa haole	Yes	22.005785	-159.748661
157	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Guinea grass and koa haole	No	22.005785	-159.748661
157	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Guinea grass and koa haole	No	22.005785	-159.748661
157	Zebra Dove	*Geopelia striata*	Good	Adult	4	NA	NA	Guinea grass and koa haole	No	22.005785	-159.748661
157	Warbling White-eye	*Zosterops japonicus*	Good	Adult	6	NA	NA	Guinea grass and koa haole	No	22.005785	-159.748661
158	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Agricultural field	Yes	22.006573	-159.760479
158	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Agricultural field	No	22.006573	-159.760479
158	Rock Pigeon	*Columba livia*	Good	Adult	3	NA	NA	Agricultural field	No	22.006573	-159.760479
158	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Agricultural field	No	22.006573	-159.760479
159	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	6	NA	NA	Ditch, adjacent to agricultural lands, vegetation scrub	Yes	22.001922	-159.761726
159	Common Myna	*Acridotheres tristis*	Good	Adult	12	NA	NA	Ditch, adjacent to agricultural lands, vegetation scrub	No	22.001922	-159.761726
159	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Ditch, adjacent to agricultural lands, vegetation scrub	No	22.001922	-159.761726
159	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Ditch, adjacent to agricultural lands, vegetation scrub	Yes	22.001922	-159.761726
159	Warbling White-eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Ditch, adjacent to agricultural lands, vegetation scrub	No	22.001922	-159.761726
160	Great Frigatebird	*Fregata minor*	Good	Adult	1	NA	NA	Agricultural field	Yes	21.998388	-159.754505
160	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	1	NA	NA	Agricultural field	Yes	21.998388	-159.754505
160	Rock Pigeon	*Columba livia*	Good	Adult	8	NA	NA	Agricultural field	No	21.998388	-159.754505
160	Common Myna	*Acridotheres tristis*	Good	Adult	6	NA	NA	Agricultural field	No	21.998388	-159.754505
160	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Agricultural field	No	21.998388	-159.754505
160	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Agricultural field	Yes	21.998388	-159.754505
161	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Ditch with koa haole	Yes	22.000107	-159.750996
161	Warbling White-eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Ditch with koa haole	No	22.000107	-159.750996
161	Rock Pigeon	*Columba livia*	Good	Adult	2	NA	NA	Ditch with koa haole	No	22.000107	-159.750996

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
161	Common Myna	*Acridotheres tristis*	Good	Adult	8	NA	NA	Ditch with koa haole	No	22.000107	-159.750996
161	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Ditch with koa haole	Yes	22.000107	-159.750996
161	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Ditch with koa haole	Yes	Redacted	Redacted
162	Cattle Egret	*Bubulcus ibis*	Good	Adult	57	NA	NA	Agricultural land and koa haole	Yes	22.000353	-159.742549
162	Common Myna	*Acridotheres tristis*	Good	Adult	6	NA	NA	Agricultural land and koa haole	No	22.000353	-159.742549
162	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Agricultural land and koa haole	No	22.000353	-159.742549
162	House Finch	*Haemorhous mexicanus*	Good	Adult	3	NA	NA	Agricultural land and koa haole	Yes	22.000353	-159.742549
162	Zebra Dove	*Geopelia striata*	Good	Adult	4	NA	NA	Agricultural land and koa haole	No	22.000353	-159.742549
163	Zebra Dove	*Geopelia striata*	Good	Adult	4	NA	NA	Grass and koa haole	No	22.000017	-159.739938
163	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Grass and koa haole	Yes	22.000017	-159.739938
163	House Finch	*Haemorhous mexicanus*	Good	Adult	4	NA	NA	Grass and koa haole	Yes	22.000017	-159.739938
163	White-rumped Shama	*Copsychus malabaricus*	Good	Adult	1	NA	NA	Grass and koa haole	No	22.000017	-159.739938
164	House Finch	*Haemorhous mexicanus*	Good	Adult	6	NA	NA	Ditch, kiawe, and koa haole	Yes	22.000627	-159.736323
164	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	1	Endangered	Endangered	Ditch, kiawe, and koa haole	Yes	Redacted	Redacted
165	Warbling White-eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Kiawe and koa haole	No	21.999328	-159.737248
165	White-rumped Shama	*Copsychus malabaricus*	Good	Adult	2	NA	NA	Kiawe and koa haole	No	21.999328	-159.737248
165	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Kiawe and koa haole	No	21.999328	-159.737248
166	Cattle Egret	*Bubulcus ibis*	Good	Adult	12	NA	NA	Agricultural field	Yes	21.99631	-159.741109
166	Common Waxbill	*Estrilda astrild*	Good	Adult	4	NA	NA	Agricultural field	No	21.99631	-159.741109
166	Zebra Dove	*Geopelia striata*	Good	Adult	9	NA	NA	Agricultural field	No	21.99631	-159.741109
166	Black Francolin	*Francolinus francolinus*	Good	Adult	1	NA	NA	Agricultural field	No	21.99631	-159.741109
167	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Guinea grass, koa haole, ditch	Yes	21.994865	-159.745839
167	Warbling White-eye	*Zosterops japonicus*	Good	Adult	4	NA	NA	Guinea grass, koa haole, ditch	No	21.994865	-159.745839
167	Rock Pigeon	*Columba livia*	Good	Adult	1	NA	NA	Guinea grass, koa haole, ditch	No	21.994865	-159.745839
167	Black-tailed Deer	*Odocoileus hemionus hemionus*	Good	Adult	1	NA	NA	Guinea grass, koa haole, ditch	No	21.994865	-159.745839
168	Cattle Egret	*Bubulcus ibis*	Good	Adult	13	NA	NA	Agricultural field and koa haole	Yes	21.99421	-159.748654
168	Great Frigatebird	*Fregata minor*	Good	Adult	1	NA	NA	Agricultural field and koa haole	Yes	21.99421	-159.748654

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
168	Common Myna	*Acridotheres tristis*	Good	Adult	24	NA	NA	Agricultural field and koa haole	No	21.99421	-159.748654
168	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	1	NA	NA	Agricultural field and koa haole	Yes	21.99421	-159.748654
168	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Agricultural field and koa haole	No	21.99421	-159.748654
168	Spotted Dove	*Spilopelia chinensis*	Good	Adult	4	NA	NA	Agricultural field and koa haole	No	21.99421	-159.748654
168	Warbling White-eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Agricultural field and koa haole	No	21.99421	-159.748654
169	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Kiawe, koa haole scrub, ditch	No	22.027333	-159.765519
169	African Silverbill	*Euodice cantans*	Good	Adult	2	NA	NA	Kiawe, koa haole scrub, ditch	No	22.027333	-159.765519
170	White-tailed Tropicbird	*Phaethon lepturus*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	Yes	22.067301	-159.754847
171	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	5	Threatened	Endangered	Flooded land	Yes	Redacted	Redacted
171	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	4	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
171	Cattle Egret	*Bubulcus ibis*	Good	Adult	5	NA	NA	Flooded land	Yes	22.010633	-159.761177
171	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	3	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
171	Hawaiian Coot	*Fulica alai*	Good	Adult	1	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
171	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
171	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	1	NA	NA	Flooded land	Yes	22.010633	-159.761177
171	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	4	NA	NA	Flooded land	Yes	22.010633	-159.761177
171	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	4	NA	NA	Flooded land	No	22.010633	-159.761177
172	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	2	NA	NA	Flooded land	Yes	22.005919	-159.756648
172	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	3	NA	NA	Flooded land	Yes	22.005919	-159.756648
172	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	6	Threatened	Endangered	Flooded land	Yes	Redacted	Redacted
172	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	3	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
172	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
172	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	8	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
172	Common Myna	*Acridotheres tristis*	Good	Adult	4	NA	NA	Flooded land	No	22.005919	-159.756648

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude[1]	Longitude
173	Black-crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Ditch, Guinea grass and koa haole	Yes	22.003239	-159.753801
173	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Ditch, Guinea grass and koa haole	Yes	Redacted	Redacted
174	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	2	Threatened	Endangered	Large open water, koa haole scrub, wetland fringe	Yes	Redacted	Redacted
174	Hawaiian Coot	*Fulica alai*	Good	Adult	3	Endangered	Endangered	Large open water, koa haole scrub, wetland fringe	Yes	Redacted	Redacted
174	Wandering Tattler	*Tringa incana*	Good	Adult	2	NA	NA	Large open water, koa haole scrub, wetland fringe	Yes	22.036699	-159.778251
300	Warbling White-eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Pines and lantana	No	22.12606	-159.717367
300	House Finch	*Haemorhous mexicanus*	Good	Adult	1	NA	NA	Pines and lantana	Yes	22.12606	-159.717367
300	Red-crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Pines and lantana	No	22.12606	-159.717367
301	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Pine, silky oak, lantana	No	22.126048	-159.71768
302	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Swollenfinger grass and pines	No	22.137896	-159.717534
302	Warbling White-eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Swollenfinger grass and pines	No	22.137896	-159.717534
302	White-tailed Tropicbird	*Phaethon lepturus*	Good	Adult	3	NA	NA	Steep rocky cliffs	Yes	22.137896	-159.717534
303	House Finch	*Haemorhous mexicanus*	Good	Adult	3	NA	NA	Swollenfinger grass and pines	Yes	22.138847	-159.718733
303	Warbling White-eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Swollenfinger grass and pines	No	22.138847	-159.718733
304	Warbling White-eye	*Zosterops japonicus*	Good	Adult	10	NA	NA	Swollenfinger grass and pines	No	22.138934	-159.719149
304	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Swollenfinger grass and pines	No	22.138934	-159.719149

Table B-2. Field Survey Event 2 Data Matrix

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
101	African Silverbill	*Euodice cantans*	Good	Adult	1	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	No	22.07983447	-159.7635997
101	House Sparrow	*Passer domesticus*	Good	Adult	2	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	No	22.07983447	-159.7635997
101	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	5	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	No	22.07983447	-159.7635997
101	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	Yes	22.07983447	-159.7635997
101	Rock Pigeon	*Columba livia*	Good	Adult	1	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	No	22.07983447	-159.7635997
101	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	4	NA	NA	Sand dunes, coastal scrub, naupaka/koa haole/kiawe dominant	No	22.07983447	-159.7635997
102	House Finch	*Haemorhous mexicanus*	Good	Adult	1	NA	NA	Sand dunes, koa haole and kiawe low scrubland	Yes	22.07465773	-159.7686571
102	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Sand dunes, koa haole and kiawe low scrubland	Yes	22.07465773	-159.7686571
102	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Sand dunes, koa haole and kiawe low scrubland	No	22.07465773	-159.7686571
102	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	1	NA	NA	Sand dunes, koa haole and kiawe low scrubland	No	22.07465773	-159.7686571
102	Black Francolin	*Francolinus francolinus*	Good	Adult	1	NA	NA	Sand dunes, koa haole and kiawe low scrubland	No	22.07465773	-159.7686571
102	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Sand dunes, koa haole and kiawe low scrubland	No	22.07465773	-159.7686571
103	House Sparrow	*Passer domesticus*	Good	Adult	2	NA	NA	Koa haole and kiawe forest, dirt/sand road	No	22.07403606	-159.7681494
103	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, dirt/sand road	No	22.07403606	-159.7681494
103	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, dirt/sand road	No	22.07403606	-159.7681494
103	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, dirt/sand road	No	22.07403606	-159.7681494
103	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Koa haole and kiawe forest, dirt/sand road	No	22.07403606	-159.7681494
104	House Finch	*Haemorhous mexicanus*	Good	Adult	1	NA	NA	Koa haole dominated scrubland	Yes	22.07175101	-159.7671439
104	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Koa haole dominated scrubland	Yes	22.07175101	-159.7671439
104	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Koa haole dominated scrubland	No	22.07175101	-159.7671439
104	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Koa haole dominated scrubland	No	22.07175101	-159.7671439

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
105	African Silverbill	*Euodice cantans*	Good	Adult	25	NA	NA	Active and fallow agricultural land	No	22.07504884	-159.7631649
105	Chestnut Munia	*Lonchura atricapilla*	Good	Adult	25	NA	NA	Active and fallow agricultural land	No	22.07504884	-159.7631649
105	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	11	NA	NA	Active and fallow agricultural land	Yes	22.07504884	-159.7631649
105	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Active and fallow agricultural land	No	22.07504884	-159.7631649
105	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Active and fallow agricultural land	No	22.07504884	-159.7631649
105	Zebra Dove	*Geopelia striata*	Good	Adult	4	NA	NA	Active and fallow agricultural land	No	22.07504884	-159.7631649
106	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Irrigation canal, kiawe and koa haole scrub	Yes	22.06860061	-159.7677718
106	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Irrigation canal, kiawe and koa haole scrub	No	22.06860061	-159.7677718
106	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Irrigation canal, kiawe and koa haole scrub	No	22.06860061	-159.7677718
107	Cattle Egret	*Bubulcus ibis*	Good	Adult	4	NA	NA	Active and fallow agricultural land	Yes	22.07131318	-159.762032
107	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Active and fallow agricultural land	No	22.07131318	-159.762032
107	House Finch	*Haemorhous mexicanus*	Good	Adult	5	NA	NA	Active and fallow agricultural land	Yes	22.07131318	-159.762032
107	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Active and fallow agricultural land	Yes	22.07131318	-159.762032
107	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Active and fallow agricultural land	No	22.07131318	-159.762032
107	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Active and fallow agricultural land	No	22.07131318	-159.762032
107	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Active and fallow agricultural land	No	22.07131318	-159.762032
107	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Active and fallow agricultural land	No	22.07131318	-159.762032
108	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Steep rocky cliffs, adjacent to active fallow agricultural land	Yes	22.07109512	-159.7568651
108	Common Myna	*Acridotheres tristis*	Good	Adult	10	NA	NA	Steep rocky cliffs, adjacent to active fallow agricultural land	No	22.07109512	-159.7568651
108	Feral Goat	*Capra hircus*	Good	Adult	2	NA	NA	Steep rocky cliffs, adjacent to active fallow agricultural land	No	22.07109512	-159.7568651
108	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active fallow agricultural land	Yes	22.07109512	-159.7568651
108	Rock Pigeon	*Columba livia*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active fallow agricultural land	No	22.07109512	-159.7568651
108	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Steep rocky cliffs, adjacent to active fallow agricultural land	No	22.07109512	-159.7568651
108	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Steep rocky cliffs, adjacent to active fallow agricultural land	No	22.07109512	-159.7568651

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
109	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	Yes	22.06508444	-159.76612
109	House Sparrow	*Passer domesticus*	Good	Adult	4	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	No	22.06508444	-159.76612
109	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	5	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	Yes	22.06508444	-159.76612
109	Scaly-Breasted Munia	*Lonchura punctulate*	Good	Adult	180	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	No	22.06508444	-159.76612
109	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	No	22.06508444	-159.76612
109	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Kiawe and koa haole, dry ditch, side drainage with water	No	22.06508444	-159.76612
110	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	Yes	22.06428671	-159.7584011
110	Feral Goat	*Capra hircus*	Good	Adult	3	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.06428671	-159.7584011
110	Black Francolin	*Francolinus francolinus*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.06428671	-159.7584011
110	Common Myna	*Acridotheres tristis*	Good	Adult	5	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.06428671	-159.7584011
110	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	2	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	Yes	22.06428671	-159.7584011
110	Rock Pigeon	*Columba livia*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.06428671	-159.7584011
110	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.06428671	-159.7584011
110	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Steep rocky cliffs, adjacent to active and fallow agricultural land	No	22.06428671	-159.7584011
111	Cattle Egret	*Bubulcus ibis*	Good	Adult	23	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	Yes	22.06152848	-159.7589066
111	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	1	Endangered	Endangered	Reservoir, scrub habitat, hau thicket, irrigation ditch	Yes	Redacted	Redacted
111	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	2	Endangered	Endangered	Reservoir, scrub habitat, hau thicket, irrigation ditch	Yes	Redacted	Redacted
111	Black Francolin	*Francolinus francolinus*	Good	Adult	1	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.06152848	-159.7589066
111	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.06152848	-159.7589066
111	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	2	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	Yes	22.06152848	-159.7589066

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
111	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.06152848	-159.7589066
111	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Reservoir, scrub habitat, hau thicket, irrigation ditch	No	22.06152848	-159.7589066
112	Cattle Egret	*Bubulcus ibis*	Good	Adult	9	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	Yes	22.05468696	-159.764374
112	Chestnut Munia	*Lonchura atricapilla*	Good	Adult	2	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	No	22.05468696	-159.764374
112	Scaly-Breasted Munia	*Lonchura punctulate*	Good	Adult	10	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	No	22.05468696	-159.764374
112	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	No	22.05468696	-159.764374
112	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	No	22.05468696	-159.764374
112	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Dry canal, kiawe/koa haole scrub, guinea grass, agricultural land adjacent	No	22.05468696	-159.764374
113	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Actively cultivated and fallow agricultural land	Yes	22.05036454	-159.7681726
113	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	1	Endangered	Endangered	Actively cultivated and fallow agricultural land	Yes	Redacted	Redacted
113	House Finch	*Haemorhous mexicanus*	Good	Adult	3	NA	NA	Actively cultivated and fallow agricultural land	Yes	22.05036454	-159.7681726
113	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Actively cultivated and fallow agricultural land	Yes	22.05036454	-159.7681726
113	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Actively cultivated and fallow agricultural land	No	22.05036454	-159.7681726
113	Scaly-Breasted Munia	*Lonchura punctulate*	Good	Adult	2	NA	NA	Actively cultivated and fallow agricultural land	No	22.05036454	-159.7681726
113	Spotted Dove	*Spilopelia chinensis*	Good	Adult	15	NA	NA	Actively cultivated and fallow agricultural land	No	22.05036454	-159.7681726
113	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	1	NA	NA	Actively cultivated and fallow agricultural land	No	22.05036454	-159.7681726
113	Zebra Dove	*Geopelia striata*	Good	Adult	10	NA	NA	Actively cultivated and fallow agricultural land	No	22.05036454	-159.7681726
114	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.0482618	-159.7703294

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
114	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	Yes	22.0482618	-159.7703294
114	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.0482618	-159.7703294
114	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.0482618	-159.7703294
114	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	3	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.0482618	-159.7703294
114	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Kiawe koa haole scrub, dry, no path or access	No	22.0482618	-159.7703294
115	Common Myna	*Acridotheres tristis*	Good	Adult	5	NA	NA	Dry ditch, papyrus weed, koa haole scrub	No	22.05378003	-159.7764138
115	House Sparrow	*Passer domesticus*	Good	Adult	5	NA	NA	Dry ditch, papyrus weed, koa haole scrub	No	22.05378003	-159.7764138
115	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Dry ditch, papyrus weed, koa haole scrub	Yes	22.05378003	-159.7764138
115	Rock Pigeon	*Columba livia*	Good	Adult	1	NA	NA	Dry ditch, papyrus weed, koa haole scrub	No	22.05378003	-159.7764138
115	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Dry ditch, papyrus weed, koa haole scrub	No	22.05378003	-159.7764138
115	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Dry ditch, papyrus weed, koa haole scrub	No	22.05378003	-159.7764138
115	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Dry ditch, papyrus weed, koa haole scrub	Yes	22.05378003	-159.7764138
116	African Silverbill	*Euodice cantans*	Good	Adult	20	NA	NA	Agricultural fallow field	No	22.04366158	-159.7719712
116	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Agricultural fallow field	Yes	22.04366158	-159.7719712
116	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	7	Endangered	Endangered	Agricultural fallow field	Yes	Redacted	Redacted
116	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Agricultural fallow field	Yes	22.04366158	-159.7719712
116	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Agricultural fallow field	No	22.04366158	-159.7719712
116	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	4	NA	NA	Agricultural fallow field	No	22.04366158	-159.7719712
116	Zebra Dove	*Geopelia striata*	Good	Adult	4	NA	NA	Agricultural fallow field	No	22.04366158	-159.7719712
117	Cane Toad	*Rhinella marina*	Good	Adult	1	NA	NA	Agricultural fields	No	22.04307442	-159.7669166
117	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Agricultural fields	Yes	22.04307442	-159.7669166
117	Common Myna	*Acridotheres tristis*	Good	Adult	9	NA	NA	Agricultural fields	No	22.04307442	-159.7669166
117	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	2	NA	NA	Agricultural fields	Yes	22.04307442	-159.7669166

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
117	Scaly-Breasted Munia	*Lonchura punctulate*	Good	Adult	20	NA	NA	Agricultural fields	No	22.04307442	-159.7669166
117	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Agricultural fields	No	22.04307442	-159.7669166
118	Cattle Egret	*Bubulcus ibis*	Good	Adult	19	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	Yes	22.04458225	-159.7612665
118	Feral Goat	*Capra hircus*	Good	Adult	2	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	No	22.04458225	-159.7612665
118	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	21	Endangered	Endangered	Reservoir, surrounded by koa haole/kiawe scrub	Yes	Redacted	Redacted
118	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	No	22.04458225	-159.7612665
118	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	No	22.04458225	-159.7612665
118	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	No	22.04458225	-159.7612665
118	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Reservoir, surrounded by koa haole/kiawe scrub	No	22.04458225	-159.7612665
119	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	Yes	22.03976394	-159.7604283
119	Common Myna	*Acridotheres tristis*	Good	Adult	5	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.03976394	-159.7604283
119	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	2	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	Yes	22.03976394	-159.7604283
119	Red Junglefowl	*Gallus gallus*	Good	Adult	3	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.03976394	-159.7604283
119	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.03976394	-159.7604283
119	Zebra Dove	*Geopelia striata*	Good	Adult	8	NA	NA	Adjacent to mango farm, koa haole scrub, irrigation canal with water	No	22.03976394	-159.7604283
120	Common Myna	*Acridotheres tristis*	Good	Adult	6	NA	NA	Wiliwili trees, steep rock habitat, koa haole scrubland	No	22.04049005	-159.7541637
120	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Wiliwili trees, steep rock habitat, koa haole scrubland	Yes	22.04049005	-159.7541637
120	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	4	NA	NA	Wiliwili trees, steep rock habitat, koa haole scrubland	No	22.04049005	-159.7541637
120	White-Tailed Tropic Bird	*Phaethon lepturus*	Good	Adult	1	NA	NA	Wiliwili trees, steep rock habitat, koa haole scrubland	Yes	22.04049005	-159.7541637
120	Zebra Dove	*Geopelia striata*	Good	Adult	4	NA	NA	Wiliwili trees, steep rock habitat, koa haole scrubland	No	22.04049005	-159.7541637
121	Common Myna	*Acridotheres tristis*	Good	Adult	5	NA	NA	Koa haole scrubland	No	22.03690242	-159.7547605

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
121	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Koa haole scrubland	No	22.03690242	-159.7547605
121	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Koa haole scrubland	No	22.03690242	-159.7547605
121	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	4	NA	NA	Koa haole scrubland	No	22.03690242	-159.7547605
122	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Dry reservoir	Yes	22.03175036	-159.7577246
122	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Dry reservoir	No	22.03175036	-159.7577246
122	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Dry reservoir	No	22.03175036	-159.7577246
122	Zebra Dove	*Geopelia striata*	Good	Adult	6	NA	NA	Dry reservoir	No	22.03175036	-159.7577246
123	Cattle Egret	*Bubulcus ibis*	Good	Adult	10	NA	NA	Agricultural field	Yes	22.0329723	-159.763853
123	Chestnut Munia	*Lonchura atricapilla*	Good	Adult	20	NA	NA	Agricultural field	No	22.0329723	-159.763853
123	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Agricultural field	No	22.0329723	-159.763853
123	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Agricultural field	No	22.0329723	-159.763853
123	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Agricultural field	No	22.0329723	-159.763853
123	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Agricultural field	No	22.0329723	-159.763853
124	African Silverbill	*Euodice cantans*	Good	Adult	20	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.03286791	-159.7717564
124	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Sand quarry, ponded water with scrub vegetation	Yes	22.03286791	-159.7717564
124	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Sand quarry, ponded water with scrub vegetation	Yes	22.03286791	-159.7717564
124	Chestnut Munia	*Lonchura atricapilla*	Good	Adult	1	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.03286791	-159.7717564
124	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.03286791	-159.7717564
124	Common Waxbill	*Estrilda astrild*	Good	Adult	80	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.03286791	-159.7717564
124	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	2	Endangered	Endangered	Sand quarry, ponded water with scrub vegetation	Yes	Redacted	Redacted
124	Hawaiian Short-Eared Owl	*Asio flammeus sandwichensis*	Good	Adult	1	NA	NA	Sand quarry, ponded water with scrub vegetation	Yes	Redacted	Redacted
124	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	2	NA	NA	Sand quarry, ponded water with scrub vegetation	Yes	22.03286791	-159.7717564
124	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	3	NA	NA	Sand quarry, ponded water with scrub vegetation	Yes	22.03286791	-159.7717564
124	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.03286791	-159.7717564

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
124	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.03286791	-159.7717564
124	Zebra Dove	*Geopelia striata*	Good	Adult	25	NA	NA	Sand quarry, ponded water with scrub vegetation	No	22.03286791	-159.7717564
125	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Unmanaged open grass/koa haole kiawe scrub land adjacent to sand pit	Yes	22.03072611	-159.7736248
125	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Unmanaged open grass/koa haole kiawe scrub land adjacent to sand pit	No	22.03072611	-159.7736248
125	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Unmanaged open grass/koa haole kiawe scrub land adjacent to sand pit	No	22.03072611	-159.7736248
126	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	5	Endangered	Endangered	Fallow agricultural kiawe, koa haole scrub	Yes	Redacted	Redacted
126	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	2	Endangered	Endangered	Fallow agricultural kiawe, koa haole scrub	Yes	Redacted	Redacted
126	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Fallow agricultural kiawe, koa haole scrub	Yes	22.01808202	-159.7640655
126	African Silverbill	*Euodice cantans*	Good	Adult	3	NA	NA	Fallow agricultural kiawe, koa haole scrub	No	22.01808202	-159.7640655
126	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Fallow agricultural kiawe, koa haole scrub	Yes	22.01808202	-159.7640655
126	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Fallow agricultural kiawe, koa haole scrub	No	22.01808202	-159.7640655
126	Zebra Dove	*Geopelia striata*	Good	Adult	4	NA	NA	Fallow agricultural kiawe, koa haole scrub	No	22.01808202	-159.7640655
127	African Silverbill	*Euodice cantans*	Good	Adult	3	NA	NA	Irrigation canal, kiawe/koa haole scrub	No	22.01253999	-159.7768534
127	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	3	NA	NA	Irrigation canal, kiawe/koa haole scrub	Yes	22.01253999	-159.7768534
127	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Irrigation canal, kiawe/koa haole scrub	Yes	22.01253999	-159.7768534
127	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	4	Endangered	Endangered	Irrigation canal, kiawe/koa haole scrub	Yes	Redacted	Redacted
127	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	2	Endangered	Endangered	Irrigation canal, kiawe/koa haole scrub	Yes	Redacted	Redacted
127	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Irrigation canal, kiawe/koa haole scrub	No	22.01253999	-159.7768534
127	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Irrigation canal, kiawe/koa haole scrub	No	22.01253999	-159.7768534
128	Black Francolin	*Francolinus francolinus*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, sand dune slope	No	22.0802767	-159.761311
128	House Finch	*Haemorhous mexicanus*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, sand dune slope	Yes	22.0802767	-159.761311
128	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	2	NA	NA	Koa haole and kiawe forest, sand dune slope	Yes	22.0802767	-159.761311

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
128	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Koa haole and kiawe forest, sand dune slope	No	22.0802767	-159.761311
128	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Koa haole and kiawe forest, sand dune slope	No	22.0802767	-159.761311
128	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, sand dune slope	No	22.0802767	-159.761311
128	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Koa haole and kiawe forest, sand dune slope	No	22.0802767	-159.761311
129	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Irrigation canal, kiawe/koa haole scrub	No	22.03733631	-159.7799903
129	House Sparrow	*Passer domesticus*	Good	Adult	5	NA	NA	Irrigation canal, kiawe/koa haole scrub	No	22.03733631	-159.7799903
129	Spotted Dove	*Spilopelia chinensis*	Good	Adult	5	NA	NA	Irrigation canal, kiawe/koa haole scrub	No	22.03733631	-159.7799903
130	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Koa haole and kiawe scrub along irrigation canal	No	22.03504979	-159.7802224
130	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Koa haole and kiawe scrub along irrigation canal	Yes	22.03504979	-159.7802224
130	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	3	NA	NA	Koa haole and kiawe scrub along irrigation canal	Yes	22.03504979	-159.7802224
130	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	2	NA	NA	Koa haole and kiawe scrub along irrigation canal	No	22.03504979	-159.7802224
130	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Koa haole and kiawe scrub along irrigation canal	No	22.03504979	-159.7802224
131	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Irrigation canal, koa haole scrub on banks	Yes	22.03052091	-159.7801199
131	House Sparrow	*Passer domesticus*	Good	Adult	1	NA	NA	Irrigation canal, koa haole scrub on banks	No	22.03052091	-159.7801199
131	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Irrigation canal, koa haole scrub on banks	Yes	22.03052091	-159.7801199
131	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	2	NA	NA	Irrigation canal, koa haole scrub on banks	Yes	22.03052091	-159.7801199
131	Red Junglefowl	*Gallus gallus*	Good	Adult	5	NA	NA	Irrigation canal, koa haole scrub on banks	No	22.03052091	-159.7801199
131	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Irrigation canal, koa haole scrub on banks	No	22.03052091	-159.7801199
132	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Irrigation canal, koa haole scrub on banks	No	22.02575435	-159.7819525
132	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	2	Endangered	Endangered	Irrigation canal, koa haole scrub on banks	Yes	Redacted	Redacted
132	Hawaiian Goose	*Branta sandvicensis*	Good	Chick	2	Endangered	Endangered	Irrigation canal, koa haole scrub on banks	Yes	Redacted	Redacted
133	Ruddy Turnstone	*Arenaria interpres*	Good	Adult	1	NA	NA	Maintained turf near airfield, with irrigation ditch containing stagnant	Yes	22.01597215	-159.7813804

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
								water. Koa-haole and kiawe scrub adjacent to point			
133	Saffron Finch	*Sicalis flaveola*	Good	Adult	2	NA	NA	Maintained turf near airfield, with irrigation ditch containing stagnant water. Koa-haole and kiawe scrub adjacent to point	No	22.01597215	-159.7813804
133	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Maintained turf near airfield, with irrigation ditch containing stagnant water. Koa-haole and kiawe scrub adjacent to point	Yes	22.01597215	-159.7813804
133	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Maintained turf near airfield, with irrigation ditch containing stagnant water. Koa-haole and kiawe scrub adjacent to point	No	22.01597215	-159.7813804
134	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	2	NA	NA	Kiawe and koa haole scrub, irrigation canal	Yes	22.02067347	-159.7764797
134	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.02067347	-159.7764797
134	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.02067347	-159.7764797
134	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Juvenile	1	Endangered	Endangered	Kiawe and koa haole scrub, irrigation canal	Yes	Redacted	Redacted
135	Cattle Egret	*Bubulcus ibis*	Good	Adult	5	NA	NA	Kiawe and koa haole scrub, irrigation canal	Yes	22.02229061	-159.7747401
135	Grey Francolin	*Ortygornis pondicerianus*	Good	Adult	1	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.02229061	-159.7747401
135	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.02229061	-159.7747401
135	Zebra Dove	*Geopelia striata*	Good	Adult	7	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.02229061	-159.7747401
136	Cattle Egret	*Bubulcus ibis*	Good	Adult	4	NA	NA	Kiawe and koa haole scrub, irrigation canal	Yes	22.02096825	-159.7719946
136	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	11	Endangered	Endangered	Kiawe and koa haole scrub, irrigation canal	Yes	Redacted	Redacted
136	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Kiawe and koa haole scrub, irrigation canal	Yes	22.02096825	-159.7719946
136	Scaly-Breasted Munia	*Lonchura punctulate*	Good	Adult	2	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.02096825	-159.7719946
136	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Kiawe and koa haole scrub, irrigation canal	No	22.02096825	-159.7719946
137	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Fallow field, unmanaged land	Yes	22.01943347	-159.7675337

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
137	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	6	Endangered	Endangered	Fallow field, unmanaged land	Yes	Redacted	Redacted
137	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Fallow field, unmanaged land	No	22.01943347	-159.7675337
137	Zebra Dove	*Geopelia striata*	Good	Adult	25	NA	NA	Fallow field, unmanaged land	No	22.01943347	-159.7675337
138	African Silverbill	*Euodice cantans*	Good	Adult	9	NA	NA	Kiawe and koa haole scrub	No	22.0190916	-159.7651063
138	Cattle Egret	*Bubulcus ibis*	Good	Adult	4	NA	NA	Kiawe and koa haole scrub	Yes	22.0190916	-159.7651063
138	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Kiawe and koa haole scrub	No	22.0190916	-159.7651063
138	Zebra Dove	*Geopelia striata*	Good	Adult	15	NA	NA	Kiawe and koa haole scrub	No	22.0190916	-159.7651063
139	Cattle Egret	*Bubulcus ibis*	Good	Adult	9	NA	NA	Kiawe, koa haole scrub, irrigation canal	Yes	22.02265428	-159.7639603
139	Spotted Dove	*Spilopelia chinensis*	Good	Adult	5	NA	NA	Kiawe, koa haole scrub, irrigation canal	No	22.02265428	-159.7639603
139	Zebra Dove	*Geopelia striata*	Good	Adult	8	NA	NA	Kiawe, koa haole scrub, irrigation canal	No	22.02265428	-159.7639603
140	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Kiawe scrub, guinea grass	Yes	22.0267624	-159.7575936
140	Common Myna	*Acridotheres tristis*	Good	Adult	3	NA	NA	Kiawe scrub, guinea grass	No	22.0267624	-159.7575936
140	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Kiawe scrub, guinea grass	Yes	22.0267624	-159.7575936
140	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Kiawe scrub, guinea grass	No	22.0267624	-159.7575936
140	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Kiawe scrub, guinea grass	No	22.0267624	-159.7575936
141	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	9	Endangered	Endangered	Reservoir	Yes	Redacted	Redacted
141	Hawaiian Coot	*Fulica alai*	Good	Adult	1	Endangered	Endangered	Reservoir	Yes	Redacted	Redacted
141	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Reservoir	No	22.02345477	-159.7529692
141	Zebra Dove	*Geopelia striata*	Good	Adult	2	NA	NA	Reservoir	No	22.02345477	-159.7529692
142	Rose-Ringed Parakeet	*Psittacula krameri*	Good	Adult	1	NA	NA	Scrub grassland, koa haole and kiawe scrub	No	22.02092396	-159.7529205
142	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Scrub grassland, koa haole and kiawe scrub	Yes	22.02092396	-159.7529205
142	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Scrub grassland, koa haole and kiawe scrub	No	22.02092396	-159.7529205
142	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Scrub grassland, koa haole and kiawe scrub	No	22.02092396	-159.7529205
142	Zebra Dove	*Geopelia striata*	Good	Adult	18	NA	NA	Scrub grassland, koa haole and kiawe scrub	No	22.02092396	-159.7529205
143	Common Myna	*Acridotheres tristis*	Good	Adult	12	NA	NA	Koa hale scrub land	No	22.02086512	-159.7500873
144	Cattle Egret	*Bubulcus ibis*	Good	Adult	6	NA	NA	Kiawe scrub, guinea grass	Yes	22.01906953	-159.7550123
144	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Kiawe scrub, guinea grass	Yes	22.01906953	-159.7550123
144	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Kiawe scrub, guinea grass	No	22.01906953	-159.7550123

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
144	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Kiawe scrub, guinea grass	No	22.01906953	-159.7550123
144	Zebra Dove	*Geopelia striata*	Good	Adult	4	NA	NA	Kiawe scrub, guinea grass	No	22.01906953	-159.7550123
145	Ring-Necked Pheasant	*Phasianus colchicus*	Good	Adult	3	NA	NA	Fallow agricultural field	No	22.02184088	-159.7573248
145	Cattle Egret	*Bubulcus ibis*	Good	Adult	5	NA	NA	Fallow agricultural field	Yes	22.02184088	-159.7573248
145	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Fallow agricultural field	No	22.02184088	-159.7573248
145	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	11	Endangered	Endangered	Fallow agricultural field	Yes	Redacted	Redacted
145	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	1	NA	NA	Fallow agricultural field	Yes	22.02184088	-159.7573248
145	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Fallow agricultural field	No	22.02184088	-159.7573248
145	Rock Pigeon	*Columba livia*	Good	Adult	8	NA	NA	Fallow agricultural field	No	22.02184088	-159.7573248
145	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Fallow agricultural field	No	22.02184088	-159.7573248
145	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Fallow agricultural field	No	22.02184088	-159.7573248
145	Zebra Dove	*Geopelia striata*	Good	Adult	28	NA	NA	Fallow agricultural field	No	22.02184088	-159.7573248
146	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	4	NA	NA	Unleased land, fallow field, irrigation canal	Yes	22.01575537	-159.7668283
146	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Unleased land, fallow field, irrigation canal	Yes	22.01575537	-159.7668283
146	Common Myna	*Acridotheres tristis*	Good	Adult	5	NA	NA	Unleased land, fallow field, irrigation canal	No	22.01575537	-159.7668283
146	Hawaiian Coot	*Fulica alai*	Good	Adult	4	Endangered	Endangered	Unleased land, fallow field, irrigation canal	Yes	Redacted	Redacted
146	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	10	Endangered	Endangered	Unleased land, fallow field, irrigation canal	Yes	Redacted	Redacted
146	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	22	Endangered	Endangered	Unleased land, fallow field, irrigation canal	Yes	Redacted	Redacted
146	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	31	Endangered	Endangered	Unleased land, fallow field, irrigation canal	Yes	Redacted	Redacted
146	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	3	NA	NA	Unleased land, fallow field, irrigation canal	Yes	22.01575537	-159.7668283
146	Rock Pigeon	*Columba livia*	Good	Adult	5	NA	NA	Unleased land, fallow field, irrigation canal	No	22.01575537	-159.7668283
146	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Unleased land, fallow field, irrigation canal	No	22.01575537	-159.7668283
146	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Unleased land, fallow field, irrigation canal	No	22.01575537	-159.7668283

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
146	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	1	Endangered	Endangered	Unleased land, fallow field, irrigation canal	Yes	Redacted	Redacted
146	Sanderling	*Calidris alba*	Good	Adult	5	NA	NA	Unleased land, fallow field, irrigation canal	Yes	22.01575537	-159.7668283
146	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Juvenile	1	NA	NA	Unleased land, fallow field, irrigation canal	Yes	22.01575537	-159.7668283
147	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	4	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	Yes	22.01722966	-159.7739508
147	Cane Toad	*Rhinella marina*	Good	Adult	3	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	No	22.01722966	-159.7739508
147	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	Yes	22.01722966	-159.7739508
147	Hawaiian Coot	*Fulica alai*	Good	Adult	3	Endangered	Endangered	Water present, open mudflats, wetlands scrub, koa haole	Yes	Redacted	Redacted
147	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	11	Endangered	Endangered	Water present, open mudflats, wetlands scrub, koa haole	Yes	Redacted	Redacted
147	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	Yes	22.01722966	-159.7739508
147	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	No	22.01722966	-159.7739508
147	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Water present, open mudflats, wetlands scrub, koa haole	No	22.01722966	-159.7739508
147	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Juvenile	3	Endangered	Endangered	Water present, open mudflats, wetlands scrub, koa haole	Yes	Redacted	Redacted
148	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	23	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
148	African Silverbill	*Euodice cantans*	Good	Adult	1	NA	NA	Flooded land	No	22.01299244	-159.7636238
148	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	3	NA	NA	Flooded land	Yes	22.01299244	-159.7636238
148	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Flooded land	Yes	22.01299244	-159.7636238
148	Hawaiian Coot	*Fulica alai*	Good	Adult	10	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
148	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	11	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
148	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	3	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
148	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	22	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
148	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	2	NA	NA	Flooded land	Yes	22.01299244	-159.7636238
148	Hawaiian Coot	*Fulica alai*	Good	Juvenile	2	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
148	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Juvenile	1	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude	Longitude
149	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	7	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
149	White-Faced Ibis	*Plegadis chihi*	Good	Adult	1	NA	NA	Flooded land	Yes	22.00997521	-159.7604176
149	Hawaiian Coot	*Fulica alai*	Good	Adult	4	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
149	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	18	Endangered	Endangered	Flooded land	Yes	Redacted	Redacted
149	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	1	NA	NA	Flooded land	Yes	22.00997521	-159.7604176
149	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Flooded land	No	22.00997521	-159.7604176
150	Black Francolin	*Francolinus francolinus*	Good	Adult	2	NA	NA	Irrigation canal, unleased land	No	22.00519025	-159.7565693
150	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	3	NA	NA	Irrigation canal, unleased land	Yes	22.00519025	-159.7565693
150	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Irrigation canal, unleased land	Yes	22.00519025	-159.7565693
150	Hawaiian Coot	*Fulica alai*	Good	Adult	3	Endangered	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
150	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	18	Endangered	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
150	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	6	Endangered	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
150	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	7	Endangered	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
150	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	12	Endangered	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
150	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	4	NA	NA	Irrigation canal, unleased land	Yes	22.00519025	-159.7565693
150	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Irrigation canal, unleased land	No	22.00519025	-159.7565693
150	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Irrigation canal, unleased land	No	22.00519025	-159.7565693
150	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Juvenile	1	NA	NA	Irrigation canal, unleased land	Yes	22.00519025	-159.7565693
150	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Juvenile	3	Endangered	Endangered	Irrigation canal, unleased land	Yes	Redacted	Redacted
151	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Guinea grass and koa haole	Yes	22.00508039	-159.7525084
151	Common Waxbill	*Estrilda astrild*	Good	Adult	10	NA	NA	Guinea grass and koa haole	No	22.00508039	-159.7525084
151	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Guinea grass and koa haole	No	22.00508039	-159.7525084
151	Zebra Dove	*Geopelia striata*	Good	Adult	15	NA	NA	Guinea grass and koa haole	No	22.00508039	-159.7525084
152	Cattle Egret	*Bubulcus ibis*	Good	Adult	9	NA	NA	Agricultural field	Yes	22.00789934	-159.7513726
152	House Sparrow	*Passer domesticus*	Good	Adult	1	NA	NA	Agricultural field	No	22.00789934	-159.7513726
152	Zebra Dove	*Geopelia striata*	Good	Adult	11	NA	NA	Agricultural field	No	22.00789934	-159.7513726
153	Cattle Egret	*Bubulcus ibis*	Good	Adult	13	NA	NA	Fallow field	Yes	22.01101497	-159.7523385

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude	Longitude
153	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	7	Endangered	Endangered	Fallow field	Yes	Redacted	Redacted
153	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Fallow field	No	22.01101497	-159.7523385
153	Zebra Dove	*Geopelia striata*	Good	Adult	10	NA	NA	Fallow field	No	22.01101497	-159.7523385
154	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Fallow field, uncultivated, guinea grass	No	22.01292	-159.7547633
154	Scaly-Breasted Munia	*Lonchura punctulate*	Good	Adult	30	NA	NA	Fallow field, uncultivated, guinea grass	No	22.01292	-159.7547633
154	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Fallow field, uncultivated, guinea grass	No	22.01292	-159.7547633
154	Cattle Egret	*Bubulcus ibis*	Good	Adult	55	NA	NA	Fallow field, uncultivated, guinea grass	Yes	22.01292	-159.7547633
154	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	6	NA	NA	Fallow field, uncultivated, guinea grass	No	22.01292	-159.7547633
154	Zebra Dove	*Geopelia striata*	Good	Adult	24	NA	NA	Fallow field, uncultivated, guinea grass	No	22.01292	-159.7547633
154	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	9	Endangered	Endangered	Fallow field, uncultivated, guinea grass	Yes	Redacted	Redacted
155	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	1	NA	NA	Reservoir, guinea grass, monkey pod	Yes	22.00865464	-159.7460215
155	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Reservoir, guinea grass, monkey pod	Yes	22.00865464	-159.7460215
155	Zebra Dove	*Geopelia striata*	Good	Adult	5	NA	NA	Reservoir, guinea grass, monkey pod	No	22.00865464	-159.7460215
156	Northern Mockingbird	*Mimus polyglottos*	Good	Adult	1	NA	NA	Reservoir, guinea grass, monkey pod	Yes	22.0100879	-159.744521
156	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Koa haole, kiawe, guinea grass scrub	Yes	22.0100879	-159.744521
156	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Koa haole, kiawe, guinea grass scrub	No	22.0100879	-159.744521
156	Java Sparrow	*Padda oryzivora*	Good	Adult	30	NA	NA	Koa haole, kiawe, guinea grass scrub	No	22.0100879	-159.744521
157	Erckel's Francolin	*Pternistis erckelii*	Good	Adult	1	NA	NA	Guinea grass and koa haole	No	22.00574893	-159.7485149
157	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Guinea grass and koa haole	Yes	22.00574893	-159.7485149
157	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Guinea grass and koa haole	No	22.00574893	-159.7485149
157	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Guinea grass and koa haole	No	22.00574893	-159.7485149
157	Zebra Dove	*Geopelia striata*	Good	Adult	9	NA	NA	Guinea grass and koa haole	No	22.00574893	-159.7485149
158	Ring-Necked Pheasant	*Phasianus colchicus*	Good	Adult	3	NA	NA	Agricultural field	No	22.0066361	-159.7605678
158	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	4	NA	NA	Agricultural field	Yes	22.0066361	-159.7605678
158	Black Francolin	*Francolinus francolinus*	Good	Adult	1	NA	NA	Agricultural field	No	22.0066361	-159.7605678

Observation Point ID	Common Name	Scientific Name	Health Condition	Life Stage	Number Observed	ESA Status	State Status	Vegetation/Habitat	MBTA Species (Yes/No)	Latitude	Longitude
158	Cattle Egret	*Bubulcus ibis*	Good	Adult	9	NA	NA	Agricultural field	Yes	22.0066361	-159.7605678
158	Chestnut Munia	*Lonchura atricapilla*	Good	Adult	3	NA	NA	Agricultural field	No	22.0066361	-159.7605678
158	Common Waxbill	*Estrilda astrild*	Good	Adult	1	NA	NA	Agricultural field	No	22.0066361	-159.7605678
158	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	6	Endangered	Endangered	Agricultural field	Yes	Redacted	Redacted
158	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	3	NA	NA	Agricultural field	Yes	22.0066361	-159.7605678
158	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Agricultural field	No	22.0066361	-159.7605678
158	Scaly-Breasted Munia	*Lonchura punctulate*	Good	Adult	2	NA	NA	Agricultural field	No	22.0066361	-159.7605678
158	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Agricultural field	No	22.0066361	-159.7605678
158	Zebra Dove	*Geopelia striata*	Good	Adult	4	NA	NA	Agricultural field	No	22.0066361	-159.7605678
159	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	13	Endangered	Endangered	Ditch, adjacent to agricultural lands, vegetation scrub	Yes	Redacted	Redacted
159	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	4	NA	NA	Ditch, adjacent to agricultural lands, vegetation scrub	Yes	22.00178804	-159.7616025
159	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Ditch, adjacent to agricultural lands, vegetation scrub	No	22.00178804	-159.7616025
159	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Ditch, adjacent to agricultural lands, vegetation scrub	No	22.00178804	-159.7616025
159	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Ditch, adjacent to agricultural lands, vegetation scrub	No	22.00178804	-159.7616025
159	Hawaiian Goose	*Branta sandvicensis*	Good	Chick	3	Endangered	Endangered	Ditch, adjacent to agricultural lands, vegetation scrub	Yes	Redacted	Redacted
160	Zebra Dove	*Geopelia striata*	Good	Adult	150	NA	NA	Agricultural field	No	21.99838559	-159.7544993
160	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	39	Endangered	Endangered	Agricultural field	Yes	Redacted	Redacted
160	Cattle Egret	*Bubulcus ibis*	Good	Adult	2	NA	NA	Agricultural field	Yes	21.99838559	-159.7544993
160	Common Myna	*Acridotheres tristis*	Good	Adult	6	NA	NA	Agricultural field	No	21.99838559	-159.7544993
160	Common Waxbill	*Estrilda astrild*	Good	Adult	200	NA	NA	Agricultural field	No	21.99838559	-159.7544993
161	Rose-Ringed Parakeet	*Psittacula krameri*	Good	Adult	3	NA	NA	Ditch with koa haole	No	22.00030945	-159.7510968
161	Cattle Egret	*Bubulcus ibis*	Good	Adult	3	NA	NA	Ditch with koa haole	Yes	22.00030945	-159.7510968
161	Common Myna	*Acridotheres tristis*	Good	Adult	3	NA	NA	Ditch with koa haole	No	22.00030945	-159.7510968
161	Cow	*Bos taurus*	Good	Adult	1	NA	NA	Ditch with koa haole	No	22.00030945	-159.7510968
161	Hawaiian Coot	*Fulica alai*	Good	Adult	2	Endangered	Endangered	Ditch with koa haole	Yes	Redacted	Redacted
161	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	1	Endangered	Endangered	Ditch with koa haole	Yes	Redacted	Redacted

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
161	House Sparrow	*Passer domesticus*	Good	Adult	1	NA	NA	Ditch with koa haole	No	22.00030945	-159.7510968
161	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Ditch with koa haole	No	22.00030945	-159.7510968
161	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Ditch with koa haole	No	22.00030945	-159.7510968
161	Zebra Dove	*Geopelia striata*	Good	Adult	26	NA	NA	Ditch with koa haole	No	22.00030945	-159.7510968
161	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	4	Endangered	Endangered	Ditch with koa haole	Yes	Redacted	Redacted
162	Cane Toad	*Rhinella marina*	Good	Adult	4	NA	NA	Agricultural land and koa haole	No	22.00032005	-159.7425099
162	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Agricultural land and koa haole	Yes	22.00032005	-159.7425099
162	Common Myna	*Acridotheres tristis*	Good	Adult	4	NA	NA	Agricultural land and koa haole	No	22.00032005	-159.7425099
162	Common Waxbill	*Estrilda astrild*	Good	Adult	3	NA	NA	Agricultural land and koa haole	No	22.00032005	-159.7425099
162	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Agricultural land and koa haole	No	22.00032005	-159.7425099
162	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Agricultural land and koa haole	No	22.00032005	-159.7425099
162	Zebra Dove	*Geopelia striata*	Good	Adult	11	NA	NA	Agricultural land and koa haole	No	22.00032005	-159.7425099
163	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Grass and koa haole	Yes	22.00008351	-159.7399542
163	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Grass and koa haole	Yes	22.00008351	-159.7399542
163	Scaly-Breasted Munia	*Lonchura punctulate*	Good	Adult	40	NA	NA	Grass and koa haole	No	22.00008351	-159.7399542
163	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Grass and koa haole	No	22.00008351	-159.7399542
164	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Ditch, kiawe, and koa haole	No	22.00062808	-159.7363772
164	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Ditch, kiawe, and koa haole	No	22.00062808	-159.7363772
164	Feral Pig	*Sus scrofa*	Good	Adult	2	NA	NA	Ditch, kiawe, and koa haole	No	22.00062808	-159.7363772
165	Zebra Dove	*Geopelia striata*	Good	Adult	13	NA	NA	Kiawe and koa haole	No	21.99945135	-159.7373241
166	Rose-Ringed Parakeet	*Psittacula krameri*	Good	Adult	11	NA	NA	Agricultural field	No	21.99615035	-159.7408829
166	Cattle Egret	*Bubulcus ibis*	Good	Adult	49	NA	NA	Agricultural field	Yes	21.99615035	-159.7408829
166	Chestnut Munia	*Lonchura atricapilla*	Good	Adult	70	NA	NA	Agricultural field	No	21.99615035	-159.7408829
166	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Agricultural field	No	21.99615035	-159.7408829
166	Rock Pigeon	*Columba livia*	Good	Adult	4	NA	NA	Agricultural field	No	21.99615035	-159.7408829
166	Spotted Dove	*Spilopelia chinensis*	Good	Adult	33	NA	NA	Agricultural field	No	21.99615035	-159.7408829
166	Zebra Dove	*Geopelia striata*	Good	Adult	3	NA	NA	Agricultural field	No	21.99615035	-159.7408829
167	Rose-Ringed Parakeet	*Psittacula krameri*	Good	Adult	48	NA	NA	Guinea grass, koa haole, ditch	No	21.99490839	-159.7458841
167	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	3	Endangered	Endangered	Guinea grass, koa haole, ditch	Yes	Redacted	Redacted

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
167	Hawaiian Coot	*Fulica alai*	Good	Adult	2	Endangered	Endangered	Guinea grass, koa haole, ditch	Yes	Redacted	Redacted
167	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Guinea grass, koa haole, ditch	Yes	21.99490839	-159.7458841
167	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Guinea grass, koa haole, ditch	Yes	21.99490839	-159.7458841
167	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	1	Endangered	Endangered	Guinea grass, koa haole, ditch	Yes	Redacted	Redacted
167	Zebra Dove	*Geopelia striata*	Good	Adult	6	NA	NA	Guinea grass, koa haole, ditch	No	21.99490839	-159.7458841
168	Rose-Ringed Parakeet	*Psittacula krameri*	Good	Adult	79	NA	NA	Agricultural field and koa haole	No	21.99406254	-159.7484897
168	Cattle Egret	*Bubulcus ibis*	Good	Adult	25	NA	NA	Agricultural field and koa haole	Yes	21.99406254	-159.7484897
168	Common Waxbill	*Estrilda astrild*	Good	Adult	20	NA	NA	Agricultural field and koa haole	No	21.99406254	-159.7484897
168	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	13	Endangered	Endangered	Agricultural field and koa haole	Yes	Redacted	Redacted
168	Zebra Dove	*Geopelia striata*	Good	Adult	23	NA	NA	Agricultural field and koa haole	No	21.99406254	-159.7484897
169	Black Francolin	*Francolinus francolinus*	Good	Adult	1	NA	NA	Kiawe, koa haole scrub, ditch	No	22.02740185	-159.7655472
169	Cattle Egret	*Bubulcus ibis*	Good	Adult	1	NA	NA	Kiawe, koa haole scrub, ditch	Yes	22.02740185	-159.7655472
169	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Kiawe, koa haole scrub, ditch	No	22.02740185	-159.7655472
169	Pacific Golden Plover	*Pluvialis fulva*	Good	Adult	1	NA	NA	Kiawe, koa haole scrub, ditch	Yes	22.02740185	-159.7655472
169	Spotted Dove	*Spilopelia chinensis*	Good	Adult	3	NA	NA	Kiawe, koa haole scrub, ditch	No	22.02740185	-159.7655472
169	Zebra Dove	*Geopelia striata*	Good	Adult	1	NA	NA	Kiawe, koa haole scrub, ditch	No	22.02740185	-159.7655472
173	Hawaiian Duck	*Anas wyvilliana*	Good	Adult	1	Endangered	Endangered	Ditch, Guinea grass and koa haole	Yes	Redacted	Redacted
173	Hawaiian Short-Eared Owl	*Asio flammeus sandwichensis*	Good	Adult	1	NA	NA	Ditch, Guinea grass and koa haole	Yes	Redacted	Redacted
173	Java Sparrow	*Padda oryzivora*	Good	Adult	34	NA	NA	Ditch, Guinea grass and koa haole	No	22.0033046	-159.7537777
173	Red-Crested Cardinal	*Paroaria coronata*	Good	Adult	1	NA	NA	Ditch, Guinea grass and koa haole	No	22.0033046	-159.7537777
173	Spotted Dove	*Spilopelia chinensis*	Good	Adult	12	NA	NA	Ditch, Guinea grass and koa haole	No	22.0033046	-159.7537777
173	Zebra Dove	*Geopelia striata*	Good	Adult	20	NA	NA	Ditch, Guinea grass and koa haole	No	22.0033046	-159.7537777
173	Black-Crowned Night Heron	*Nycticorax nycticorax*	Good	Adult	2	NA	NA	Ditch, Guinea grass and koa haole	Yes	22.0033046	-159.7537777
173	Hawaiian Duck	*Anas wyvilliana*	Good	Juvenile	2	Endangered	Endangered	Ditch, Guinea grass and koa haole	Yes	Redacted	Redacted
174	Hawaiian Coot	*Fulica alai*	Good	Adult	4	Endangered	Endangered	Large open water, koa haole scrub, wetland fringe	Yes	Redacted	Redacted
174	Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Good	Adult	1	Endangered	Endangered	Large open water, koa haole scrub, wetland fringe	Yes	Redacted	Redacted
174	Hawaiian Goose	*Branta sandvicensis*	Good	Adult	4	Endangered	Endangered	Large open water, koa haole scrub, wetland fringe	Yes	Redacted	Redacted

Observation Point ID	*Common Name*	*Scientific Name*	*Health Condition*	*Life Stage*	*Number Observed*	*ESA Status*	*State Status*	*Vegetation/Habitat*	*MBTA Species (Yes/No)*	*Latitude*	*Longitude*
174	Hawaiian Stilt	*Himantopus mexicanus knudseni*	Good	Adult	2	Endangered	Endangered	Large open water, koa haole scrub, wetland fringe	Yes	Redacted	Redacted
174	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Large open water, koa haole scrub, wetland fringe	No	22.03670369	-159.7781801
174	Rock Pigeon	*Columba livia*	Good	Adult	1	NA	NA	Large open water, koa haole scrub, wetland fringe	No	22.03670369	-159.7781801
174	Spotted Dove	*Spilopelia chinensis*	Good	Adult	2	NA	NA	Large open water, koa haole scrub, wetland fringe	No	22.03670369	-159.7781801
300	Saffron Finch	*Sicalis flaveola*	Good	Adult	1	NA	NA	Pines and lantana	No	22.12603021	-159.717368
301	Saffron Finch	*Sicalis flaveola*	Good	Adult	1	NA	NA	Pine, silky oak, lantana	No	22.12621472	-159.7175943
301	Common Myna	*Acridotheres tristis*	Good	Adult	1	NA	NA	Pine, silky oak, lantana	No	22.12621472	-159.7175943
301	Northern Cardinal	*Cardinalis cardinalis*	Good	Adult	1	NA	NA	Pine, silky oak, lantana	Yes	22.12621472	-159.7175943
301	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	5	NA	NA	Pine, silky oak, lantana	No	22.12621472	-159.7175943
302	Feral Goat	*Capra hircus*	Good	Adult	4	NA	NA	Swollenfinger grass and pines	No	22.13790195	-159.7175287
302	Red Junglefowl	*Gallus gallus*	Good	Adult	2	NA	NA	Swollenfinger grass and pines	No	22.13790195	-159.7175287
302	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Swollenfinger grass and pines	No	22.13790195	-159.7175287
302	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	2	NA	NA	Swollenfinger grass and pines	No	22.13790195	-159.7175287
302	White-Tailed Tropic Bird	*Phaethon lepturus*	Good	Adult	1	NA	NA	Steep rocky cliffs	Yes	22.13790195	-159.7175287
303	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	6	NA	NA	Swollenfinger grass and pines	No	22.13880305	-159.7187224
303	Common Myna	*Acridotheres tristis*	Good	Adult	2	NA	NA	Swollenfinger grass and pines	No	22.13880305	-159.7187224
303	White-Tailed Tropic Bird	*Phaethon lepturus*	Good	Adult	1	NA	NA	Steep rocky cliffs	Yes	22.13880305	-159.7187224
304	Common Myna	*Acridotheres tristis*	Good	Adult	4	NA	NA	Swollenfinger grass and pines	No	22.1388909	-159.7190938
304	Feral Goat	*Capra hircus*	Good	Adult	1	NA	NA	Swollenfinger grass and pines	No	22.1388909	-159.7190938
304	Red Junglefowl	*Gallus gallus*	Good	Adult	1	NA	NA	Swollenfinger grass and pines	No	22.1388909	-159.7190938
304	Spotted Dove	*Spilopelia chinensis*	Good	Adult	1	NA	NA	Swollenfinger grass and pines	No	22.1388909	-159.7190938
304	Warbling White-Eye	*Zosterops japonicus*	Good	Adult	12	NA	NA	Swollenfinger grass and pines	No	22.1388909	-159.7190938
304	White-Tailed Tropic Bird	*Phaethon lepturus*	Good	Adult	1	NA	NA	Steep rocky cliffs	Yes	22.1388909	-159.7190938

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Appendix C
Complete List of Species Observations

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English Common Name	Scientific Name	Life Form
African Silverbill	*Euodice cantans*	Bird
Barn Owl	*Tyto alba*	Bird
Black Francolin	*Francolinus francolinus*	Bird
Black-crowned Night Heron	*Nycticorax nycticorax*	Bird
Black-tailed Deer	*Odocoileus hemionus hemionus*	Bird
Cane Toad	*Rhinella marina*	Amphibian
Cattle Egret	*Bubulcus ibis*	Bird
Chestnut Munia	*Lonchura atricapilla*	Bird
Common Myna	*Acridotheres tristis*	Bird
Common Waxbill	*Estrilda astrild*	Bird
Cow	*Bos taurus*	Mammal
Donkey	*Equus asinus*	Mammal
Erckel's Francolin	*Pternistis erckelii*	Bird
Feral Cat	*Felis catus*	Mammal
Feral Goat	*Capra hircus*	Mammal
Feral Pig	*Sus scrofa*	Mammal
Grey Francolin	*Ortygornis pondicerianus*	Bird
Great Frigatebird	*Fregata minor*	Bird
Hawaiian Coot	*Fulica alai*	Bird
Hawaiian Duck	*Anas wyvilliana*	Bird
Hawaiian Gallinule	*Gallinula galeata sandvicensis*	Bird
Hawaiian Goose	*Branta sandvicensis*	Bird
Hawaiian Short-eared Owl	*Asio flammeus sandwichensis*	Bird
Hawaiian Stilt	*Himantopus mexicanus knudseni*	Bird
House Finch	*Haemorhous mexicanus*	Bird
House Sparrow	*Passer domesticus*	Bird
Java Sparrow	*Padda oryzivora*	Bird
Moth Skink	*Lipinia noctua*	Reptile
Northern Cardinal	*Cardinalis cardinalis*	Bird
Northern Mockingbird	*Mimus polyglottos*	Bird
Pacific Golden Plover	*Pluvialis fulva*	Bird
Red Junglefowl	*Gallus gallus*	Bird
Red-crested Cardinal	*Paroaria coronata*	Bird
Ring-necked Pheasant	*Phasianus colchicus*	Bird
Rock Pigeon	*Columba livia*	Bird
Rose-ringed Parakeet	*Psittacula krameri*	Bird
Ruddy Turnstone	*Arenaria interpres*	Bird
Saffron Finch	*Sicalis flaveola*	Bird
Sanderling	*Calidris alba*	Bird
Scaly-breasted Munia	*Lonchura punctulata*	Bird
Spotted Dove	*Spilopelia chinensis*	Bird
Wandering Tattler	*Tringa incana*	Bird
Warbling White-eye	*Zosterops japonicus*	Bird
White-faced Ibis	*Plegadis chihi*	Bird
White-tailed Tropic Bird	*Phaethon lepturus*	Bird
White-rumped Shama	*Copsychus malabaricus*	Bird

English Common Name	Scientific Name	Life Form
Yellow-faced Bee	*Hylaeus* spp.	Insect
Zebra Dove	*Geopelia striata*	Bird

PMRF Hoary Bat Survey Report

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Final V3

Hawaiian Hoary Bat Survey Report at Pacific Missile Range Facility in Support of Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Kauaʻi, Hawaiʻi

Prepared for:

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Naval Facilities Engineering Systems Command, Pacific
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Final V3

Hawaiian Hoary Bat Survey Report in Support of Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Kauaʻi, Hawaiʻi

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ACRONYMS AND ABBREVIATIONS

ANOVA	analysis of variance
HSD	honest significance difference
KPGO	Kōkeʻe Park Geophysical Observatory
NAVFAC	Naval Facilities Engineering Systems Command
PMRF	Pacific Missile Range Facility
SM4	Song Meter SM4BAT-FS ultrasonic acoustic recorders
Tetra Tech	Tetra Tech, Inc.

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CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

This report details the results of a habitat assessment and 12 months of acoustic monitoring surveys for Hawaiian hoary bats (*Aeorestes semotus*) conducted between 1 October 2023 and 30 September 2024 at the Pacific Missile Range Facility (PMRF). This study was conducted in support of the proposed PMRF and the Kōkeʻe Park Geophysical Observatory (KPGO) Real Estate Environmental Impact Statement.

Under the direction of Naval Facilities Engineering Systems Command (NAVFAC), and in accordance with the 9 September 2022 Statement of Work for Contract N62742-18-D-1802, Task Order N62742-22-F-0206, Tetra Tech, Inc. (Tetra Tech) conducted a high-level habitat assessment and acoustic monitoring surveys for Hawaiian hoary bats within identified survey area components of the PMRF and KPGO real estate study area in Kauaʻi, Hawaiʻi (Figure 1-1). Survey results will be used for future project planning, development of avoidance and minimization measures, National Environmental Policy Act analysis, Chapter 343, Hawaiʻi Revised Statutes (commonly referred as the Hawaiʻi Environmental Policy Act) analysis, and potential Endangered Species Act section 7 consultation.

Tetra Tech prepared a work plan in September 2023 outlining the proposed methodology, data management, reporting, scheduling, and personnel roles. The work plan also included results from a desktop analysis of a high-level bat habitat assessment on the potential quality of bat habitat within the study area.

1.2 PURPOSE AND OBJECTIVE OF THE SURVEY

The primary goal of these surveys is to provide crucial data on potential bat habitats, bat presence, detection rates, and patterns of nightly and seasonal activity within the four designated survey areas of the PMRF Succeeding Leases and Easements study area (Figure 1-1). The results will inform future project planning, contribute to the development of avoidance and minimization strategies, and provide analysis for the National Environmental Policy Act, Chapter 343 of the Hawaiʻi Revised Statutes (commonly referred as the Hawaiʻi Environmental Policy Act), and potential Endangered Species Act section 7 consultation.

1.3 SURVEY AREAS

Acoustic monitoring for Hawaiian hoary bats was conducted at six locations within four survey areas: Miloliʻi Ridge, Mākaha Ridge, Kamokalā Ridge, and the Mānā Plain (Figure 1-1). Acoustic monitor locations ranged in elevation from approximately 9 to 12 feet (2.7 to 3.7 meters) above sea level across the Mānā Plain, 190 feet (58 meters) above sea level on Kamokalā Ridge, 1,630 feet (497 meters) above sea level on Mākaha Ridge, and 1,780 feet (542 meters) above sea level on Miloliʻi Ridge.

Figure 1-1 Location of the Hawaiian Hoary Bat Survey Areas

1.4 SURVEY SCHEDULE AND PERSONNEL

Habitat assessment surveys were conducted in September 2023. Acoustic monitors were deployed during the last week of September 2023. Active monitoring started on 1 October 2023 and ended on 30 September 2024. Data collection and maintenance checks were conducted monthly, with the exclusion of January and September 2024. Survey activities and dates are provided in Table 1-1.

Table 1-1 Hawaiian Hoary Bat Survey Schedule

Field Activity	Dates
Bat habitat assessment site visits	September 25–27, 2023
Deploy bat acoustic recorders	September 25–27, 2023
Monthly Data collection & maintenance (November)	November 17, 2023
Monthly Data collection & maintenance (December)	December 19, 2023
Monthly data collection/ maintenance (February)	February 2, 2024
Monthly data collection/ maintenance (March)	March 1, 2024
Monthly data collection/ maintenance (April)	April 1, 2024
Monthly data collection/ maintenance (May)	May 1, 2024
Monthly data collection/ maintenance (June)	June 7, 2024
Monthly data collection/ maintenance (July)	July 16, 2024
Monthly data collection/ maintenance (August)	August 30, 2024
Monthly data collection/ remove equipment (October)	October 1–2, 2024

Tetra Tech team members that were involved in performing various project tasks related to the Hawaiian hoary bat surveys are listed in Table 1-2 along with their task-specific roles.

Table 1-2 Project Personnel for PMRF Hawaiian Hoary Bat Surveys

Role	Name
Project Manager	Eric Jensen/Susan Hurley
Principal Investigator	Christopher Todd
Biologist	Jacob Dutton
Biologist	Torrey Edell
GIS Specialist	Kristina Dick/Meg Reesor

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CHAPTER 2
HAWAIIAN HOARY BAT DESKTOP ANALYSIS

2.1 SPECIES BACKGROUND

The Hawaiian hoary bat or ʻōpeʻapeʻa is an endangered endemic mammal found in the Hawaiian archipelago. Although no historical or current population estimates exist for the species, recent studies and ongoing research have shown the bats to be distributed across all the major Hawaiian Islands, including Kauaʻi, Oʻahu, Lānaʻi, Maui, Molokaʻi, and Hawaiʻi (USFWS 2021). The Hawaiian hoary bat holds a significant place in the archipelago's biodiversity, given the species' limited distribution and status as being the only native land mammal.

The Hawaiian hoary bat is regarded as a habitat generalist and demonstrates considerable flexibility in its use of native and non-native habitats for roosting and foraging. Radio telemetry studies on Hawaiʻi Island have documented the hoary bat traversing greater than 10.5 miles (17 kilometers) from its roost site to forage among a mosaic of habitat elements such as the edges of cluttered forests and within open spaces including forest gaps, gulches, windrows, roadways, open water, pastures, and above forest canopy (Bonaccorso et al. 2015; Whitaker and Tomich 1983; Belwood and Fullard 1984; Jacobs 1996, 1999; Poe 2007).

Hawaiian hoary bats use both native and non-native tree species for roosting. At least 19 different roost trees species have been identified to date (Montoya-Aiona et al. 2023) The diversity in roost trees used by Hawaiian hoary bats is primarily among non-native species. Only three native species, ʻōhiʻa lehua (*Metrosideros polymorpha*), lama (*Diospyros sandwicensis*), and uluhe (*Dicranopteris linearis*) have been confirmed being used by hoary bats. Habitat use studies of radio telemetered bats indicate that Hawaiian hoary bats select roost trees with a mean height of 68 feet (21 meters), a mean diameter at breast height of 29 inches (75 centimeters), a mean canopy cover of 43 percent, and are a mean distance of 95 feet (29 meters) from the forest edge (Montoya-Aiona et al. 2023). These results suggest that vegetation structure, which provides protection and thermoregulatory benefits, and not tree species, is the deciding factor of roosting use by Hawaiian hoary bats.

Hawaiian hoary bats forage on a variety of insects encompassing 24 families from 10 different orders (Todd 2012; Pinzari et al. 2019). However, Lepidoptera (moths) represent the most abundant and diverse insect taxa in the diet of hoary bats, followed by Coleoptera (beetles) (Todd 2012; Pinzari et al. 2019). Following lactation, a period of high energetic demand, Hawaiian hoary bats have been shown to selectively forage on Coleoptera, which may be easier to catch and satisfy additional nutrient demands (Todd 2012). For many bat species, including Hawaiian hoary bats, increased rates in activity are associated with increased abundance of insect prey (Gorresen et al. 2018; Todd 2012; Haddad et al. 2001; Knops et al. 1999).

On Hawaiʻi island, hoary bats have been shown to migrate along elevational gradients in response to changes in temperature, rainfall, and food resources; they occupy low elevations during the summer and fall breeding seasons and migrate to the interior highlands during the winter post-lactation period (Menard 2001; Todd 2012 Bonaccorso et al. 2015). Seasonal changes in acoustic activity observed at several locations on Oʻahu (Thompson and Starcevich 2021; Gorresen et al. 2015), Maui (Todd et al. 2016; Kaheawa Wind Power I 2020; Kaheawa Wind Power II 2020), and Kauaʻi (Bonaccorso and Pinzari 2011; Welch et al. 2021) suggest similar elevational migrations occur on these islands.

2.2 EXISTING DATA IN THE SURVEY AREAS

2.2.1 Miloli‘i and Mākaha Ridge

The vegetation communities on the Miloli‘i and Mākaha Ridge can be roughly classified as a mixture of native and non-native plant species. The dominant canopy cover tree species include the non-native silk oak (*Grevillea robusta*), slash pine *(Pinus elliottii*), and eucalyptus (*Eucalyptus* spp.), along with the native koa (*Acacia koa*) and ‘ōhi'a lehua (Wood 2006). The understory consists of strawberry guava (*Psidium cattleianum*), shrubs of *Lantana camara*, and beardgrass (*Schizachyrium condensatum* or *Andropogon glomeratus*) (Wood 2006; NAVFAC Pacific 2024).

No acoustic surveys have been conducted for bats along the Miloli‘i Ridge prior to this survey; however, bat acoustic surveys have been conducted along the Mākaha Ridge and bat activity patterns are expected to be similar due to the close proximity (0.75 mile or 1.2 kilometers) of the two areas. Previous bat acoustic surveys conducted within and just outside of the Mākaha Ridge installation boundary indicate year-round bat activity, with increased seasonal activity occurring during late fall, winter, and early spring (November–April) (Bonaccorso and Pinzari 2011).

2.2.2 Kamokalā Ridge

Vegetation cover within the PMRF Kamokalā Ridge installation boundary consists primarily of kiawe (*Prosopis pallida)* and koa haole (*Leucaena leucocephala*). Just outside of the installation boundary are several irrigation ditches with large mango trees (*Magnifera indica*) as well as several agricultural reservoirs. The surrounding Kamokalā Ridge topography steepens quickly from 40 to 700 feet (12 to 213 meters) where vegetation becomes less dense.

Previous bat acoustic surveys conducted within the installation boundary at Kamokalā Ridge indicate year-round bat activity with increases in bat activity occurring in September and February (Bonaccorso and Pinzari 2011).

2.2.3 Mānā Plain

Vegetation cover on the Mānā Plain is primarily composed of cultivated crops, pasture/hay, grassland, and scrub/shrub. The two dominant plant species in unmanaged areas consists of kiawe and koa haole (NAVFAC Pacific 2024). There are several water features throughout the Mānā Plain including irrigation ditches, mud flats, and flooded ponds.

Bat acoustic surveys conducted within the PMRF Barking Sands Main Base installation boundary, adjacent to the Mānā Plain (see Figure 1-1), detected bats year-round, including active foraging by multiple individuals (Bonaccorso and Pinzari 2011; Welch at al. 2021). Bat activity peaked in the fall (September–November) with lower activity levels occurring during the winter. During peak periods, bat activity in the northern portion of the PMRF Barking Sands Main Base Installation over a 7-day sampling period was measured at almost 26,000 calls (echolocation pulses) in September 2010 and exceeded 500,000 total calls in November 2010 (Bonaccorso and Pinzari 2011). Surveys conducted more recently measured lower bat activity, 1,920 calls in September 2020 and 609 calls in November 2020 during a similar 7-day sampling period (Welch at al. 2021). The high rates of activity suggest that the habitat features in the region serve as important foraging resources and maybe roosting resources as well.

CHAPTER 3
SURVEY METHODOLOGY AND PROTOCOLS

3.1 SURVEY METHODS

3.1.1 Habitat Assessment

Existing literature and aerial imagery data were reviewed as part of the desktop analysis to assess potential habitat. A field-based assessment of habitat was conducted for each of the four bat survey areas to evaluate the potential quality of the habitat for use by bats. The field-based habitat assessment was used to 1) ground truth the quality of habitat from the desktop assessment, and 2) further evaluate the quality of the habitat as a potential roosting and foraging area. The field-based habitat assessment was conducted in September 2023 in conjunction with the deployment of acoustic monitoring equipment (see Table 1-1). Additional plant species data provided by the Vegetation Surveys were incorporated into the bat habitat assessment (NAVFAC Pacific 2024).

3.1.2 Acoustic Monitoring

Hawaiian hoary bat activity was monitored over a 12-month period (1 October 2023–30 September 2024) at six locations within four survey areas (Miloli‘i Ridge n = 1, Mākaha Ridge n = 1, Kamokalā Ridge n = 1, and the Mānā Plain n = 3). The monitoring site locations at each of the four bat survey areas is provided in Figures 3-1 through 3-5 and site photos are available in Appendix A. Acoustic monitoring locations were chosen based on 1) monitoring needs expressed by the Navy during the site visit on 27 July 2023, 2) the best spatial distribution across potential bat foraging and roosting habitat, 3) historical monitoring locations, and 4) minimizing theft.

Acoustic monitoring was conducted with Song Meter SM4BAT-FS (SM4) ultrasonic acoustic recorders equipped with a high frequency waterproof microphone (SMM-U2; Wildlife Acoustics, Inc., Maynard, Massachusetts), elevated 10 feet (3 meters) above the ground on poles and powered by 12-volt, 36-amp hour batteries connected to 20 watt, 12-volt Solar Panels (ACOPower, Walnut, California). SM4 units and SMM-U2 microphones were placed within forest gaps, along forest edges, or under sparse vegetated canopies within forests to minimize obstruction of the microphones from the airspace above. SM4 acoustic recorders are passive recorders only and do not have transmission capabilities. The advanced triggering systems of the acoustic monitors only recorded when bats were detected and were programmed with a 16 kilohertz high pass filter to ensure low frequency noises below 16 kilohertz were not recorded. All acoustic monitors recorded nightly beginning 1 hour before sunset and ending 1 hour after sunrise. Acoustic recordings with associated dates and times were stored on SDXC class 10 memory cards (Western Digital, San Jose, California) within the SM4 (see Appendix B for a complete list of hardware settings). All electrical equipment was housed in a sealed container to prevent ant ingress. Data collection and equipment maintenance (i.e., microphone sensitivity check and solar and battery health) was conducted monthly, with the exclusion of January and September 2024 (see Table 1-1). All bat acoustic data was stored locally on an external hard drive and backed up monthly on secure servers.

Figure 3-1 Miloli‘i Ridge and Mākaha Ridge Survey Areas

Figure 3-2 Kamokalā Ridge Survey Area

Figure 3-3 Mānā Plain Northern Region Survey Area

Figure 3-4 Mānā Plain Central Region Survey Area

Figure 3-5 Mānā Plain Southern Region Survey Area

3.2 DATA ANALYSIS

Acoustic recordings were processed in Kaleidoscope PRO version 5.4.0 (Wildlife Acoustics, Inc., Maynard, Massachusetts) using the Bats of North America 5.1.0 AutoID classifier for Hawai‘i to assign a preliminary classification (see Appendix B for a complete list of software settings). Manual verification was conducted by an expert on 100 percent of classified acoustic call files to remove any false-positive/negative identification errors from the data set prior to analysis. A minimum threshold of two echolocation pulses within a single recording file was used to confirm a positive detection. The proportion of sampling nights with a bat detection, or "detection rate" was used as a metric to quantify monthly and annual bat activity at the survey areas. The number of call files recorded per hour was used to examine the timing of nightly bat activity at each monitoring location. While call files identifying multiple individuals foraging were observed, quantification of this metric was not included within the scope of analysis.

Analysis of variance (ANOVA) and Tukey's honest significance difference (Tukey's HSD) were used to test for differences in annual detection rates and the frequency of nightly call files between monitoring sites. Data were normalized with an Ordered Quantile Normalization transformation using the 'bestNormalize' package in R (Peterson 2021). All tests were two-tailed, employed an alpha value of 0.05, and were conducted in R version 4.4.1 (R Core Team 2024). The characterization of Hawaiian hoary bat seasons corresponds approximately to Gorresen et al. (2013).

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CHAPTER 4
SURVEY RESULTS

4.1 ANNUAL AND SEASONAL BAT ACTIVITY

Hawaiian hoary bats were detected on 1,752 nights out of 2,144 detector-nights sampled across all pooled monitoring sites and months, resulting in a detection rate of 0.82 (Table 4-1). Annual detection rates varied between monitoring sites (Table 4-1) and were significantly higher (ANOVA: $F_{6,72} = 5.27$, $P < 0.001$) at Miloli‘i Ridge compared to Middle Gate Wetland (Tukey’s HSD: $P < 0.050$), Kamokalā Ridge (Tukey’s HSD: $P < 0.017$), and South Ag Site (Tukey’s HSD: $P < 0.002$). Detection rates were also significantly higher at the North PMRF Site compared to the South Ag Site (Tukey’s HSD: $P < 0.010$).

Table 4-1 Annual Detection Rates for Hawaiian Hoary Bats Monitored at Six Locations Across PMRF Between October 1, 2023 and September 30, 2024.

Monitoring Location	Elevation (Feet)	No. of Nights Sampled	No. of Nights with Detections	Detection Rate
North PMRF Site (Mānā Plain)	10	354	337	0.95
Middle Gate Wetland (Mānā Plain)	9	335	246	0.73
South Ag Site (Mānā Plain)	12	357	224	0.63
Kamokalā Ridge	190	366	258	0.71
Mākaha Ridge	1,630	366	329	0.90
Miloli‘i Ridge	1,780	366	358	0.98
Total		**2,144**	**1,752**	**0.82**

Seasonal fluctuations in detection rates were evident across the six monitoring locations (Figure 4-1). In October and November of the post-lactation reproductive period, detection rates were consistently high across all monitoring locations. In December, during the transition into the pre-pregnancy reproductive period, detection rates remained relatively stable and high generally (above 0.68), but declined at South Ag Site and Kamokalā Ridge, reaching their lowest in March. At South Ag Site and Kamokalā Ridge, detection rates increased in April of the pregnancy reproductive period and decreased in May and June along with a decrease at Middle Gate Wetland. Following the decline in June, detection rates sharply increased during July and August of the lactation reproductive period and into September of the post-lactation reproductive period. (Figure 4-1).

Seasonal fluctuations in detection rates were minimal at North PMRF Site (range: 0.81 – 1.00) and Miloli‘i Ridge (range: 0.90 – 1.00) (Figure 4-1).

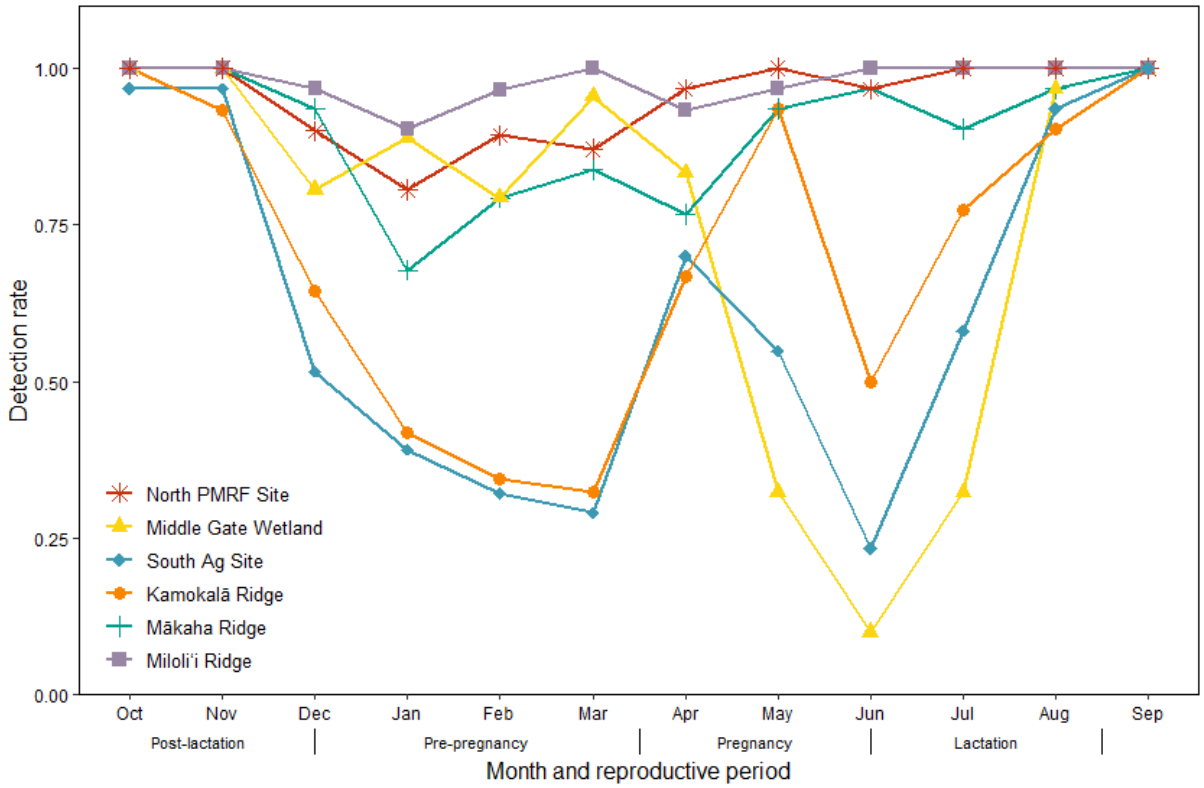

Figure 4-1 Monthly Detection Rates for Hawaiian Hoary Bats Monitored at Six Locations Across PMRF Between October 1, 2023 and September 30, 2024 with Corresponding Reproductive Periods

4.2 NIGHTLY BAT ACTIVITY

The timing and duration of nightly bat activity varied across sites and elevation. Among lower elevation sites (9 to 190 feet or 2.7 to 57 meters above sea level), the North PMRF Site had a significantly higher number of calls compared to other sites (ANOVA: $F_{5,75} = 73.22$, $P < 0.001$), accounting for 50 percent of all call files. Bat activity began 45 minutes prior to sunset and increased sharply, peaking approximately 2 hours after sunset. After the peak, bat activity gradually declined with activity diminishing around 9–10 hours after sunset (Figure 4-2). Nightly bat activity at the other low elevation sites and Kamokalā Ridge followed this general trend, with bat activity starting just after sunset, peaking approximately 2 hours after sunset, and gradually declining throughout the night (Figure 4-2).

Nightly bat activity at the high elevation sites (1,630 and 1,780 feet or 497 and 542 meters above sea level) was bimodal, although patterns differed between sites. At Miloli‘i Ridge, which had the second greatest number of call files and made up 20 percent of all call files recorded, the bimodal activity pattern was more pronounced. Nightly activity began 1 hour before sunset and reached the first nightly peak approximately 30 minutes after sunset (Figure 4-2). Nightly activity at Mākaha Ridge did not begin until sunset occurred and then gradually increased until 4 to 5 hours after sunset (Figure 4-2). Bat activity at both high elevation sites increased again approximately 10 hours after sunset with a second peak approximately 12 hours after sunset (Figure 4-2). The last calls recorded occurred 53 minutes after sunrise at Miloli‘i Ridge and 48 minutes after sunrise at Mākaha Ridge.

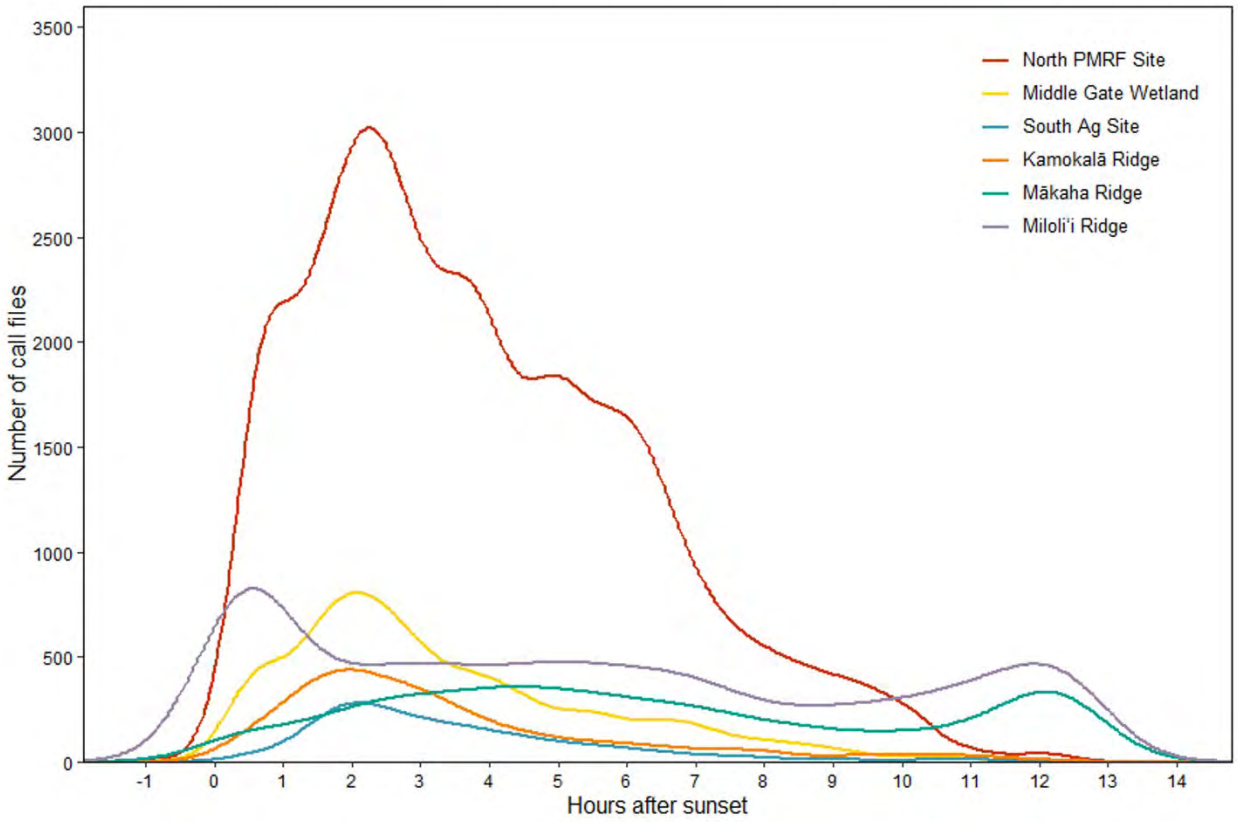

Figure 4-2 Timing of Nightly Bat Activity at the Six Survey Areas

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CHAPTER 5
DISCUSSION

This Hawaiian hoary bat acoustic survey provides valuable insight on the seasonal and nightly use of habitats across the four survey areas. Results from this study indicate year-round bat presence across all survey areas between October 2023 and September 2024, with an overall detection rate of 0.82. There was considerable site-level variation in both seasonal and overall detection rates (Figure and Table 4-1, and Appendix C). Detection rates were highest at Miloli‘i Ridge and North PMRF Site. These two high and low elevation sites, respectively, also demonstrated the least amount of seasonal fluctuation in detection rates. Among the other low elevation sites (South Ag Site, Kamokalā Ridge, and Middle Gate Wetland), seasonal fluctuations in detection rates were particularly pronounced (Figure 4-1 and Appendix C). On other Hawaiian islands, seasonal fluctuations in detection rates are broadly associated with reproductive periods and elevation (Menard 2001; Todd 2012; Gorresen et al. 2013; Thompson and Starcevich 2021). The seasonal fluctuation in detection rates observed in this study do appear to be associated with reproductive periods. Detection rates were highest during the lactation and post-lactation reproductive periods (August through November), when there is an abundance of females with newly born juveniles, followed by adult males in search of reproductive females. Lower detection rates occurred during the pre-pregnancy and pregnancy reproductive periods, when males and females are separated until the following post-lactation/mating season and are thought to enter prolonged bouts of torpor (Menard 2001; Todd 2012). Seasonal fluctuations in detection rates do not appear to be associated with elevation and instead may be related to other site-specific habitat features (i.e., changes in agricultural land use, vegetation cover, or insect abundance). The differences in the nightly activity patterns observed between low and high elevations may provide insight as to how bats are using these areas generally. Hawaiian hoary bats are considered a generalist species and will forage and roost in a variety of habitats (Bonaccorso et al. 2015; Whitaker and Tomich 1983; Belwood and Fullard 1984; Jacobs 1996, 1999; Poe 2007). The unimodal peak in activity that occurred approximately 2 hours after sunset among low elevation sites may indicate that the primary use of these habitats is for foraging. Similar peaks in activity have been observed in diet studies conducted on Hawai‘i island and shown to be correlated with peaks in insect abundance (Todd 2012). After foraging bouts, bats may rest at a temporary night-roost in proximity to their foraging site before having a second foraging bout or returning to their day-roost (Bonaccorso et al. 2015; Todd pers., obs.). Among high elevations, the nightly activity was bimodal with early evening peaks occurring just after sunset at Miloli‘i Ridge and a second peak occurring at both high elevation sites at sunrise (see Figure 4-2). These bimodal patterns with peaks so close to sunrise and sunset may indicate that bats are leaving and returning to a day-roost site. The higher elevations would also provide cooler temperatures for roosting bats during the day compared to temperatures at lower elevations. Some individuals will forage near their day-roost site and the interim period between the bimodal peaks indicates that some individuals are foraging near these areas throughout the evening (see Figure 4-2) (Barclay 1989; Bonaccorso et al. 2015).

The high detection rates at Miloli‘i Ridge and North PMRF Site combined with the high frequency in the number of call files, particularly at the North PMRF Site, indicate these sites provide stable and favorable conditions for bats and underscores the importance of the habitats surrounding these areas. The abundance and duration of nightly activity at the North PMRF Site is of particular interest. The North PMRF Site had almost five times the amount of call files than the next closest site, Middle Gate Wetland (see Figure 4-2), only 2.3 miles (3.7 kilometers) away. However, there are no notable structural differences in foraging habitat between the two sites. Additional observations, including on-site visual surveys during the evening

accompanied by light trapping surveys for insects would be required to further understand the driving factors that influence the high rates of bat activity at the North PMRF Site.

This report's findings will inform future planning for the PMRF and KPGO areas, aiding in the development of effective avoidance and minimization and adds to the limited information that exists on bat populations and habitat use on Kauaʻi.

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Appendix A
SM4 Acoustic Monitor Site Photos

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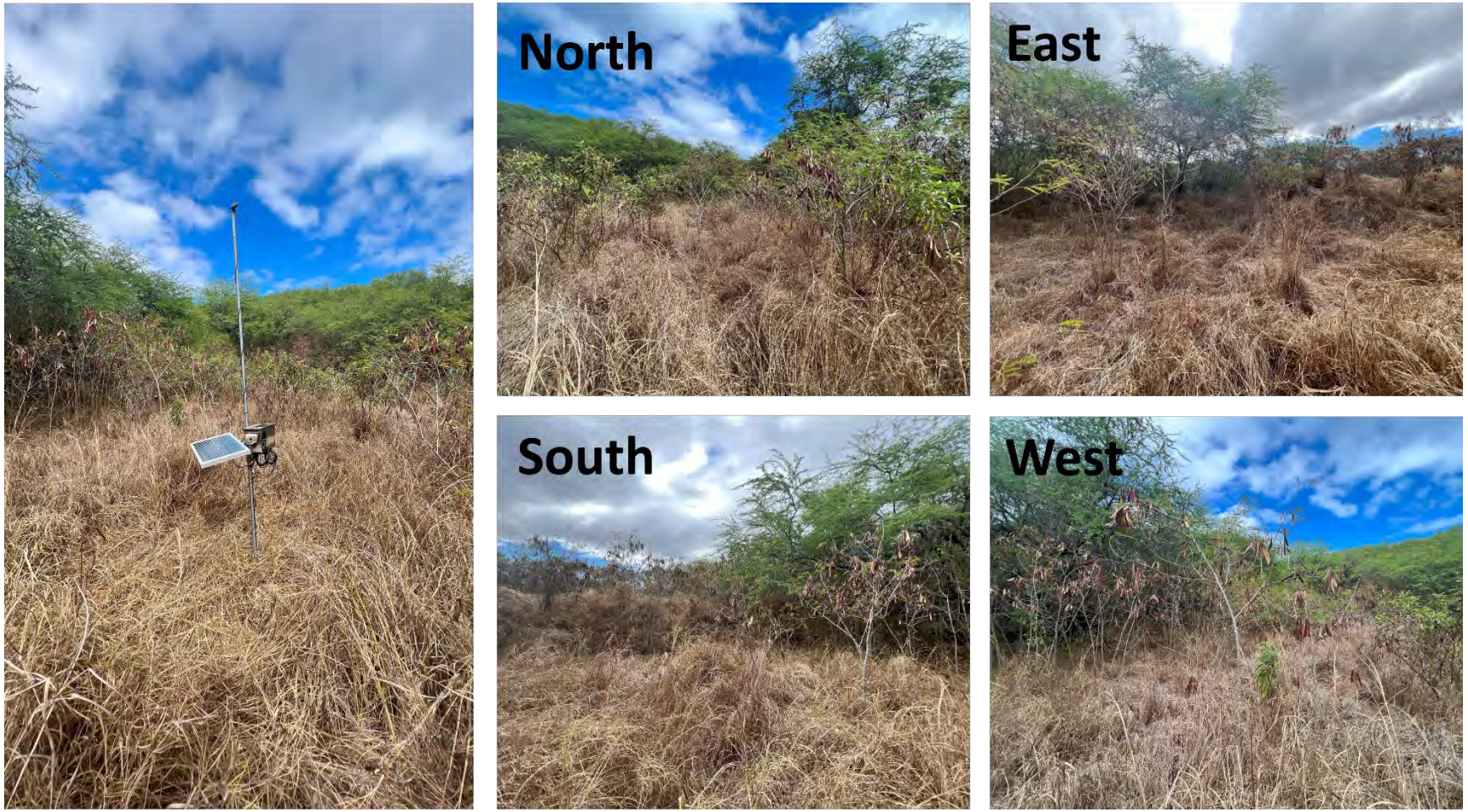

Figure A-1 Photos of the SM4 Acoustic Monitor and Immediate Surrounding Habitat at the North PMRF Site, Mānā Plain

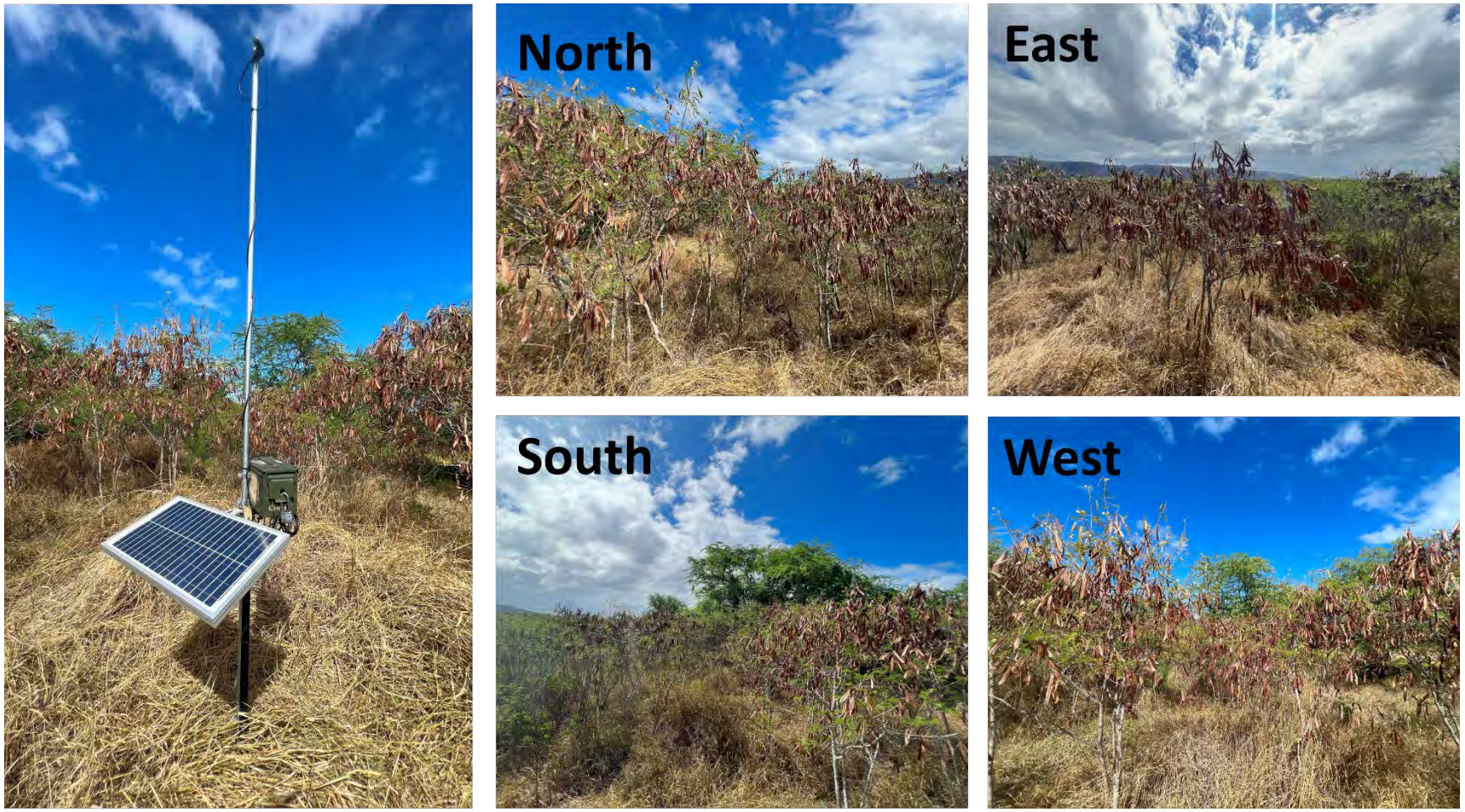

Figure A-2 Photos of the SM4 Acoustic Monitor and Immediate Surrounding Habitat at the Middle Gate Wetland Site, Mānā Plain

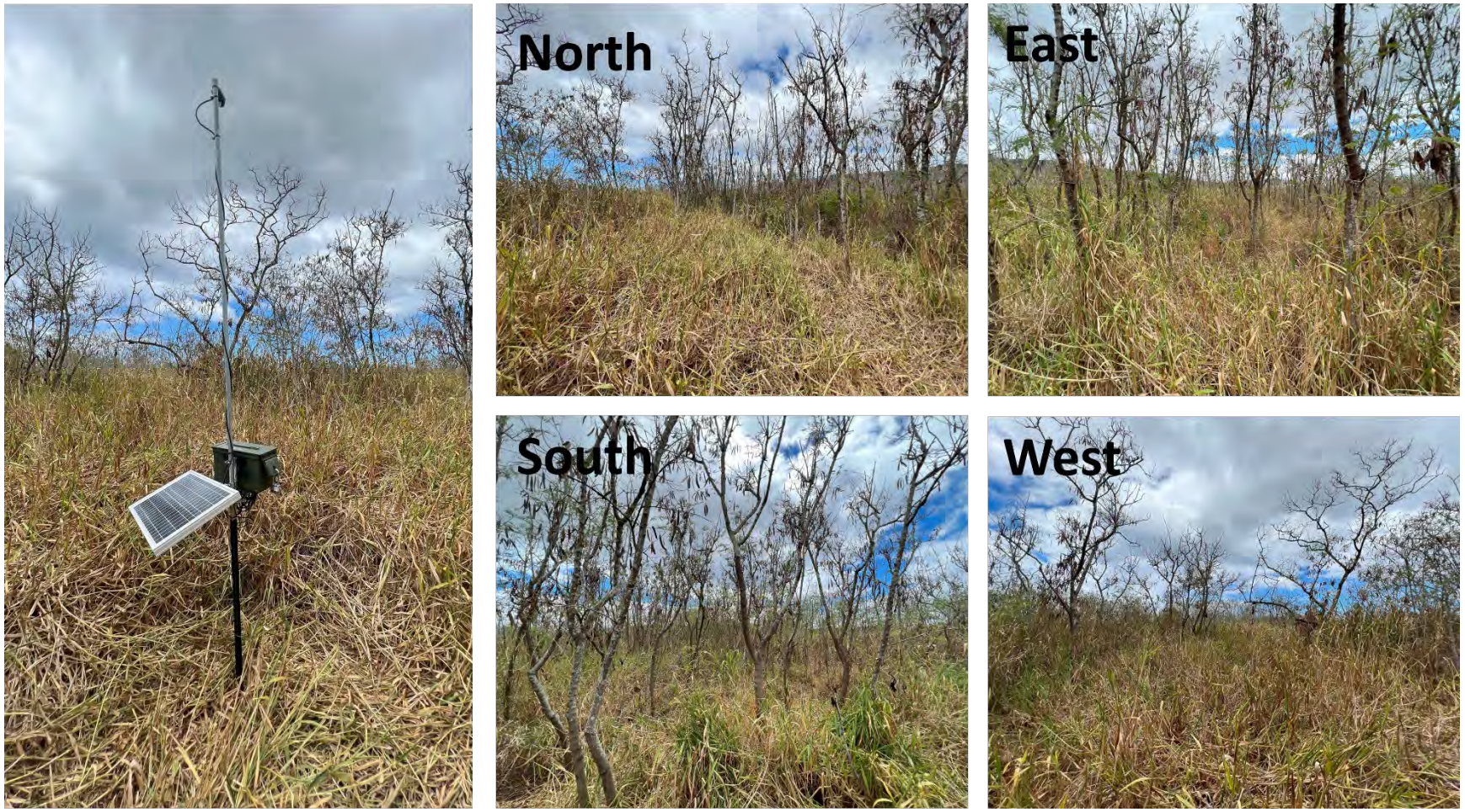

Figure A-3 Photos of the SM4 Acoustic Monitor and Immediate Surrounding Habitat at the South Agricultural Site, Mānā Plain

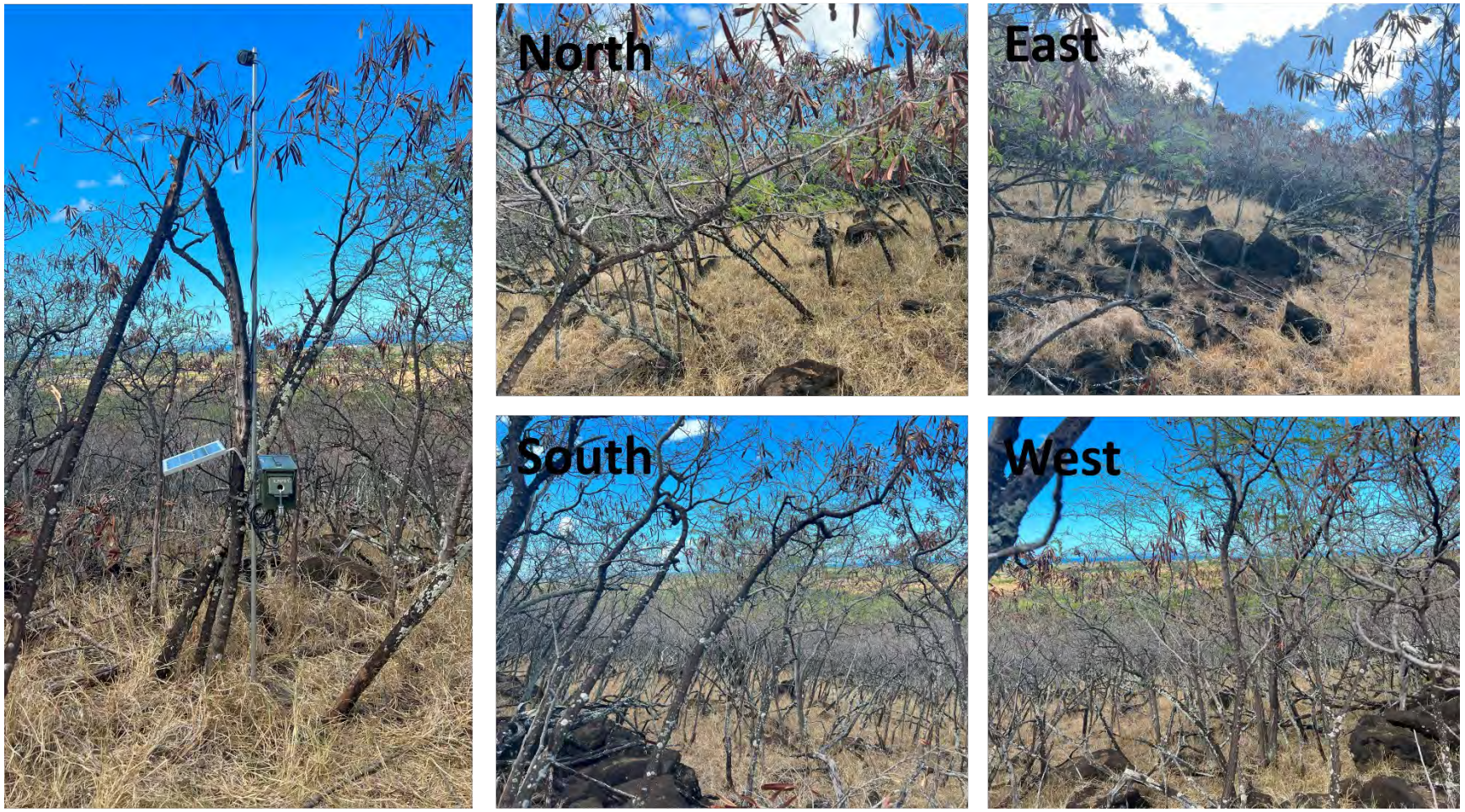

Figure A-4 Photos of the SM4 Acoustic Monitor and Immediate Surrounding Habitat at the Kamokalā Ridge Site

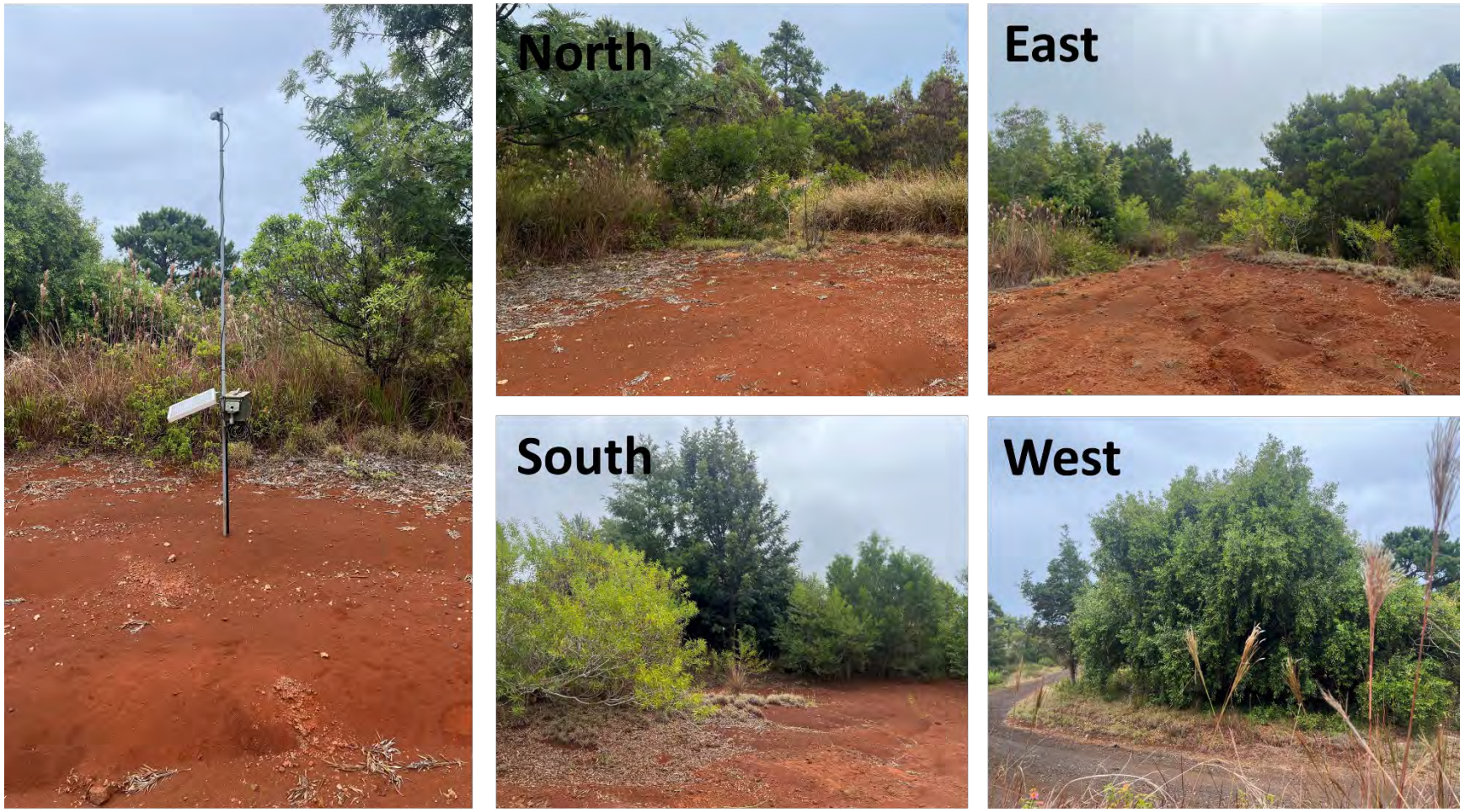

Figure A-4 Photos of the SM4 Acoustic Monitor and Immediate Surrounding Habitat at the Mākaha Ridge Site

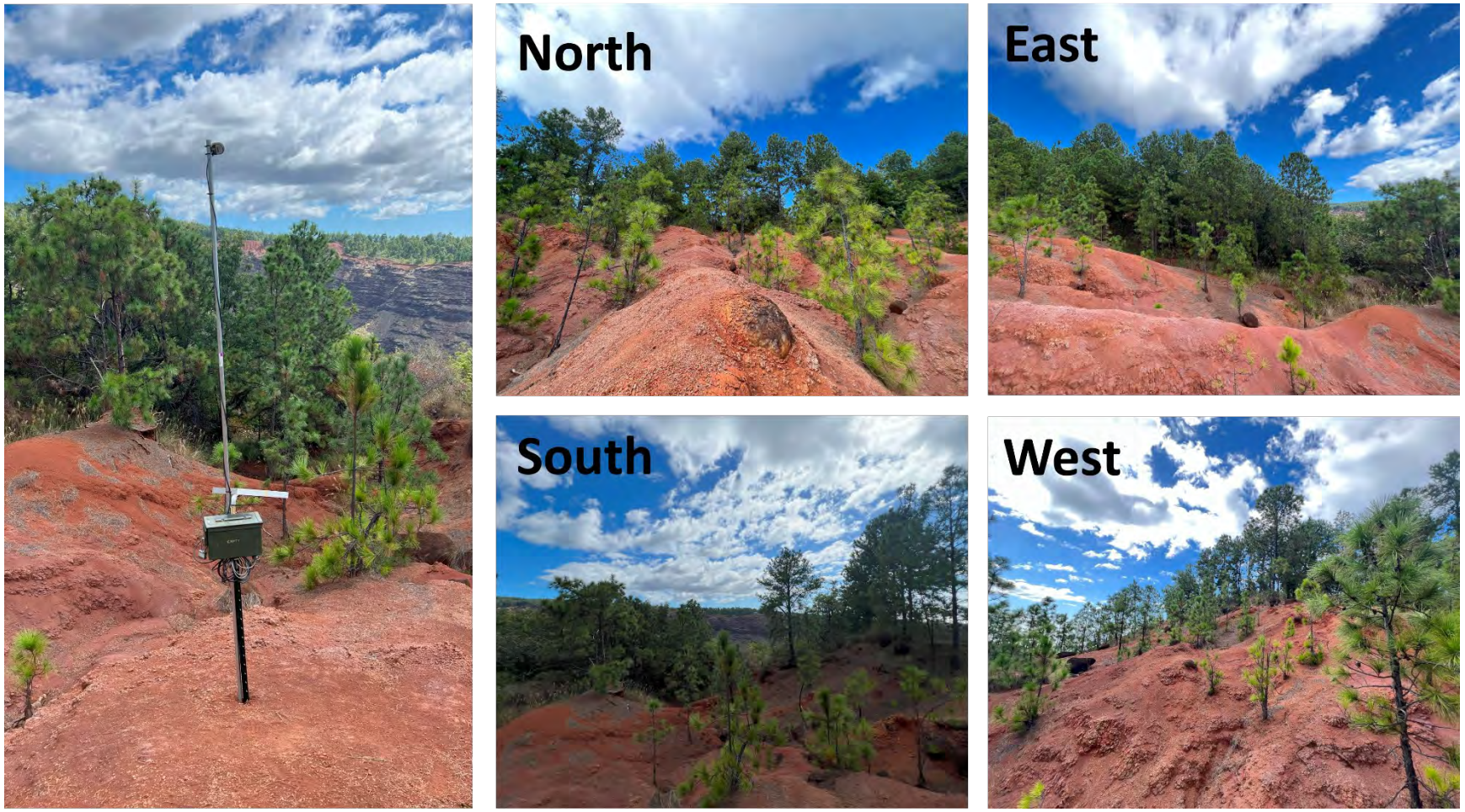

Figure A-4 Photos of the SM4 Acoustic Monitor and Immediate Surrounding Habitat at the Miloli‘i Ridge Site

Appendix B
Hardware and Software Parameters and Settings

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Platform	Parameter	Setting
Hardware		
Wildlife Acoustics SM4BAT-FS	Data type	Full spectrum
	Trigger window	3 seconds
	Trigger max	15 seconds
	Sampling rate	192 kilohertz
	Gain	12 decibels
	Minimum trigger frequency	16 kilohertz
	File format	.WAV
	Survey window	1 hour before sunset to 1 hour after sunrise
Software		
Kaleidoscope Pro v5.6.4	Signal of interest	8–120 kilohertz
	Duration	2–500 milliseconds
	Minimum pulses	2
	Classifier	Bats of North America 5.4.0
	Sensitivity	0 Balanced (neutral)

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Appendix C
Monthly Detection Rates for Hawaiian Hoary Bats Monitored Across PMRF Between 1 October 2023 and 30 September 2024

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Monitoring Location	Sampling Period	No. of Nights Sampled	No. of Nights with Detections	Detection Rate
Kamokalā Ridge	October 2023	31	31	1.00
	November 2023	30	28	0.93
	December 2023	31	20	0.65
	January 2024	31	13	0.42
	February 2024	29	10	0.34
	March 2024	31	10	0.32
	April 2024	30	20	0.67
	May 2024	31	29	0.94
	June 2024	30	15	0.50
	July 2024	31	24	0.77
	August 2024	31	28	0.90
	September 2024	30	30	1.00
Mākaha Ridge	October 2023	31	31	1.00
	November 2023	30	30	1.00
	December 2023	31	29	0.94
	January 2024	31	21	0.68
	February 2024	29	23	0.79
	March 2024	31	26	0.84
	April 2024	30	23	0.77
	May 2024	31	29	0.94
	June 2024	30	29	0.97
	July 2024	31	28	0.90
	August 2024	31	30	0.97
	September 2024	30	30	1.00
Middle Gate Wetland	October 2023	31	31	1.00
	November 2023	30	30	1.00
	December 2023	31	25	0.81
	January 2024	9	8	0.89
	February 2024	29	23	0.79
	March 2024	22	21	0.95
	April 2024	30	25	0.83
	May 2024	31	10	0.32
	June 2024	30	3	0.10
	July 2024	31	10	0.32
	August 2024	31	30	0.97

Monitoring Location	Sampling Period	No. of Nights Sampled	No. of Nights with Detections	Detection Rate
	September 2024	30	30	1.00
Miloli‘i Ridge	October 2023	31	31	1.00
	November 2023	30	30	1.00
	December 2023	31	30	0.97
	January 2024	31	28	0.90
	February 2024	29	28	0.97
	March 2024	31	31	1.00
	April 2024	30	28	0.93
	May 2024	31	30	0.97
	June 2024	30	30	1.00
	July 2024	31	31	1.00
	August 2024	31	31	1.00
	September 2024	30	30	1.00
North PMRF Site	October 2023	31	31	1.00
	November 2023	30	30	1.00
	December 2023	20	18	0.90
	January 2024	31	25	0.81
	February 2024	28	25	0.89
	March 2024	31	27	0.87
	April 2024	30	29	0.97
	May 2024	31	31	1.00
	June 2024	30	29	0.97
	July 2024	31	31	1.00
	August 2024	31	31	1.00
	September 2024	30	30	1.00
South Ag Site	October 2023	31	30	0.97
	November 2023	30	29	0.97
	December 2023	31	16	0.52
	January 2024	23	9	0.39
	February 2024	28	9	0.32
	March 2024	31	9	0.29
	April 2024	30	21	0.70
	May 2024	31	17	0.55
	June 2024	30	7	0.23
	July 2024	31	18	0.58

Monitoring Location	Sampling Period	No. of Nights Sampled	No. of Nights with Detections	Detection Rate
	August 2024	31	29	0.94
	September 2024	30	30	1.00

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KPGO Flora Survey Report

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Vegetation Survey Final Report of the Kōkeʻe Park Geophysical Observatory

Kauaʻi, Hawaiʻi

Task Order 28
Contract No. 80GSFC21CA008

Prepared For:

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May 14, 2025

Recommended Citation: Hamer Environmental. 2025. Vegetation Survey Final Report of the Kōkeʻe Park Geophysical Observatory. In support of the Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate EIS. Kauaʻi, Hawaiʻi.

Errata - Addendum to:

Vegetation Survey Final Report of the Kōkeʻe Park Geophysical Observatory. Kauaʻi, Hawaiʻi.

Prepared by:

Erin Colclazier

Hamer Environmental, L.P.

Date: May 14, 2025

Explanation of correction: A U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) report was produced to identify known federally listed species habitat and occurrences in the vicinity of the Kōkeʻe Park Geophysical Observatory (KPGO) study area (USFWS 2024). Within the IPaC report, critical habitat for multiple plant species with protected status was identified within a small portion of the KPGO study area, at the edge of Site D. Those species included: Broadleaf Dubautia (koholāpehu, *Dubautia latifolia*), ʻAiea (hālena, *Nothocestrum peltatum*), ʻAiakeakua (pōpolo, *Solanum sandwicense*), 'Akoko (*Euphorbia halemanui*), and Mann's Bluegrass (*Poa mannii*). A review of those plant species' mapped critical habitat boundaries was completed by USFWS Fish and Wildlife Biologist – DoD Coordinator, Ryan Pea and team on March 30, 2026. The USFWS determined that critical habitat for the above-named species erroneously included a small portion of the KPGO study area, due to a mapping error, and no critical habitat is designated for those species within KPGO.

As a result of this determination, Table 2-1. Special Status Plant Species Known to Occur or with Potential to Occur in the KPGO Study Area (Pages 9-12, Section 2.2) was revised as below, to exclude any text indicating critical habitat for these plant species occurs within the KPGO study area.

Original text:

> **Table 2-1. Special Status Plant Species Known to Occur or with Potential to Occur in the KPGO Study Area.**

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
Broadleaf Dubautia (Koholāpehu)	*Dubautia latifolia*	E	Endemic to the western side of the island of Kaua'i, scattered in mesic forests on ridges and in gulches with 20,355 acres of mostly state land designated as critical habitat, and includes the KPGO study area (USFWS 2024).	The survey area falls within designated critical habitat for the species and contains mesic forest with potential for this species to occur, though no extensive gulch or ridgeline habitat is found within the KPGO study area.

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
Halemanu Broom-spurge ('Akoko)	*Euphorbia halemanui* (syn. *Chamaesyce halemanui*)	E	Endemic to Kaua'i in mesic forests on gulch slopes. Previously documented on State of Hawaii lands just outside the boundary of Kōke'e Site D	The survey area contains mesic forest habitat with potential for this species to occur, though no extensive gulch habitat is found within the KPGO study area.
Nā Pali coast labordia (kāmakahala)	*Geniostoma helleri* (syn. *Labordia helleri*)	E	Occur in mesic forests of Kōke'e and western canyons in Kaua'i.	The survey area contains mesic forest habitat with potential for this species to occur, though no canyon habitat is found within the KPGO study area. Designated critical habitat for this species does not overlap with the survey area (USFWS 2024).
Kōlea	*Myrsine knudsenii* (syn. *M. mezii*)	E	Occur above streams through disturbed mixed mesic forest of *Acacia koa* and *Metrosideros polymorpha* with *Syzygium, Dodonaea, Hedyotis, Psychotria, Scaevola, Perrottetia*, and *Diplazium*.	The survey area contains disturbed mesic forest with associated species in Sites B, D, and E with potential for this species to occur, though designated critical habitat does not overlap with the survey area (USFWS 2024).
'Aiea (hālena)	*Nothocestrum peltatum*	E	Occur in mesic forest of *Acacia koa* and *Metrosideros polymorpha* mesic forests with deep rich soil on steep slopes at elevations of 915-1,220 m.	The survey area falls within designated critical habitat for the species and contains mesic forest with potential for this species to occur, though steep forest slope habitat is limited within the KPGO study area.
kōpiko	*Psychotria grandiflora*	E	Endemic to Kaua'i, in Kōke'e and Alaka'i Swamp. Occur in mesic to mesic-wet forest at elevations of 1,040-1,230 m.	The survey area falls outside of designated critical habitat, mostly within Kōke'e State Park, but mesic forest habitat and elevational range for the species overlaps with the KPGO study area, so there is potential for this species to occur.

`aiakeakua, pōpolo	*Solanum sandwicense*	E	Endemic to Kauaʻi and Oʻahu and found in open areas of lowland to montane mesic forests of *Acacia koa* and Metrosideros polymorpha at elevations of 760-1,220 m.	The survey area falls within designated critical habitat for the species, and mesic forests are present, so there is potential for the species to occur.
-	*Xylosma crenatum*	E	Occur in diverse *Acacia koa* and *Metrosideros polymorpha* montane mesic forest, sometimes along streambanks, at elevations of 975-1,065 m.	The survey area falls outside of designated critical habitat, but mesic forest habitat and elevational range for the species overlaps with the KPGO study area, so there is potential for this species to occur.

Common (Hawaiian) Name	**Scientific Name**	**Regulatory Status[1]**	**Known Habitat & Occurrences**	**Potential to Occur in the KPGO Vegetation Survey Area**
Federal Species of Concern (no regulatory status)				
Kauila, Kauwila	*Alphitonia ponderosa*	SOC	Occur in dry to mesic forests and woodlands at elevations of 240-1250 m. Present in several different plant communities, including Koa Lowland Dry Forest, Olopua (*Nestegis*) Montane Mesic Forest, and a dry woodland with an open canopy of ʻōhiʻa (*Metrosideros polymorpha)* trees and a sparse hopbush (Dodonaea viscosa*)* and pūkiawe(*Leptocophylla tameiameiae*) shrub understory.	The survey area occurs within the upper elevational range for this species, and dry woodland habitat with an open canopy of ʻōhiʻa with sparse hopbush and pūkiawe shrub understory does occur, so potential habitat is present.
Haha lua (hāhā lua, Hāhā)	*Cyanea leptostegia*	SOC	Endemic to the western side of the island of Kauaʻi in wet-mesic forests.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present.
Pua maka nui, akaʻakaʻawa	*Hillebrandia sandwicensis*	SOC	Occur in mesic forest ravines at elevations of 900–1800 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present, but few forest ravines are found within the KPGO study area.
Pānaunau	*Lobelia yuccoides*	SOC	Occur in mesic forests and shrublands on ridge crests, gulch slopes, cliff faces and streambanks.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present, but ridge crests, cliff faces, steep gulches, and streambanks are absent from the KPGO study area.

Stone's alani (alani)	*Melicope stonei*	SOC	Occur in mesic montane forest within a narrow elevation range of 988-1,097 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present.
ʻohe'ohe	*Polyscias kavaiensis*	SOC	Occur in mesic to wet forests at elevations of 650-1,600 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present.
Common (Hawaiian) Name	**Scientific Name**	**Regulatory Status[1]**	**Known Habitat & Occurrences**	**Potential to Occur in the KPGO Vegetation Survey Area**
Alakaʻi Swamp pritchardia (loulu)	*Pritchardia minor*	SOC	Occur in mesic to wet forests, in valleys and on exposed slopes from the Alakaʻi Swamp to the Kōkeʻe area and western Nāpali Coast and Waimea Canyon on Kauaʻi at elevations of 500 to 1,300 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present, though valleys and exposed slope areas are limited within the KPGO study area.
Keahi	*Sideroxylon polynesicum*	SOC	Occur in dry to dry-mesic forests at elevations of 130-640m.	The survey area occurs within the range of this species and contains dry-mesic forests, so potential habitat is present.
Kāwaʻu, kāwaʻu kua kuku kapa	*Zanthoxylum dipetalum*	SOC	Occur in degraded *Metrosideros polymorpha*-dominated montane mesic forests, often on aʻa lava, at elevations of 915-1,040 m. Associated species include mamane, lama, alaa, iliahi, ohe kolea, and kopiko.	The survey area occurs within the range of this species and contains ʻohia-dominated mesic forests, so potential habitat is present.
Kauaʻi pricklyash, (aʻe)	*Zanthoxylum kauaense*	SOC	Occur in mixed mesic, dry or wet forests at elevations of 300-1,980 m.	The survey area occurs within the range of this species and contains dry-mesic forests, so potential habitat is present.

[1]Regulatory Status: E = Federal and State Endangered. SOC = Federal Species of Concern, no protection status.

Corrections to Table 2-1 in Track Changes:

Table 2-1. Special Status Plant Species Known to Occur or with Potential to Occur in the KPGO Study Area.

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
Broadleaf Dubautia (Koholāpehu)	*Dubautia latifolia*	E	Endemic to the western side of the island of Kaua'i, scattered in mesic forests on ridges and in gulches with 20,355 acres of mostly state land designated as critical habitat, and includes the KPGO study area (USFWS 2024).	The survey area falls ~~within~~ outside of designated critical habitat for the species ~~and~~ but contains mesic forest with potential for this species to occur, though no extensive gulch or ridgeline habitat is found within the KPGO study area.

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
'Aiea (hālena)	*Nothocestrum peltatum*	E	Occur in mesic forest of *Acacia koa* and *Metrosideros polymorpha* mesic forests with deep rich soil on steep slopes at elevations of 915-1,220 m.	The survey area falls ~~within~~ outside of designated critical habitat for the species ~~and~~ but contains mesic forest with potential for this species to occur, though steep forest slope habitat is limited within the KPGO study area.
`Aiakeakua, pōpolo	*Solanum sandwicense*	E	Endemic to Kaua'i and O'ahu and found in open areas of lowland to montane mesic forests of *Acacia koa* and Metrosideros polymorpha at elevations of 760-1,220 m.	The survey area falls ~~within~~ outside of designated critical habitat for the species, ~~and~~ but mesic forests are present, so there is potential for the species to occur.

Corrected version of the full Table 2.1:

Table 2-1. Special Status Plant Species Known to Occur or with Potential to Occur in the KPGO Study Area.

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
Broadleaf Dubautia (Koholāpehu)	*Dubautia latifolia*	E	Endemic to the western side of the island of Kauaʻi, scattered in mesic forests on ridges and in gulches with 20,355 acres of mostly state land designated as critical habitat, and includes the KPGO study area (USFWS 2024).	The survey area falls outside of designated critical habitat for the species but contains mesic forest with potential for this species to occur, though no extensive gulch or ridgeline habitat is found within the KPGO study area.
Halemanu Broom-spurge (ʻAkoko)	*Euphorbia halemanui* (syn. *Chamaesyce halemanui*)	E	Endemic to Kauaʻi in mesic forests on gulch slopes. Previously documented on State of Hawaii lands just outside the boundary of Kōkeʻe Site D.	The survey area contains mesic forest habitat with potential for this species to occur, though no extensive gulch habitat is found within the KPGO study area.
Nā Pali coast labordia (kāmakahala)	*Geniostoma helleri* (syn. *Labordia helleri*)	E	Occur in mesic forests of Kōkeʻe and western canyons in Kauaʻi.	The survey area contains mesic forest habitat with potential for this species to occur, though no canyon habitat is found within the KPGO study area. Designated critical habitat for this species does not overlap with the survey area (USFWS 2024).
Kōlea	*Myrsine knudsenii* (syn. *M. mezii*)	E	Occur above streams through disturbed mixed mesic forest of Acacia koa and Metrosideros polymorpha with Syzygium, Dodonaea, Hedyotis, Psychotria, Scaevola, Perrottetia, and Diplazium.	The survey area contains disturbed mesic forest with associated species in Sites B, D, and E with potential for this species to occur, though designated critical habitat does not overlap with the survey area (USFWS 2024).
ʻAiea (hālena)	*Nothocestrum peltatum*	E	Occur in mesic forest of *Acacia* koa and Metrosideros polymorpha mesic forests with deep rich soil on steep slopes at elevations of 915-1,220 m.	The survey area falls outside of designated critical habitat for the species but contains mesic forest with potential for this species to occur, though steep forest slope habitat is limited within the KPGO study area.

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
kōpiko	*Psychotria grandiflora*	E	Endemic to Kauaʻi, in Kōkeʻe and Alakaʻi Swamp. Occur in mesic to mesic-wet forest at elevations of 1,040-1,230 m.	The survey area falls outside of designated critical habitat, mostly within Kōkeʻe State Park, but mesic forest habitat and elevational range for the species overlaps with the KPGO study area, so there is potential for this species to occur.
`aiakeakua,	*Solanum sandwicense*	E	Endemic to Kauaʻi and Oʻahu and found in open areas of lowland to montane mesic forests of *Acacia koa* and Metrosideros polymorpha at elevations of 760-1,220 m.	The survey area falls outside of designated critical habitat for the species, but mesic forests are present, so there is potential for the species to occur.
-	*Xylosma crenatum*	E	Occur in diverse *Acacia koa* and Metrosideros polymorpha montane mesic forest, sometimes along streambanks, at elevations of 975-1,065 m.	The survey area falls outside of designated critical habitat, but mesic forest habitat and elevational range for the species overlaps with the KPGO study area, so there is potential for this species to occur.
Federal Species of Concern (no regulatory status)				
Kauila, Kauwila	*Alphitonia ponderosa*	SOC	Occur in dry to mesic forests and woodlands at elevations of 240-1250 m. Present in several different plant communities, including Koa Lowland Dry Forest, Olopua (*Nestegis*) Montane Mesic Forest, and a dry woodland with an open canopy of ʻōhiʻa (*Metrosideros polymorpha)* trees and a sparse hopbush (Dodonaea viscosa*)* and pūkiawe(*Leptocophylla tameiameiae*) shrub understory.	The survey area occurs within the upper elevational range for this species, and dry woodland habitat with an open canopy of ʻōhiʻa with sparse hopbush and pūkiawe shrub understory does occur, so potential habitat is present.
Haha lua (Hāhā lua, Hāhā)	*Cyanea leptostegia*	SOC	Endemic to the western side of the island of Kauaʻi in wet-mesic forests.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present.
Pua maka nui, akaʻakaʻawa	*Hillebrandia sandwicensis*	SOC	Occur in mesic forest ravines at elevations of 900–1800 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present, but few forest ravines are found within the KPGO study area.

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
Pānaunau	*Lobelia yuccoides*	SOC	Occur in mesic forests and shrublands on ridge crests, gulch slopes, cliff faces and streambanks.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present, but ridge crests, cliff faces, steep gulches, and streambanks are absent from the KPGO study area.
Stone's alani (alani)	*Melicope stonei*	SOC	Occur in mesic montane forest within a narrow elevation range of 988-1,097 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present.
'ohe'ohe	*Polyscias kavaiensis*	SOC	Occur in mesic to wet forests at elevations of 650-1,600 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present.

[1]Regulatory Status: E = Federal and State Endangered. SOC = Federal Species of Concern, no protection status.

Signed: _____ **Date:** **April 6, 2026**

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ACRONYMS AND ABBREVIATIONS

DLNR	Department of Land and Natural Resources
DON	Department of the Navy
EIS	Environmental Impact Statement
ESA	Endangered Species Act
GIS	geographic information system
GPS	global positioning system
INRMP	Integrated Natural Resources Management Plan
KISC	Kauaʻi Invasive Species Committee
KPGO	Kōkeʻe Park Geophysical Observatory
KRCP	Kōkeʻe Resource Conservation Program
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Systems Command
NEPA	National Environmental Policy Act
PMRF	Pacific Missile Range Facility
SOW	Statement of Work
USFWS	United States Fish and Wildlife Service

1. INTRODUCTION

1.1 BACKGROUND

Hamer Environmental, L.P. (Hamer) was contracted by DAWSON to conduct vegetation mapping and plant surveys for the National Aeronautics and Space Administration (NASA) at Kōkeʻe Park Geophysical Observatory (KPGO) properties on Kauaʻi, Hawaiʻi. The KPGO study area is approximately 25 acres (ac) and consists of five parcels (Figure 1-1). NASA and the U.S. Department of the Navy (Navy) in coordination with the Hawaiʻi Department of Land and Natural Resources (DLNR) are preparing a Real Estate Environmental Impact Statement (EIS) which evaluates the potential environmental consequences of the Navy's and NASA's proposal to retain the use of lands for the Navy's continued and ongoing military testing and training at Pacific Missile Range Facility (PMRF) and NASA's continued operations at KPGO. Existing NASA and Navy real estate agreements with the DLNR are set to expire between 2027 and 2030. The survey results will be used for future project planning, development of avoidance and minimization measures, National Environmental Policy Act (NEPA) analysis, Chapter 343, Hawaiʻi Revised Statutes (HRS) referred to as Hawaiʻi Environmental Policy Act (HEPA) analysis, and/or potential ESA Section 7 consultation.

Following the project Statement of Work (SOW) issued January 2024, Hamer completed desktop vegetation mapping and developed a work plan in April 2024 of vegetation resources for the survey area, Endangered Species Act (ESA)-listed plant species with potential to occur in the KPGO study area, proposed methodology and data collection, reporting, and schedule and personnel for field surveys. Hamer conducted vegetation surveys for ESA-listed plant species and completed a full botanical inventory within the KPGO study area over two survey seasons of April to May and October 2024. This report summarizes the findings of the vegetation surveys.

1.2 PURPOSE OF SURVEY

As stated in the project SOW, the purpose of the terrestrial vegetation surveys was to document protected plant species, map plant cover types and invasive plant species as well as predator and wildlife pest species within the KPGO study area (Figure 1-1). The objective of the vegetation surveys was to identify the terrestrial vegetation resources within the KPGO study area to support environmental evaluations and consultations.

1.3 SURVEY AREA

Based on the results of the desktop analysis presented in Chapter 2, specific plant species were targeted for surveys using the methodologies presented in Chapter 3. The KPGO study area is 24.9 ac and consists of five parcels (listed from north to south), Site E (5.7 ac), Site D (6.5 ac), Site C (6.2 ac), Site B (1.2 ac) and Site A (5.3 ac) (Figure 1-1). The KPGO study area is located between 1,130 and 1,160 meters (m) (3,710 feet [ft] and 3,800 ft) elevation in Kōkeʻe State Park on the northerly Kaunuohua Ridge east of Mākaha Ridge and the northwestern end of Waimea Canyon (NAVFAC 2023). The KPGO study area is comprised of buildings and other impervious surfaces, as well as mowed lawns in open areas with forest along the

property margins. The KPGO study area is located within the Waimea-Kekaha region of the State of Hawai'i's Conservation District, within a Resource Subzone, as classified by Chapter 205 of Hawai'i Revised Statutes. The KPGO study area is close to the Division of Forestry and Wildlife-managed Kuia Natural Area Reserve, located within a Protected Resource Subzone. Lands surrounding the KPGO study area are primarily used for recreation with trails, campgrounds and scenic overlooks (NAVFAC 2023). Hunting and cultural plant harvesting also occur in the surrounding lands.

The terrestrial vegetation survey area is 19.2 ac, consisting of all lands not comprised of impervious surfaces (roads, buildings) (National Oceanic and Atmospheric Administration [NOAA] 2010). The terrestrial vegetation survey area is 79% (15.1 ac), with evergreen forest of 6% (1.2 ac), scrub-shrub land covers, and 15% (2.9 ac) developed open space (managed grasses like lawn or low-lying vegetation) (Figure 1-2).
The vegetation survey area consists of 15.1 ac of evergreen forest and 1.2 ac of scrub-shrub habitats to be surveyed by 10-m spaced parallel transects, and 2.9 ac of developed open space that will be surveyed more generally.

1.4 Survey Schedule and Personnel

Vegetation surveys were completed by one to two botanists from May 6-10, 2024 (spring survey) and from October 10-11, 14-17, 2024 (fall survey), with daily surveys conducted between 6:15 am and 3:30 pm Hawai'i Standard Time. Hamer botanists, Kenneth Woods and Erin Colclazier, conducted the vegetation surveys and determined the target special status plant species most likely to occur in the vegetation survey area. For all KPGO surveys (vegetation, fauna, and bat), Erin Colclazier was the project manager, and Kendra Ritchie was the GIS analyst.

Figure 1-1. Kōkeʻe Park Geophysical Observatory Study Area, Comprised of Five (5) Parcels (Sites A, B, C, D, E) on Kauaʻi, Hawaiʻi.

Figure 1-2. Land Cover Types for Vegetation Surveys (all but Impervious [Green]) within the KPGO Study Area on Kauaʻi, Hawaiʻi.

2. VEGETATION DESKTOP ANALYSIS

2.1 EXISTING DATA IN THE VEGETATION SURVEY AREA

Existing literature and GIS data from the Scope of Work (SOW) listed sources, additional sources, PMRF Navy Biologists, and Hamer's internal team knowledge was reviewed to determine potential habitats for special status flora species in the study area. Data reviewed by Hamer included:

- U.S. Navy PMRF Integrated Management Plan (INRMP) (NAVFAC 2023, NAVFAC 2010), and associated GIS data (NAVFAC 2024);
- NOAA Coastal Change Analysis Program Regional Land Cover and Change (NOAA 2010);
- Hawai'i State Wildlife Action Plan (SWAP) for federal- and state-listed species with potential to occur in the vegetation survey areas and species fact sheets (DLNR 2015, DLNR 2024);
- U. S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) report produced to identify known federally listed species habitat and occurrences in the vicinity of the KPGO study area (USFWS 2024);
- Previous records for federal- and state-listed plant species within 1,000 m of the KPGO study area, maintained for the island of Kaua'i by Senior Botanist Ken Wood (Hamer team);
- Soil data (Natural Resources Conservation Service [NRCS] 2024), and
- Satellite imagery, site topography, and other available data resources to assess vegetation cover and potentially suitable habitats for vegetation in the KPGO study area.

2.2 SPECIAL STATUS PLANT SPECIES HABITAT REVIEW

Special status plants with potential to occur in the KPGO study area and details on their known habitat and likelihood of potential habitat presence within the vegetation survey area are listed in Table 2-1. This list includes all federally listed species and federal species of concern found in suitable habitats within 1,000-m of the KPGO study area. Plant species in the Hawai'i SWAP with potentially suitable habitat in the KPGO study area were also included.

Table 2-1. Special Status Plant Species Known to Occur or with Potential to Occur in the KPGO Study Area.

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
Broadleaf Dubautia (Koholāpehu)	*Dubautia latifolia*	E	Endemic to the western side of the island of Kaua'i, scattered in mesic forests on ridges and in gulches with 20,355 acres of mostly state land designated as critical habitat, and includes the KPGO study area (USFWS 2024).	The survey area falls within designated critical habitat for the species and contains mesic forest with potential for this species to occur, though no extensive gulch or ridgeline habitat is found within the KPGO study area.

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
Halemanu Broom-spurge (ʻAkoko)	*Euphorbia halemanui* (syn. *Chamaesyce halemanui*)	E	Endemic to Kauaʻi in mesic forests on gulch slopes. Previously documented on State of Hawaii lands just outside the boundary of Kōkeʻe Site D	The survey area contains mesic forest habitat with potential for this species to occur, though no extensive gulch habitat is found within the KPGO study area.
Nā Pali coast labordia (kāmakahala)	*Geniostoma helleri* (syn. *Labordia helleri*)	E	Occur in mesic forests of Kōkeʻe and western canyons in Kauaʻi.	The survey area contains mesic forest habitat with potential for this species to occur, though no canyon habitat is found within the KPGO study area. Designated critical habitat for this species does not overlap with the survey area (USFWS 2024).
Kōlea	*Myrsine knudsenii* (syn. *M. mezii*)	E	Occur above streams through disturbed mixed mesic forest of *Acacia koa* and *Metrosideros polymorpha* with *Syzygium, Dodonaea, Hedyotis, Psychotria, Scaevola, Perrottetia*, and *Diplazium*.	The survey area contains disturbed mesic forest with associated species in Sites B, D, and E with potential for this species to occur, though designated critical habitat does not overlap with the survey area (USFWS 2024).
ʻAiea (hālena)	*Nothocestrum peltatum*	E	Occur in mesic forest of *Acacia koa* and *Metrosideros polymorpha* mesic forests with deep rich soil on steep slopes at elevations of 915-1,220 m.	The survey area falls within designated critical habitat for the species and contains mesic forest with potential for this species to occur, though steep forest slope habitat is limited within the KPGO study area.
kōpiko	*Psychotria grandiflora*	E	Endemic to Kauaʻi, in Kōkeʻe and Alakaʻi Swamp. Occur in mesic to mesic-wet forest at elevations of 1,040-1,230 m.	The survey area falls outside of designated critical habitat, mostly within Kōkeʻe State Park, but mesic forest habitat and elevational range for the species overlaps with the KPGO study area, so there is potential for this species to occur.
`aiakeakua, pōpolo	*Solanum sandwicense*	E	Endemic to Kauaʻi and Oʻahu and found in open areas of lowland to montane mesic forests of *Acacia koa* and Metrosideros polymorpha at elevations of 760-1,220 m.	The survey area falls within designated critical habitat for the species, and mesic forests are present, so there is potential for the species to occur.
-	*Xylosma crenatum*	E	Occur in diverse *Acacia koa* and *Metrosideros polymorpha* montane mesic forest, sometimes along streambanks, at elevations of 975-1,065 m.	The survey area falls outside of designated critical habitat, but mesic forest habitat and elevational range for the species overlaps with the KPGO study

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
				area, so there is potential for this species to occur.
Federal Species of Concern (no regulatory status)				
Kauila, Kauwila	*Alphitonia ponderosa*	SOC	Occur in dry to mesic forests and woodlands at elevations of 240-1250 m. Present in several different plant communities, including Koa Lowland Dry Forest, Olopua (*Nestegis*) Montane Mesic Forest, and a dry woodland with an open canopy of ʻōhiʻa (*Metrosideros polymorpha)* trees and a sparse hopbush (Dodonaea viscosa*)* and pūkiawe(*Leptocophylla tameiameiae*) shrub understory.	The survey area occurs within the upper elevational range for this species, and dry woodland habitat with an open canopy of ʻōhiʻa with sparse hopbush and pūkiawe shrub understory does occur, so potential habitat is present.
Haha lua (hāhā lua, Hāhā)	*Cyanea leptostegia*	SOC	Endemic to the western side of the island of Kauaʻi in wet-mesic forests.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present.
Pua maka nui, akaʻakaʻawa	*Hillebrandia sandwicensis*	SOC	Occur in mesic forest ravines at elevations of 900–1800 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present, but few forest ravines are found within the KPGO study area.
Pānaunau	*Lobelia yuccoides*	SOC	Occur in mesic forests and shrublands on ridge crests, gulch slopes, cliff faces and streambanks.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present, but ridge crests, cliff faces, steep gulches, and streambanks are absent from the KPGO study area.
Stone's alani (alani)	*Melicope stonei*	SOC	Occur in mesic montane forest within a narrow elevation range of 988-1,097 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present.
ʻohe'ohe	*Polyscias kavaiensis*	SOC	Occur in mesic to wet forests at elevations of 650-1,600 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present.

Common (Hawaiian) Name	Scientific Name	Regulatory Status[1]	Known Habitat & Occurrences	Potential to Occur in the KPGO Vegetation Survey Area
Alaka'i Swamp pritchardia (loulu)	*Pritchardia minor*	SOC	Occur in mesic to wet forests, in valleys and on exposed slopes from the Alaka'i Swamp to the Kōke'e area and western Nāpali Coast and Waimea Canyon on Kaua'i at elevations of 500 to 1,300 m.	The survey area occurs within the range of this species and contains mesic forests, so potential habitat is present, though valleys and exposed slope areas are limited within the KPGO study area.
Keahi	*Sideroxylon polynesicum*	SOC	Occur in dry to dry-mesic forests at elevations of 130-640m.	The survey area occurs within the range of this species and contains dry-mesic forests, so potential habitat is present.
Kāwa'u, kāwa'u kua kuku kapa	*Zanthoxylum dipetalum*	SOC	Occur in degraded *Metrosideros polymorpha*-dominated montane mesic forests, often on a'a lava, at elevations of 915-1,040 m. Associated species include mamane, lama, alaa, iliahi, ohe kolea, and kopiko.	The survey area occurs within the range of this species and contains 'ohia-dominated mesic forests, so potential habitat is present.
Kaua'i pricklyash, (a'e)	*Zanthoxylum kauaense*	SOC	Occur in mixed mesic, dry or wet forests at elevations of 300-1,980 m.	The survey area occurs within the range of this species and contains dry-mesic forests, so potential habitat is present.

[1]Regulatory Status: E = Federal and State Endangered. SOC = Federal Species of Concern, no protection status.

2.3 INVASIVE PLANT SPECIES

Several invasive and/or noxious weeds species have been previously documented within the KPGO study area and include Prickly Blackberry (*Rubus argutus*), Strawberry Guava (*Psidium cattleianum*), Kāhili Ginger (*Hedychium gardnerianum*), Asian Melastome (*Melastoma candidum*), Banana Poka (*Passiflora mollissima*), and Fire Tree (*Morella faya*) (NAVFAC Pacific 2023).

3. SURVEY METHODS

Vegetation field surveys in spring and fall 2024 were conducted by two botanists for all special status plants, throughout potentially suitable habitats within the KPGO study area. Vegetation survey tracks represent one botanist's survey coverage, with the other botanist typically within 10-15 m (Figure 3-1, Figure 3-2). Botanical surveys were not conducted in areas deemed unsafe by NASA and Navy personnel (portion of western Site D), and areas where dense vegetation precluded access for coverage and consisted of dense monotypic stands of invasive plants such as strawberry guava, Prickly blackberry, and/or Lantana (*Lantana camara*) (Figure 3-1, Figure 3-2).

Field surveyors conducted presence/absence surveys for all special status plant species with potential to occur in the KPGO study area, with a focus on those species listed in Table 2-1. A comprehensive plant

species list was compiled for each site within the KPGO study area during the vegetation surveys. Vegetation community/land cover types were refined in the field and remapped when needed. Garmin Global Positioning System (GPS) units were pre-loaded with survey transects, and GPS tracklogs recorded botanist coverage of the study area. When a special status plant was identified, the population was mapped with a sub-meter level accuracy GPS unit (Juniper Geode™). All special status plant data was recorded as specified in the SOW, in addition to collection of close-up and overview photos of the plant population. Incidental observations of special status fauna or invasive fauna were documented when encountered.

Figure 3-1. Spring 2024 Vegetation Survey Coverage of the KPGO Study Area on Kauaʻi, Hawaiʻi.

Figure 3-2. Fall 2024 Vegetation Survey Coverage of the KPGO Study Area on Kaua‘i, Hawai‘i.

4. SURVEY RESULTS

All plant species observed during the spring and fall vegetation surveys, were identified, and individual lists were created for each of the 5 sites (A, B, C, D, and E) comprising the KPGO study area. For all sites combined, a total of 234 plant species were documented, including multiple special status plant species, and numerous noxious weeds and invasive plants (Appendix A). Photos of all special status plants and invasive weeds were collected as part of the plant survey Photo log (Appendix B). Representative photos were collected of vegetation cover types mapped in the KPGO study area (Appendix C). Overview photos were collected in different areas of the KPGO study area to show habitats (Appendix D).

4.1 SPECIAL STATUS PLANTS

Three special status plant species were identified during the 2024 vegetation surveys of the KPGO study area, the federal- and state-endangered Kōpiko (*Psychotria grandiflora*), and two federal species of concern Kauila (*Alphitonia ponderosa*), and Kauaʻi Pricklyash or Aʻe, (*Zanthoxylum kauaense*) (Table 4-1, Figure 4-1):

- **Kōpiko, Federally Endangered** – Six individual small trees-shrubs were documented within Site E in a small patch previously found by Ken Woods in 2006, and revisited, monitored, and tagged by Kauaʻi Plant Extinction Prevention Program (PEPP) August 12, 2020 (Figure 4-3, Appendix B). Of the 10 individuals previously tagged by Kauaʻi PEPP in 2020, only 6 were alive on May 9, 2024, and several had growth from a side shoot lower on the woody stem after previous upper growth had died. Overall, the population appeared non-vigorous and in decline, all individuals were vegetative (no flowers/fruits), and one individual (tag no. 3) had insect-damaged leaves. A revisit to the population was conducted on October 10, 2024 and a large branch had broken from a nearby tree and fallen into the center of the kōpiko population, reducing the total number of plants to 5 individuals, and the plants continue to look unhealthy, with insect damage and only vegetative growth (Appendix B).

- **Kauila, Federal Species of Concern** – Seven detections of these trees were made within the KPGO study area, and two additional detections were made just outside of the boundary for Site E. All detections consisted of a single individual tree, and all were deemed as healthy but for one, which showed some evidence of dieback on some branches, and insect damage on some leaves. Detections were made within KPGO study area Sites B (2 detections), C (4 detections), Site E (1 detection) and two just outside of Site E.

- **Kauaʻi pricklyash or aʻe, Federal Species of Concern** – Two detections, both outside of the KPGO study area, were made of this species. One detection was of a single tree 7.5 m south of Site C boundary, and the other was of 5 individual trees 36 m south of Site B. Individual plants in both locations were deemed healthy.

Although federally endangered Halemanu (*Euphorbia halemanui*) was previously documented outside Site D of the KPGO study area, the plant species was not identified during the 2024 vegetation surveys (NAVFAC Pacific 2010, 2023). Oheʻohe (*Polyscias kavaiensis* syn. *Tetraplasandra k.*), a state species of concern, was noted previously in the KPGO study area (NAVFAC Pacific 2010, 2023). While Oheʻohe was not observed during this survey, two others, Hawaiʻi ʻohe (*P. hawaiensis*) and ʻOhe kikoʻola (*P. waimeae*), both endemic and a closely related species of the same genus, were documented.

Table 4-1. Special Status Plants Observed in the KPGO Study Area (Sites A, B, C, D, E) on Kaua'i, Hawai'i.

Common Name	Scientific Name	Status[1]	Site A	Site B	Site C	Site D	Site E	No. of Plants[2]	Life Stage/Condition/Notes
Kōpiko	*Psychotria grandiflora*	E					x	5	One location in Site E, with 5 total individuals, in decline, with fewer surviving individuals than when documented in 2020 by Kaua'i PEPP.
Kauila, Kauwila	*Alphitonia ponderosa*	SOC		x	x		x	7 (2)[2]	Seven locations: 2 in Site B, 4 in Site C, and 1 in Site E (+2 just outside of Site E/KPGO study area), all but 1 appeared healthy.
Kaua'i Pricklyash, A'e	*Zanthoxylum kauaense*	SOC		(x)	(x)			(6)[2]	No detections were made within the KPGO study area, but 2 locations were documented just outside, 1 tree outside of Site C, and 5 individual trees just south of Site B.

[1]Regulatory Status: E = Federal and State Endangered, SOC = Federal Species of Concern.
[2]Number of Plants, when plants were identified outside of the KPGO project area their numbers were reported in parentheses and detailed in the notes column.

4.2 INVASIVE PLANTS

Seven State-listed noxious weeds were documented in the KPGO study area: Prickly Blackberry and Chinese Privet (*Ligustrum sinense*) were the most abundant noxious weeds found in every site, Black Wattle (*Acacia mearnsii*), Spreading Mist Flower (*Ageratina riparia*), Bull Thistle (*Cirsium vulgare*), and Ivy Gourd (*Coccinia grandis*) were all found in limited numbers, each in only one site of the KPGO study area (Table 4-2, Appendix B). Noted as highly invasive by the Kōke'e Resource Conservation Program (KRCP), Strawberry Guava (*Psidium cattleianum*) infestations were documented in every site of the KPGO study area, and in some areas were so dense that field botanists could not pass through (Sites A, D, and E contained dense patches). All five of the invasive plant species targeted by the KRCP occur in the KPGO study area: Kāhili Ginger, Fire Tree (*Morella faya*), Firethorn (*Pyracantha angustifolia*), Chinese Privet, and Strawberry Guava. Thirteen Kaua'i Invasive Species Council (KISC) invasives were found including widespread Lantana (*Lantana camara*), Prickly Blackberry, and Daisy Fleabane (*Erigeron karvinskianus*). Those KISC species with more limited presence and potential for eradication included Kāhili Ginger (*Hedychium gardnerium*), Smoke Bush (*Buddleia madagascariensis*), Dogtail (*B. asiatica*), Bolivian Fuschia (*Fuschia boliviana*), Castor Bean (*Ricinus communis*), and Australian Tree Fern (*Sphaeropteris cooperi*).

Table 4-2. Hawai'i State Designated Noxious Weeds and Invasive Species in the KPGO Study Area.

Common Name	Scientific Name	Regulatory Status	Site A	Site B	Site C	Site D	Site E	Previous KPGO Detection	Notes
Black Wattle	*Acacia mearnsii*	NW			x	x			few in Site C, abundant on one slope in Site D
Spreading Mist Flower	*Ageratina riparia*	NW	x	x	x			x	widespread in meadow and disturbed areas
Dogtail	*Buddleia asiatica*	KISC	x		x				1-2 plants at each site, few
Bull Thistle	*Cirsium vulgare*	KISC				x		x	2 plants
Ivy Gourd, Tam Lung	*Coccinia grandis*	NW, KISC	x						limited to a few small areas of Site A
Australian Daisy	*Erigeron karvinskianus*	KISC	x	x	x	x	x	x	widespread
Bolivian Fuschia	*Fuschia boliviana*	KISC	x		x	x	x		few patches at forest edges
Kāhili Ginger	*Hedychium gardnerium*	KISC, KRCP	x		x			x	few dense patches, each 80-200 sqft
Comb Hyptis	*Hyptis pectinata*	NW	x		x				few individuals
Lantana	*Lantana camara*	KISC	x	x	x	x		x	widespread
Chinese Privet	*Ligustrum sinense*	KISC, KRCP	x	x	x	x	x		widespread
Japanese Honeysuckle	*Lonicera japonica*	KISC	x	x	x	x	x		widespread
Asian Melastome	*Melastoma malabathricum* subsp. *Malabathricum* (was *M. candidum*)	NW	x			x		x	few individuals
Fire Tree	*Morella faya* (syn. *Myrica f.*)	NW, KRCP	x	x	x	x	x	x	common along forest edges
Strawberry Guava	*Psidium cattleyanum*	KISC, KRCP	x	x	x	x	x	x	widespread
Narrowleaf Firethorn	*Pyracantha angustifolia*	KISC, KRCP		x	x	x		x	few small patches of 2-5 each, few
Prickly Blackberry	*Rubus argutus*	NW	x	x	x	x	x	x	widespread
Australian Tree Fern	*Sphaeropteris cooperi*	KISC	x				x		1-2 plants at each site, few

[1]Regulatory Status: NW = State of Hawai'i Department of Agriculture designated noxious weed (1992). KISC = Kaua'i Invasive Species Committee invasive species targeted for removal. KRCP = Kōke'e Resource Conservation Program.

4.3 VEGETATION AND LAND COVER TYPES

Vegetation and land cover mapping was conducted by desktop and refined in the field to document common plant species and concurrently with the special status plant surveys. The vegetation survey area was 19.2 ac, consisting of all lands not comprised of impervious surfaces (roads, buildings) (NOAA 2010).

The survey area was 79% (15.1 ac) evergreen forest, 6% (1.2 ac) scrub-shrub land covers, and 15% (2.9 ac) developed open space (managed grasses like lawn or low-lying vegetation) (Table 4-3, Figure 4-1,Figure 4-2).

Table 4-3. Vegetation and Land Cover Types Mapped within the KPGO Study Area, Kauaʻi, Hawaiʻi.

Vegetation Types[1] Mapped	Nativity	Land Cover Type[2]	Acres
Non-native Grass-forb Meadow, Lawn	Non-native	Developed, Open Space (Lawn, Meadow), Landscaped	2.9
Blackberry, Lantana Thicket	Non-native	Scrub/**Shrub**	1.2
Blackberry Thicket	Non-native	Scrub/**Shrub**	
Silk Oak, Lantana, Blackberry Invasive Forest	Non-native	Evergreen **Forest**	15.1
Mixed Koa, Non-Native Forest	Native, Non-native	Evergreen **Forest**	
Koa ʻŌhiʻa Mixed Montane Mesic Forest	Native	Evergreen **Forest**	
		Total Acres	**19.2[3]**

[1]Vegetation Type (NAVFAC Pacific 2023).
[2]Land Cover Type (NOAA 2010).
[3]Vegetation Acreage of 19.2 excludes Bare Ground and Impervious Surfaces.

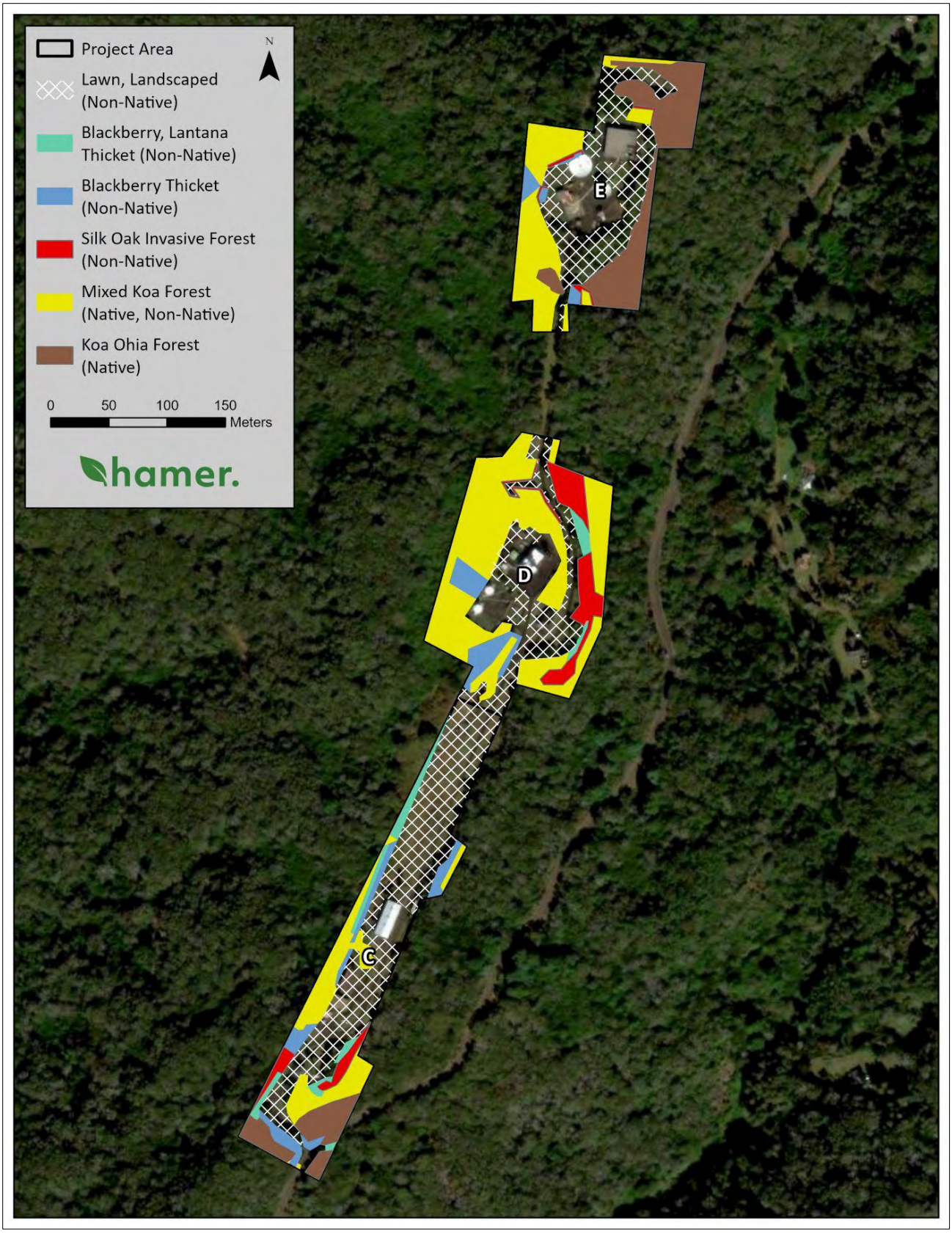

Figure 4-1. Vegetation Cover Types within the North KPGO Study Area, Kauaʻi, Hawaiʻi.

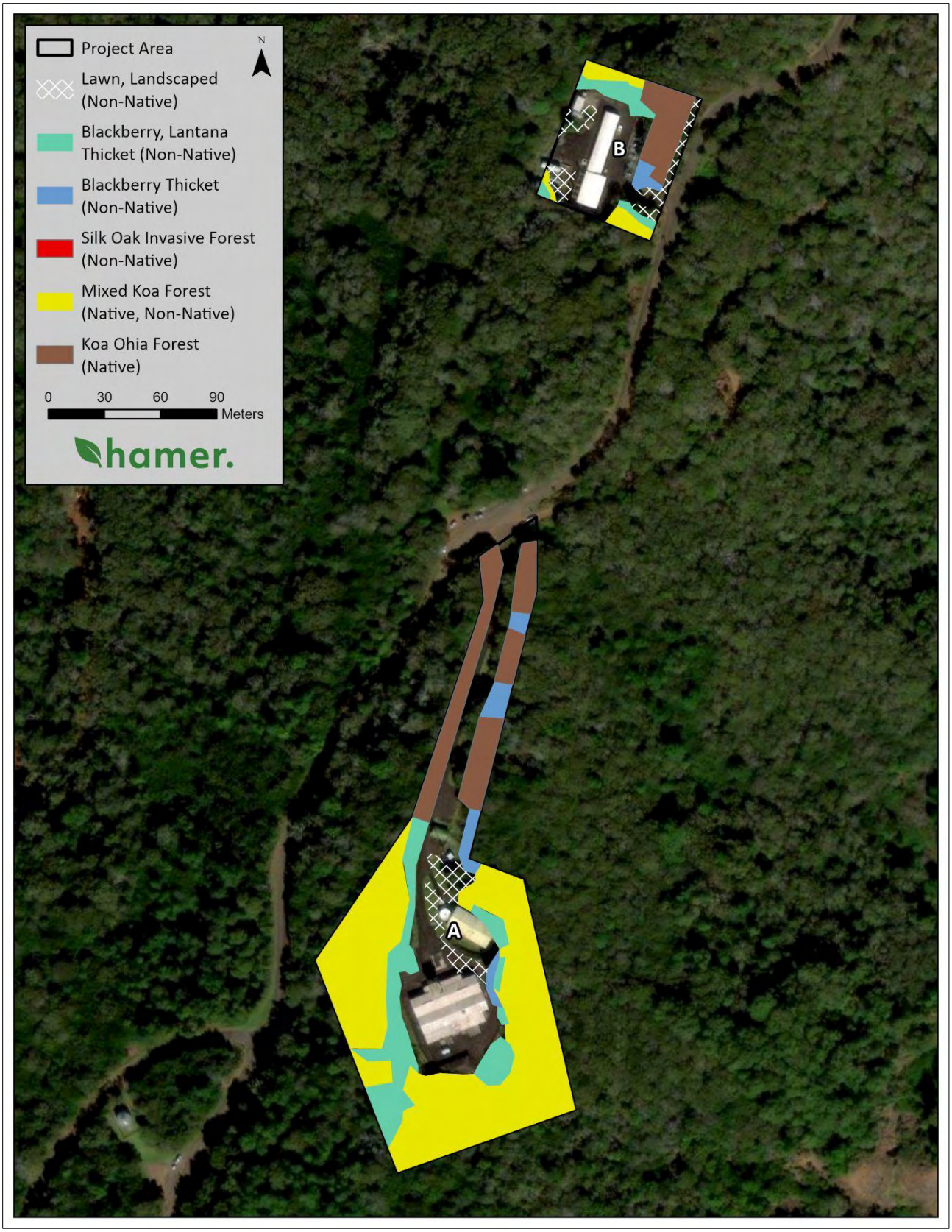

Figure 4-2. Vegetation Cover Types Mapped within the South KPGO Study Area, Kaua'i, Hawai'i.

Grass-forb Meadow, Lawn, Landscaped

This cover type includes Kikuyu Grass (*Cenchrus clandestinus*) dominated areas with weedy forbs Hairy Catsear (*Hypochaeris radicata*), Narrow-leaved Plantain (*Plantago lanceolata*), and grasses maintained as lawn by regular mowing, along the access road, tower, building, and satellite structures in Sites A, C, D, and E (Appendix C). Grass-forb meadow areas have a more diverse array of weedy, non-natives including: Daisy Fleabane, Bushy Bluestem (*Andropogon glomeratus*), Smutgrass (*Sporobolus indicus*), Yellow Foxtail (*Setaria parviflora*), and Glenwood Grass (*Sacciolepis indica*), with other weedy annual and low growing perennial forbs. The largest meadow is within central Site C, and used by the State of Hawai'i for helicopter-based equipment and people transfers. The meadow area is periodically mown and contains some seedling and patchy shrubs at the edges. Smaller meadow areas are in northern Site E and central Site D.

A variety of cultivated plants are found within the KPGO study area from a small grove of Methley Plums (*Prunus salicina*) and Asian Pear (*Pyrus pyrifolia* var. *culta*) trees in Site E, Domestic Pear (*Pyrus communis*), plums, Avocado (*Persea americana*), and French Plantains (*Musa x paradisiaca*) in Site B, to shrub and flower beds near parking strips of Hydrangea, roses and Calla Lily with some weedy forbs and grasses in Sites A and E. Mature Avocado trees are found adjacent to parking areas and installation buildings in south and central Site C, and Site E.

Blackberry Thicket

Dense non-native Prickly blackberry thickets were found between forest and maintained areas of the KPGO study area. This cover type co-occurs with other invasive shrubs like Fire Tree, Lantana, Chinese Privet, Fuschias (*Fuschia magellanica, F. boliviana*), Daisy Fleabane (*Erigeron karvinskianus*) and grasses Bushy Bluestem, and Molasses Grass (*Melinis minutiflora*). These weedy thickets occur in lower Site D, Site C surrounding the central meadow and west fenceline, and central Site A on steep slopes.

Blackberry, Lantana Thicket

Blackberry and Lantana thickets include many of the same non-native associated species as the blackberry thickets but tend to have taller vegetation from the dense Lantana shrubs, and blackberry growing on top. Chinese Privet, seedling Strawberry Guava, and Fire Tree are common with Daisy Fleabane, and grasses in groundcover. These scrub-shrub thickets occur in central Site A outside of the fence, northern Site B, patches in central Site C, and lower Site D.

Silk Oak, Lantana, Blackberry Invasive Forest

This forested vegetation type occurs in narrow bands between blackberry, Lantana thickets and mixed Koa, non-native forest areas. Invasive Silk Oak (*Grevillea robusta*), is the dominant tree with an understory of Lantana, Prickly Blackberry and Strawberry Guava with sparse grasses and forbs, including Daisy Fleabane and Molasses Grass. This invasive non-native forest occur in narrow bands within southern Site C, eastern Site D and southern Site E.

Mixed Koa, Non-native Forest

This forest is dominated by native Koa trees, and also contains sparse 'Ōhi'a, and other native trees and shrubs. Common non-native species include Silk Oak, Paperbark (*Melaleuca quinquenervia*), and Taiwan Cherry (*Prunus campanulata*) with understory of invasive Strawberry Guava, sometimes in dense monotypic patches, shrubs like Chinese Privet, and Japanese Honeysuckle, and sparse grasses like Velvet Grass (*Holcus lanatus*) and forbs. The edges of these forests contain denser patches of non-native species

like Fire Tree, Lantana and Prickly Blackberry. This forest type occurs throughout Site A, in Site B and western portions of Sites C, D and E.

Koa- ʻŌhiʻa Mixed Montane Mesic Forest

This forest is dominated by native trees Koa (*Acacia koa*) and ʻŌhiʻa (*Metrosideros polymorpha* var. *glaberrima*) with a mixed native and non-native understory of ʻIliahi (*Santalum freycinetianum*) and smaller trees, and shrubs like Olena (*Coprosma waimeae*), Colicwood (*Myrsine* spp.), A`ali`i (*Dodonaea viscosa*) and vining Maile (*Alyxia stellata*), with sparse ferns, forbs, and sedges. Common understory species include Uki or Forest Sawsedge (*Gahnia beecheyi*), ʻUkiʻuki (*Dianella sandwicensis*), ferns, and Meyen's and Oʻahu Sedge (*Carex meyenii, C. wahuensis*). The most intact of these forest areas occur in north and east Site E, north Site D, lower Site C and small areas of Site B and northern Site A.

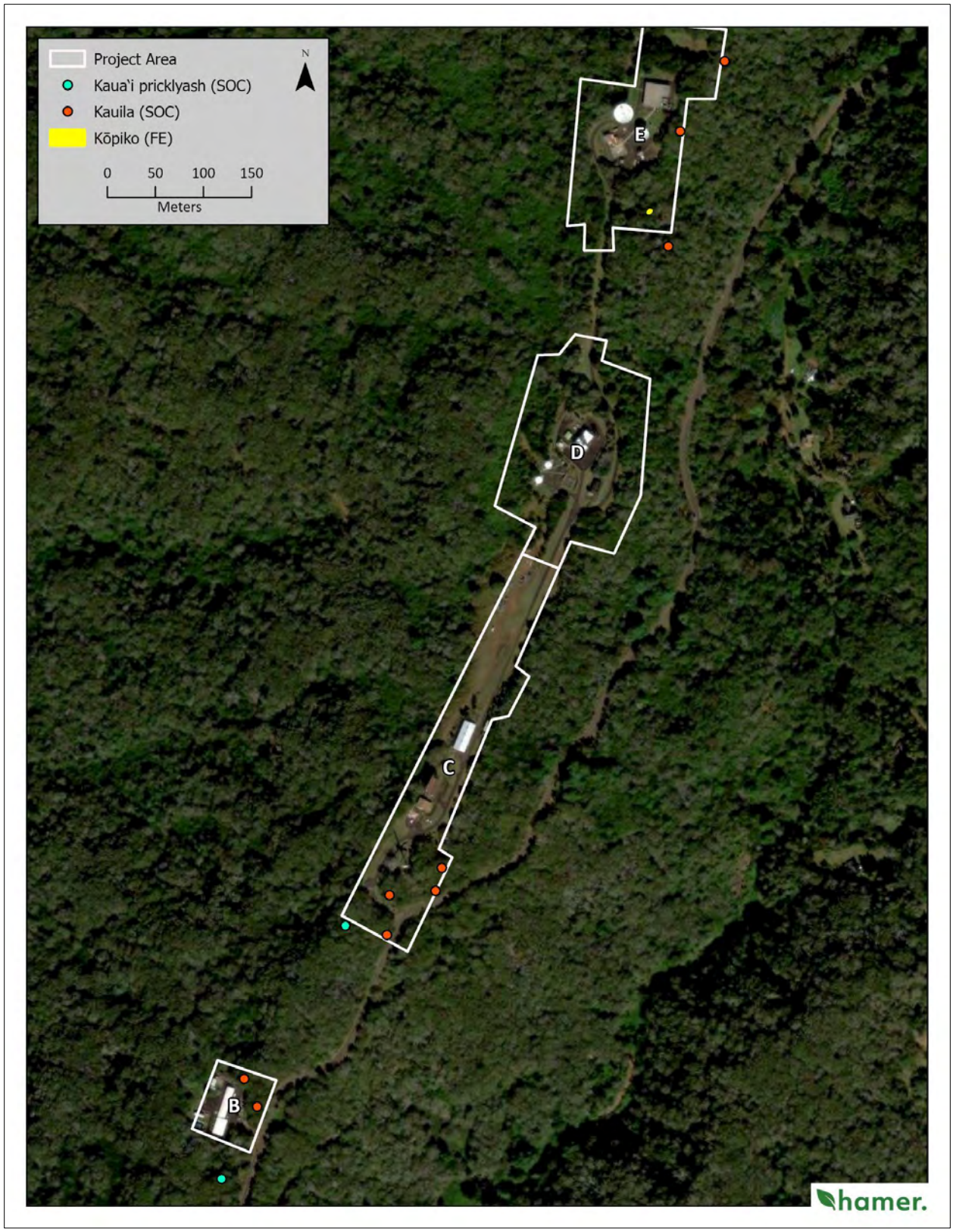

Figure 4-3. Special Status Plants within the KPGO Study Area, Kaua'i, Hawai'i.

5. DISCUSSION

This section provides further details on special status species documented during the vegetation surveys.

5.1 KŌPIKO (*PSYCHOTRIA GRANDIFLORA*)

Federally endangered, Kōpiko plants occur within a narrow band of koa and ʻŌʻhia montane mesic to wet forest and are endemic to the Island of Kauaʻi, with most of the fewer than fifty remaining trees found within Kōkeʻe State Park (USFWS 2017). The small population of 5 plants within the KPGO study area shows a similar trend of decline in numbers and immediate threats include habitat degradation from ungulates and herbivory by insects (Appendix B). Other populations of Kōpiko face these same threats as well as herbivory by rodents (USFWS 2017). Within Kōkeʻe State Park, two populations have been fenced to protect them from ungulates, and fencing and maintaining a fence around this population would similarly provide protection to these plants (USFWS 2017). A fenced enclosure could provide additional space for native plant outplantings to increase native species diversity and protect the population from invasive plant encroachment. Herbivory by insects was noted as a threat to four other populations of this plant, and treatment with insecticide – under consultation with Kauaʻi PEPP, may also be beneficial to this population's recovery. Finally, although no evidence of herbivory by rodents was observed, placement of a good nature rodent trap in the vicinity of the population may be useful to ensure no herbivory takes place.

5.2 INVASIVE SPECIES

Invasive species common to forest areas and shrub edges in the KPGO study area include Strawberry Guava, Chinese Privet, and Fire Tree. Shrub areas at the edge of forest and meadow areas are dominated by invasive species Prickly Blackberry and Lantana with small Strawberry Guava seedlings and low-growing Daisy Fleabane. Many of the invasive plants and noxious weeds listed in Table 4-2 have limited distribution and numbers of plants and should be prioritized for eradication. Further, Kāhili Ginger, and Narrowleaf Firethorn have limited distribution and are KRCP priority invasives for eradication. Although Chinese Privet, Strawberry Guava, and Fire Tree are widespread on the KPGO study area, coordinating removal actions with KRCP on lands adjacent to Kōkeʻe State Park could provide a meaningful reduction of these weeds.

5.3 SURVEY NOTES AND RECOMMENDATIONS

Site D - Restoration

Recent restoration outplanting in the Koa Kipuka of Site D consisted of twelve individually fenced native trees, grown at Kōkeʻe by Hui Ku and outplanted by Sustainable Resources Group International, Inc. in December 2022 (SRGII 2023). Plants were germinated from local seed stock to preserve local genetics of species evolved to ecotypes historic to the site, and to reduce introduction of alien species and pests. Plants were fenced individually to protect from browse by ungulates, and maintained and monitored for six months, and deemed healthy at the conclusion of the monitoring period. The restoration plantings in Site D were observed during the spring and fall surveys and most continue to appear healthy and growing (Appendix B). This Picture-Wing Fly habitat and native plant restoration site is adjacent to disturbed forest habitat with abundant invasive species including Strawberry Guava, Chinese Privet, and Black Wattle (*Acacia mearnsii*) with Prickly Blackberry and Lantana in open areas nearby. Monitoring and management

of the restoration site for invasive plants and to ensure continued maintenance of enclosures to exclude ungulates is recommended.

KPGO Facilities Trash

At several sites within the KPGO study area, trash from the Navy and NASA facilities was found discarded in the woods, including fluorescent light bulbs and light covers (Sites A & upper D), metal drawer parts (Site D), and other materials that appeared to originate from the facilities and not as trash from recreationalists or hunters.

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APPENDIX A. PLANT SPECIES LIST

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
FABACEAE	*Acacia koa*	Koa	Koa		tree	native	x	x	x	x	x	x
FABACEAE	*Acacia mearnsii*	Black Wattle		NW	tree	non-native, HI noxious weed				x	x	
PTERIDACEAE	*Adiantum hispidulum*	Five-finger Maidenhair Fern			fern	non-native	x	x	x	x		x
BROMELIACEAE	*Aechmea* sp.	Aechmea			forb	non-native, cultivated				x		
ASTERACEAE	*Ageratina riparia*	Spreading Mist Flower	Hamakua Pamakani	NW	forb	non-native, HI noxious weed	x	x	x	x		
ASTERACEAE	*Ageratum houstonianum*	Floss Flower	Maile Honohono		forb	non-native, naturalized	x	x				
POACEAE	*Agrostis stolonifera*	Creeping Bentgrass	He‘upueo		grass	non-native				x	x	
POACEAE	*Aira caryophyllea*	Silver Hairgrass			grass	non-native		x				
RHAMNACEAE	***Alphitonia ponderosa***	**Kauila, Kauwila**	**Kauila, Kauwila**	**SOC**	**tree**	**native**	**x**		**x**	**x**		**x**
APOCYNACEAE	*Alyxia stellata* (was *A. olivifomis*)	Maile	Maile		shrub	native	x	x	x	x		x
PRIMULACEAE	*Lysimachia arvensis* (was *Anagallis a.*)	Scarlet Pimpernel			forb	non-native	x	x		x	x	x
POACEAE	*Andropogon gerardi*	Big Bluestem			grass	non-native, naturalized		x				
POACEAE	*Andropogon glomeratus*	Bushy Bluestem			grass	non-native, naturalized	x	x	x	x	x	x
POACEAE	*Anthoxanthum nitens*	Sweet Grass			grass	non-native			x	x	x	x
POACEAE	*Anthoxanthum odoratum*	Sweet Vernal Grass			grass	non-native, naturalized				x	x	
EUPHORBIACEAE	*Antidesma platyphyllum*	Hame	Hame		shrub /tree	native, endemic	x	x	x	x		x
ASPLENIACEAE	*Asplenium macraei*	‘Iwa‘iwa Lau Li‘i	‘Iwa‘iwa Lau Li‘i		fern	native		x		x		x
ASPLENIACEAE	*Asplenium normale*	Asplenium Fern			fern	native					x	
ASPLENIACEAE	*Asplenium polyodon*	Spleenwort, Punana Manu			fern	native				x	x	x

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
ASPLENIACEAE	*Asplenium praemorsum*	Asplenium Fern			fern	native				x	x	
POACEAE	*Axonopus fissifolius*	Common Carpetgrass			grass	non-native	x	x	x	x	x	x
ASTERACEAE	*Bidens pilosa*	Hairy Beggarticks	Ki, Ki Nehe, Ki Pipili, Nehe		forb	non-native, naturalized	x	x		x		x
BLECHNACEAE	*Blechnum appendiculatum*	Palm Fern			fern	non-native, naturalized	x		x	x	x	x
BLECHNACEAE	*Blechnum norfolkense* (syn. *Doodia kunthiana*)	Kunth's Hacksaw Fern	Okupukupu		fern	native, endemic		x	x	x		x
RUBIACEAE	*Bobea brevipes*	'Ahakea	'Ahakea		tree	native	x				x	x
NYCTAGINACEAE	*Boerhavia coccinea* (was *B. diffusa*)	Red Spiderling, Scarlet Spiderling			forb	non-native	x	x		x		
POACEAE	*Briza minor*	Lesser Quaking- Grass			grass	non-native						x
POACEAE	*Bromus catharticus*	Rescue Grass			grass	non-native		x		x	x	
POACEAE	*Bromus hordeaceus*	Soft Chess			grass	non-native	x		x	x		
BUDDLEJACEAE	*Buddleia asiatica*	Dogtail		KISC	shrub	non-native, invasive		x		x		
BUDDLEJACEAE	*Buddleia madagascariensis*	Smoke Bush		KISC	shrub	non-native, invasive					x	
FABACEAE	*Cajanus kerstingii* (was *C. cajan*)	Pigeon Pea			shrub	non-native, naturalized				x		
ASTERACEAE	*Calyptocarpus vialis*	Straggler Daisy			sub-shrub	non-native	x		x	x		x
LAMIACEAE	*Cantinoa mutabilis*	Tropical Bushmint			forb	non-native		x				
CYPERACEAE	*Carex meyenii*	Meyen's Sedge			sedge	native	x	x	x	x	x	x
CYPERACEAE	*Carex wahuensis*	O'ahu Sedge			sedge	native	x	x	x	x	x	x
OROBANCHACEAE	*Castilleja arvensis*	Field Indian Paintbrush			forb	non-native, naturalized		x		x		
POACEAE	*Cenchrus echinatus*	Comon Sandbur			grass	non-native				x	x	
GENTIANACEAE	*Centaurium erythraea* ssp. *erythraea*	Bitter Herb, European Centaury			forb	non-native	x	x		x	x	

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
CARYOPHYLLACEAE	*Cerastium fontanum* ssp. *triviale*	Common Mouse-Ear Chickweed			forb	non-native, naturalized				x		
FABACEAE	*Chamaecrista nictitans* var. *glabrata*	Partridge Pea	Laukī		forb	non-native	x	x		x		
ARALIACEAE	*Cheirodendron platyphyllum*	Lapalapa	Lapalapa		shrub /tree	native, Indigenous						x
ARALIACEAE	*Cheirodendron trigynum*	Olapa, Olapalapa	Olapa, Olapalapa		tree	native, Indigenous	x					x
POACEAE	*Chloris barbata*	Swollen Fingergrass			forb	non-native	x			x		x
EUPHORBIACEAE	*Chamaesyce hirta* (now *Euphorbia h.*)	Hairy Spurge			forb	non-native	x			x	x	x
POACEAE	*Chrysopogon aciculatus*	Golden Beardgrass	Mānienie ʻUla		grass	non-native	x		x			x
LAURACEAE	*Cinnamomum burmanni*	Cinnamon, Padang Cassia			tree	non-native, naturalized		x				
ASTERACEAE	*Cirsium vulgare*	Bull Thistle	Pua Kala	KISC	forb	non-native, weed	x				x	
EUPHORBIACEAE	*Claoxylon sandwicense*	Laukea, Poʻola	Poʻola, Laukea		shrub /tree	native, Indigenous	x			x		x
CUCURBITACEAE	*Coccinia grandis*	Ivy Gourd, Tam Lung		NW, KISC	vine	non-native, naturalized		x				
PTERIDACEAE	*Coniogramme pilosa*	Loulu	Loulu		fern	native, Indigenous					x	
ASTERACEAE	*Conyza bonariensis*	Hairy Horseweed			forb	non-native		x		x		
RUBIACEAE	*Coprosma waimeae*	Olena Coprosma	Olena		shrub /tree	native, endemic		x	x	x	x	x
LILIACEAE	*Cordyline fruticosa* (syn. *C. terminalis*)	Ti Plant	Ti, Ki		shrub	non-native	x	x	x	x	x	x
CORYNOCARPACEAE	*Corynocarpus laevigatus*	Karaka Nut			shrub /tree	non-native	x	x	x			
IRIDACEAE	*Crocosmia × crocosmiiflora*	Montbretia			forb	non-native, naturalized				x	x	
FABACEAE	*Crotalaria incana*	Fuzzy Rattlepod	Kūkaehoki, Kolomona		forb/ shrub		x			x		

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
LAURACEAE	*Cryptocarya mannii*	Holio	Holio		tree	native, endemic				x	x	x
CUPRESSACEAE	*Cryptomeria japonica*	Japanese Cedar			tree	non-native		x				
APIACEAE	*Cyclospermum leptophyllum*	Fir-leaved Celery			forb	non-native, naturalized	x	x		x		x
POACEAE	*Cynodon dactylon*	Bermuda Grass	Mānienie		forb	non-native	x	x	x	x	x	x
CYPERACEAE	*Cyperus meyenianus*	Meyen's Flatsedge			sedge	non-native, naturalized		x		x	x	x
CYPERACEAE	*Cyperus polystachyos*	Manyspike Flatsedge			sedge	native	x	x		x	x	
POLYPODIACEAE	*Cyrtomium caryotideum*	Holly Fern			fern	native					x	
DRYOPTERIDACEAE	*Cyrtomium falcatum*	Holly Leaf Fern			fern	non-native			x	x		x
POACEAE	*Dactylis glomerata*	Orchardgrass			grass	non-native, naturalized	x	x	x	x	x	x
FABACEAE	*Desmanthus pernambucanus*	Slender Mimosa			shrub	non-native, naturalized	x			x		
FABACEAE	*Desmodium triflorum*	Tick Trefoil, Three-flowered Beggarweed			forb	non-native, naturalized	x	x		x		
LILIACEAE	*Dianella sandwicensis*	ʻUkiʻuki	ʻUkiʻuki, ʻUki		forb	native	x	x	x	x	x	x
GLEICHENIACEAE	*Dicranopteris linearis*	Uluhe	Uluhe		fern	native	x			x	x	x
POACEAE	*Digitaria ciliaris*	Henry's Crabgrass	Kukaepuaʻa		grass	non-native, naturalized	x			x	x	x
POACEAE	*Digitaria eriantha*	Pangola Grass, Woolly Fingergrass			grass	non-native, naturalized	x	x		x	x	x
POACEAE	*Digitaria setigera*	East Indian Crabgrass	Kukaepuaʻa, Mauʻu		grass	non-native	x		x	x		
SAPINDACEAE	*Dodonaea viscosa*	Florida Hopbush	Aʻaliʻi		shrub	native	x	x		x	x	x
DRYOTERIDACEAE	*Dryopteris fuscoatra*	Crowned Woodfern	ʻIʻi		fern	native, Indigenous	x		x	x	x	
DRYOTERIDACEAE	*Dryopteris glabra*	Kilaw	Kilau		grass	non-native, naturalized	x		x	x	x	x
POACEAE	*Echinochloa crus-galli*	Barnyard Grass			grass	non-native				x		

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
ELAEOCARPACEAE	*Elaeocarpus bifidus*	Kalia			tree	non-native, Indigenous				x	x	
PRIMULACEAE	*Embelia pacifica*	Kilioe	Kilioe		liana	native, endemic				x		
ASTERACEAE	*Emilia fosbergii*	Florida Tasselflower	Pualele		forb	non-native	x	x		x	x	x
ASTERACEAE	*Emilia sonchifolia*	Lilac Tasselflower			forb	non-native	x	x				
POACEAE	*Eragrostis amabilis* var. *tenella* (syn. *E. tenella*)	Lovegrass			grass	native		x		x	x	x
POACEAE	*Eragrostis variabilis*	Lovegrass	Kalamālō, Kāwelu		grass	native, endemic	x			x		x
ASTERACEAE	*Erigeron canadensis*	Horseweed			forb	non-native, naturalized		x		x		
ASTERACEAE	*Erigeron karvinskianus*	Daisy Fleabane, Australian Daisy		KISC	forb	non-native, invasive	x	x	x	x	x	x
GERANIACEAE	*Erodium cicutarium*	Pin Clover, Alfilaria			forb	non-native	x			x	x	
MYRTACEAE	*Eucalyptus camaldulensis*	Red Gum			tree	non-native	x				x	
EUPHORBIACEAE	*Euphorbia atrococca*	Koko	Koko		tree	native, kauai endemic				x		
EUPHORBIACEAE	*Euphorbia prostrata*	Green Creeping Spurge			forb	non-native		x				
EUPHORBIACEAE	*Euphorbia thymifolia*	Chickenweed			forb	non-native		x		x		
POACEAE	*Festuca sp.*	Fescue			grass	non-native, naturalized				x		x
MORACEAE	*Ficus edulis*	Edible Fig			tree	non-native			x			
ROSACEAE	*Fragaria vesca*	Strawberry			forb	non-native					x	x
ASPARAGACEAE	*Furcraea foetida*	Mauritius Hemp, Malina			forb	non-native		x				
ONAGRACEAE	*Fuschia boliviana*	Bolivian Fuschia		KISC	shrub	non-native		x		x	x	x
ONAGRACEAE	*Fuschia magellanica*	Hummingbird Fuschia			shrub	non-native		x		x		
CYPERACEAE	*Gahnia beecheyi*	Forest Sawsedge	Uki		sedge	native	x	x	x	x	x	x
ASTERACEAE	*Galinsoga parviflora*	Gallant Soldier			forb	non-native		x				

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
ASTERACEAE	*Gamochaeta purpurea*	Purple Cudweed, Spoonleaf Purple Everlasting			forb	non-native	x	x	x	x	x	x
GERANIACEAE	*Geranium homeanum*	Cranesbill			forb	non-native		x	x	x	x	
PROTEACEAE	*Grevillea robusta*	Silk Oak	ʻoka Kilika		tree	non-native, naturalized	x	x		x	x	
FABACEAE	*Guilandina major* (was *Caesalpinia m.*)	Yellow Nickers, Kakalaioa	Kakalaioa		shrub	non-native						x
ZINGIBERACEAE	*Hedychium coronarium*	White Ginger			forb	non-native, naturalized		x		x	x	
ZINGIBERACEAE	*Hedychium gardnerium*	Kāhili Ginger		KISC	forb	non-native, invasive	x	x		x		
RUBIACEAE	*Hedyotis terminalis* (syn. *Kadua affinis*)	Manono, Variable Starviolet	Manono		shrub /tree	native, endemic	x	x		x	x	x
POACEAE	*Heteropogon contortus*	Pili Grass	Pili, Lule		grass	native, Indigenous	x	x		x		x
POACEAE	*Holcus lanatus*	Velvet Grass			grass	non-native, naturalized		x		x	x	x
HYDRANGEACEAE	*Hydrangea macrophylla*	French Hydrangea			shrub	non-native	x	x				
POACEAE	*Hyparrhenia rufa*	Thatching Grass			grass	non-native, naturalized	x			x	x	
ASTERACEAE	*Hypochaeris glabra*	Smooth Cat's-Ear			forb	non-native	x	x		x		
ASTERACEAE	*Hypochaeris radicata*	Hairy Cat's-Ear			forb	non-native	x	x	x	x	x	x
LAMIACEAE	*Hyptis pectinata*	Comb Hyptis		NW	forb	non-native, naturalized		x		x		
AQUIFOLIACEAE	*Ilex Anomala*	Hawaiʻi holly	ʻAiea		tree		x		x	x		x
FABACEAE	*Indigofera suffruticosa*	Upright Indigo			forb, vine	non-native	x				x	
CONVOLVULACEAE	*Ipomoea indica*	Indigo Morning Glory, Oceanblue Morning-Glory	Koali ʻawa, Koaliʻawania		vine	non-native					x	
JUNCACEAE	*Juncus tenuis*	Pathfinder Rush			rush	non-native, naturalized				x		x

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
CUPRESSACEAE	*Juniperus virginiana*	Eastern Red Juniper			tree	non-native, cultivated			x			
CYPERACEAE	*Kyllinga brevifolia (was Cyperus brevifolius)*	Green Kyllinga			sedge	non-native, naturalized		x		x		x
POACEAE	*Lachnagrostis filiformis* (syn. *Agrostis avenaceae*)	Heupueo	Heupueo		grass	non-native				x		x
VERBENACEAE	*Lantana camara*	Lantana	Lākana, Lʻau Kalakala	KISC	shrub	non-native		x	x	x	x	
POLYPODIACEAE	*Lepisorus thunbergianus* (was *Pleopeltis thunbergiana*)	Weeping Fern	Pakahakaha		fern	native, Indigenous		x				
EPACRIDACEAE	*Leptecophylla tameiameiae*	Pūkiawe	Pūkiawe, ʻAʻaliʻi Mahu		shrub	native, Indigenous		x	x	x	x	x
OLEACEAE	*Ligustrum sinense*	Chinese Privet		KISC	shrub	non-native, invasive		x	x	x	x	x
POACEAE	*Lolium arundinaceum*	Tall Fescue			grass	non-native, naturalized		x	x	x	x	x
POACEAE	*Lolium perenne*	Perennial Ryegrass			grass	non-native, naturalized		x				
CAPRIFOLIACEAE	*Lonicera japonica*	Japanese Honeysuckle		KISC	liana	non-native		x	x	x	x	x
JUNACACEAE	*Luzula hawaiiensis*	Wood Rush			rush	native						x
PRIMULACEAE	*Lythrum maritimum*	Pukamole	Pukamole		shrub	native		x		x	x	x
FABACEAE	*Medicago lupulina*	Black Medick			forb	non-native, naturalized	x		x			x
FABACEAE	*Medicago polymorpha*	Burclover			forb	non-native			x	x		
MYRTACEAE	*Melaleuca quinquenervia*	Paperbark			tree	non-native, naturalized	x				x	x
MELASTOMATACEAE	*Melastoma candidum* (now *M. malabathricum subsp. malabathricum*)	Asian Melastome		NW	shrub /tree	non-native	x	x			x	
RUTACEAE	*Melicope anisata*	Mokihana			tree	native	x		x	x		x
RUTACEAE	*Melicope barbigera*	Uʻahiapele	Uʻahiapele		tree	native	x	x	x	x		x

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
RUTACEAE	*Melicope ovata*	Alani, Eggshape Melicope	Alani		tree	native				x	x	x
RUTACEAE	*Melicope penduncularis*	Boxfruit Alani	Alani		tree	native		x		x	x	x
POACEAE	*Melinis minutiflora*	Molasses Grass			grass	non-native, naturalized	x	x	x	x	x	x
LAMIACEAE	*Mentha spicata*	Spearmint			forb	non-native, cultivated		x				
MYRTACEAE	*Metrosideros polymorpha* var. *glaberrima*	ʻŌhiʻa	ʻŌhiʻa lehua		tree	native	x	x	x	x	x	x
POACEAE	*Microlaena stipoides* (was *Ehrharta s*.)	Weeping Grass			grass	non-native						x
DENNSTAEDTIACEAE	*Microlepia strigosa*	Palapalai	Palapalai		fern	native	x			x	x	x
CUCURBITACEAE	*Momordica charantia*	Bitter Melon, Balsam Pear			forb, vine	non-native, invasive	x	x				
MUSACEAE	*Musa* x *paradisiaca*	French Plantain	Maiʻa		tree	non-native, cultivated	x		x			
MYOPORACEAE	*Morella faya* (syn. *Myrica f*.)	Fire Tree		NW	shrub /tree	non-native, noxious weed	x	x	x	x	x	x
MYRSINACEAE	*Myrsine alyxifolia*	Forest Colicwood			tree	native, endemic	x	x		x	x	x
MYRSINACEAE	*Myrsine lanaiensis*	Lanai Colicwood, Kolea	Kolea		tree	native, Indigenous	x		x	x		x
MYRSINACEAE	*Myrsine sandwicensis*	Kōlea Lau Li L I	Kōlea Lau Li L I		tree	native, Indigenous				x	x	
POLYPODIACEAE	*Nephrolepis brownii* (syn. *N. multiflora*)	Hairy Swordfern	Kupukupu Niʻaniʻau		fern	non-native	x	x	x		x	
OLEACEAE	*Nestegis sandwicensis* (syn. *Notolaea s*.)	Hawaiʻi Olive			tree	native, Indigenous	x			x	x	x
APOCYNACEAE	*Ochrosia kauaiensis*	Holei	Holei		tree	native, endemic					x^R	
OLEACEAE	*Olea europaea*	Olive	ʻOliwa, ʻOliwa Haole		tree	non-native, naturalized	x				x	x
POACEAE	*Oplismenus hirtellus*	Basketgrass	Honohono Kukui		grass	non-native, naturalized	x				x	x

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
OXALIDACEAE	*Oxalis corniculata*	Yellow Wood Sorrel	ʻIhi ʻai, ʻIhi ʻAwa		forb	non-native	x	x	x	x	x	
OXALIDACEAE	*Oxalis debilis*	Pink Wood Sorrel	ʻIhi Pehu		forb	non-native	x					x
POACEAE	*Panicum nephelophilum*	Konakona	Konakona		grass	native, endemic				x		x
POACEAE	*Paspalum conjugatum*	Ti Grass, Hilo Grass	Mauʻu Hilo		grass	non-native, naturalized				x	x	x
POACEAE	*Paspalum dilatatum*	Browntop Millet, Dallis grass			grass	non-native, naturalized	x	x		x		
POACEAE	*Paspalum fimbriatum*	Panama Paspalum, Colombia Grass			grass	non-native, naturalized	x			x		
POACEAE	*Paspalum urvillei*	Vaseygrass			grass	non-native, naturalized		x		x		x
PASSIFLORACEAE	*Passiflora edulis*	Passion Fruit, Liliko'i	Liliko'i		liana	non-native, naturalized		x		x		
POACEAE	*Cenchrus clandestinus* (was *Pennisetum clandestinum*)	Kikuyu Grass			grass	non-native	x	x	x	x	x	x
LAURACEAE	*Persea americana*	Avocado			tree	non-native, cultivated	x	x	x	x		x
POLYGONACEAE	*Persicaria capitata*	Pink-Head Knotweed, Heartweed			forb	non-native, naturalized		x				x
EUPHORBIACEAE	*Phyllanthus airy-shawii* (was *P. debilis*)	Phyllanthus Weed	Niruri		forb	non-native	x				x	x
SOLANACEAE	*Physalis peruviana*	Chinese Gooseberry, Poha	Poha		forb	non-native, naturalized					x	
PITTOSPORACEAE	*Pittosporum glabrum*	Hoawa	Hoawa		tree	native, endemic	x	x				
PITTOSPORACEAE	*Pittosporum kauaiense*	Kaua'i Cheesewood			tree	native, endemic					x	
PLANTAGINACEAE	*Plantago lanceolata*	Narrow Leaved Plantain			forb	non-native, naturalized		x	x	x	x	x
PLANTAGINACEAE	*Plantago major*	Common Plantain	Laukahi		forb	non-native, naturalized				x		

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
ASPARAGACEAE	*Pleomele aurea* (syn. *Dracaena a.*)	Golden Hala Pepe	Halapepe		tree	native, endemic		x		x	x	x
ASTERACEAE	*Pluchea carolinensis*	Sourbush, Cure for All			shrub /tree	non-native, naturalized	x	x	x	x	x	
CARYOPHYLLACEAE	*Polycarpon tetraphyllum*	Four-Leaf Allseed			forb	non-native, naturalized	x		x			x
POLYGONACEAE	*Polygonum aviculare*	Prostrate Knotweed			forb	non-native, naturalized						x
PORTULACACEAE	*Portulaca oleracea*	Little Hogweed, Pusley, Pigweed	Akulikuli Kula, Ihi		forb	non-native, naturalized	x	x				
SAPOTACEAE	*Pouteria sandwicensis* (now *Planchonella s.*)	Alaʻa	Alaʻa		shrub /tree	native, endemic	x	x		x	x	x
ARECACEAE	***Pritchardia minor***	**Loulu, Alakai Swamp Pritchardia**	**Loulu**	**SOC**	**tree**	**native**					**x[R]**	
ROSACEAE	*Prunus salicina*	Methley Plum Tree			tree	non-native, cultivated	x	x	x	x	x	x
ROSACEAE	*Prunus campanulata*	Taiwan Cherry			tree	non-native		x	x	x	x	x
ASTERACEAE	*Pseudognaphalium luteoalbum*	Cud Weed			forb	non-native		x		x	x	
MYRTACEAE	*Psidium cattleianum* (syn. *P. cattleyanum*)	Strawberry Guava	Waiawi ʻUlaʻula	KISC	shrub /tree	non-native, invasive	x	x	x	x	x	x
MYRTACEAE	*Psidium guajava*	Common Guava	Kuawa, Kuawa Keʻokeʻo		tree	non-native	x			x		
PSILOTACEAE	*Psilotum nudum*	Upright Whiskfern	Moa, Moa Nahele		fern	native	x	x	x	x		x
RUBIACEAE	***Psychotria grandiflora***	**Kōpiko**	**Kōpiko**	**FE**	**shrub /tree**	**native, endemic**						**x**
RUBIACEAE	*Psychotria greenwelliae*	Kauaʻi Wild Coffee	Kōpiko		tree	native, endemic	x		x	x	x	x
RUBIACEAE	*Psychotria mariniana*	Forest Wild Coffee	Kōpiko		tree	native, Indigenous	x		x	x	x	x

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
RUBIACEAE	*Psydrax odoratus* (syn. *P. odorata*)	Alahe‘e	Alahe‘e		shrub	native, Indigenous					x[R]	
DENNSTAEDTIACEAE	*Pteridium decompositum* (was *P. aquilinum v. decompositum*)	Hawaiian Bracken Fern	Kīlau		fern	native, Indigenous	x	x	x	x		x
ROSACEAE	*Pyracantha angustifolia*	Narrowleaf Firethorn		KISC	shrub	non-native, invasive	x		x	x	x	
ROSACEAE	*Pyrus pyrifolia* var. *culta*	Asian Pear			tree	non-native, cultivated			x			x
ROSACEAE	*Pyrus communis*	Pear			tree	non-native, cultivated	x		x			
CYPERACEAE	*Rhynchospora rugosa*	Claybank Beaksedge, Pu‘uko‘a	Pu‘uko‘a		sedge	native				x		
RUBIACEAE	*Richardia brasiliensis*	Tropical Mexican Clover			forb	non-native	x	x				x
EUPHORBIACEAE	*Ricinus communis*	Castor bean, Palma Cristi	P‘aila, Ka‘apeh		shrub	non-native, invasive	x					x
PETIVERIACEAE	*Rivina humilis*	Coral Berry, Rouge Plant			shrub	non-native, naturalized					x	x
ROSACEAE	*Rosa sp.* (cultivar)	Cultivated Rose			shrub	non-native	x				x	x
ROSACEAE	*Rubus argutus*	Prickly Blackberry, Florida Blackberry		NW	shrub	non-native, invasive	x	x	x	x	x	x
ROSACEAE	*Rubus rosifolius*	Thimbleberry	Olaa		shrub	non-native						x
ACANTHACEAE	*Ruellia simplex*	Mexican Petunia			forb	non-native					x	
POACEAE	*Sacciolepis indica*	Glenwood Grass			grass	non-native, naturalized	x	x		x	x	
LAMIACEAE	*Salvia rosmarinus*	Rosemary			shrub	non-native, cultivated					x	
SANTALACEAE	*Santalum freycinetianum*	Sandalwood, ‘Iliahi	‘Iliahi		tree	native	x	x	x	x	x	x
GOODENIACEAE	*Scaevola procera*	Naupaka Kuahiwi	Naupaka Kuahiwi		tree	native	x	x		x	x	x
POLYGALACEAE	*Senega incarnata* (syn. *Polygala paniculata*)	Milkwort, Root Beer Plant			forb	non-native, naturalized		x		x		x
FABACEAE	*Sesbania tomentosa*	O‘ahu Riverhemp	‘Ohai		shrub	native				x	x	

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
POACEAE	*Schizachyrium condensatum* (was *Setaria gracilis*)	Marsh Bristlegrass, Tufted Beardgrass			grass	non-native, naturalized	x	x		x		
POACEAE	*Setaria parviflo`ra*	Yellow Foxtail, Perennial Foxtail	Mauʻu Kaleponi		grass	non-native, naturalized	x	x		x	x	x
MALVACEAE	*Sida fallax*	ʻIlima	ʻIlima		shrub	native	x			x		
ASTERACEAE	*Sonchus asper*	Prickly Cow Thistle			forb	non-native, naturalized			x			
ASTERACEAE	*Sonchus oleraceus*	Sow Thistle	Pualele		forb	non-native, naturalized	x	x	x			x
FABACEAE	*Sophora chrysophylla*	Mamani	Mamani		shrub /tree	native		x		x		
RUBIACEAE	*Spermacoce rubescens* (was *S. assurgens*)	Buttonweed			subsh rub	non-native	x	x		x		x
CYATHEACEAE	*Sphaeropteris cooperi*	Australian Tree Fern		KISC	tree	non-native, invasive		x				x
ASTERACEAE	*Sphagneticola trilobata*	Wedelia			subsh rub	non-native, naturalized	x	x		x	x	
POACEAE	*Sporobolus indicus*	Smutgrass, West Indian Dropseed			grass	non-native, naturalized		x	x	x	x	x
CARYOPHYLLACEAE	*Stellaria media*	Common Chickweed			forb	non-native, naturalized		x		x		x
MORACEAE	*Paratrophis pendulina* (was *Streblus pendulinus*)	Aʻaiʻa	Aʻaiʻa		shrub /tree	native	x			x	x	x
ASTERACEAE	*Taraxacum sect. Taraxacum* (was *T. officinale*)	Dandelion, Lau-Lele	Lau-Lele		forb	non-native, naturalized	x	x	x	x	x	x
ARALIACEAE	*Tetraplasandra hawaiensis* (syn. *Polyscias h.*)	Hawaiʻi ʻOhe	ʻOheʻohe		tree	native, endemic				x	x	
ARALIACEAE	*Tetraplasandra waimeae* (syn. *Polyscias w*)	ʻOhe Kiko ʻOla	ʻOhe Kikoʻola		tree	native, endemic				x	x^R	
ASPLENIACEAE	*Thelypteris parasitica*	Woodfern			fern	non-native	x			x		x
FABACEAE	*Trifolium campestre*	Field Clover			forb	non-native, naturalized				x		x
FABACEAE	*Trifolium hybridum*	Alsike Clover			forb	non-native, naturalized			x	x		

Family	Scientific Name	Common Name	Hawaiian Name	Status[1]	Plant Type	Nativity	Previous KPGO Detection	Site A	Site B	Site C	Site D	Site E
FABACEAE	*Trifolium repens*	White Clover			forb	non-native, naturalized	x	x	x	x		x
TROPAEOLACEAE	*Tropaeolum majus*	Garden Nasturtium			forb	non-native		x		x		
ERICACEAE	*Vaccinium dentatum*	Hawaiian Blueberry, Ohelo	Ohelo		shrub	native				x		x
VERBENACEAE	*Verbena litoralis*	Seashore Vervain, Vervain	Ha‘uoi, Owi		forb	non-native	x	x	x	x		x
ASTERACEAE	*Verbesina encelioides*	Golden Crownbeard, Butter Daisy			forb	non-native		x		x		
POACEAE	*Festuca bromoides* (was *Vulpia b.*)	Brome Fescue, Rat’s-Tail Fescue			grass	non-native, naturalized				x	x	x
STERCULIACEAE	*Waltheria indica*	‘Uhaloa	‘Uhaloa		shrub	non-native			x	x		
THYMELAECEAE	*Wikstroemia furcata*	Forest False Ohelo	Akia		tree	native, endemic	x	x	x	x		x
FLACOURTIACEAE	*Xylosma hawaiensis*	Hawai‘i Brushholly, Maua	Maua		tree	native, Indigenous	x			x	x	x
ARACEAE	*Zantedeschia aethiopica*	Calla Lily			forb	non-native, cultivated		x			x	
RUTACEAE	***Zanthoxylum kauaense***	**Kaua‘i Pricklyash**	**A‘e**	**SOC**	**tree**	**native, Indigenous**	**x**				**x**	
RUTACEAE	*Zanthoxylum oahuense*	Oahu Pricklyash			tree	native, Indigenous				x		

[1]Status: E = Endangered, SOC = Species of Concern, nw = State of Hawai‘i Department of Agriculture designated noxious weed (1992). KISC = Kaua‘i Invasive Species Committee invasive species targeted for removal.

[R] = Restoration area native species outplanted in December 2022 by SRGII and Hui Ku to benefit picture wing fly critical habitat (McFarland 2024).

APPENDIX B. PLANT SURVEY PHOTO LOG

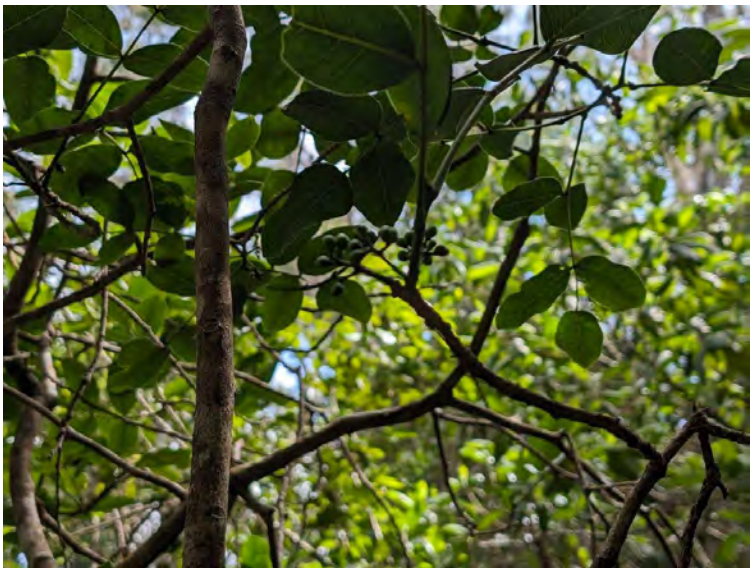
1. Special Status Plants

1. Kōpiko, *Psychotria grandiflora* (Endangered) - showing individual plants with tags #8 (top left), #10 (top right), #6 (bottom left), #10 tag (bottom right).

2. Kōpiko, *Psychotria grandiflora* (Endangered) - showing individual plants #3 (left), Kōpiko with no tag (right), overview looking North at population (bottom).

3. Kauila, *Alphitonia ponderosa* (Species of Concern) – Showing #1 Site C, tree (top left) and canopy (top right), #2 Site C, 4.5" dbh tree showing bark and trunk (bottom left), and canopy (bottom right).

4. Kauila, *Alphitonia ponderosa* (Species of Concern) – Showing #6 in lower Site C, photo of 10-in dbh tree trunk (top left), and tree canopy (top right), Showing #7 in east Site B, photo of tree trunk in hedge (lower left) and tree canopy (lower right).



5. **Kaua‘i Prickly Ash, A‘e, *Zanthoxylum kauaense* (Species of Concern) – Showing 1 small tree south of Site C (top left), and immature fruits on tree (top right), Showing 5 young trees south of Site B, young seedling (bottom left), and largest individual (bottom right).**

2. Invasive Plants

1. **Black Wattle, Spreading Mist Flower, Smoke Bush, Bull Thistle, Bolivian Fuschia, And Kāhili Ginger (from top left to bottom right).**

2. Lantana, Chinese Privet, Fire Tree, Strawberry Guava, Narrowleaf Firethorn, and Prickly Blackberry with guava in background (from top left to bottom right).

3. Australian Tree Fern, Castor Bean, Dogtail, And Daisy Fleabane (from top left to bottom right).

APPENDIX C. VEGETATION COVER TYPE PHOTOS

1. Grass-forb Meadow, Lawn, showing meadow in central Site C (left, right).

2. Lawn in lower Site D (left); Landscaped, showing Methley Plum trees in front of building at Site E (right).

3. Blackberry, Lantana Thicket. Showing thicket in Site A (left) and closeup (right).

4. Blackberry thicket in western Site C foreground.

5. Silk Oak, Lantana, Blackberry Invasive Forest with Lantana and Prickly Blackberry in foreground and Silk Oak trees in background in southern Site C.

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KPGO Fauna Survey Report

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Terrestrial Fauna Final Survey Report of the Kōkeʻe Park Geophysical Observatory

Kauaʻi, Hawaiʻi

Task Order 28
Contract No. 80GSFC21CA008

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ACRONYMS AND ABBREVIATIONS

ac	acre
DLNR	Hawai‘i Department of Land and Natural Resources
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ft	foot
GIS	geographic information system
GPS	global positioning system
Hamer	Hamer Environmental, L.P.
HST	Hawai‘i Standard Time
HEPA	Hawai‘i Environmental Policy Act
HRS	Hawai‘i Revised Statute
INRMP	Integrated Natural Resources Management Plan
KISC	Kaua‘i Invasive Species Council
KPGO	Kōke‘e Park Geophysical Observatory
m	meter
MBTA	Migratory Bird Treaty Act
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Systems Command
Navy	Department of the Navy
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
PMRF	Pacific Missile Range Facility
SME	Subject Matter Expert
SOW	Statement of Work
USFWS	United States Fish and Wildlife Service
UTM	Universal Transverse Mercator

1. INTRODUCTION

1.1 BACKGROUND

DAWSON contracted Hamer Environmental, L.P. (Hamer) to conduct terrestrial fauna surveys for the National Aeronautics and Space Administration (NASA) at Kōkeʻe Park Geophysical Observatory (KPGO) properties on Kauaʻi, Hawaiʻi. The KPGO study area is approximately 25 acres (ac) and consists of five parcels (Figure 1-1). NASA and the U.S. Department of the Navy (Navy) in coordination with the Hawaiʻi Department of Land and Natural Resources (DLNR) are preparing a Real Estate Environmental Impact Statement (EIS) which evaluates the potential environmental consequences of the Navy's and NASA's proposal to retain the use of lands for the Navy's continued and ongoing military testing and training at Pacific Missile Range Facility (PMRF) and NASA's continued operations at KPGO. Existing NASA and Navy real estate agreements with the DLNR are set to expire between 2027 and 2030. The survey results will be used for future project planning, development of avoidance and minimization measures, National Environmental Policy Act (NEPA) analysis, Chapter 343, Hawaiʻi Revised Statutes (HRS) referred to as Hawaiʻi Environmental Policy Act (HEPA) analysis, and/or potential Endangered Species Act (ESA) Section 7 consultation.

Following the project Statement of Work (SOW) issued January 2024, Hamer developed a work plan in April 2024 to identify terrestrial fauna habitat resources in the survey area, and proposed methodology and data collection, reporting, and schedule and personnel for field surveys. Hamer conducted terrestrial fauna surveys for protected fauna species, to identify mammalian and avian predators, and Kauaʻi Invasive Species Committee Priority Pest species (coqui frog [*Eleutherodactylus coqui*], little fire ant [*Wasmannia auropunctata*], and mongoose [*Herpestes javanicus*]) within the KPGO study area. This report summarizes the findings of the 2024 terrestrial fauna surveys over two seasons from April to May (spring) and October (fall). A recent, 2022 terrestrial invertebrate survey, conducted by expert entomologists within the KPGO study area, documented the presence of Hawaiian picture wing fly (*Drosophila musaphilia*) and found a high level of insect biodiversity within the remnant native forest and mixed native non-native forests of the study area (Magnacca 2022).

1.2 PURPOSE OF SURVEY

As stated in the project SOW, the purpose of the terrestrial fauna surveys was to document protected animal species, as well as predator and wildlife pest species within the KPGO study area. The objective of the terrestrial fauna surveys was to identify the faunal resources within the KPGO study area to support environmental evaluations and consultations. A separate study for Hawaiian hoary bat (ʻŌpeʻapeʻa, *Lasiurus semotus*) using acoustic detectors was conducted and findings will be reported separately from this effort.

1.3 SURVEY AREA

Survey areas for terrestrial fauna were developed by KPGO Subject Matter Experts (SMEs) and Hamer. Based on the results of the desktop analysis (Hamer Environmental 2024), specific species were targeted for

surveys using the methodologies presented in Chapter 2. The KPGO study area is 24.9[1] ac and consists of five parcels (listed from north to south), Site E (5.7 ac), Site D (6.5 ac), Site C (6.2 ac), Site B (1.2 ac) and Site A (5.3 ac) (Figure 1-1). The KPGO study area is located between 1,130 and 1,160 m (3,710 ft and 3,800 ft) elevation in Kōkeʻe State Park on the northerly Kaunuohua Ridge east of Mākaha Ridge and the northwestern end of Waimea Canyon (NAVFAC 2023). The KPGO study area is comprised of buildings and other impervious surfaces, as well as mowed lawns in open areas with forest along the property margins. The KPGO study area is located within the Waimea-Kekaha region of the State of Hawaiʻi's Conservation District, within a Resource Subzone, as classified by Chapter 205 of Hawaiʻi Revised Statutes. The KPGO study area is close to the Division of Forestry and Wildlife-managed Kuia Natural Area Reserve, located within a Protected Resource Subzone. Lands surrounding the KPGO study area are primarily used for recreation with trails, campgrounds and scenic overlooks (NAVFAC 2023).

The terrestrial fauna survey area is 19.2 ac, consisting of all lands not comprised of impervious surfaces (roads, buildings) (National Oceanic and Atmospheric Administration [NOAA] 2010). The terrestrial fauna survey area is 79% (15.1 ac) evergreen forest, 6% (1.2 ac) scrub-shrub land covers, and 15% (2.9 ac) developed open space (managed grasses like lawn or low-lying vegetation) (Figure 1-2).

1.4 Special Status Terrestrial Fauna Species With Potential to Occur

Special status fauna with potential to occur in the KPGO study area and details on their known habitat and likelihood of potential habitat presence within the fauna survey area are listed in Table 1-1. This list includes all federal- and state-listed species and federal species of concern previously found or with potential to occur within the KPGO study area (Magnacca 2022, NAVFAC 2023, NAVFAC 2010, USFWS 2024). Fauna species in the State Wildlife Action Plan (SWAP) with potentially suitable habitat in the KPGO study area were also included (DLNR 2015).

Table 1-1. Special Status Fauna Species Known to Occur or with Potential to Occur in the KPGO Study Area, Kauaʻi, Hawaiʻi.

Common Name	Scientific Name	Hawaiian Name	Regulatory Status[1]	Previous Occurrence in the KPGO Study Area?	Habitat
Birds					
Hawaiian Goose	*Branta sandvicensis*	Nēnē	FT, SE	Yes	Variety of habitats such as coastal dunes and grasslands, shrubland, and shrubland-woodland interfaces

[1] This survey acreage (24.9 ac) is slightly larger than the acreage reported in the EIS for PMRF and KPGO Real Estate (April 2025) (23 ac) due to the removal of Site F (included in the ac for Site C above). The original lease noted a Site F; however NASA is not seeking to renew their lease for this site only. Site F was included in this survey, therefore the acreage differs.

Common Name	Scientific Name	Hawaiian Name	Regulatory Status[1]	Previous Occurrence in the KPGO Study Area?	Habitat
Band-rumped Storm-petrel (Hawai'i DPS)	*Hydrobates castro*	ʻAkēʻakē	FE, SE	Yes[2]	Colonies are in steep inland valleys vegetated with shrubs and grasses
Hawaiian Petrel	*Pterodroma sandwichensis*	ʻUaʻu	FE, SE	Yes[2]	Colonies occur in lower-elevation forests dominated by native ʻōhiʻa trees
Newell's Shearwater	*Puffinus newelli*	ʻAʻo	FT, ST	Yes[2]	Most colonies occur on steep, densely vegetated inland mountains and also nest on sparsely vegetated coastal cliffs along west Kauaʻi
Scarlet Honeycreeper	*Drepanis coccinea*	ʻIʻiwi	FT, SE	Yes	Mesic and wet native forest above 1,200 m (4,000 ft)
Mammals					
Hawaiian Hoary Bat	*Lasiurus cinereus semotus*	ʻŌpeʻapeʻa	FE, SE	Yes	Mesic and wet native forest above 1,200 m (4,000 ft)
Insects					
Hawaiian Picture-wing Fly	*Drosophila musaphilia*		FE, SE	Yes[3]	Koa forest within regions of Kōkeʻe State Park
Hawaiian Picture-wing Fly	*Drosophila sharpi*		FE, SE	No	ʻOhe (*Polyscias hawaiensis*) or Lapalapa (*Cheirodendron* spp.) forest within regions of Kōkeʻe State Park

[1]Regulatory Status: FE = Federally Endangered, FT = Federally Threatened, SE = State Endangered, ST = State Threatened.
[2]Potential to fly over and/or known to fall-out on base (NAVFAC 2023).
[3]Documented within the KPGO Study Area in Site E (2022) and previously in Site B (2009) (Magnacca 2022).

1.5 Survey Schedule and Personnel

Terrestrial fauna surveys were completed by one biologist between April 28 and May 13, 2024 (spring survey) and between October 11 and 24, 2024 (fall survey), with daily surveys conducted between 6:15 am and 11:00 am for observation point surveys and for fauna habitat surveys until 3:30 pm Hawaiʻi Standard Time (HST). Hamer Lead Biologist, Erin Colclazier, conducted vegetation surveys and determined the target special status fauna species most likely to occur in the terrestrial fauna survey area. For all KPGO surveys (vegetation, fauna, and bat). Erin Colclazier was the Project Manager and Kendra Ritchie was the GIS Analyst. Erin Colclazier completed the data analysis and report.

Figure 1-1. Kōkeʻe Park Geophysical Observatory Study Area, Comprised of Five (5) Parcels (Sites A, B, C, D, E) on Kauaʻi, Hawaiʻi.

Figure 1-2. Land Cover Types for Terrestrial Fauna Surveys (all but Impervious [Green]) within the KPGO Study Area on Kauaʻi, Hawaiʻi.

2. SURVEY METHODS

2.1 TERRESTRIAL FAUNA SURVEY METHODS

Observation points were selected throughout the fauna survey area in all regions anticipated to capture the most representative biological resources present (Figure 2-1). A total of 15 observation point locations were selected: six (6) in evergreen forest, six (6) in scrub-shrub, and three (3) in open-developed habitat types. Potentially occurring special status species targeting those listed in (Table 1-1), and Migratory Bird Treaty Act (MBTA) species were the focus, but all observed fauna were recorded. One Hamer biologist conducted terrestrial fauna surveys for 11 minutes at each of 15 observation points and were surveyed 3 times each in spring and fall, for 6 total visits. Invasive fauna or their sign were documented when observed, with Kaua'i Invasive Species Council's (KISC) priority species reported if observed (KISC 2023).

To ensure adequate opportunity for incidental wildlife observations, the Hamer biologist walked between observation points and regularly scanned areas with binoculars when conducting other fieldwork in the survey area. Following the SOW, data was reviewed each day after collection and backed-up. A sub-meter level accuracy GPS (global positioning system) unit (Juniper Geode™) was utilized for sensitive species data collection. All special status fauna data was recorded as specified in the SOW into ArcGIS Field Maps data forms. Incidental observations of special status fauna or invasive fauna were documented when encountered.

2.2 DATA COLLECTED

Special Status Wildlife Species

When a special status fauna species was detected, Hamer biologist recorded the following information:

1. Species name and number of individuals.
2. GPS location (with sub-meter level accuracy GPS)
    a. ESA-protected special status fauna were mapped as points, with approximate number of individuals added as a note. When a special status fauna species was observed the approximate distance and bearing to the individual or group was recorded and mapped from the observation point.
    b. MBTA and all other wildlife species were collected at the established observation locations.
3. Life stage (e.g., juvenile, adult) if possible to determine in the field.
4. Condition (e.g., dead, poor, fair, good) if possible to determine in the field.

Representative photos were taken to document federally listed species, or other items of note, when possible.

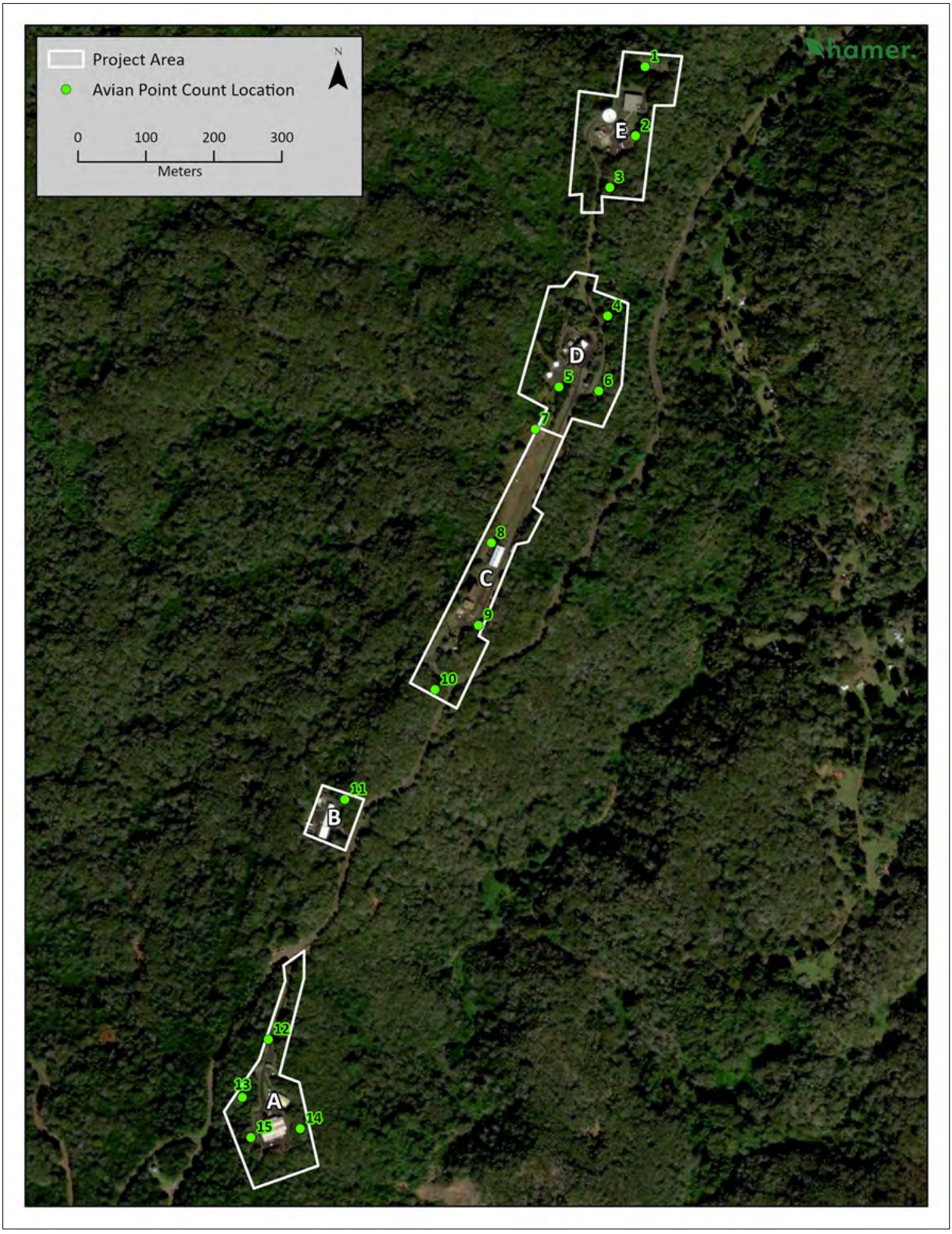

Figure 2-1. Fauna Observation Points (Avian Point Count Locations) within the KPGO Study Area, Kauaʻi, Hawaiʻi.

Habitat Assessment

As stated in the SOW, plant community and land cover mapping of the survey area was conducted concurrent to the fauna and vegetation field surveys in Spring and Fall 2024. Habitat at each observation point was noted, and dominant plant species recorded, as were any other items of interest or high disturbance. Representative photos were taken to document habitats, or other items of note, when possible.

When identified within the KPGO study area, koa (*Acacia koa*), ʻohe (*Polyscias hawaiensis*) or lapalapa (*Cheirodendron* spp.) tree trunks were quickly scanned for scars/seeps/slime flux to attempt to visually observe sign of the federally endangered Hawaiian picture-wing fly (*Drosophila musaphilia, D. sharpi*) in suitable habitat. Surveys of trees were done during the spring fauna survey, with a revisit to a subsample of areas in the fall (winter and summer appear to be best seasons for observing the species, though they have been identified in spring) (USFWS 2008, 2022).

3. SURVEY RESULTS

Results of the spring and fall 2024 terrestrial fauna surveys are detailed below. Results of surveys include all species documented at each of 15 observation points throughout the KPGO study area, number of individuals observed, condition, life stage, regulatory status, and GPS coordinates for the locations in a data matrix (Appendix A). Photos were collected at each of 15 fauna observation points of the KPGO study area, showing the habitats they covered (Appendix B). Finally, a complete list was compiled of all fauna species observed in the KPGO study area, noting their relative abundance (Appendix C).

3.1 SPECIAL STATUS WILDLIFE SPECIES

Special status avians observed included two Federally threatened species:

- **Hawaiian Goose** (Nēnē, *Branta sandvicensis*), 2 adult birds were observed flying low over Site A (obs. pt. 13) on April 30, 2024 (Figure 3-1).
- **Hawaiian Goose**, 2 adult birds were heard calling while flying over Site C (obs. pt. 7) on October 15, 2024.
- **Scarlet Honeycreeper** (ʻIʻiwi, *Drepanis coccinea*) 1 adult bird seen in an ʻōhiʻa tree (*Metrosideros polymorpha*) in northern Site E (obs. pt. 1), and 1 bird heard only during the same survey visit (possibly the same individual) on May 1, 2024.
- **Scarlet Honeycreeper,** 1 adult bird, observed feeding on ʻōhiʻa flowers in a tree in northern Site E (obs. pt. 1) on May 13, 2024.
- **Scarlet Honeycreeper** 1 adult bird, seen in an ʻōhiʻa tree in northern Site A (obs. pt. 12) on April 30, 2024.

No waterbird habitat was observed within the KPGO study area. No federally protected seabirds like ʻAʻo (Newell's Shearwater, *Puffinus newelli*) were observed, as surveys were conducted during the morning and not when these nocturnal/crepuscular seabirds would be active. During the fall 2024 field survey, a seabird decoy was observed in two locations within KPGO study area, likely to ensure regular sweeps were made for downed nocturnal seabirds during the fall fledging period. Multiple avian carcasses were noted during the fall field surveys, which were part of a PMRF carcass removal study, where the carcasses were monitored daily for removal by predators (cats, dogs, and rats) (Figure 3-2). Together these efforts by PMRF are to ensure that any nocturnal seabirds that may fall out at PMRF facilities during the fall juvenile fledging season (between

September 15 and December 15), are immediately located and recovered by PMRF personnel. To reduce the likelihood of fallout for these federally protected seabirds during fall fledging, PMRF implemented and follows the Dark Skies Program annually, which requires outdoor lighting be reduced to only those lights needed for safety and mission requirements, and curtains and blinds be closed between the hours of 6:00 pm and 6:00 am HST (NAVFAC 2023).

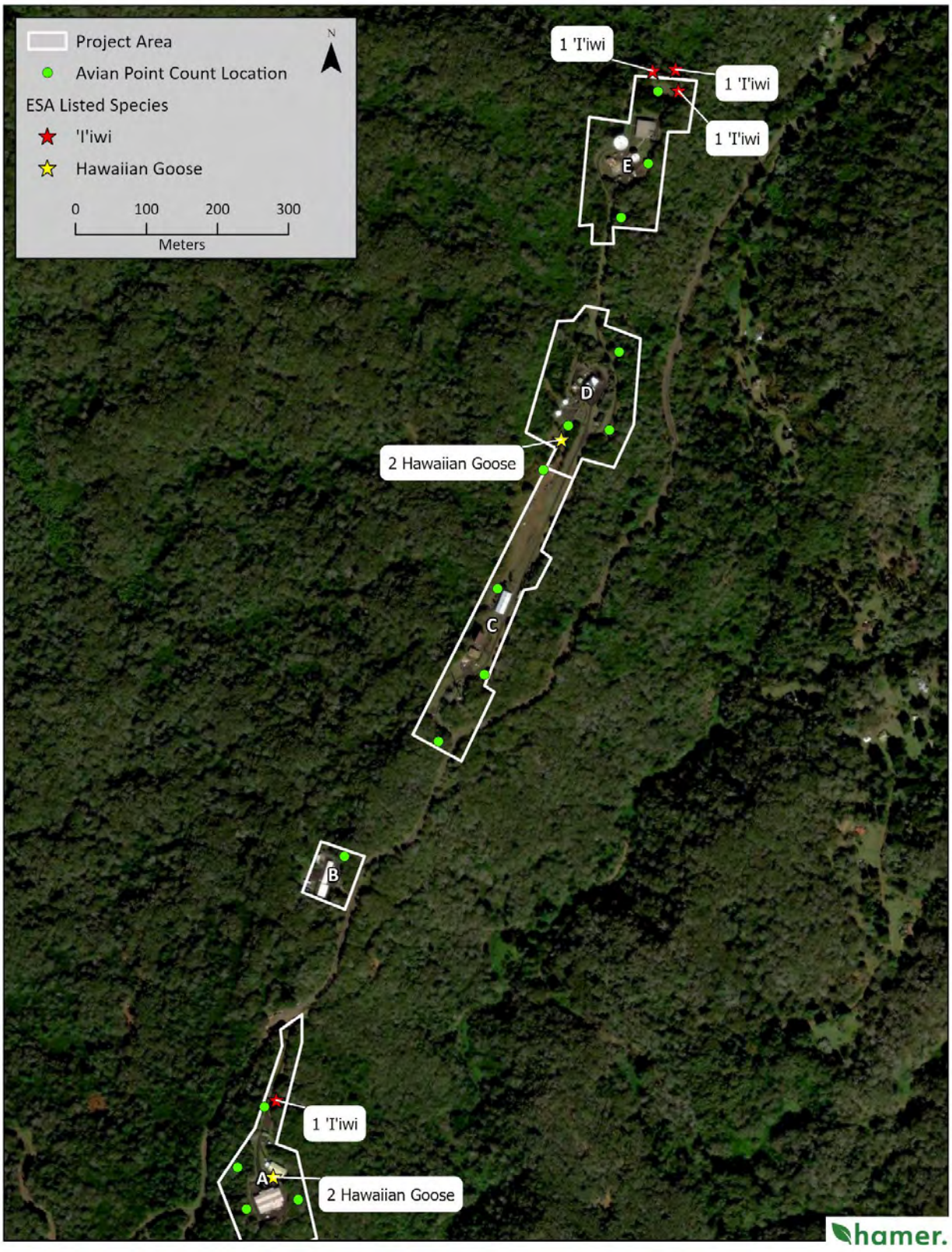

Figure 3-1. Federally Listed Birds in the KPGO Study Area, Kauaʻi, Hawaiʻi.

Figure 3-2. PMRF Carcass Removal Trial Avian Carcass, KPGO Study Area, Kauaʻi, Hawaiʻi.

3.2 Migratory Bird Treaty Act Protected Species

MBTA protected species observed in the KPGO study area included: Pacific Golden Plover (Kōlea, *Pluvialis fulva,* 9 birds), White-tailed Tropicbird (*Phaethon lepturus*, 2 birds), and native forest birds Kauaʻi ʻAmakihi (ʻAmakihi, *Chlorodrepanis stejnegeri*, 17 birds), ʻAnianiau (*Magumma parvus*, 17 birds), and ʻApapane (*Himatione sanguinea*, 11 birds). Non-native MBTA birds observed included state invasive Western Cattle Egret (*Ardea ibis*, 7 birds), House Finch (*Haemorhous mexicanus*, 120 birds), Northern Mockingbird (*Mimus polyglottos*, 3 birds), and the most abundant migratory species, Northern Cardinal (*Cardinalis cardinalis*, 151 birds) (Table 3-1).

Table 3-1. Migratory Bird Treaty Act Species Observed in KPGO Study Area, Kauaʻi, Hawaiʻi.

Common Name	Scientific Name	No. of Individuals (Spring Visits 1-3)	Life Stage/Notes: Spring	No. of Individuals (Fall Visits 4-6)	Life Stage/Notes: Fall	No. of Individuals (Total All Visits)
ʻAnianiau	*Magumma parva*	6	Adults, observed in forested areas in Sites A, B, and C	11	Adults, observed in forested areas in Sites A, B, C, and E	17
ʻApapane	*Himatione sanguinea*	7	Adults and 1 Juvenile, observed in forested areas foraging and calling within Sites E, A, and C	4	Adults observed in forested areas foraging and calling within Sites E, A, and C	11
Western Cattle Egret	*Ardea ibis*	0	- n/a -	7	Adults observed flying over Kōkeʻe and foraging on ground in open areas within Sites C, A, and D	7
House Finch	*Haemorhous mexicanus*	78	Adults observed in all habitats of all Sites (A, B, C, D, E)	42	Adults observed in all habitats of all Sites (A, B, C, D, E)	120
Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	14	Adults observed in forested areas in Sites A, C, and E	3	Adults observed in forested areas in Sites A, C, D, and E	17
Northern Cardinal	*Cardinalis cardinalis*	94	Adults and juveniles observed in forested and edge of forest habitats of all Sites (A, B, C, D, E)	57	Adults observed in forested and edge of forest habitats of all Sites (A, B, C, D, E)	151
Northern Mockingbird	*Mimus polyglottos*	2	Adults observed in Sites C and E	1	Adult observed in forest edge of Site E	3

Common Name	Scientific Name	No. of Individuals (Spring Visits 1-3)	Life Stage/Notes: Spring	No. of Individuals (Fall Visits 4-6)	Life Stage/Notes: Fall	No. of Individuals (Total All Visits)
Pacific Golden Plover (Kōlea)	*Pluvialis fulva*	1	Adult observed in Site A as audio detection, and later visually observed in developed area of Site A as incidental observation	8	Adults observed in Sites C, D, and E. Birds observed in Site C open grass area as breeding pair, and at other sites in open areas/grass lands	9
White-tailed Tropic Bird	*Phaethon lepturus*	1	Adult observed flying over Site A	1	Adult observed flying over Site D	2

3.3 Invasive Fauna

Evidence of invasive feral pigs (*Sus scrofa*), feral goats (*Capra hircus*), and Black-tailed deer (*Odocoileus hemionus hemionus*) were observed in the KPGO project area. Two dogs and a single Black-tailed deer were observed on site during the fall surveys (Appendix A). Invasive Western Cattle Egret (*Ardea ibis*) were observed in Sites A, C and D, and although an MBTA species, egrets are controlled at PMRF (through a 2017 USFWS depredation control order) to reduce the predation impacts to native bird eggs and nestlings (NAVFAC 2010). Multiple rat traps (Goodnature©) were observed along the periphery of the KPGO project area, and a single cat trap without bait was also noted (Figure 3-3). No incidental observations were made of KISC Priority Pest species, coqui frog (*Eleutherodactylus coqui*), little fire ant (*Wasmannia auropunctata*), coconut rhinoceros beetle (*Oryctes rhinoceros*), or mongoose (*Herpestes javanicus*).

Figure 3-3. Goodnature© rat trap, one of several observed at the boundary of the KPGO study area, Kaua'i, Hawai'i.

3.4 Other Wildlife Species

Other birds detected during the fauna surveys included, most commonly, Warbling White-eye (Mejiro, *Zosterops japonicus*) with 746 individuals documented over the course of the six survey visits (Appendix D).

The next most commonly observed birds were Red Junglefowl (*Gallus gallus*) with 202 birds, and White-rumped Shama (*Copsychus malabaricus*) with 179 birds detected over the course of six survey visits.

Specialized surveys were not conducted in 2024 specifically for the picture-wing fly. However, koa, ʻohe, and lapalapa trees, the host plants for the fly, were inspected for evidence of injury resulting in seeps of tree sap, where the picture-wing flies lay their eggs. No signs of active tree sap seeps or picture-wing flies were observed in all areas of habitat inspected (Sites A, B, C, D and E) during spring fauna surveys. No evidence of Hawaiian Picture-wing fly (*Drosophila spp.*) individuals were observed during the 2024 fauna surveys,

3.5 HABITAT ASSESSMENT

Suitability of potential fauna habitat in the KPGO study area was assessed and completed concurrent with the fauna observation surveys and vegetation surveys. All areas of the fauna survey area were visually assessed for fauna habitat suitability, dominant plants and presence of invasive plant species, except for an inaccessible part of western Site D (safety issue). Habitats within the majority of the KPGO study area fenceline were highly modified and contained roads, installation equipment and structures, as well as maintained meadow, lawn and landscaped areas. Habitat beyond the fenceline of each site was typically forest and scrub-shrub, with some areas of dense invasive species like strawberry guava in the understory. Native forest habitat was also present and described in the associated vegetation survey report (Hamer Environmental 2024).

The KPGO study area is relatively small in size, so the fauna observation points were often placed at the edge of two vegetation cover types in areas with best visibility to detect fauna. For this reason, the fauna habitats were best described by the vegetation cover types found in the KPGO study area. Photos were collected for each fauna observation point (Appendix B).

The fauna survey area was 19.2 ac, consisting of all lands not comprised of impervious surfaces (roads, buildings) (NOAA 2010). The survey area is 79% (15.1 ac) evergreen forest, 6% (1.2 ac) scrub-shrub land covers, and 15% (2.9 ac) developed open space (managed grasses like lawn or low-lying vegetation) (Table 3-2).

Table 3-2. Vegetation and Land Cover Types within the KPGO Study Area, Kauaʻi, Hawaiʻi.

Vegetation Type[1]	**Nativity**	**Land Cover Type[2]**
Non-native Grass-forb Meadow, Lawn	Non-native	Developed, Open Space (lawn, meadow)
Blackberry, Lantana Thicket	Non-native	Scrub/**Shrub**
Blackberry Thicket	Non-native	
Mixed Koa, Non-native Forest	Native, Non-native	Evergreen **Forest**

Vegetation Type[1]	Nativity	Land Cover Type[2]
Koa ʻŌhiʻa Mixed Montane Mesic Forest	Native	

[1]Vegetation Type (NAVFAC 2023).
[2]Land Cover Type (NOAA 2010).

3.6 NOTABLE HABITAT

Notable habitats within the KPGO study area included native koa-ʻōhiʻa mixed montane forest, with little encroachment by invasive species. Northern and eastern Site E and southern Site C contained the largest areas of this habitat, with smaller patches found in northern Site D, and small patches of Sites C and A. Most forest areas within the KPGO study area contained some amount of strawberry guava in the understory, which grows in monotypic stands that reduce overall species diversity.

Koa (Fusarium) Wilt

Koa trees observed within all KPGO study area sites showed evidence of partial dieback (sections of trees were completely defoliated and appeared dead, while other main branches appeared unaffected) as a result of a fungal infection known as Koa or Fusarium wilt (*Fusarium oxysporum*, Figure 3-4). Koa wilt has recently expanded on Kauaʻi and is visibly impacting koa trees along Waimea Canyon Road leading to the KPGO site, as well as within both Waimea Canyon and Kōkeʻe State Parks near the KPGO site.

Figure 3-4. Koa wilt (*Fusarium oxysporum*) is shown as dead lower branches on koa tree in Site C within the KPGO Study Area, Kauaʻi, Hawaiʻi.

4. DISCUSSION

4.1 FEDERALLY PROTECTED HAWAIIAN BIRDS

Two species of Federally threatened birds were observed within the KPGO study area, the Hawaiian Goose (four individuals) and the ʻIʻiwi (four individuals). The Hawaiian Geese were observed both times as pairs flying over the KPGO study area, not utilizing any of the habitats within. One pair of geese was likely flying from the large grassy meadow by the lodge in nearby Kōkeʻe State Park based on trajectory and regular presence in the meadow. Three of the ʻIʻiwi detections, all individual birds, were made from Observation Point 1 in northern Site E, on land managed by NASA (Figure 2-1, Figure 3-1). This area of Site E contains an open maintained meadow, surrounded by native koa and ʻōhiʻa forest, and represented some of the best native intact forest habitat within the KPGO study area. Although high quality for the KPGO study area, invasive strawberry guava and Chinese privet were present in some parts of this forest, particularly at the edges.

4.2 HAWAIIAN PICTURE-WING FLY

No Hawaiian picture-wing fly species were observed during the 2024 fauna survey effort. Surveys were focused on the presence of habitat for picture-wing fly and not conducted by entomologist specialists during peak season (summer, winter) to observe and properly identify them. However, in 2022, an entomologist did detect Federally endangered picture-wing fly (*Drosophila musaphilia*) in Site E, at a Koa tree with an active seep during terrestrial invertebrate surveys (Magnacca 2022). Two Picture-wing flies were documented in 2010 by expert entomologists in close proximity to KPGO Site B (NAVFAC 2010). Critical habitat designated for this species is also in the vicinity but outside of the KPGO study area. In KPGO Site D, a small restoration planting of twelve native plants was installed in 2022 to benefit Hawaiian picture-wing fly habitat, and while still young, are establishing successfully (Appendix B).

4.3 MIGRATORY BIRD TREATY ACT PROTECTED SPECIES

Nine species of MBTA-protected birds were observed in the KPGO study area, including native forest birds Kauaʻi ʻAmakihi, ʻAnianiau, and ʻApapane, observed in all sites but most abundantly in Sites C and E. Other native species, Kōlea (Pacific Golden Plover), and White-tailed Tropicbird were observed infrequently. The Kōlea were observed multiple times as a pair during the fall survey in the center of the meadow in Site C in the general area used by the State of Hawaiʻi for helicopter activities. White-tailed Tropicbirds were only observed twice, flying over Site A and Site D. Non-native MBTA species were common throughout the KPGO study area and birds like the Northern Cardinal were more abundant than the native MBTA species.

4.4 INVASIVE SPECIES

Invasive fauna species or sign observed in the KPGO study area included Black-tailed deer, feral pig, dogs, and Western Cattle Egrets. Of those listed, feral pigs, dogs and egrets, are known to predate on native, ESA- and MBTA-protected birds. Feral pigs and other ungulates also degrade native habitats through disturbance, allowing introduction and spread of invasive plants. No KISC invasive species, such as coqui frog or little fire ant were observed during the fauna field surveys.

4.5 SURVEY NOTES

The 2022 terrestrial invertebrate survey authors noted that Sites B and E contained suitable habitat with native host trees for the picture-wing fly, despite a sometimes dense understory of invasive strawberry guava (Magnacca 2022). However, the lack of young native host trees in these forests due to invasive plants, and to a lesser extent pigs, were noted as a threat to future survival of picture-wing fly species in the KPGO study area. This 2024 fauna study confirmed that the native koa tree habitat that the picture-wing flies require, is present in most forested areas, but additionally noted that more than half of the mature koa trees in the KPGO study area are infected with Fusarium wilt, a fungal pathogen (Figure 3-4).

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APPENDIX A. FAUNA SURVEYS DATA MATRIX

The following matrix incorporates all species observed during Spring 2024 field visits 1-3, with a combined count of individuals of the same species at each observation point, as well as mean number of individuals per visit. When an ESA-protected animal was detected, data was presented in the matrix for that individual detection, and not averaged. Location coordinates are reported in WGS84 Universal Transverse Mercator (UTM).

Obs. Station No.	Common Name	Scientific Name	No. of Observations (V1-3)[1]	Mean No. per Visit (V1-3)[2]	Health Condition	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
1	Common Myna	*Acridotheres tristis*	1	0.3	Good	Adult	-	N	431459.37	2447064.92	
1	Northern Cardinal	*Cardinalis cardinalis*	10	3.3	Good	Adults, Juveniles	-	Y	431459.37	2447064.92	
1	Kauaʻi Elepaio	*Chasiempis sclateri*	1	0.3	Good	Adult	-	N	431459.37	2447064.92	
1	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	1	0.3	Good	Adult	-	Y	431459.37	2447064.92	
1	White-rumped Shama	*Copsychus malabaricus*	9	3.0	Good	Adults	-	N	431459.37	2447064.92	
1	Red Junglefowl	*Gallus gallus*	9	3.0	Good	Adults	-	N	431459.37	2447064.92	
1	House Finch	*Haemorhous mexicanus*	4	1.3	Good	Adults	-	N	431459.37	2447064.92	
1	ʻApapane	*Himatione sanguinea*	3	1.0	Good	Adults	-	Y	431459.37	2447064.92	
1	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	4	1.3	Good	Adults	-	N	431459.37	2447064.92	
1	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	4	1.3	Good	Adults	-	N	431459.37	2447064.92	
1	Northern Mockingbird	*Mimus polyglottos*	1	0.3	Good	Adult	-	Y	431459.37	2447064.92	
1	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	431459.37	2447064.92	
1	Saffron Finch	*Sicalis flaveola*	1	0.3	Good	Adult	-	N	431459.37	2447064.92	
1	Scarlet Honeycreeper (ʻIʻiwi)	*Drepanis coccinea*	1	-	Good	Adult	FT, SE	N	431488.23	2447065.84	5-1-2024, auditory detection
1	Scarlet Honeycreeper (ʻIʻiwi)	*Drepanis coccinea*	1	-	Good	Adult	FT, SE	N	431484.01	2447096.04	5-1-2024, both visual and auditory detection
1	Scarlet Honeycreeper (ʻIʻiwi)	*Drepanis coccinea*	1	-	Good	Adult	FT, SE	N	431451.78	2447093.96	5-13-2024, both visual and auditory detection
1	Warbling White-eye (Mejiro)	*Zosterops japonicus*	13	4.3	Good	Adults	-	N	431459.37	2447064.92	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V1-3)[1]	Mean No. per Visit (V1-3)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
2	Northern Cardinal	*Cardinalis cardinalis*	6	2.0	Good	Adults	-	Y	431445.59	2446963.16	
2	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	1	0.3	Good	Adult	-	Y	431445.59	2446963.16	
2	White-rumped Shama	*Copsychus malabaricus*	3	1.0	Good	Adults	-	N	431445.59	2446963.16	
2	Erckel's Francolin	*Pternistis erckelii*	1	0.3	Good	Adult	-	N	431445.59	2446963.16	
2	Red Junglefowl	*Gallus gallus*	7	2.3	Good	Adults	-	N	431445.59	2446963.16	
2	House Finch	*Haemorhous mexicanus*	6	2.0	Good	Adults	-	N	431445.59	2446963.16	
2	ʻApapane	*Himatione sanguinea*	1	0.3	Good	Adult	-	Y	431445.59	2446963.16	
2	Red-crested Cardinal	*Paroaria coronata*	5	1.7	Good	Adults	-	N	431445.59	2446963.16	
2	Saffron Finch	*Sicalis flaveola*	1	0.3	Good	Adult	-	N	431445.59	2446963.16	
2	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	431445.59	2446963.16	
2	Warbling White-eye (Mejiro)	*Zosterops japonicus*	8	2.7	Good	Adults	-	N	431445.59	2446963.16	
3	Northern Cardinal	*Cardinalis cardinalis*	6	2.0	Good	Adults	-	Y	431407.40	2446886.91	
3	Kauaʻi Elepaio	*Chasiempis sclateri*	5	1.7	Good	Adults	-	N	431407.40	2446886.91	
3	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	2	0.7	Good	Adults	-	Y	431407.40	2446886.91	
3	White-rumped Shama	*Copsychus malabaricus*	7	2.3	Good	Adults	-	N	431407.40	2446886.91	
3	Erckel's Francolin	*Pternistis erckelii*	1	0.3	Good	Adult	-	N	431407.40	2446886.91	
3	Red Junglefowl	*Gallus gallus*	6	2.0	Good	Adults	-	N	431407.40	2446886.91	
3	House Finch	*Haemorhous mexicanus*	4	1.3	Good	Adults	-	N	431407.40	2446886.91	
3	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	4	1.3	Good	Adults	-	N	431407.40	2446886.91	
3	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	431407.40	2446886.91	
3	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	431407.40	2446886.91	
3	Saffron Finch	*Sicalis flaveola*	3	1.0	Good	Adults	-	N	431407.40	2446886.91	
3	Spotted Dove	*Spilopelia chinensis*	2	0.7	Good	Adults	-	N	431407.40	2446886.91	
3	Warbling White-eye (Mejiro)	*Zosterops japonicus*	18	6.0	Good	Adults	-	N	431407.40	2446886.91	
4	Common Myna	*Acridotheres tristis*	2	0.7	Good	Adults	-	N	431404.19	2446697.84	
4	Northern Cardinal	*Cardinalis cardinalis*	9	3.0	Good	Adults, Juveniles	-	Y	431404.19	2446697.84	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V1-3)[1]	Mean No. per Visit (V1-3)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
4	Kauaʻi Elepaio	*Chasiempis sclateri*	2	0.7	Good	Adult, Juvenile	-	N	431404.19	2446697.84	
4	White-rumped Shama	*Copsychus malabaricus*	10	3.3	Good	Adults	-	N	431404.19	2446697.84	
4	Erckel's Francolin	*Pternistis erckelii*	3	1.0	Good	Adults	-	N	431404.19	2446697.84	
4	Red Junglefowl	*Gallus gallus*	10	3.3	Good	Adults	-	N	431404.19	2446697.84	
4	House Finch	*Haemorhous mexicanus*	6	2.0	Good	Adults	-	N	431404.19	2446697.84	
4	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	8	2.7	Good	Adults	-	N	431404.19	2446697.84	
4	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	431404.19	2446697.84	
4	Scaly-breasted Munia	*Lonchura punctulata*	1	0.3	Good	Adult	-	N	431404.19	2446697.84	
4	Red-crested Cardinal	*Paroaria coronata*	5	1.7	Good	Adults	-	N	431404.19	2446697.84	
4	Saffron Finch	*Sicalis flaveola*	2	0.7	Good	Adults	-	N	431404.19	2446697.84	
4	Spotted Dove	*Spilopelia chinensis*	2	0.7	Good	Adults	-	N	431404.19	2446697.84	
4	Warbling White-eye (Mejiro)	*Zosterops japonicus*	13	4.3	Good	Adults	-	N	431404.19	2446697.84	
5	Common Myna	*Acridotheres tristis*	3	1.0	Good	Adults	-	N	431332.83	2446593.50	
5	Northern Cardinal	*Cardinalis cardinalis*	7	2.3	Good	Adults	-	Y	431332.83	2446593.50	
5	White-rumped Shama	*Copsychus malabaricus*	6	2.0	Good	Adults	-	N	431332.83	2446593.50	
5	Erckel's Francolin	*Pternistis erckelii*	3	1.0	Good	Adults	-	N	431332.83	2446593.50	
5	Red Junglefowl	*Gallus gallus*	8	2.7	Good	Adults	-	N	431332.83	2446593.50	
5	House Finch	*Haemorhous mexicanus*	4	1.3	Good	Adults	-	N	431332.83	2446593.50	
5	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	5	1.7	Good	Adults	-	N	431332.83	2446593.50	
5	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	3	1.0	Good	Adults	-	N	431332.83	2446593.50	
5	Saffron Finch	*Sicalis flaveola*	4	1.3	Good	Adults	-	N	431332.83	2446593.50	
5	Spotted Dove	*Spilopelia chinensis*	2	0.7	Good	Adults	-	N	431332.83	2446593.50	
5	Warbling White-eye (Mejiro)	*Zosterops japonicus*	12	4.0	Good	Adults	-	N	431332.83	2446593.50	
6	Common Myna	*Acridotheres tristis*	2	0.7	Good	Adults	-	N	431390.97	2446587.81	
6	Northern Cardinal	*Cardinalis cardinalis*	7	2.3	Good	Adults	-	Y	431390.97	2446587.81	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V1-3)[1]	Mean No. per Visit (V1-3)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
6	Kauaʻi Elepaio	*Chasiempis sclateri*	1	0.3	Good	Juvenile	-	N	431390.97	2446587.81	
6	White-rumped Shama	*Copsychus malabaricus*	6	2.0	Good	Adults	-	N	431390.97	2446587.81	
6	Erckel's Francolin	*Pternistis erckelii*	5	1.7	Good	Adults, Juveniles	-	N	431390.97	2446587.81	
6	Red Junglefowl	*Gallus gallus*	8	2.7	Good	Adults	-	N	431390.97	2446587.81	
6	House Finch	*Haemorhous mexicanus*	6	2.0	Good	Adults	-	N	431390.97	2446587.81	
6	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	6	2.0	Good	Adults	-	N	431390.97	2446587.81	
6	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	431390.97	2446587.81	
6	Scaly-breasted Munia	*Lonchura punctulata*	2	0.7	Good	Adults	-	N	431390.97	2446587.81	
6	Red-crested Cardinal	*Paroaria coronata*	4	1.3	Good	Adults	-	N	431390.97	2446587.81	
6	Saffron Finch	*Sicalis flaveola*	1	0.3	Good	Adult	-	N	431390.97	2446587.81	
6	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	431390.97	2446587.81	
6	Warbling White-eye (Mejiro)	*Zosterops japonicus*	10	3.3	Good	Adults	-	N	431390.97	2446587.81	
7	Common Myna	*Acridotheres tristis*	3	1.0	Good	Adults	-	N	431297.90	2446531.57	
7	Northern Cardinal	*Cardinalis cardinalis*	7	2.3	Good	Adults	-	Y	431297.90	2446531.57	
7	White-rumped Shama	*Copsychus malabaricus*	6	2.0	Good	Adults	-	N	431297.90	2446531.57	
7	Erckel's Francolin	*Pternistis erckelii*	3	1.0	Good	Adults, Juveniles	-	N	431297.90	2446531.57	
7	Red Junglefowl	*Gallus gallus*	7	2.3	Good	Adults	-	N	431297.90	2446531.57	
7	House Finch	*Haemorhous mexicanus*	10	3.3	Good	Adults	-	N	431297.90	2446531.57	
7	ʻApapane	*Himatione sanguinea*	1	0.3	Good	Adult	-	Y	431297.90	2446531.57	
7	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	5	1.7	Good	Adults	-	N	431297.90	2446531.57	
7	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	3	1.0	Good	Adults	-	N	431297.90	2446531.57	
7	Scaly-breasted Munia	*Lonchura punctulata*	5	1.7	Good	Adults	-	N	431297.90	2446531.57	
7	Red-crested Cardinal	*Paroaria coronata*	2	0.7	Good	Adults	-	N	431297.90	2446531.57	
7	Saffron Finch	*Sicalis flaveola*	4	1.3	Good	Adults	-	N	431297.90	2446531.57	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V1-3)[1]	Mean No. per Visit (V1-3)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
7	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	431297.90	2446531.57	
7	Warbling White-eye (Mejiro)	*Zosterops japonicus*	16	5.3	Good	Adults	-	N	431297.90	2446531.57	
8	Common Myna	*Acridotheres tristis*	2	0.7	Good	Adults	-	N	431233.10	2446364.05	
8	Northern Cardinal	*Cardinalis cardinalis*	4	1.3	Good	Adults	-	Y	431233.10	2446364.05	
8	White-rumped Shama	*Copsychus malabaricus*	6	2.0	Good	Adults	-	N	431233.10	2446364.05	
8	Erckel's Francolin	*Pternistis erckelii*	3	1.0	Good	Adults, Juveniles	-	N	431233.10	2446364.05	
8	Red Junglefowl	*Gallus gallus*	12	4.0	Good	Adults	-	N	431233.10	2446364.05	
8	Zebra Dove	*Geopelia striata*	1	0.3	Good	Adult	-	N	431233.10	2446364.05	
8	House Finch	*Haemorhous mexicanus*	5	1.7	Good	Adults	-	N	431233.10	2446364.05	
8	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	8	2.7	Good	Adults	-	N	431233.10	2446364.05	
8	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	431233.10	2446364.05	
8	Scaly-breasted Munia	*Lonchura punctulata*	3	1.0	Good	Adults	-	N	431233.10	2446364.05	
8	Northern Mockingbird	*Mimus polyglottos*	1	0.3	Good	Adult	-	Y	431233.10	2446364.05	
8	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	431233.10	2446364.05	
8	Saffron Finch	*Sicalis flaveola*	3	1.0	Good	Adults	-	N	431233.10	2446364.05	
8	Warbling White-eye (Mejiro)	*Zosterops japonicus*	15	5.0	Good	Adults	-	N	431233.10	2446364.05	
9	Common Myna	*Acridotheres tristis*	6	2.0	Good	Adults	-	N	431214.39	2446242.95	
9	Northern Cardinal	*Cardinalis cardinalis*	4	1.3	Good	Adults	-	Y	431214.39	2446242.95	
9	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	2	0.7	Good	Adults	-	Y	431214.39	2446242.95	
9	White-rumped Shama	*Copsychus malabaricus*	9	3.0	Good	Adults	-	N	431214.39	2446242.95	
9	Erckel's Francolin	*Pternistis erckelii*	1	0.3	Good	Adult	-	N	431214.39	2446242.95	
9	Red Junglefowl	*Gallus gallus*	13	4.3	Good	Adults	-	N	431214.39	2446242.95	
9	House Finch	*Haemorhous mexicanus*	6	2.0	Good	Adults	-	N	431214.39	2446242.95	
9	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	11	3.7	Good	Adults	-	N	431214.39	2446242.95	
9	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	431214.39	2446242.95	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V1-3)[1]	Mean No. per Visit (V1-3)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
9	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	431214.39	2446242.95	
9	Saffron Finch	*Sicalis flaveola*	1	0.3	Good	Adult	-	N	431214.39	2446242.95	
9	Warbling White-eye (Mejiro)	*Zosterops japonicus*	15	5.0	Good	Adults	-	N	431214.39	2446242.95	
10	Common Myna	*Acridotheres tristis*	4	1.3	Good	Adults	-	N	431150.18	2446148.52	
10	Northern Cardinal	*Cardinalis cardinalis*	8	2.7	Good	Adults	-	Y	431150.18	2446148.52	
10	Kauaʻi Elepaio	*Chasiempis sclateri*	2	0.7	Good	Adults	-	N	431150.18	2446148.52	
10	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	3	1.0	Good	Adults	-	Y	431150.18	2446148.52	
10	White-rumped Shama	*Copsychus malabaricus*	10	3.3	Good	Adults, Juvenile	-	N	431150.18	2446148.52	
10	Red Junglefowl	*Gallus gallus*	8	2.7	Good	Adults	-	N	431150.18	2446148.52	
10	House Finch	*Haemorhous mexicanus*	3	1.0	Good	Adults	-	N	431150.18	2446148.52	
10	ʻApapane	*Himatione sanguinea*	1	0.3	Good	Adult	-	Y	431150.18	2446148.52	
10	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	3	1.0	Good	Adults	-	N	431150.18	2446148.52	
10	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	3	1.0	Good	Adults	-	N	431150.18	2446148.52	
10	Scaly-breasted Munia	*Lonchura punctulata*	1	0.3	Good	Adult	-	N	431150.18	2446148.52	
10	ʻAnianiau	*Magumma parva*	2	0.7	Good	Adults	-	Y	431150.18	2446148.52	
10	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	431150.18	2446148.52	
10	Saffron Finch	*Sicalis flaveola*	1	0.3	Good	Adult	-	N	431150.18	2446148.52	
10	Warbling White-eye (Mejiro)	*Zosterops japonicus*	16	5.3	Good	Adults	-	N	431150.18	2446148.52	
11	Common Myna	*Acridotheres tristis*	2	0.7	Good	Adults	-	N	431017.59	2445986.71	
11	Red Avadavat	*Amandava amandava*	1	0.3	Good	Adult	-	N	431017.59	2445986.71	
11	Northern Cardinal	*Cardinalis cardinalis*	6	2.0	Good	Adults	-	Y	431017.59	2445986.71	
11	White-rumped Shama	*Copsychus malabaricus*	3	1.0	Good	Adults	-	N	431017.59	2445986.71	
11	Red Junglefowl	*Gallus gallus*	4	1.3	Good	Adults	-	N	431017.59	2445986.71	
11	Zebra Dove	*Geopelia striata*	1	0.3	Good	Adult	-	N	431017.59	2445986.71	
11	House Finch	*Haemorhous mexicanus*	3	1.0	Good	Adults	-	N	431017.59	2445986.71	
11	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	6	2.0	Good	Adults	-	N	431017.59	2445986.71	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V1-3)[1]	Mean No. per Visit (V1-3)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
11	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	431017.59	2445986.71	
11	ʻAnianiau	*Magumma parva*	2	0.7	Good	Adults	-	Y	431017.59	2445986.71	
11	Red-crested Cardinal	*Paroaria coronata*	5	1.7	Good	Adults	-	N	431017.59	2445986.71	
11	Saffron Finch	*Sicalis flaveola*	3	1.0	Good	Adults	-	N	431017.59	2445986.71	
11	Warbling White-eye (Mejiro)	*Zosterops japonicus*	12	4.0	Good	Adults	-	N	431017.59	2445986.71	
12	Common Myna	*Acridotheres tristis*	1	0.3	Good	Adult	-	N	430904.79	2445633.75	
12	Northern Cardinal	*Cardinalis cardinalis*	8	2.7	Good	Adults, Juveniles	-	Y	430904.79	2445633.75	
12	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	2	0.7	Good	Adults	-	Y	430904.79	2445633.75	
12	White-rumped Shama	*Copsychus malabaricus*	4	1.3	Good	Adults	-	N	430904.79	2445633.75	
12	Gray Francolin	*Francolinus pondicerianus*	1	0.3	Good	Adult	-	N	430904.79	2445633.75	
12	Red Junglefowl	*Gallus gallus*	5	1.7	Good	Adults	-	N	430904.79	2445633.75	
12	House Finch	*Haemorhous mexicanus*	5	1.7	Good	Adults	-	N	430904.79	2445633.75	
12	ʻApapane	*Himatione sanguinea*	1	0.3	Good	Adult	-	Y	430904.79	2445633.75	
12	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	7	2.3	Good	Adults	-	N	430904.79	2445633.75	
12	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	2	0.7	Good	Adults	-	N	430904.79	2445633.75	
12	Scaly-breasted Munia	*Lonchura punctulata*	2	0.7	Good	Adults	-	N	430904.79	2445633.75	
12	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	430904.79	2445633.75	
12	White-tailed tropic bird	*Phaethon lepturus*	1	0.3	Good	Adult	-	Y	430904.79	2445633.75	
12	Saffron Finch	*Sicalis flaveola*	3	1.0	Good	Adults	-	N	430904.79	2445633.75	
12	Scarlet Honeycreeper (ʻIʻiwi)	*Drepanis coccinea*	1	-	Good	Adult	FT, SE	N	430921.48	2445642.97	seen in an ohia tree to northeast
12	Warbling White-eye (Mejiro)	*Zosterops japonicus*	21	7.0	Good	Adults	-	N	430904.79	2445633.75	
13	Common Myna	*Acridotheres tristis*	10	3.3	Good	Adults	-	N	430866.75	2445548.38	
13	Red Avadavat	*Amandava amandava*	2	0.7	Good	Adults	-	N	430866.75	2445548.38	
13	Hawaiian Goose	*Branta sandvicensis*	1	-	Good	Adult	FT, SE	Y	430917.25	2445534.76	seen and heard flying over site A
13	Northern Cardinal	*Cardinalis cardinalis*	6	2.0	Good	Adults	-	Y	430866.75	2445548.38	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V1-3)[1]	Mean No. per Visit (V1-3)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
13	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	1	0.3	Good	Adult	-	Y	430866.75	2445548.38	
13	White-rumped Shama	*Copsychus malabaricus*	3	1.0	Good	Adults	-	N	430866.75	2445548.38	
13	Erckel's Francolin	*Pternistis erckelii*	2	0.7	Good	Adults	-	N	430866.75	2445548.38	
13	Red Junglefowl	*Gallus gallus*	2	0.7	Good	Adults	-	N	430866.75	2445548.38	
13	House Finch	*Haemorhous mexicanus*	4	1.3	Good	Adults	-	N	430866.75	2445548.38	
13	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	13	4.3	Good	Adults	-	N	430866.75	2445548.38	
13	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	430866.75	2445548.38	
13	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	430866.75	2445548.38	
13	Saffron Finch	*Sicalis flaveola*	3	1.0	Good	Adults	-	N	430866.75	2445548.38	
13	Spotted Dove	*Spilopelia chinensis*	3	1.0	Good	Adults	-	N	430866.75	2445548.38	
13	Warbling White-eye (Mejiro)	*Zosterops japonicus*	15	5.0	Good	Adults	-	N	430866.75	2445548.38	
14	Common Myna	*Acridotheres tristis*	4	1.3	Good	Adults	-	N	430952.13	2445502.52	
14	Northern Cardinal	*Cardinalis cardinalis*	4	1.3	Good	Adults	-	Y	430952.13	2445502.52	
14	Kauaʻi Elepaio	*Chasiempis sclateri*	1	0.3	Good	Adult	-	N	430952.13	2445502.52	
14	White-rumped Shama	*Copsychus malabaricus*	8	2.7	Good	Adults	-	N	430952.13	2445502.52	
14	Erckel's Francolin	*Pternistis erckelii*	3	1.0	Good	Adults	-	N	430952.13	2445502.52	
14	Red Junglefowl	*Gallus gallus*	4	1.3	Good	Adults	-	N	430952.13	2445502.52	
14	House Finch	*Haemorhous mexicanus*	6	2.0	Good	Adults	-	N	430952.13	2445502.52	
14	ʻApapane	*Himatione sanguinea*	1	0.3	Good	Adult	-	Y	430952.13	2445502.52	
14	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	10	3.3	Good	Adults	-	N	430952.13	2445502.52	
14	ʻAnianiau	*Magumma parva*	1	0.3	Good	Adult	-	Y	430952.13	2445502.52	
14	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	430952.13	2445502.52	
14	Pacific Golden-Plover (Kōlea)	*Pluvialis fulva*	1	0.3	Good	Adult	-	Y	430952.13	2445502.52	
14	Saffron Finch	*Sicalis flaveola*	4	1.3	Good	Adults	-	N	430952.13	2445502.52	
14	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	430952.13	2445502.52	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V1-3)[1]	Mean No. per Visit (V1-3)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
14	Warbling White-eye (Mejiro)	*Zosterops japonicus*	14	4.7	Good	Adults	-	N	430952.13	2445502.52	
15	Common Myna	*Acridotheres tristis*	4	1.3	Good	Adults	-	N	430879.42	2445489.42	
15	Northern Cardinal	*Cardinalis cardinalis*	2	0.7	Good	Adults	-	Y	430879.42	2445489.42	
15	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	1	0.3	Good	Adult	-	Y	430879.42	2445489.42	
15	White-rumped Shama	*Copsychus malabaricus*	6	2.0	Good	Adults	-	N	430879.42	2445489.42	
15	Erckel's Francolin	*Pternistis erckelii*	2	0.7	Good	Adults	-	N	430879.42	2445489.42	
15	Red Junglefowl	*Gallus gallus*	2	0.7	Good	Adults	-	N	430879.42	2445489.42	
15	House Finch	*Haemorhous mexicanus*	3	1.0	Good	Adults	-	N	430879.42	2445489.42	
15	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	10	3.3	Good	Adults	-	N	430879.42	2445489.42	
15	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	3	1.0	Good	Adults	-	N	430879.42	2445489.42	
15	Scaly-breasted Munia	*Lonchura punctulata*	1	0.3	Good	Adult	-	N	430879.42	2445489.42	
15	ʻAnianiau	*Magumma parva*	1	0.3	Good	Adult	-	Y	430879.42	2445489.42	
15	Red-crested Cardinal	*Paroaria coronata*	2	0.7	Good	Adults	-	N	430879.42	2445489.42	
15	Saffron Finch	*Sicalis flaveola*	4	1.3	Good	Adults	-	N	430879.42	2445489.42	
15	Warbling White-eye (Mejiro)	*Zosterops japonicus*	14	4.7	Good	Adults	-	N	430879.42	2445489.42	

[1]Number of observations (V1-3) = Total number of individual birds of this species observed over the course of 3 visits. Note, any ESA-listed birds detected were noted as their individual detection, and not summed across multiple visits.

[2]Mean Number of observations (V1-3) = Average number of individual birds of this species observed per visit.

[3]Regulatory Status = Federal Endangered (FE), Federal Threatened (FT), State of Hawaii Endangered (SE), State of Hawaii Threatened (ST).

The following matrix incorporates all species observed during Fall 2024 field visits 4-6, with a combined count of individuals of the same species at each observation point, as well as mean number of individuals per visit. When an ESA-protected animal was detected, data was presented in the matrix for that individual detection, and not averaged. Location coordinates are reported in WGS84 UTM.

Obs. Station No.	Common Name	Scientific Name	No. of Observations (V4-6)[1]	Mean No. per Visit (V4-6)[2]	Health Condition	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
1	Northern Cardinal	*Cardinalis cardinalis*	7	2.3	Good	Adults	-	Y	431459.37	2447064.92	
1	White-rumped Shama	*Copsychus malabaricus*	7	2.3	Good	Adults	-	N	431459.37	2447064.92	
1	Red Junglefowl	*Gallus gallus*	7	2.3	Good	Adults	-	N	431459.37	2447064.92	
1	Zebra Dove	*Geopelia striata*	1	0.3	Good	Adult	-	N	431459.37	2447064.92	
1	House finch	*Haemorhous mexicanus*	7	2.3	Good	Adults	-	Y	431459.37	2447064.92	
1	ʻApapane	*Himatione sanguinea*	2	0.7	Good	Adults	-	Y	431459.37	2447064.92	
1	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	1	0.3	Good	unk	-	N	431459.37	2447064.92	
1	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	4	1.3	Good	Adults	-	N	431459.37	2447064.92	
1	Red-crested Cardinal	*Paroaria coronata*	2	0.7	Good	Adults	-	N	431459.37	2447064.92	
1	Pacific Golden Plover (Kōlea)	*Pluvialis fulva*	2	0.7	Good	Adults	-	Y	431459.37	2447064.92	
1	Spotted Dove	*Spilopelia chinensis*	3	1.0	Good	Adults	-	N	431459.37	2447064.92	
1	Warbling White-eye (Mejiro)	*Zosterops japonicus*	23	7.7	Good	Adults	-	N	431459.37	2447064.92	
2	Northern Cardinal	*Cardinalis cardinalis*	1	0.3	Good	Adult	-	Y	431445.59	2446963.16	
2	Red Junglefowl	*Gallus gallus*	2	0.7	Good	Adults	-	N	431445.59	2446963.16	
2	Zebra Dove	*Geopelia striata*	1	0.3	Good	Adult	-	N	431445.59	2446963.16	
2	House finch	*Haemorhous mexicanus*	4	1.3	Good	Adults	-	Y	431445.59	2446963.16	
2	Red-crested Cardinal	*Paroaria coronata*	4	1.3	Good	Adults	-	N	431445.59	2446963.16	
2	Saffron Finch	*Sicalis flaveola*	2	0.7	Good	Adults	-	N	431445.59	2446963.16	
2	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	431445.59	2446963.16	
2	Warbling White-eye (Mejiro)	*Zosterops japonicus*	24	8.0	Good	Adults	-	N	431445.59	2446963.16	
3	Common Myna	*Acridotheres tristis*	1	0.3	Good	Adult	-	N	431407.40	2446886.91	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V4-6)[1]	Mean No. per Visit (V4-6)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
3	Northern Cardinal	*Cardinalis cardinalis*	7	2.3	Good	Adults	-	Y	431407.40	2446886.91	
3	Kauaʻi Elepaio	*Chasiempis sclateri*	3	1.0	Good	Adults	-	N	431407.40	2446886.91	
3	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	1	0.3	Good	Adult	-	Y	431407.40	2446886.91	
3	White-rumped Shama	*Copsychus malabaricus*	3	1.0	Good	Adults	-	N	431407.40	2446886.91	
3	Erckel's Francolin	*Pternistis erckelii*	2	0.7	Good	Adults	-	N	431407.40	2446886.91	
3	Red Junglefowl	*Gallus gallus*	6	2.0	Good	Adults	-	N	431407.40	2446886.91	
3	Zebra Dove	*Geopelia striata*	2	0.7	Good	Adults	-	N	431407.40	2446886.91	
3	House finch	*Haemorhous mexicanus*	3	1.0	Good	Adults	-	Y	431407.40	2446886.91	
3	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	4	1.3	Good	Adults	-	N	431407.40	2446886.91	
3	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	3	1.0	Good	Adults	-	N	431407.40	2446886.91	
3	ʻAnianiau	*Magumma parva*	1	0.3	Good	Adult	-	Y	431407.40	2446886.91	
3	Red-crested Cardinal	*Paroaria coronata*	5	1.7	Good	Adults	-	N	431407.40	2446886.91	
3	Saffron Finch	*Sicalis flaveola*	1	0.3	Good	Adult	-	N	431407.40	2446886.91	
3	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	431407.40	2446886.91	
3	Warbling White-eye (Mejiro)	*Zosterops japonicus*	22	7.3	Good	Adults	-	N	431407.40	2446886.91	
incidental	Domestic dog	*Canus lupus domesticus*	2	0.7	Good	Adults	-	N	431404.19	2446697.84	2 hunting dogs, pets observed in north Site D, 10/21/2024
4	Common Myna	*Acridotheres tristis*	4	1.3	Good	Adults	-	N	431404.19	2446697.84	
4	Northern Cardinal	*Cardinalis cardinalis*	4	1.3	Good	Adults	-	Y	431404.19	2446697.84	
4	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	1	0.3	Good	Adult	-	Y	431404.19	2446697.84	
4	White-rumped Shama	*Copsychus malabaricus*	9	3.0	Good	Adults	-	N	431404.19	2446697.84	
4	Erckel's Francolin	*Pternistis erckelii*	1	0.3	Good	Adult	-	N	431404.19	2446697.84	
4	Red Junglefowl	*Gallus gallus*	7	2.3	Good	Adults	-	N	431404.19	2446697.84	
4	House finch	*Haemorhous mexicanus*	1	0.3	Good	Adult	-	Y	431404.19	2446697.84	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V4-6)[1]	Mean No. per Visit (V4-6)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
4	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	1	0.3	Good	unk	-	N	431404.19	2446697.84	
4	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	431404.19	2446697.84	
4	Red-crested Cardinal	*Paroaria coronata*	6	2.0	Good	Adults	-	N	431404.19	2446697.84	
4	House Sparrow	*Passer domesticus*	1	0.3	Good	Adult	-	N	431404.19	2446697.84	
4	White-tailed tropic bird	*Phaethon lepturus*	1	0.3	Good	Adult	-	Y	431404.19	2446697.84	
4	Pacific Golden Plover (Kōlea)	*Pluvialis fulva*	1	0.3	Good	Adult	-	Y	431404.19	2446697.84	
4	Spotted Dove	*Spilopelia chinensis*	6	2.0	Good	Adults	-	N	431404.19	2446697.84	
4	Warbling White-eye (Mejiro)	*Zosterops japonicus*	21	7.0	Good	Adults	-	N	431404.19	2446697.84	
5	Common Myna	*Acridotheres tristis*	1	0.3	Good	Adult	-	N	431332.83	2446593.50	
5	Northern Cardinal	*Cardinalis cardinalis*	2	0.7	Good	Adult, Juvenile	-	Y	431332.83	2446593.50	
5	White-rumped Shama	*Copsychus malabaricus*	6	2.0	Good	Adults	-	N	431332.83	2446593.50	
5	Red Junglefowl	*Gallus gallus*	8	2.7	Good	Adults	-	N	431332.83	2446593.50	
5	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	5	1.7	Good	unk	-	N	431332.83	2446593.50	
5	Scaly-breasted Munia	*Lonchura punctulata*	3	1.0	Good	Adults	-	N	431332.83	2446593.50	
5	Red-crested Cardinal	*Paroaria coronata*	3	1.0	Good	Adults	-	N	431332.83	2446593.50	
5	Saffron Finch	*Sicalis flaveola*	2	0.7	Good	Adults	-	N	431332.83	2446593.50	
5	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	431332.83	2446593.50	
5	Warbling White-eye (Mejiro)	*Zosterops japonicus*	25	8.3	Good	Adults	-	N	431332.83	2446593.50	
6	Common Myna	*Acridotheres tristis*	4	1.3	Good	Adults	-	N	431390.97	2446587.81	
6	Cattle Egret	*Bubulcus ibis*	1	0.3	Good	Adult	-	Y	431390.97	2446587.81	
6	Northern Cardinal	*Cardinalis cardinalis*	2	0.7	Good	Adults	-	Y	431390.97	2446587.81	
6	White-rumped Shama	*Copsychus malabaricus*	8	2.7	Good	Adults	-	N	431390.97	2446587.81	
6	Red Junglefowl	*Gallus gallus*	6	2.0	Good	Adults	-	N	431390.97	2446587.81	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V4-6)[1]	Mean No. per Visit (V4-6)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
6	Zebra Dove	*Geopelia striata*	1	0.3	Good	Adult	-	N	431390.97	2446587.81	
6	House finch	*Haemorhous mexicanus*	1	0.3	Good	Adult	-	Y	431390.97	2446587.81	
6	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	6	2.0	Good	Adults	-	N	431390.97	2446587.81	
6	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	431390.97	2446587.81	
6	Chestnut Munia	*Lonchura atricapilla*	2	0.7	Good	Adults	-	N	431390.97	2446587.81	
6	Scaly-breasted Munia	*Lonchura punctulata*	3	1.0	Good	Adults	-	N	431390.97	2446587.81	
6	Red-crested Cardinal	*Paroaria coronata*	4	1.3	Good	Adults	-	N	431390.97	2446587.81	
6	Pacific Golden Plover (Kōlea)	*Pluvialis fulva*	2	0.7	Good	Adults	-	Y	431390.97	2446587.81	
6	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	431390.97	2446587.81	
6	Warbling White-eye (Mejiro)	*Zosterops japonicus*	18	6.0	Good	Adults	-	N	431390.97	2446587.81	
Inciden tal	Black-tailed Deer	*Odocoileus hemionus*	1	-	Good	Adult	-	N	431371.29	2446585.99	Seen walking through open area of Site D 10-16-2024
7	Common Myna	*Acridotheres tristis*	1	0.3	Good	Adult	-	N	431297.90	2446531.57	
7	Hawaiian Goose	*Branta sandvicensis*	1	0.3	unk	Adult	FT, SE	Y	431323.07	2446574.17	auditory detection of 2 birds calling
7	Northern Cardinal	*Cardinalis cardinalis*	5	1.7	Good	Adults	-	Y	431297.90	2446531.57	
7	White-rumped Shama	*Copsychus malabaricus*	5	1.7	Good	Adults	-	N	431297.90	2446531.57	
7	Red Junglefowl	*Gallus gallus*	5	1.7	Good	Adults	-	N	431297.90	2446531.57	
7	Zebra Dove	*Geopelia striata*	1	0.3	Good	Adult	-	N	431297.90	2446531.57	
7	House finch	*Haemorhous mexicanus*	1	0.3	Good	Adult	-	Y	431297.90	2446531.57	
7	ʻApapane	*Himatione sanguinea*	1	0.3	Good	Adult	-	Y	431297.90	2446531.57	
7	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	5	1.7	Good	Adults	-	N	431297.90	2446531.57	
7	ʻAnianiau	*Magumma parva*	1	0.3	Good	Adult	-	Y	431297.90	2446531.57	
7	Red-crested Cardinal	*Paroaria coronata*	3	1.0	Good	Adults	-	N	431297.90	2446531.57	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V4-6)[1]	Mean No. per Visit (V4-6)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
7	Pacific Golden Plover (Kōlea)	*Pluvialis fulva*	1	0.3	Good	Adult	-	Y	431297.90	2446531.57	
7	Saffron Finch	*Sicalis flaveola*	1	0.3	Good	Adult	-	N	431297.90	2446531.57	
7	Warbling White-eye (Mejiro)	*Zosterops japonicus*	29	9.7	Good	Adults	-	N	431297.90	2446531.57	
8	Cattle Egret	*Bubulcus ibis*	1	0.3	Good	Adult	-	Y	431233.10	2446364.05	
8	Northern Cardinal	*Cardinalis cardinalis*	3	1.0	Good	Adults	-	Y	431233.10	2446364.05	
8	Kauaʻi Elepaio	*Chasiempis sclateri*	1	0.3	Good	Adult	-	N	431233.10	2446364.05	
8	White-rumped Shama	*Copsychus malabaricus*	2	0.7	Good	Adults	-	N	431233.10	2446364.05	
8	Red Junglefowl	*Gallus gallus*	4	1.3	Good	Adults	-	N	431233.10	2446364.05	
8	House finch	*Haemorhous mexicanus*	1	0.3	Good	Adult	-	Y	431233.10	2446364.05	
8	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	4	1.3	Good	unk	-	N	431233.10	2446364.05	
8	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	3	1.0	Good	Adults	-	N	431233.10	2446364.05	
8	Scaly-breasted Munia	*Lonchura punctulata*	1	0.3	Good	Adult	-	N	431233.10	2446364.05	
8	Northern Mockingbird	*Mimus polyglottos*	1	0.3	Good	Adult	-	Y	431233.10	2446364.05	
8	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	431233.10	2446364.05	
8	Pacific Golden Plover (Kōlea)	*Pluvialis fulva*	1	0.3	Good	Adult	-	Y	431233.10	2446364.05	
8	Saffron Finch	*Sicalis flaveola*	1	0.3	Good	Adult	-	N	431233.10	2446364.05	
8	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	431233.10	2446364.05	
8	Warbling White-eye (Mejiro)	*Zosterops japonicus*	25	8.3	Good	Adults	-	N	431233.10	2446364.05	
9	Common Myna	*Acridotheres tristis*	4	1.3	Good	Adults	-	N	431214.39	2446242.95	
9	Cattle Egret	*Bubulcus ibis*	2	0.7	Good	Adults	-	Y	431214.39	2446242.95	
9	Northern Cardinal	*Cardinalis cardinalis*	3	1.0	Good	Adults	-	Y	431214.39	2446242.95	
9	Kauaʻi Elepaio	*Chasiempis sclateri*	2	0.7	Good	Adults	-	N	431214.39	2446242.95	
9	White-rumped Shama	*Copsychus malabaricus*	6	2.0	Good	Adults	-	N	431214.39	2446242.95	
9	Red Junglefowl	*Gallus gallus*	9	3.0	Good	Adults	-	N	431214.39	2446242.95	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V4-6)[1]	Mean No. per Visit (V4-6)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
9	House finch	*Haemorhous mexicanus*	2	0.7	Good	Adults	-	Y	431214.39	2446242.95	
9	Melodious Laughingthrush (Hwamei)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	431214.39	2446242.95	
9	Red-crested Cardinal	*Paroaria coronata*	3	1.0	Good	Adults	-	N	431214.39	2446242.95	
9	Warbling White-eye (Mejiro)	*Zosterops japonicus*	20	6.7	Good	Adults	-	N	431214.39	2446242.95	
10	Common Myna	*Acridotheres tristis*	1	0.3	Good	Adult	-	N	431150.18	2446148.52	
10	Northern Cardinal	*Cardinalis cardinalis*	3	1.0	Good	Adults	-	Y	431150.18	2446148.52	
10	Kauaʻi Elepaio	*Chasiempis sclateri*	1	0.3	Good	Adult	-	N	431150.18	2446148.52	
10	White-rumped Shama	*Copsychus malabaricus*	3	1.0	Good	Adults	-	N	431150.18	2446148.52	
10	Red Junglefowl	*Gallus gallus*	6	2.0	Good	Adults	-	N	431150.18	2446148.52	
10	House finch	*Haemorhous mexicanus*	4	1.3	Good	Adults	-	Y	431150.18	2446148.52	
10	ʻAnianiau	*Magumma parva*	4	1.3	Good	Adults	-	Y	431150.18	2446148.52	
10	Red-crested Cardinal	*Paroaria coronata*	2	0.7	Good	Adults	-	N	431150.18	2446148.52	
10	Saffron Finch	*Sicalis flaveola*	2	0.7	Good	Adults	-	N	431150.18	2446148.52	
10	Spotted Dove	*Spilopelia chinensis*	4	1.3	Good	Adults	-	N	431150.18	2446148.52	
10	Warbling White-eye (Mejiro)	*Zosterops japonicus*	21	7.0	Good	Adults	-	N	431150.18	2446148.52	
11	Common Myna	*Acridotheres tristis*	1	0.3	Good	Adult	-	N	431017.59	2445986.71	
11	Northern Cardinal	*Cardinalis cardinalis*	3	1.0	Good	Adults	-	Y	431017.59	2445986.71	
11	Kauaʻi Elepaio	*Chasiempis sclateri*	2	0.7	Good	Adults	-	N	431017.59	2445986.71	
11	White-rumped Shama	*Copsychus malabaricus*	7	2.3	Good	Adults	-	N	431017.59	2445986.71	
11	Erckel's Francolin	*Pternistis erckelii*	1	0.3	Good	Adult	-	N	431017.59	2445986.71	
11	Red Junglefowl	*Gallus gallus*	8	2.7	Good	Adults	-	N	431017.59	2445986.71	
11	House finch	*Haemorhous mexicanus*	2	0.7	Good	Adults	-	Y	431017.59	2445986.71	
11	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	2	0.7	Good	Adults	-	N	431017.59	2445986.71	
11	ʻAnianiau	*Magumma parva*	3	1.0	Good	Adults	-	Y	431017.59	2445986.71	
11	Red-crested Cardinal	*Paroaria coronata*	3	1.0	Good	Adults	-	N	431017.59	2445986.71	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V4-6)[1]	Mean No. per Visit (V4-6)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
11	House Sparrow	*Passer domesticus*	1	0.3	Good	Adult	-	N	431017.59	2445986.71	
11	Saffron Finch	*Sicalis flaveola*	3	1.0	Good	Adults	-	N	431017.59	2445986.71	
11	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	431017.59	2445986.71	
11	Warbling White-eye (Mejiro)	*Zosterops japonicus*	11	3.7	Good	Adults	-	N	431017.59	2445986.71	
12	Common Myna	*Acridotheres tristis*	4	1.3	Good	Adults	-	N	430904.79	2445633.75	
12	Cattle Egret	*Bubulcus ibis*	1	0.3	Good	Adult	-	Y	430904.79	2445633.75	
12	Northern Cardinal	*Cardinalis cardinalis*	7	2.3	Good	Adults	-	Y	430904.79	2445633.75	
12	Kauaʻi Elepaio	*Chasiempis sclateri*	2	0.7	Good	Adults	-	N	430904.79	2445633.75	
12	White-rumped Shama	*Copsychus malabaricus*	6	2.0	Good	Adults	-	N	430904.79	2445633.75	
12	Red Junglefowl	*Gallus gallus*	3	1.0	Good	Adults	-	N	430904.79	2445633.75	
12	ʻApapane	*Himatione sanguinea*	1	0.3	Good	Adult	-	Y	430904.79	2445633.75	
12	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	1	0.3	Good	unk	-	N	430904.79	2445633.75	
12	ʻAnianiau	*Magumma parva*	1	0.3	Good	Adult	-	Y	430904.79	2445633.75	
12	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	430904.79	2445633.75	
12	Spotted Dove	*Spilopelia chinensis*	2	0.7	Good	Adults	-	N	430904.79	2445633.75	
12	Warbling White-eye (Mejiro)	*Zosterops japonicus*	19	6.3	Good	Adults	-	N	430904.79	2445633.75	
13	Common Myna	*Acridotheres tristis*	5	1.7	Good	Adults	-	N	430866.75	2445548.38	
13	Northern Cardinal	*Cardinalis cardinalis*	4	1.3	Good	Adults	-	Y	430866.75	2445548.38	
13	Kauaʻi Elepaio	*Chasiempis sclateri*	1	0.3	Good	Adult	-	N	430866.75	2445548.38	
13	White-rumped Shama	*Copsychus malabaricus*	6	2.0	Good	Adults	-	N	430866.75	2445548.38	
13	Red Junglefowl	*Gallus gallus*	5	1.7	Good	Adults	-	N	430866.75	2445548.38	
13	House finch	*Haemorhous mexicanus*	3	1.0	Good	Adults	-	Y	430866.75	2445548.38	
13	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	2	0.7	Good	Adults	-	N	430866.75	2445548.38	
13	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	1	0.3	Good	Adult	-	N	430866.75	2445548.38	

Obs. Station No.	Common Name	Scientific Name	No. of Obser-vations (V4-6)[1]	Mean No. per Visit (V4-6)[2]	Health Condi-tion	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
13	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	430866.75	2445548.38	
13	Warbling White-eye (Mejiro)	*Zosterops japonicus*	16	5.3	Good	Adults	-	N	430866.75	2445548.38	
14	Common Myna	*Acridotheres tristis*	2	0.7	Good	Adults	-	N	430952.13	2445502.52	
14	Cattle Egret	*Bubulcus ibis*	1	0.3	Good	Adult	-	Y	430952.13	2445502.52	
14	Northern Cardinal	*Cardinalis cardinalis*	2	0.7	Good	Adults	-	Y	430952.13	2445502.52	
14	Kauaʻi Elepaio	*Chasiempis sclateri*	2	0.7	Good	Adults	-	N	430952.13	2445502.52	
14	Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	1	0.3	Good	Adult	-	Y	430952.13	2445502.52	
14	White-rumped Shama	*Copsychus malabaricus*	7	2.3	Good	Adults	-	N	430952.13	2445502.52	
14	Red Junglefowl	*Gallus gallus*	5	1.7	Good	Adults	-	N	430952.13	2445502.52	
14	Zebra Dove	*Geopelia striata*	1	0.3	Good	Adult	-	N	430952.13	2445502.52	
14	House finch	*Haemorhous mexicanus*	4	1.3	Good	Adults	-	Y	430952.13	2445502.52	
14	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	2	0.7	Good	unk	-	N	430952.13	2445502.52	
14	Red-crested Cardinal	*Paroaria coronata*	2	0.7	Good	Adults	-	N	430952.13	2445502.52	
14	Warbling White-eye (Mejiro)	*Zosterops japonicus*	18	6.0	Good	Adults	-	N	430952.13	2445502.52	
15	Common Myna	*Acridotheres tristis*	4	1.3	Good	Adults	-	N	430879.42	2445489.42	
15	Northern Cardinal	*Cardinalis cardinalis*	4	1.3	Good	Adults	-	Y	430879.42	2445489.42	
15	White-rumped Shama	*Copsychus malabaricus*	4	1.3	Good	Adults	-	N	430879.42	2445489.42	
15	Red Junglefowl	*Gallus gallus*	4	1.3	Good	Adults	-	N	430879.42	2445489.42	
15	House finch	*Haemorhous mexicanus*	2	0.7	Good	Adults	-	Y	430879.42	2445489.42	
15	Japanese Bush Warbler (Uguisu)	*Horornis diphone*	1	0.3	Good	unk	-	N	430879.42	2445489.42	
15	Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	4	1.3	Good	Adults	-	N	430879.42	2445489.42	
15	ʻAnianiau	*Magumma parva*	1	0.3	Good	Adult	-	Y	430879.42	2445489.42	
15	Red-crested Cardinal	*Paroaria coronata*	1	0.3	Good	Adult	-	N	430879.42	2445489.42	
15	House Sparrow	*Passer domesticus*	1	0.3	Good	Adult	-	N	430879.42	2445489.42	

Obs. Station No.	Common Name	Scientific Name	No. of Observations (V4-6)[1]	Mean No. per Visit (V4-6)[2]	Health Condition	Life Stage	Reg. Status[3]	MBTA Spp. (Y/N)	Location UTM (X)	Location UTM (Y)	Notes
15	Spotted Dove	*Spilopelia chinensis*	1	0.3	Good	Adult	-	N	430879.42	2445489.42	
15	Warbling White-eye (Mejiro)	*Zosterops japonicus*	22	7.3	Good	Adults	-	N	430879.42	2445489.42	

[1]Number of observations (V4-6) = Total number of individual birds of this species observed over the course of 3 visits. Note, any ESA-listed birds detected were noted as their individual detection, and not summed across multiple visits.

[2]Mean Number of observations (V4-6) = Average number of individual birds of this species observed per visit.

[3]Regulatory Status = Federal Endangered (FE), Federal Threatened (FT), State of Hawai‘i Endangered (SE), State of Hawai‘i Threatened (ST).

APPENDIX B. FAUNA SURVEY PHOTO LOG

1. Fauna Observation Points

Observation Point 1, Site E. Native koa-ʻōhiʻa forest with halapepe (*Dracaena aurea*) in background.

Observation Point 2, Site E. Fence line separating native koa-ʻōhiʻa forest from maintained lawn.

Observation Point 3, Site E. Invasive Florida blackberry and grasses with koa and non-native forest in background.

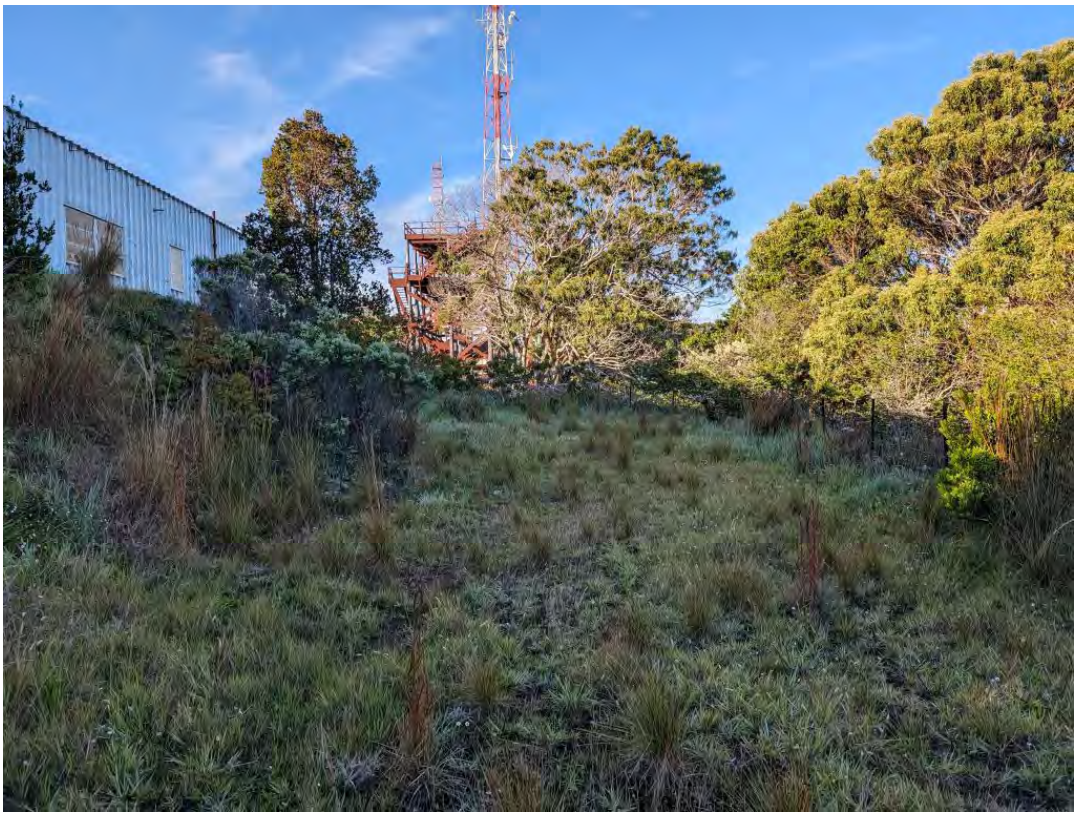
Observation Point 4, Site D. Invasives lantana shrubs with strawberry guava at edge of koa and non-native forest.

Observation Point 5, Site D. Mixed native and non-native forest patch and meadow adjacent to Navy infrastructure.

Observation Point 6, Site D. Meadow and mixed koa and non-native forest edge habitat at fenceline near access road.

Observation Point 7, Site C. Open meadow grassland with koa and non-native forest in background.

Observation Point 8, Site C. Open meadow with mixed koa non-native forest and Navy structures in background.



Observation Point 9, Site C. Non-native grasses and Daisy fleabane (*Erigeron karvinskianus*) meadow and native koa-ʻōhiʻa forest.

Observation Point 10, Site C. Native koa-ʻōhiʻa forest with pūkiawe and ʻukiʻuki.

Observation Point 11, Site B. Native koa-ʻōhiʻa forest with sparse invasive strawberry guava.

Observation Point 12, Site A. Native koa-ʻōhiʻa forest and maintained lawn strip at road edge.

Observation Point 13, Site A. Mixed koa non-native forest with invasive strawberry guava and natives in understory.

Observation Point 14, Site A. Mixed koa and non-native forest with invasive strawberry guava and natives in understory.

Observation Point 15, Site A. Blackberry, lantana scrub-shrub with mixed koa and non-native forest in background.

2. Site D Restoration of Hawaiian Picture Wing Fly Habitat

Restoration photos of holei (*Ochrosia kaua'iensis*) (top left), *loulu* (*Pritchardia minor*) (top right & bottom left), and alahe'e (*Psydrax odorata*) (bottom right)

APPENDIX C. COMPLETE LIST OF FAUNA

All fauna observed in the KPGO study area, and their relative abundance are noted.

Species (Common Name)	Scientific Name	Life Form	No. of Observations	No. of Individuals	Relative Abundance
Common Myna	*Acridotheres tristis*	Bird	77	101	5%
Red Avadavat	*Amandava amandava*	Bird	3	3	0%
Hawaiian Goose	*Branta sandvicensis*	Bird	2	4	0%
Western Cattle Egret	*Ardea ibis*	Bird	6	7	0%
Domestic Dog	*Canus lupus familiaris*	Mammal	1	2	-
Northern Cardinal	*Cardinalis cardinalis*	Bird	148	151	7%
Kauai Elepaio	*Chasiempis sclateri*	Bird	26	26	1%
Kauaʻi ʻAmakihi	*Chlorodrepanis stejnegeri*	Bird	17	17	1%
White-rumped Shama	*Copsychus malabaricus*	Bird	176	179	9%
Erckel's Francolin	*Pternistis erckelii*	Bird	31	39	2%
Gray Francolin	*Francolinus pondicerianus*	Bird	1	1	0%
Red Junglefowl	*Gallus gallus*	Bird	190	202	10%
Zebra Dove	*Geopelia striata*	Bird	9	18	1%
House Finch	*Haemorhous mexicanus*	Bird	108	120	6%
ʻApapane	*Himatione sanguinea*	Bird	11	11	1%
Japanese Bush Warbler (Uguisu)	*Horornis diphone*	Bird	133	135	7%
Hwamei (Melodius Laughingthrush)	*Garrulax canorus*	Bird	44	44	2%
Chestnut Munia	*Lonchura atricapilla*	Bird	2	3	0%
Scaly-breasted Munia	*Lonchura punctulata*	Bird	23	38	2%
ʻAnianiau	*Magumma parva*	Bird	17	17	1%
Northern Mockingbird	*Mimus polyglottos*	Bird	3	3	0%
Black-tailed Deer	*Odocoileus hemionus hemionus*	Mammal	1	1	-
Red-crested Cardinal	*Paroaria coronata*	Bird	72	79	4%
House Sparrow	*Passer domesticus*	Bird	3	4	0%
White-tailed Tropic Bird	*Phaethon lepturus*	Bird	2	2	0%
Pacific Golden Plover (Kōlea)	*Pluvialis fulva*	Bird	8	9	0%
Saffron Finch	*Sicalis flaveola*	Bird	49	63	3%
Spotted Dove	*Spilopelia chinensis*	Bird	23	38	2%
Scarlet Honeycreeper (ʻIʻiwi)	*Drepanis coccinea*	Bird	3	3	0%
Warbling White-eye (Mejiro)	*Zosterops japonicus*	Bird	524	743	36%

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KPGO Hoary Bat Survey Report

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Hawaiian Hoary Bat (ʻŌpeʻapeʻa) Acoustic Surveys of the Kōkeʻe Park Geophysical Observatory, Kauaʻi, Hawaiʻi Final Report

Task Order 28
Contract No. 80GSFC21CA008

Prepared for:

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1. INTRODUCTION

1.1 BACKGROUND

DAWSON contracted Hamer Environmental, L.P. (Hamer) to conduct Hawaiian hoary bat (ʻŌpeʻapeʻa, *Lasiurus semotus*) (bat) acoustic surveys for the National Aeronautics and Space Administration (NASA) at Kōkeʻe Park Geophysical Observatory (KPGO) properties on Kauaʻi, Hawaiʻi. The KPGO study area is approximately 25 acres and consists of five parcels (Figure 1-1). NASA and the U.S. Department of the Navy (Navy) in coordination with the Hawaiʻi Department of Land and Natural Resources (DLNR) are preparing a Real Estate Environmental Impact Statement (EIS) which evaluates the potential environmental consequences of the Navy's and NASA's proposal to retain the use of lands for the Navy's continued and ongoing military testing and training at Pacific Missile Range Facility (PMRF) and NASA's continued operations at KPGO. Existing NASA and Navy real estate agreements with the DLNR are set to expire between 2027 and 2030. The survey results will be used for future project planning, development of avoidance and minimization measures, National Environmental Policy Act (NEPA) analysis, Chapter 343, Hawaiʻi Revised Statutes (HRS) (referred to as HEPA) analysis, and/or potential Endangered Species Act (ESA) Section 7 consultation.

Following the project Statement of Work (SOW) issued January 2024, Hamer developed a work plan in April 2024 to identify bat habitat resources in the survey area, determine acoustic detector locations, data collection, reporting, schedule and personnel for the field effort. Hamer completed 12 months of acoustic bat surveys, which began May 13, 2024, and concluded on May 13, 2025. This report summarizes the findings of the acoustic bat surveys from the year of data collected.

1.2 PURPOSE OF SURVEY

As stated in the project SOW, the purpose of the acoustic bat surveys was to document potential bat habitats, bat presence and detection rates, and seasonal activity within the KPGO study area to support environmental evaluatins and consultations. A separate study for other terrestrial fauna was conducted concurrently and findings will be reported separately from this effort.

1.3 SURVEY AREA

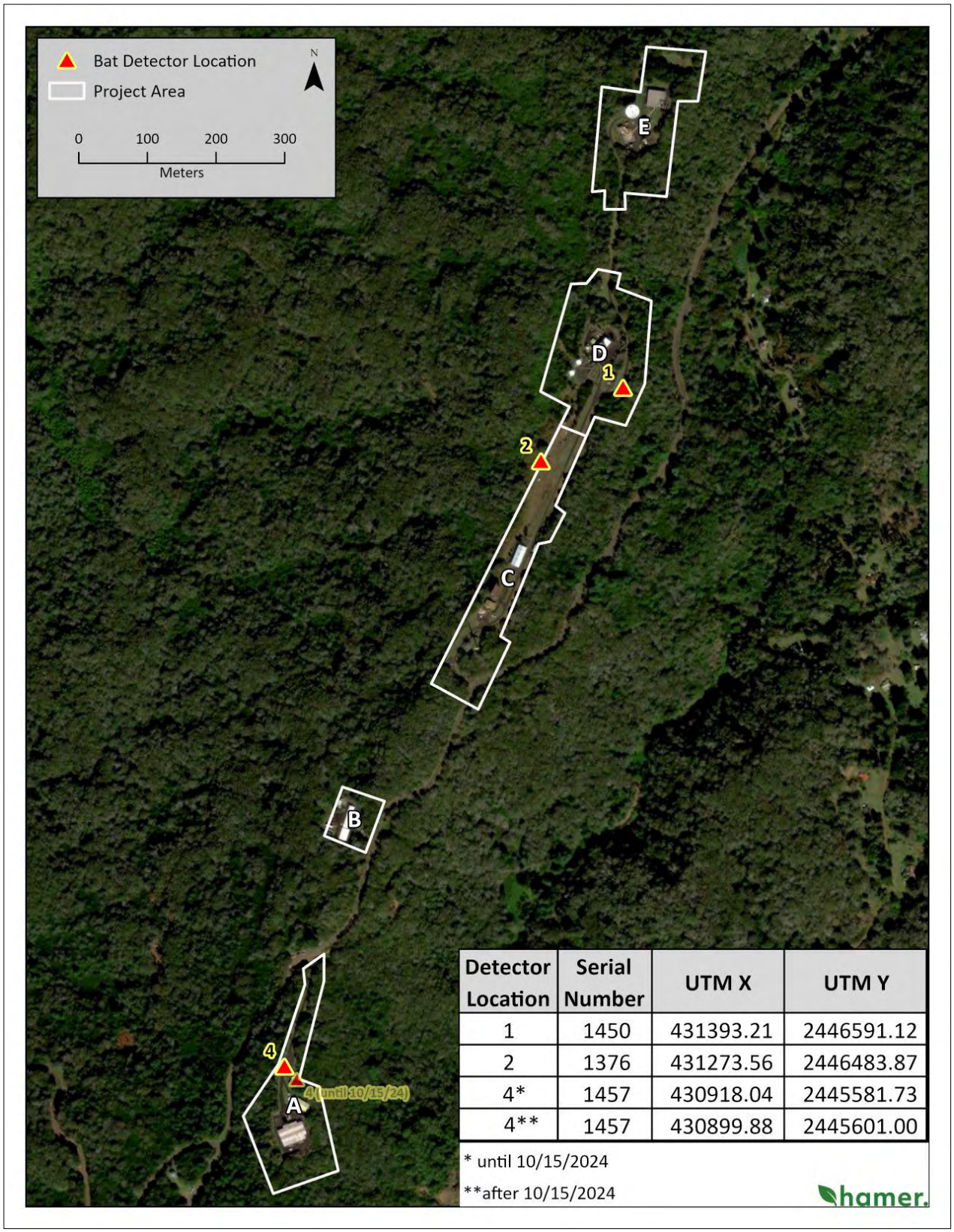
Bat detectors were placed within suitable forage and adjacent to roosting habitats to provide stratified coverage throughout the KPGO study area. A total of 3 detectors were placed within Sites A, C, and D. Four detector locations were initially planned, but multiple sources of interference precluded any additional locations. Sources of equipment interference included: satellite cooling fans, transmitting radars, unknown tower-mounted transmitters, and other sources. Final bat detector locations for Detector Site 1 (Site D) and Detector Site 4 (Site A) differed than the planned location due to interference sources and to reduce risk of theft by placing all detectors inside fenced area. Detector 4 collected data from its original location from May 13, 2024-October 14, 2024. However, due to noise interference that continued to be high after initial testing and deployment, Detector 4 was relocated in October 2024, 27 meters WNW of the original location in Site A (Figure 1-2) and continued to collect data from that location for the remainder of the survey duration. In July 2024, a new source of noise interference was documented at Detector Site 2 (Site C) which coincided with additional technology installed by the Navy south of the detector

location. Higher capacity SD data cards were installed into Detectors 2 and 4, where outside noise interference continued to be regularly detected. The three detector locations provided stratified coverage throughout the KPGO study area and a significantly higher relative area of coverage than previous and current acoustic bat studies at other installations of larger size.

1.4 Survey Schedule and Personnel

Erin Colclazier, Hamer Environmental Project Manager and Lead Biologist, conducted bat habitat assessment and acoustic bat detector deployment, testing, and data collection within the KPGO study area May 4-13, 2024, and acoustic bat detector extraction on May 22, 2025. Field technician, Natalia Tangalin, collected bat detector data, battery swap, and mic calibration testing monthly June 2024 to April 2025. Data Manager, Kendra Ritchie and Data Analyst, Kaylee Underwood, completed bat acoustic data processing and analysis.

Figure 1-1. Kōkeʻe Park Geophysical Observatory Study Area, Comprised of Five (5) Parcels (Sites A, B, C, D, E) on Kauaʻi, Hawaiʻi.



Detector Location	Serial Number	UTM X	UTM Y
1	1450	431393.21	2446591.12
2	1376	431273.56	2446483.87
4*	1457	430918.04	2445581.73
4**	1457	430899.88	2445601.00

* until 10/15/2024

**after 10/15/2024

Figure 1-2. Final Acoustic Bat Detector Locations (3 Total) within the KPGO Study Area, Kaua'i, Hawaii.

2. Desktop Analysis of Hawaiian Hoary Bat

2.1. Species Background

The Hawaiian hoary bat (ʻōpeʻapeʻa, *Lasiurus cinereus semotus*) is the only extant endemic land mammal in the Hawaiian archipelago. The species was listed as endangered on October 13, 1970; it is also listed under state endangered species statutes (USFWS 2005, DLNR 1998). The Hawaiian Hoary Bat weighs 5 to 8 ounces (142 to 227 grams), is predominantly nocturnal, and preys on both native and alien volant insects. Females are larger than males and have wing spans of 10.5 to 13.5 in (27 to 34 cm). The Hawaiian hoary bat is solitary, typically leaving its roost shortly before sunset and returning before sunrise. Like its North American relative, the Hawaiian hoary bat gives birth to twins during the summer months.

Hawaiian hoary bats roost among trees in areas within and near forests in both native and alien plant species 15 ft (4.5 m) and taller (Montoya-Aiona et al. 2023, Bonaccorso et al. 2015, Whitaker and Tomich 1983). Telemetry studies of the bats found that roost trees were typically taller, averaging 68 ft (21 m) in height, of 19 distinct species, and 95 ft (29 m) from the forest edge (Montoya-Aiona et al. 2023), indicating that tree species is not as important as other factors when selecting a roost tree. The Hawaiian hoary bat is known to have a higher occupancy rate in areas with mature forest cover (Gorresen et al. 2013).

The bat forages in a large variety of habitats, including native and non-native shrublands and forests, pastures, along roads and trails, over fresh and brackish waters and open ocean (Bonaccorso et al. 2015, Frasher et al. 2007, Jacobs 1996, 1999, Whitaker and Tomich 1983). The insectivorous bats are generalists, foraging on insects from 24 different families, though moths and beetles make up the majority of their diet (Todd 2012, Pinzari et al. 2019).

The Hawaiian hoary bat has been documented on the islands of Hawaii, Maui, Oahu, Kauai, and Molokai with one unconfirmed observation on Kahoʻolawe (DLNR 2015). Presently, the largest populations are thought to occur on Kauaʻi and Hawaiʻi (Tomich 1974, 1986, Kepler and Scott 1990). On the island of Hawaiʻi, most bats observations have been made between sea level and 7,500 ft (2,286 m), though bats have been seen at elevations as high as 13,200 ft (4,023 m) (Baldwin 1950, Tomich 1974, Fujioka and Gon 1988, Kepler and Scott 1990). Duvall and Gassmann-Duvall (1991) recorded the hoary bat on Maui between 0 and 9,050 ft (2,760 m) in elevation, with most records occurring around 2,060 ft (630 m). On Hawaiʻi, Menard (2001) found that the bats at low elevations in the summer and fall breeding seasons, and at higher elevation areas during the winter, coinciding with their post-lactation period. Acoustic studies on Kauaʻi (Bonaccorso and Pinzari 2011, Welch et al. 2021) and Oʻahu (Gorresen et al. 2015, Thompson and Starcevich 2021) indicate this elevational migration occurs due to seasonal changes in acoustic activity levels detected.

3. Methods

3.1. Acoustic Monitoring

Five initial acoustic detector locations were proposed, evaluated in the field, and then reduced, based on issues of equipment sound interference and potential for theft risk. A total of 3 detector sites were established in areas of

the KPGO study area with limited interference issues (Figure 1-2). Interference sources throughout the study area were especially problematic, as the interference triggered the detectors constantly, which rapidly filled data storage cards and used limited power resources.

3.2. Data Analysis

All acoustic data recordings were processed using Wildlife Acoustics Kaleidoscope Pro version 5.6.8 or 5.7.0 when it became available in 2025. Bat analysis mode and Auto-ID for bats were utilized and all detections consisting of 2 or more pulses flagged as either LASCIN (hoary bat, *Lasiurus cinereus*) or No ID (unknown) were visually reviewed by a biologist. A subset of the recordings flagged by the software as "noise" (interference) were also reviewed. Recordings were manually identified and confirmed as either LASCIN or flagged as a feeding buzz (i.e., a rapid sequence of echolocation pulses emitted by a bat just before capturing prey) if that acoustic signature was detected.

4. Results

Twelve (12) months of acoustic bat data were collected by each of the 3 bat detectors in the KPGO study area. Interference from various sources caused multiple early months of data cards to be filled prematurely before personnel were scheduled to be on site to replace them. This interference issue occurred at Detector Sites 2 and 4 and resulted in less than a full month of data captured during the months of: May 2024, June 2024 at Detector Site 4, and August 2024 during the Navy's RIMPAC exercises at the KPGO study area. This issue was remedied through deployment of additional high-capacity SD data cards in detectors in June 2024, a secondary round of higher capacity SD cards in September 2024, and relocation of one detector (Detector 4) to further reduce interference. The results summarize data collected at the 3 Detector locations from May 13, 2024 to May 13, 2025.

4.1. Annual and Seasonal Bat Activity

Hawaiian hoary bats were detected on 683 nights out of 861 detector-nights sampled across all pooled monitoring sites and months, resulting in a detection rate of (0.79) (Table 4-1). Overall detection rates were high, with bats exhibiting "high detectability" levels (above 0.50 for the proportion of nights with bat detections) at all three sites, with detection rates being especially high August-December (during the post-lactation reproductive period) (Figure 4-2). Detector 1, located within Site D, consistently had the highest detection rates.

Table 4-1. Detection Rates for Hawaiian Hoary Bats Monitored at Three Locations between May 13, 2024 and May 13, 2025.

Monitoring Location	No. of Nights Sampled	No. of Nights with Detections	Detection Rate
Detector Site 1	310	292	0.94
Detector Site 2	276	226	0.82
Detector Site 4	275	165	0.60
Total	861	683	0.79

Across all pooled monitoring sites and months, a total of 8,509 bat calls were detected, with 5,981 at Site 1, 1,948 at Site 2, and 580 at Site 3 respectively (Table 4-2).

Table 4-2. Number of Detections of Hawaiian Hoary Bats at Three Locations between May 13, 2024 and May 13, 2025.

Month	Site 1	Site 2[1]	Site 4[1]
May 2024	234	34[1]	16[1]
Jun	492	66	23[1]
Jul	476	26	29
Aug	332	117[1]	162[1]
Sept	938	159	60
Oct	290	48	47
Nov	456	33	30
Dec	790	89	42
Jan 2025	457	231	36
Feb	28[2]	242	76
Mar	831	323	31
Apr	639	557	14
May	18	23	14
Total	5,981	1,948	580

[1]Less than a full month's data was collected at Sites 2 and 4 during some months due to high levels of interference from nearby Navy equipment.

[2]Detection rates in February were low at Site 1, partilly due to a detector data card corruption event on February 15, 2025, which resulted in no data captured between the evening of February 15th and the end of the month.

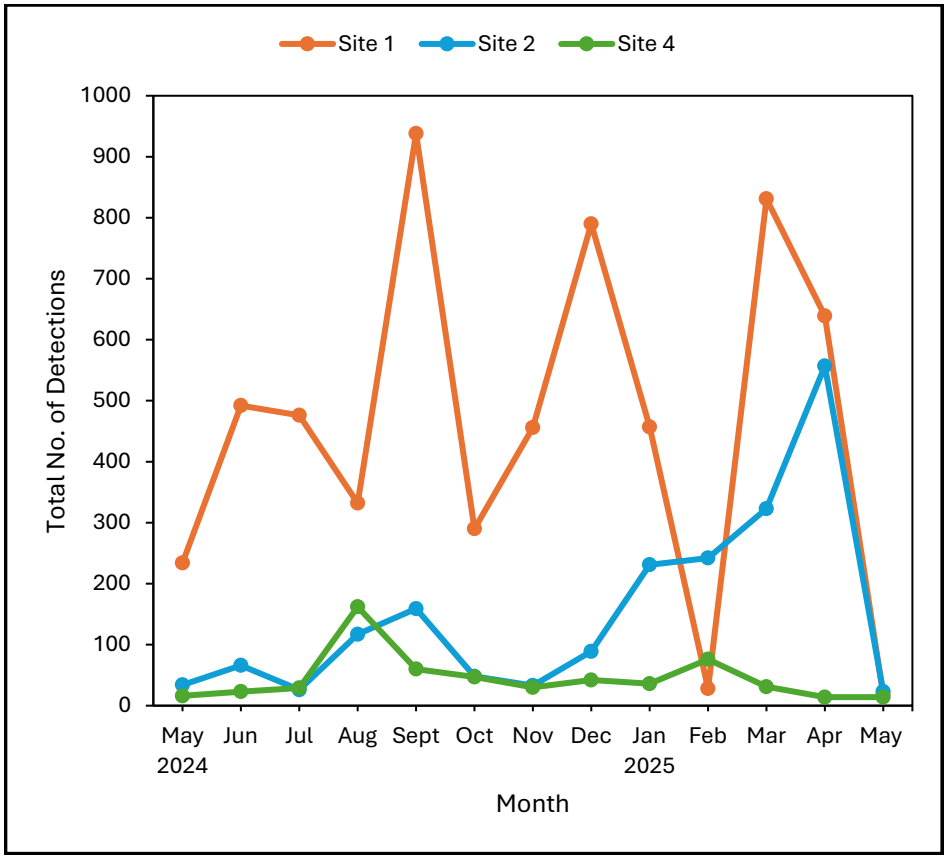


Figure 4-1. Monthly Detections of Hawaiian Hoary Bats Monitored at Three Locations Between May 13, 2024 and May 13, 2025.

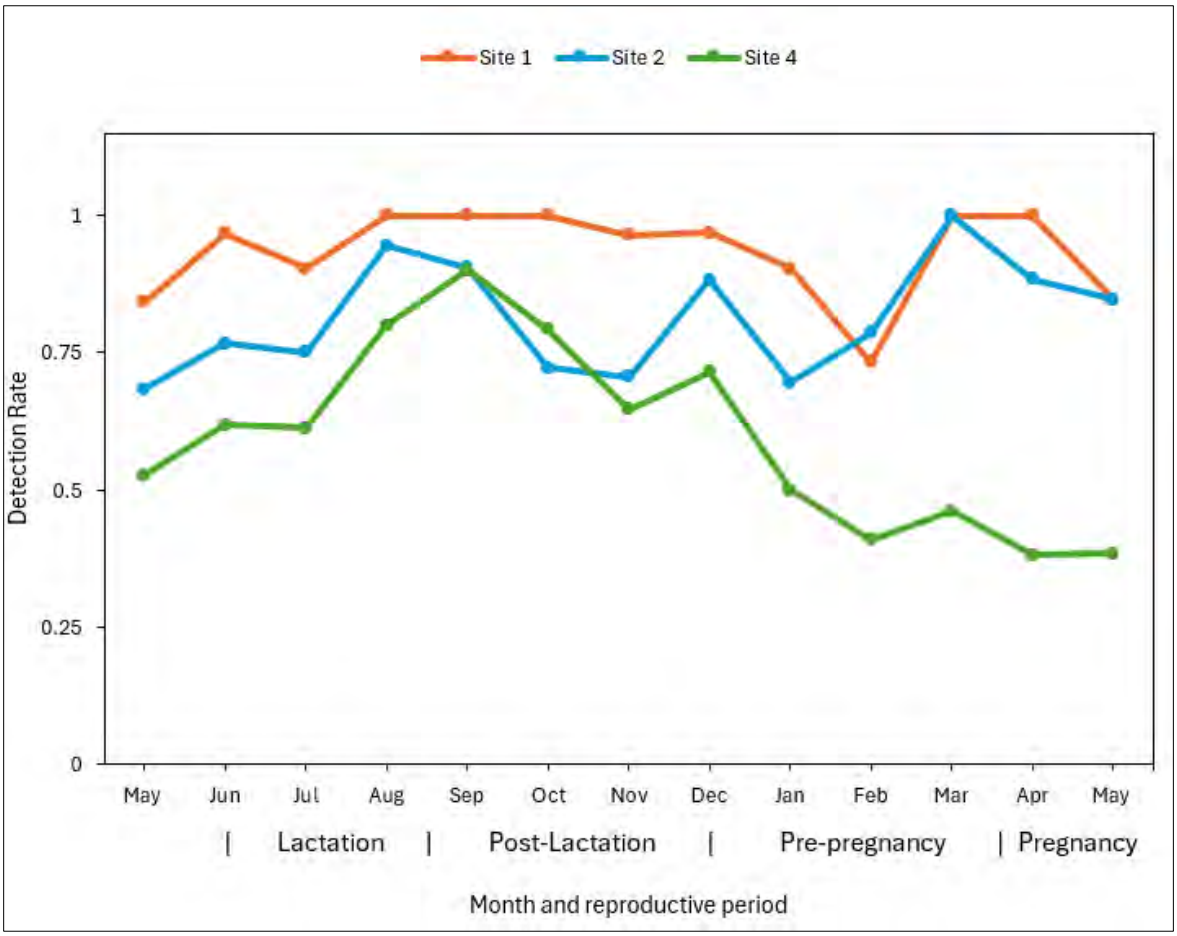


Figure 4-2. Monthly Detection Rates for Hawaiian Hoary Bats Monitored at Three Locations Between May 13, 2024 and May 13, 2025 with Corresponding Reproductive Periods.

Seasonal fluctuations in detection rates were evident across the 3 monitoring sites (Figure 4-2). Detection rates were especially high during the late lactation and early post-lactation reproductive periods (August-December), with all sites having a detection rate above 0.5 (Figure 4-2). Detection rates were more variable amongst the three sites during the pre-pregnancy reproductive period (January-early March), with all sites having declining activity December to January, but no consistent trend amongst the three sites for the rest of the period. The strong decline in detections at Site 1 in February, was partially due to a data card corruption event, where data was lost for the latter half of the month. Sites 1 and 2 experienced another peak in activity just before the pregnancy reproductive period (March and early April), however Site 4 remained consistently lower during that time. Seasonal variation in the overall number of detections followed a similar pattern amongst the three sites except during the late pre-pregnancy and Pregnancy periods (Figure 4-1, Figure 4-2).

4.2. NIGHTLY BAT ACTIVITY

Nightly bat activity was high across all sites. Site 1 had detections on 94% of nights surveyed, Site 2 had detections on 82% of nights surveyed, and Site 4 had detections on 60% of nights surveyed. In general detection rates remained

high throughout the entire year-long survey period (Appendix C), with only Site 4 dipping below 50% detection rates February through May in 2025.

Bat activity at all three sites peaked at 2:00am (approximately eight hours after sunset, and four hours before sunrise), with a steady increase and decrease in the hour before and after (Figure 4-3). A smaller peak occurred at all three sites just before sunrise (typically in the 6am-7am range). Site 1 also saw a small bump in activity just a few hours after sunset.

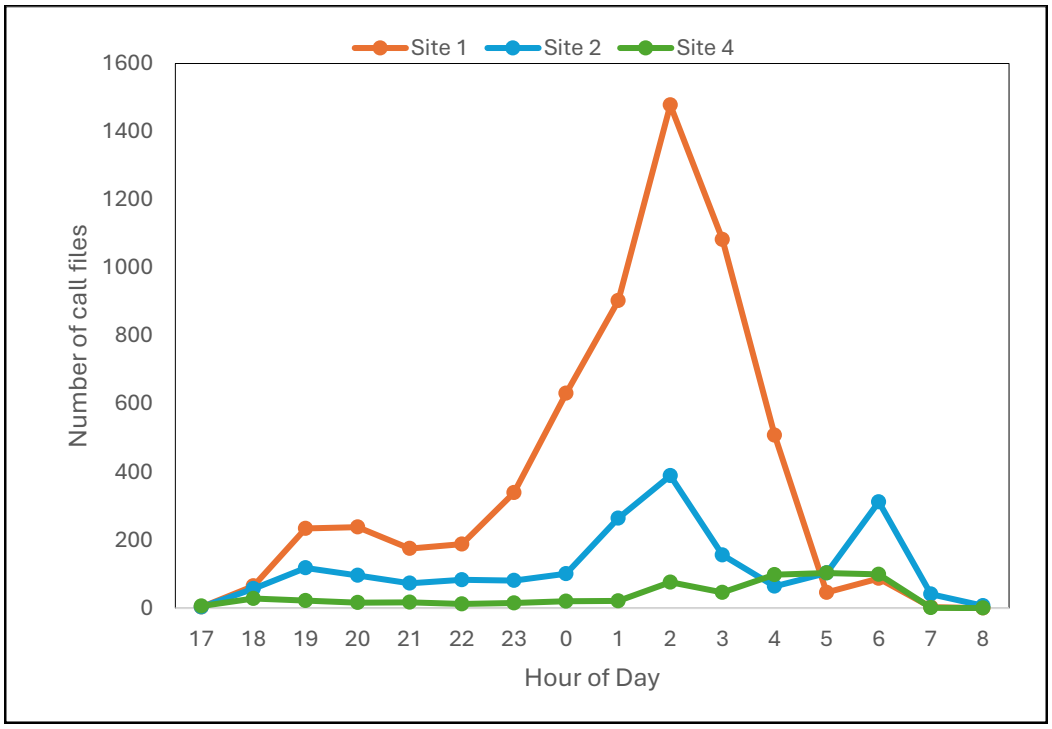


Figure 4-3. Timing of Nightly Bat Activity at the Three Survey Sites

4.3. FORAGING BEHAVIOR

Foraging buzzes were detected at all three sites throughout the survey period (Table 4-3 and Figure 4-4). While foraging buzzes made up a small percentage of overall detections, they occurred throughout the monitoring period at all three sites (Figure 4-4). The percentage of detections flagged as foraging buzzes was highest at Site 1 (Figure 4-5). Foraging behavior was much more variable across time, especially at Sites 1 and 2, with several peaks across the survey season (Figure 4-4).

Table 4-3. Foraging Buzzes Detected at Three Monitoring Locations Across Survey Period May 13, 2024 to May 13, 2025.

Monitoring Location	Total Detections	Non-foraging Detections	Foraging Buzzes
Site 1	5981	5350	621
Site 2	1948	1876	72
Site 4	583	528	55

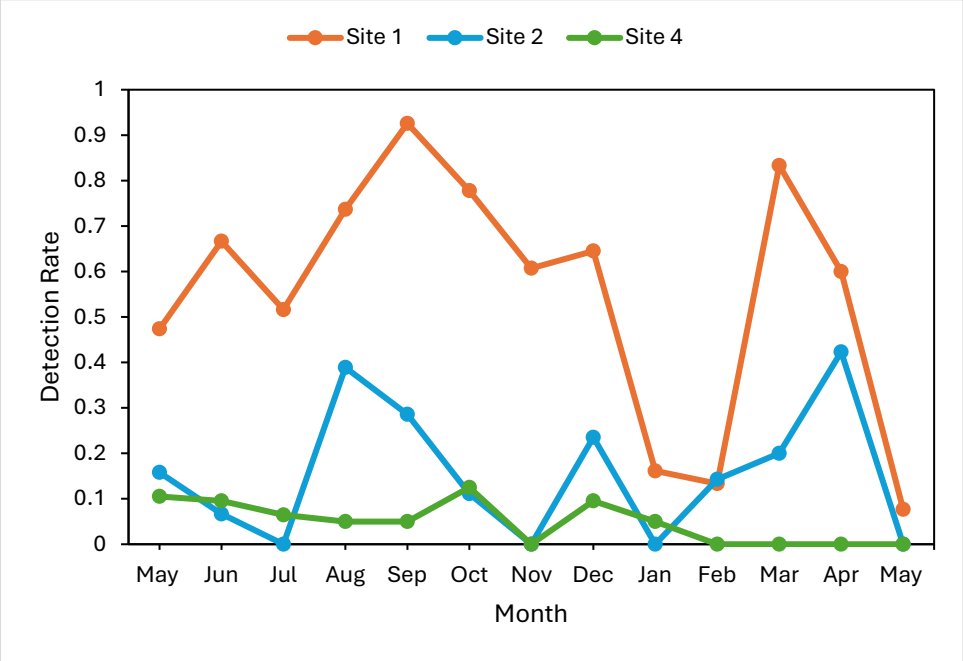


Figure 4-4. Foraging Buzz Detection Rates at Three Monitoring Locations Across Survey Period May 13, 2024 to May 13, 2025.

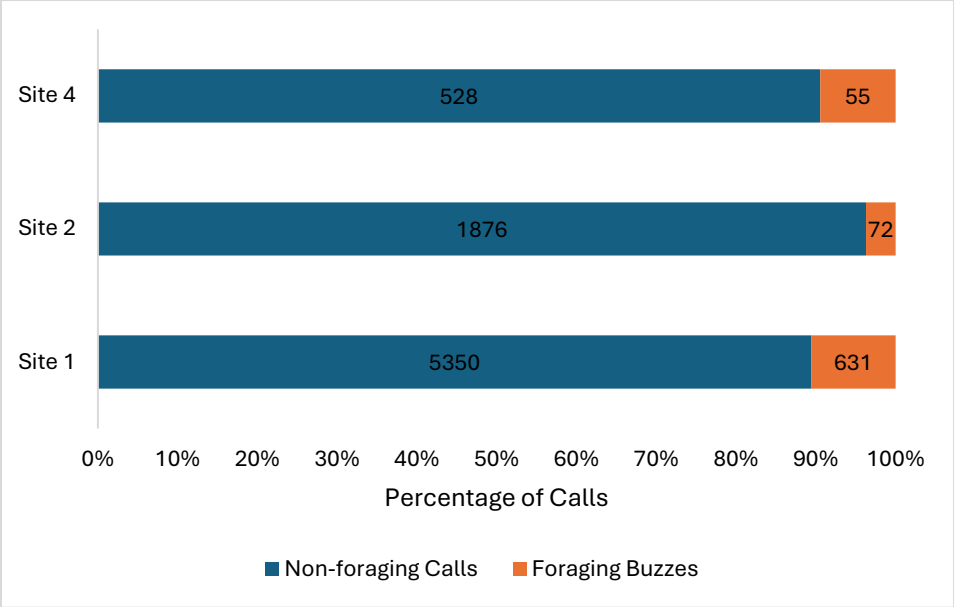


Figure 4-5. Percentage of Detections Identified as Foraging Buzzes at Three Monitoring Locations Across Survey Period May 13, 2024 to May 13, 2025.

5. Discussion

This acoustic bat study (May 13, 2024 to May 13, 2025) indicated year-round bat activity at all three detector sites within the KPGO Study Area (KPGO Study Area Sites D, C and A) at a pooled detection rate of 0.79. Site 1 (KPGO Site D) had the highest detection rate (0.94), while Site 4 (KPGO Site A) had the lowest (0.60) (Table 4-1). Seasonal fluctuations were largely consistent across all three detector sites, with an increase in bat activity from August through December, during the lactation and post-lactation reproductive periods (Figure 4-2). All sites exhibited a decrease in activity from December through January but were variable in February through early March, during most of the pre-pregnancy reproductive period, with Site 1 showing a consistent decline but not Sites 2 and 4. Sites 1 and 2 showed an increase in activity in March and early April. Results of a previous bat acoustic study conducted at Sites A and C of the KPGO Study Area from 2010 to 2011 (Bonaccorso and Pinzari 2011) indicated year-round bat activity with high detectability in fall, winter and spring sampling periods but lower in summer. Lower Hawaiian hoary bat activity levels in summer at higher elevation areas like KPGO study area are consistent with other studies findings of increased use of lower elevation areas by bats during the summer months (Menard 2001, Todd 2012, Pinzari 2014, Bonaccorso et al. 2015). However, this acoustic study did not find that bat presence was lower in the summer than at other times of the year, so elevation was not a primary factor in their presence. The seasonal fluctuations found by this study were consistent with changes in reproductive periods of the bats. Detection rates were highest during the August through December lactation and post-lactation periods when females and young are abundant and males seeking mates are present. Detection rates were lower during the January to March pre-pregnancy reproductive period at Site 1, but not at Sites 2 and 4, when adult male and female bats do not co-occur

(Menard 2001, Todd 2012). This seasonal fluctuation was similar to that found by another acoustic bat study completed at other sites on PMRF in 2024 (Tetra Tech 2025).

Nightly activity patterns were high across all three sites, peaking at 2 am, eight hours after sunset and four hours before sunrise, with smaller peaks one to two hours after sunset and one hour before sunrise (Figure 4-3). This nightly peak in overall activity at 2 am indicates that bats are utilizing these sites throughout the evening and may be roosting in the vicinity.

Foraging activity, as documented by feeding buzzes, comprised a small portion of all detections (<10%) but were documented across all three detector sites and during all survey periods, but was highest at Site 1 (Table 4-3, Figure 4-4, Figure 4-5). Other studies have noted that feeding buzzes can be difficult to detect by acoustic equipment and may have a more limited range than other types of bat detections and so may be underrepresented in acoustic studies (Bonaccorso et al. 2016, Gorresen et al. 2018).

6. Conclusions

Bat activity was high at all three sites within the KPGO study area, and activity occurred year-round, indicating that portions of the KPGO study area provide important roosting and/or foraging habitats, as well as habitat suitable for insect prey. Sites 1 and 2 (within KPGO Study Area Sites D and C) had especially elevated levels of bat activity, highlighting these areas as important for the bat's persistence in the KPGO Study Area.

Continued efforts at the KPGO Study Area to remove invasive plants and improve habitats for endemic insects will benefit Hawaiian hoary bats.

List of Preparers

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Kaylee Underwood, Data Technician and QA/QC

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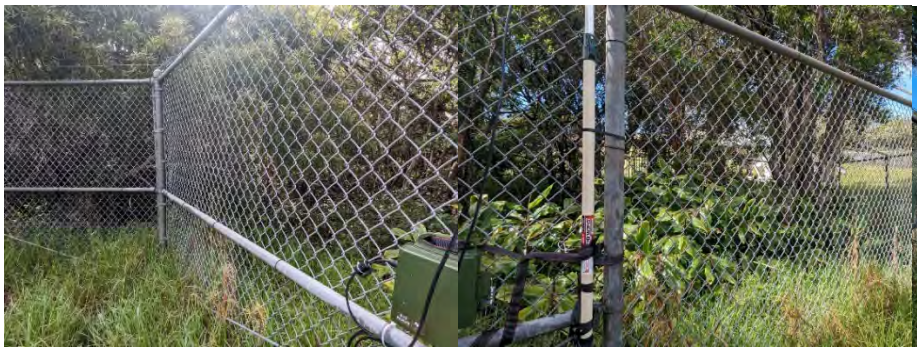
APPENDIX A. BAT DETECTOR SITE PHOTOS

Detector Site 1 (within KPGO Study Area Site D) and immediate habitats to the north, east, south, and west.

Detector Site 2 (within KPGO Study Area Site C) and immediate habitats to the north, east, south, and west.

Detector Site 4 (within KPGO Study Area Site A) and immediate habitats to the north, east, south, and west. This is the current location, beginning October 15, 2024.



Detector Site 4 (within KPGO Study Area Site A) and immediate habitats to the north, east, south, and west. This is the old detector location from May 13 to October 14, 2024.

APPENDIX B. HARDWARE AND SOFTWARE PARAMETERS AND SETTINGS

Platform	Parameter	Setting
Hardware		
Wildlife Acoustics Song Meter SM4BAT FS Ultrasonic Recorder	Data Type	Full spectrum
	Trigger Window	2 sec
	Max Length	8 seconds
	Sampling Rate	192kHz
	Gain	12db
	Minimum trigger frequency	16kHz
	File format	.WAV
	Survey window	1 hour before sunset to 1 hour after sunrise
Software		
Wildlife Acoustics Kaleidoscope Pro version 5.6.8 or 5.7.0 (released 2025)	Signal of interest	8-120lHz
	Duration	2-500milliseconds
	Minimum pulses	2
	Classifier	Bats of the Neotropics 5.7.0
	Sensitivity	0 Balanced (neutral)

APPENDIX C. MONTHLY DETECTION RATES FOR HAWAIIAN HOARY BATS MONITORED ACROSS 3 SITES BETWEEN MAY 13, 2024 AND MAY 13, 2025

Monitoring Location	Sampling Period[1]	No. of Nights Sampled	No. of Nights with Detections	Detection Rate
Site 1	May 2024[1]	19	16	0.84
	June 2024	30	29	0.97
	July 2024	31	28	0.90
	August 2024	19	19	1.00
	September 2024	27	27	1.00
	October 2024	18	18	1.00
	November 2024	28	27	0.96
	December 2024	31	30	0.97
	January 2025	31	28	0.90
	February 2025	15	11	0.73
	March 2025	18	18	1.00
	April 2025	30	30	1.00
	May 2025[1]	13	11	0.85
Site 2	May 2024[1]	19	13	0.68
	June 2024	30	23	0.77
	July 2024	16	12	0.75
	August 2024	18	17	0.94
	September 2024	21	19	0.90
	October 2024	18	13	0.72
	November 2024	17	12	0.71
	December 2024	17	15	0.88
	January 2025	23	16	0.70
	February 2025	28	22	0.79
	March 2025	30	30	1.00
	April 2025	26	23	0.88
	May 2025[1]	13	11	0.85
Site 4	May 2024[1]	19	10	0.53
	June 2024	21	13	0.62
	July 2024	31	19	0.61
	August 2024	20	16	0.80
	September 2024	20	18	0.90

Monitoring Location	Sampling Period[1]	No. of Nights Sampled	No. of Nights with Detections	Detection Rate
	October 2024	24	19	0.79
	November 2024	17	11	0.65
	December 2024	21	15	0.71
	January 2025	20	10	0.50
	February 2025	22	9	0.41
	March 2025	26	12	0.46
	April 2025	21	8	0.38
	May 2025[1]	13	5	0.38

[1]Sampling Period: Monthly sampling periods for May 2024 and May 2025 were truncated due to the 12-month sampling period. May 2024 included dates May 13-31 (19 nights), and May 2025 included dates May 1-13 (13 nights).

Relevant Biological Opinions

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
2014-F-0066

SEP 0 9 2014

Captain M.D. Williamson
Department of the Navy
Navy Region Hawaii
850 Ticonderoga Street, Suite 110
Joint Base Pearl Harbor-Hickam, Hawaii 96860

Subject: Formal Consultation for Pacific Missile Range Facility Base-wide Infrastructure, Operations, and Maintenance, Kauai

Dear Captain M.D. Williamson:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological and conference opinions on the proposed Pacific Missile Range Facility (PMRF) Base-wide Infrastructure, Operations, and Maintenance, located on the island of Kauai. Based on coordination with our office, the U.S. Department of the Navy (Navy) and the Department of Energy, National Nuclear Security Administration (NNSA) determined the proposed project may affect eight federally listed species and one candidate species. At issue are potential impacts to the endangered Hawaiian black-necked stilt (*Himantopus mexicanus knudseni)*, Hawaiian moorhen (*Gallinula chloropus sandvicensis*), Hawaiian coot (*Fulica alai*), Hawaiian duck (*Anas wyvilliana*), Hawaiian goose (*Branta sandvicensis*), Hawaiian hoary bat (*Lasiurus cinereus semotus*), and Hawaiian petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*), and the candidate band-rumped storm-petrel (*Oceanodroma castro*), in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C 1531 et seq.). The Hawaiian stilt, moorhen, coot, and duck are hereafter collectively referred to as "Hawaiian waterbirds." Formal consultation was initiated on June 20, 2014 when final details of the Naval Facilities Engineering Command Pacific's (NAVFAC Pacific) Biological Assessment (BA) (i.e., project description) were provided to our office.

We acknowledge the Navy and the NNSA made the determination that the proposed action will have no effect to two species of endangered plants (*Wilkesia hobdyi* and *Spermolepis hawaiiensis*), the Short-tailed albatross (*Phoebastria albatrus*), two species of endangered Hawaiian picture-wing flies (*Drosophila musaphilia* and *Drosophila sharpi*), and the critical habitat (currently unoccupied) for the endangered Lauehu plant (*Panicum niihauense*). The

TAKE PRIDE IN AMERICA

Navy and NNSA state in the BA that the critical habitat is protected from human disturbance by enforcing no trespassing by the public and an off-limits policy for PMRF personnel and visitors. The Navy and NNSA also state that the populations of *Wilkesia hobdyi* and *Spermolepis hawaiiensis* which occur in the action area at Makaha Ridge are located on steep cliffs and slopes away from the PMRF site which prevents human disturbance.

The Navy and NNSA requests our concurrence with the determination that the proposed action may affect but is not likely to adversely affect (NLAA) the green sea turtle (*Chelonia mydas*). To reduce or eliminate the potential for take of this species, the Navy and NNSA proposed the following avoidance and minimization measures: PMRF personnel (1) actively survey for and monitor turtle nests; (2) excavate hatched nests for additional hatchlings; (3) survey for and rescue any adults that may become stranded on the beach; and (4) ensure that light attraction does not become a problem for adult turtles or hatchlings. Additionally, Conservation Measures to reduce artificial night lighting are described in the BA and in the "Description of the Proposed Action" section of these biological and conference opinions. Based on the above avoidance and minimization measures as well as the inclusion of the conservation measures to reduce night lighting, the Service concurs with your determination that the proposed project may affect, but is not likely to adversely affect the green sea turtle.

These biological and conference opinions are based on the following: (1) the NAVFAC Pacific BA; (2) a site visit completed on May 20, 2014; (3) email and verbal communication between our staff and Dr. Angela Anders and Cory Campora of NAVFAC Pacific; (4) Hawaiian Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan (USFWS 1983); (5) Recovery Plan for the Hawaiian Hoary Bat (USFWS 1998); (6) Draft Revised Recovery Plan for the Hawaiian Goose (USFWS 2004); (7) Recovery Plan for Hawaiian Waterbirds, Second Revision (USFWS 2011); (8) other biological literature (see Literature Cited); and (9) information contained in our files. Our log number for this consultation is 2014-F-0066. Copies of pertinent materials and documentation are maintained in an administrative record in the Service's Pacific Islands Fish and Wildlife Office in Honolulu, Hawaii. These biological and conference opinions address the effects of PMRF base-wide infrastructure, operations, and maintenance on the island of Kauai throughout the foreseeable future.

Consultation History

The Service has been working with the Navy for many years to assist in the conservation and management of listed species and critical habitat on Navy lands on the island of Kauai. Early coordination for activities at the PMRF installation pertaining directly to this consultation began officially in April 2010 when the Navy requested initiation of formal consultation on the effects of facility lighting and communication towers on the Newell's shearwater, the Hawaiian petrel, and a formal conference opinion on the band-rumped storm petrel. The Service responded in a letter in May 2010 and recommended that the consultation be expanded to include all ongoing infrastructure, operations, and maintenance on all federally listed species at PMRF. The Navy expanded the scope of the BA to include all operations and species, and requested comments on the pre-draft BA in December 2011. The NNSA's Sandia National Laboratory (SNL) runs the Kauai Test Facility sites at Barking Sands, and the Navy and NNSA requested co-issuance of the

biological opinion in order to approve launches from KTF. The Service continued technical assistance to the Navy and NNSA in 2012 and 2013 by providing recommendations and comments to assist the development of a draft BA.

September 2013, the Service received from the Navy and NNSA a draft BA for PMRF's ongoing base infrastructure, operations, and maintenance and a letter requesting to initiate formal consultation. The following represents a detailed chronology of actions and correspondence applicable to finalizing the draft BA and beginning work on these biological and conference opinions.

November 19, 2013: The Service met with Dr. Angela Anders and Cory Campora of NAVFAC Pacific to discuss elements of the BA that required additional information or clarification. Based on that conversation, the Service anticipated that additional details would be submitted to the Service regarding a proposed project for the conservation of listed Hawaiian seabirds, as well as clarification on PMRF's strategic approach to limiting the bird-aircraft strike hazard (BASH) risk of Hawaiian geese.

November 22, 2013: The Service sent a letter to NAVFAC Pacific indicating that, although additional details were forthcoming, there was sufficient information to initiate formal consultation as of November 19, 2013. Section 7 of the ESA allows the Service 135 days from initiation or reinitiation of formal consultation to complete a biological opinion. Therefore, the scheduled due date was set for April 3, 2014.

January 23, 2014: Michelle Bogardus and Jiny Kim of the Service met with Cory Campora (in person) and Dr. Angela Anders (on conference call) of NAVFAC Pacific to discuss requested information needed for the biological opinion. NAVFAC Pacific would provide additional details after discussing possible options for the proposed Hawaiian seabird conservation project. Also, NAVFAC Pacific requested removal of the proposed Hawaiian goose translocation project from the BA. PMRF made the determination that the proposed actions may also affect, and is likely to adversely affect, the federally endangered Hawaiian petrel and a candidate for listing, the band-rumped storm-petrel.

January 28, 2014: Dr. Angela Anders of NAVFAC Pacific emailed the Service a habitat modification proposal and pilot study for excluding Hawaiian geese and Laysan albatrosses from PMRF airfield.

Feburary 27, 2014: Jiny Kim of the Service emailed NAVFAC Pacific a request for a written plan of PMRF's proposed seabird colony conservation project that clearly describes the direct measurable benefits for seabirds.

March 12, 2014: At this time, the Service had not received sufficient details regarding PMRF's proposed project for the conservation of Hawaiian seabirds. Jiny Kim of the Service emailed NAVFAC Pacific notification that there would be a delay in the scheduled due date of the biological opinion.

May 1, 2014: Adam Griesemer and Aaron Nadig of the Service met with Cory Campora (in person) and Dr. Angela Anders (on conference call) of NAVFAC Pacific to discuss the information pertaining Hawaiian seabird conservation measures needed for the biological opinion. NAVFAC Pacific provided an update on funding request details for section 7(a)(1) projects.

May 5, 2014: Dr. Angela Anders of NAVFAC Pacific emailed the Service a summary of information from the BA pertaining to Newell's shearwater, including updates from fall of 2013.

May 7, 2014: Adam Griesemer of the Service emailed NAVFAC Pacific to request additional details on PMRF's proposed seabird colony conservation project

May 20, 2014: Adam Griesemer of the Service conducted a site visit with Thomas Savre (NAVFAC Pacific) for the proposed project.

May 30, 2014: The Service received via email a revised BA for the base-wide consultation, including revisions sections of the BA pertaining to Hawaiian seabirds and Hawaiian geese.

June 4, 2014: The Service reviewed the project description and emailed a request to Dr. Angela Anders of NAVFAC Pacific for additional details on the specific actions of the seabird conservation measures. Also, the Service requested additional details and provided recommendations for NAVFAC Pacific's strategy to minimize impacts to the Hawaiian goose at PMRF.

June 5, 2014: Dr. Angela Anders of NAVFAC Pacific via email to Adam Griesemer of the Service indicated that NAVFAC Pacific would provide details regarding seabird conservation for discussion in the next conference call and proposed that a comprehensive management plan for Hawaiian goose be included in the project description.

June 19, 2014: Adam Griesemer and Aaron Nadig of the Service met via conference call with Cory Campora, Dr. Angela Anders, and Thomas Savre of NAVFAC Pacific to discuss final details and recommendations needed for the biological opinion pertaining to the Hawaiian goose, Hawaiian hoary bat, and Hawaiian seabirds.

June 20, 2014: Dr. Angela Anders of NAVFAC Pacific emailed the Service revisions to the BA. The Service's work on the biological opinion began again.

August 25, 2014: Dr. Angela Anders of NAVFAC Pacific emailed the Service a revised BA, including updated conservation measures for Hawaiian seabirds.

BIOLOGICAL AND CONFERENCE OPINIONS

DESCRIPTION OF THE PROPOSED ACTION

PMRF, a U.S. Navy installation, provides integrated range services for multiple Department of Defense (DoD) and NNSA activities. PMRF is the largest instrumented multi-environment test range in the U.S. and includes land, sea, and air zones. The range services accommodate training, tactics development, and evaluation for air, surface, and subsurface weapons systems for DoD and other U.S. departments and agencies, foreign military forces, and private industry. PMRF maintains facilities and provides services to support Pacific Fleet underwater, surface, and air training exercises and other activities designed by the Chief of Naval Operations.

The scope of these biological and conference opinions includes all current and ongoing base infrastructure, operations, and maintenance activities at all terrestrial PMRF sites on the island of Kauai, including activities of tenant and customer DoD commands and other federal agencies. PMRF Main Base is located at Barking Sands, which has training and Research, Development, Test, & Evaluation (RDT&E) activities areas for tracing and surveillance radars, data processing, communications networks, and an airfield. In addition to the main base at Barking Sands, PMRF is comprised of support facilities on the island of Kauai at Makaha Ridge, (secondary range), Kokee (tracking radars, telemetry, communications, command and control), Kamokala Ridge (munitions storage), Port Allen (pier for weapons recovery and Navy Seaborne Powered Targets (SEPTAR) boats), and Milolii Ridge (reflectors) (Commander Navy Region Hawaii 2010).

Although KTF previously included an area on Mount Kahili as a communications repeater site, the site is no longer used by KTF and all NNSA-owned telemetry and data acquisition equipment was removed. Mount Kahili will not be addressed further in this document.

Action Area

The action area of a project is defined by regulation as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). Firstly, the action area for this project includes the main base of PMRF, known as Barking Sands. Secondly, the action area includes all of Mana Plain, which surrounds Barking Sands, because the proposed action may cause Hawaiian geese to fly outside of the Barking Sands boundary. Thirdly, in addition to the Barking Sands and the surrounding Mana Plain, the action area is comprised of several smaller sites located at Makaha Ridge, Kokee, Kamokala Ridge, Port Allen, and Miolii Ridge. Lastly, the action area also includes the all of the Na Pali Coast, from Haena to Polihale state parks, where actions will be implemented to benefit listed seabird species.

Details of the sites which encompass the action area are provided below based on descriptions found in the draft BA and current conditions sections of the 2010 PMRF INRMP (Commander Navy Region Hawaii 2010). Additional details including maps and pictures of each PMRF site are provided in the 2010 PMRF INRMP.

Barking Sands is located along the Mana Plain on the western coastline of Kauai (Figure 1). The base is approximately 7 miles long and 0.5 miles wide, encompassing approximately 2,060 acres. Barking Sands is bordered to the north by Polihale State Park and to the south by Kokole Point. Barking Sands is bordered to the east by agricultural lands, which continue across the Mana Plain to the mountains of central Kauai. Barking Sands is bordered to the west by the Pacific Ocean, with a coastline dominated by sand beaches, beach barrier dunes, and beach strand vegetation. The Nohili Dunes provide the highest elevation at Barking Sands, approximately 100 feet. The drainage ditches constitute most of the surface water within Barking Sands.

Mana Plain extends across coastal leeward Kauai and is bordered by Makaha Ridge to the east, Na Pali coastline to the north, and Pacific Ocean to the west and south. Mana Plain once contained expansive wetland habitats that supported a variety of native plant and wildlife species. Prior to its drainage and conversion to agricultural lands during the 1900s, approximately 1,700 acres of permanent, semi-permanent, and seasonal wetlands were present on Mana Plain. Approximately 200 acres of wetland remain, predominantly within the DOFAW managed Mana Plains Forest Reserve and Kawaiele Waterbird Sanctuary. These managed wetland sites have been partially restored in an effort to increase breeding and foraging habitat for the endangered Hawaiian duck, Hawaiian coot, Hawaiian moorhen and Hawaiian stilt. Other areas on Mana Plain remain degraded, but do provide minimally beneficial habitat for Hawaiian waterbirds and Hawaiian geese.

Makaha Ridge is a finger ridge of the Na Pali coast which occurs on the west-northwest side of Kauai to the northeast of Barking Sands (Figure 3). The elevation at Makaha Ridge ranges from 1,460 feet at the cliff faces to 1,850 feet at the eastern perimeter. The site covers 244 acres and lies approximately 7 miles north of Barking Sands within State of Hawaii forest reserve areas. Steep slopes surround the station to the south, west, and north. Water drainage paths exist at the site; however, there are no perennial surface water features.

The Kokee sites of PMRF (Figure 4) occur along Kaunuohua Ridge which, near the northwestern terminus of Waimea Canyon. Kokee State Park borders the sites on all sides, and forested areas extend within the property boundaries. The Kokee sites are located on five small parcels that total 16 acres of land, which range in elevation from 3,710 to 3,800 feet. No surface water resources occur at the sites.

The Kamokala Ridge Magazines is located approximately 1.5 miles east of Barking Sands cover 89 acres on the western side of the ridge (Figure 1). Elevation of the site ranges from 240 to 320 feet. The ridge is located on the western edge of the Puu Ka Pele, an upland area with numerous valleys that are characterized by rock outcrops and lowland dry vegetation. The Mana plain extends to the west of Kamokala Ridge. There are no perennial surface water features at the site.

The PMRF Port Allen site is on the southern shore of Kauai. At this site, the Navy leases the west side of the pier and west side of the pier building from the State of Hawaii. The total area of the leased site is 1.0 acre. Because the Navy does not have jurisdiction over the lighting conditions on the east side of the pier, owned and operated by the State of Hawaii, the action area is restricted to the Navy-leased property on the east side of the building and pier.

The Miolii Ridge site is comprised of three small 10-foot^2 reflector sites. The Miolii Ridge site is included in the action area, however, as stated above, there are no facilities that occur at the site. The Miolii Ridge site will not be addressed further in this document.

The Na Pali Coast in the northwest of Kauai, extends from Haena to Polihale State Park. The elevation along the coast ranges from sea level to 3,700 feet in Kokee. The Na Pali region is characterized as a coastal cliff formation with numerous upland finger ridges, precipitous cliffs, and deeply incised valleys. The proposed seabird conservation site located at Honopu Valley occurs along the central Na Pali Coast between Kalalau Valley to the east and Awaawapuhi Valley to the west. The area where predator control will be carried out is situated on the rim of the valley, above the steep slopes and cliff walls, and extends along the Honopu trail in the State of Hawaii Na Pali Kona Forest Reserve. The elevation in the rim areas ranges from approximately 2,700 to 3,600 feet.

PMRF Main Base – Barking Sands

Barking Sands is the principal operations area for PMRF and supports surface, subsurface, air, and space activities (Commander Navy Region Hawaii 2010). Tracking and surveillance radars, data processing, and other communications networks are contained within RDT&E activity areas. Nohili Ditch and Kinikini Ditch separates Barking Sands into three zones: north, central, and south (Figure 1).

The northern third of Barking Sands, north of Nohili Ditch, comprises KTF, an area managed and operated by DOE/NNSA's SNL for missile assembly and launch operations and associated support activities, administration, and services. SNL operates Sandia's Strategic Target System (STARS) and rail-launched sounding rocket launches from KTF. Within the DOE/NNSA Work For Others program, SNL also conducts missile launches for DoD components, including the MDA. KTF personnel conduct test operations to support materials research, components development, advanced reentry vehicle technologies, water entry and recovery systems, and missile defense testing (www.sandia.gov/locations/ktf). Access to KTF, including the Nohili Dune area (the western boundary of KTF), is controlled and limited at all times. Polihale State Park, to the north of KTF, provides beach dune, camping, and surfing activities to the public. Temporary closures of State of Hawaii access roads and beach areas at Polihale occur during missile launches from KTF.

In addition to housing KTF, the northern third of Barking Sands contains U.S. Army/MDA Terminal High Altitude Area Defense (THAAD) missile launch facilities, a 50K launch pad, and the Aegis Ashore Test Center. As at KTF, beach and dune areas to the west of the THAAD, 50K, and Aegis launch facilities are off-limits to all PMRF personnel and visitors except for security personnel conducting patrols. Prior to missile launches from any launch pad, the Navy carries out security patrols to ensure no human presence in the Ground Hazard Area during launch activities (Commander Navy Region Hawaii 2010). During pre-launch and other patrols, security all-terrain vehicles (ATVs) are driven between the high tide line and beach berm (i.e. only in non-vegetated areas), and pickup trucks are driven only on existing dirt roads. Any security ATV entering the beach area is required to cross the berm only on designated permanent paths indicated by signage.

The central third of Barking Sands, delineated by Nohili Ditch on the north and Kinikini Ditch on the south (Figure 1) contains a 6,000-foot runway and associated air operations facilities. In addition to the runway, these facilities include a helicopter landing pad, main hangar, and administrative buildings. The airfield supports C5- and C17-type cargo aircraft, tactical aircraft, and helicopters. Operations support aircraft consist primarily of C-26 airplanes used for logistics and range surveillance, and S-61 helicopters used for personnel transfer, logistics, surveillance, and target recovery. Daily touch-and-go practices of cargo airplanes also occur at the airfield. In addition to air operations facilities, the central third of Barking Sands supports base administration, base services, range operations, ordnance maintenance, and fuel supply facilities. The U.S. Army and Hawaii Air National Guard (HIANG) also maintain facilities and carry out missions in this section of the installation.

The southern third of Barking Sands, south of Kinikini Ditch (Figure 1), contains a housing area, personnel support facilities, and additional base operations facilities. Just to the south of Kinikini Ditch lies a recreational beach cottage area consisting of 19 cottages. The cottages are adjacent to the beach which is open to military personnel and their families and beach cottage visitors. The southern third of the base also contains a housing area consisting of approximately 70 units (primarily single-family homes and duplexes), and personnel support facilities that include a Navy Exchange, fitness center, youth center, soccer field, movie theater, and all-hands club. A man-made oxidation pond in this section of the base provides the only surface water on Barking Sands outside of the agricultural drainage ditches. Finally, this southern section of Barking Sands contains communications facilities, an antenna array, and launch facilities, although on a small spatial scale relative to the northern third of the base (Commander Navy Region Hawaii 2010). Barking Sands is surrounded by or contains a total of 6.3 miles of barbed wire fencing, consisting of three-strand barbed wire atop chain link fence.

Figure 1. Map of the Pacific Missile Range Facility on the island of Kauai (Source: Commander Navy Region Hawaii 2010).

Barking Sands Lighting

Night lighting at Barking Sands is associated with base administration, maintenance, personnel support infrastructure, and missile assembly and launch facilities. Anti-Terrorism/Force Protection lighting is used intermittently at Barking Sands missile assembly and launch facilities to protect personnel and assets prior to launch activities. Currently, three missile assembly areas and five launch pads occur in the northern section of Barking Sands, and a launch pad occurs in the southern section of Barking Sands at Kokole Point. All white lights on all launch pads were

replaced with green bulbs prior to the 2010 nocturnal seabird fledging period. The total number of nights per year during which Force Protection lighting is required on these launch pads for all missile launch activities by all supported DoD commands and other federal agencies is currently approximately 90-120 nights. Duration of each event ranges from approximately three days to four weeks, and event schedules are spread out throughout the calendar year. Thus, the number of nights during the three-month nocturnal seabird fledging period (mid-September through mid-December) which require lighting at launch pads is not likely to exceed a total of 30 days.

Barking Sands Communication Towers and Transmission Lines

Fourteen communication towers are located at Barking Sands (Figure 2). In compliance with Federal Aviation Administration (FAA) and Commander Naval Air Systems Command requirements regarding airfield obstruction-lighting, a subset of the communication towers at Barking Sands have aircraft obstruction-lighting at the top of the structure: this lighting consists of two steady-burning, unshielded red bulbs (Federal Aviation Administration 2000 p.13, Commander Naval Air Systems Command 2009 pp.3-4). The height and lighting of all communication towers at Barking Sands is shown in Table 1.

Table 1. General locations, heights, and lighting conditions of communication towers at Barking Sands, Pacific Missile Range Facility, as of September 2008.

Building/Site	**Type of Tower or Antenna**	**Tower Height**	**Obstruction-Lighting**
Bldg 564	Metro tower	96 ft	2 red bulbs
Bldg 515	Calibration lab antennas (2)	80 ft	2 red bulbs
Bldg 556	Pyramid spiral antenna	40 ft	2 red bulbs
Bldg 396	Aircraft beacon tower	66 ft	none
North Gate	HI Telephone microwave tower	165 ft	2 red bulbs
Bldg 1100	Boresight tower	150 ft	2 red bulbs
North of Kokole Point	WWVH radio antennas (2)	90 ft	none
North of Kokole Point	WWVH radio tower	45 ft	none
Bldg 851	Radial curtain antenna tower	110 ft	none
Bldg 852	Radial curtain antenna tower	110 ft	none
Bldg 853	Radial curtain antenna tower	110 ft	none
Bldg 854	Radial curtain antenna tower	110 ft	none
Bldg 822	Communications tower	110 ft	2 red bulbs
Bldg 850	USCG/DGPS tower	200 ft	2 red bulbs

In addition to communication towers, structures with narrow profiles exceeding 26 feet in height at Barking Sands include 121 electrical distribution line poles spread over a distance of approximately 7 miles. Unlike poles supporting 69 kilovolt (kV) transmission lines that run along the main roads of Kauai and stand 70 to 85 feet tall, the poles on Barking Sands support 12 kV distribution lines and are 45 feet in height. This height is within the range of heights of the kiawe trees (*Prosopis pallida)* that dominate the non-native habitat on the base, including roadside habitat, that grow from 30 to 60 feet tall (Commander Navy Region Hawaii 2010 p. 3-51, http://www.ctahr.hawaii.edu/forestry/trees/ CommonTreesHI/CFT_Prosopis_pallida.pdf). In addition, distribution lines on 45-ft poles thoughout Barking Sands are configured in a horizontal

plane, rather than stacked vertically, such that the vertical profile is equivalent to that of a single line. All existing communication towers and power lines at Barking Sands are in use, and there is no plan for removal of any towers or lines at this time.

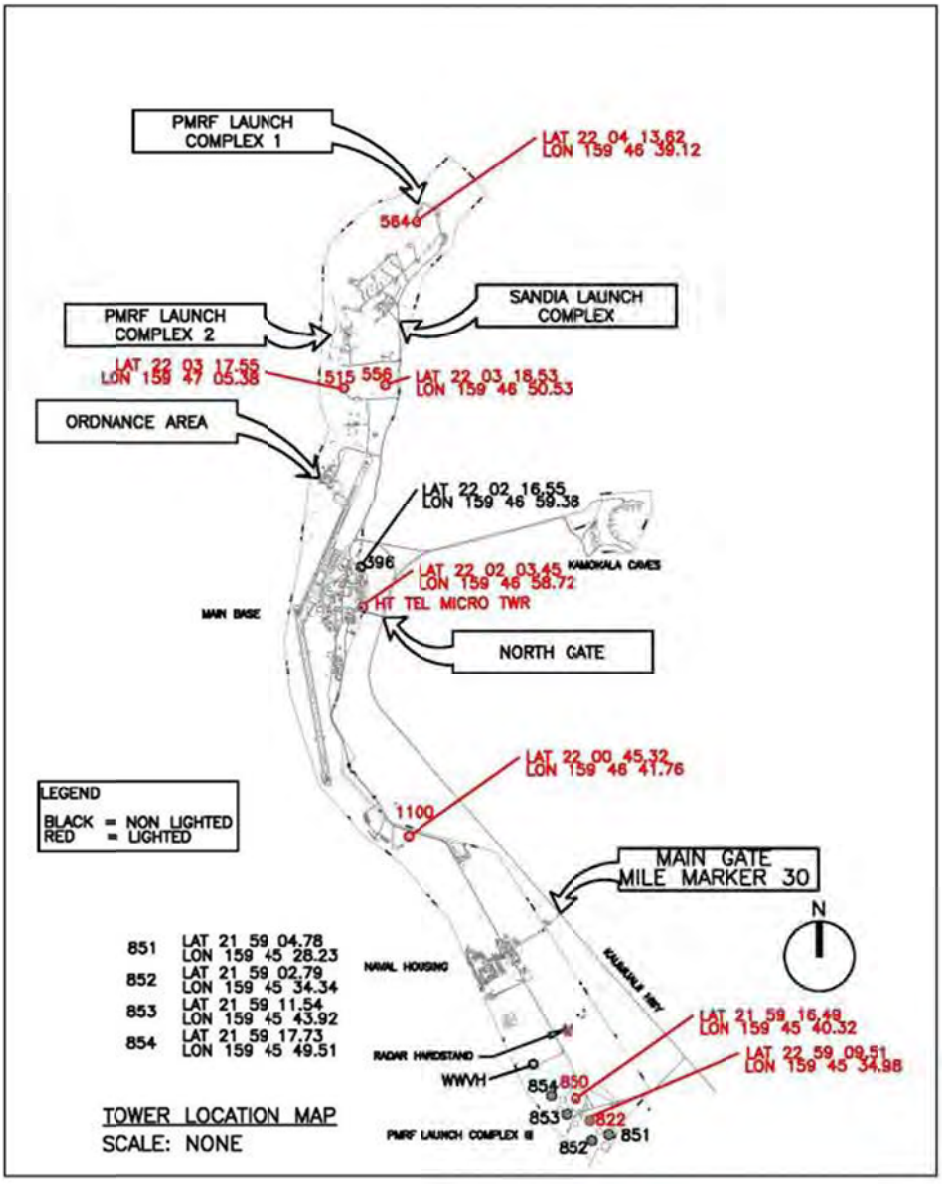

Figure 2. Locations of communication towers at Barking Sands, Pacific Missile Range Facility. Towers indicated by red font contain aircraft obstruction-lighting, consisting of two steady-burning unshielded red bulbs. Towers indicated by black font do not have lighting.

Barking Sands Air Operations and Birds Aircraft Strike Hazard Program

Barking Sands air operations facilities in the central portion of the installation include a 6,000-foot runway, four helicopter landing pads, main hangar, and administrative facilities. The airfield supports military aircraft including, but not limited to, large cargo aircraft, tactical aircraft, and

helicopters. Operations support aircraft consist of C-26 airplanes used for logistics and range surveillance, and S-61 helicopters used for personnel transfer, logistics, surveillance, and target recovery. Daily touch-and-go practices of cargo airplanes also occur at the airfield. Although field carrier landing practices (FCLPs) have not been conducted at the Barking Sands airfield, the potential exists for this training to occur. FCLPs are practices and tests of landing tactical aircraft at a land-based airfield for pilots who will land tactical aircraft on aircraft carriers. Pilots who are in the process of being assigned to aircraft carriers forward-deployed in the western Pacific normally conduct FCLP training on the west coast of the mainland U.S. The airfield at Barking Sands would be used for FCLP training and testing only if a pilot were unable to test on the mainland U.S. prior to travel to the western Pacific due to scheduling reasons.

To minimize the risk of aircraft collisions with birds and other wildlife, Commander Naval Installations Command (CNIC) contracts USDA APHIS Wildlife Services (USDA-WS) to implement an integrated wildlife control operation within the Bird Aircraft Strike Hazard (BASH) zone at Barking Sands. Control methods include lethal techniques for introduced species such as zebra doves (*Geopelia striata*), spotted doves (*Spilopelia chinensis*), mynas (*Acridotheres tristis*), bulbuls (*Pycnonotus* spp.), and mannikins (*Lonchura* spp.). Lethal control is conducted via shooting in high probability bird-strike zones along the runways and taxiways. With non-listed species that are federally protected under the Migratory Bird Treaty Act (MBTA), USDA-WS conducts non-lethal control, including non-lethal trapping/relocation and hazing by personnel on foot or in vehicles. MBTA species managed include, but are not limited to, Laysan albatrosses (*Phoebastria immutabilis*), great frigatebirds (*Fregata minor*), and Pacific golden plovers (*Pluvialis fulva*). PMRF Air Operations maintains a Migratory Bird Permit for management of MBTA-protected species within the BASH zone.

For ESA-listed species, hazing and habitat management are currently the only control methods used to deter birds from foraging, loafing, and nesting on and near the airfield. The goal of the hazing activities is to harass individual birds to the extent that they fly away from the airfield where there is high risk of bird-aircraft strikes. Hazing actions consist of auditory and visual techniques including vehicle horns, human vocalizations, hand clapping, foot stomping, and/or flashing vehicle lights. Although Hawaiian geese, Hawaiian ducks, Hawaiian moorhens, Hawaiian coots, and Hawaiian stilts all occur on PMRF Main Base, hazing is done almost exclusively for Hawaiian geese, with 490 Hawaiian goose hazing events carried out in 2012 and 887 in 2013 (Table 2). Non-nesting Hawaiian geese are currently hazed throughout Barking Sands (all nesting geese and their eggs or goslings are not hazed and are protected via ongoing base-wide predator control operations). A total of 3 Hawaiian duck and12 Hawaiian stilt hazing events occurred between 2005 and 2011 at the PMRF airfield. No Hawaiian moorhens or coots were hazed as part of the BASH program within the past eight years. All Hawaiian ducks and stilts were hazed only on the Barking Sands airfield and not on other areas of the installation.

Table 2. Number of Hawaiian geese hazed at the PMRF airfield between 2005 and 2011.

Species	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Hawaiian goose	6	7	191	364	641	629	518	490	887

USDA Wildlife Services was authorized through 31 December 2012 to haze ESA-listed birds from airfields in Hawaii via an Agent Designation Letter issued by the Service. However, we

informed the Navy that USDA Agent Designation Letters would not be renewed, such that Navy should address all current hazing activities at PMRF in this base-wide section 7 consultation. An expansion of Hawaiian goose hazing operations at Barking Sands was granted by the Service via a biological opinion issued 10 September 2012 (2012-F-0409). The previous biological opinion allowing for hazing of Hawaiian geese remains in effect through the completion of these biological and conference opinions.

USDA APHIS Wildlife Services and PMRF Air Operations and Environmental personnel will continue to haze Hawaiian geese and Hawaiian waterbirds from Barking Sands. USDA Wildlife Services will train PMRF Air Operations and Environmental personnel in the appropriate use of hazing techniques prior to implementation. Hazing operations by Air Ops and Environmental personnel will occur only within the borders of PMRF Main Base. Hawaiian geese hazing will occur as needed at the PMRF airfield as well as other areas of the installation. Hazing of Hawaiian ducks, stilts, coots, and moorhens will occur as needed only on the Barking Sands airfield, and not at the oxidation pond, drainage ditches, or other areas of the installation.

During the Hawaiian goose nesting and breeding season (September through March), personnel will observe birds prior to hazing actions to determine whether a nest or goslings are present. Brooding adults (i.e. adults with an active nest or goslings) will not be hazed at any time. Observation of a Hawaiian goose nest or gosling(s) will be reported to the USFWS Pacific Islands Fish and Wildlife Office within 24 hours. A summary of hazing techniques used for Hawaiian geese will be provided to USFWS in an annual report. Air Operations and Environmental positions requested to conduct this action are listed in Appendix A.

Makaha Ridge Tracking Station

The Makaha Ridge Tracking Station serves as PMRF's secondary missile tracking and surveillance station (Commander Navy Region Hawaii 2010 pp. 4-1 – 4-2). Structures at the site consist of eight buildings and two lattice-support communication towers (Figure 3). Tracking and surveillance activities occur inside the buildings at Makaha Ridge, including a Frequency Interference Control building, telemetry building, communications building, laboratory, power plant, maintenance facility, and guard shack. Access to Makaha Ridge Tracking Station is limited to assigned personnel and visitors on official business (Commander Navy Region Hawaii 2010 pp. 4-1 – 4-4).

Exterior security lights on buildings at Makaha Ridge are currently unshielded or partially shielded by roof overhangs. In compliance with FAA and Commander Naval Air Systems Command requirements, the two communication towers at this site each have steady-burning, unshielded red bulbs (Federal Aviation Administration 2000 p.13, Commander Naval Air Systems Command 2009 pp.3-4). Transmission lines at the Makaha Ridge site consist of 12 kV distribution lines at a height of 45 feet along a total distance of 0.6 of a mile. Makaha Ridge contains 0.17 of a mile of barbed wire fencing, consisting of three-strand barbed wire atop chain link fence.

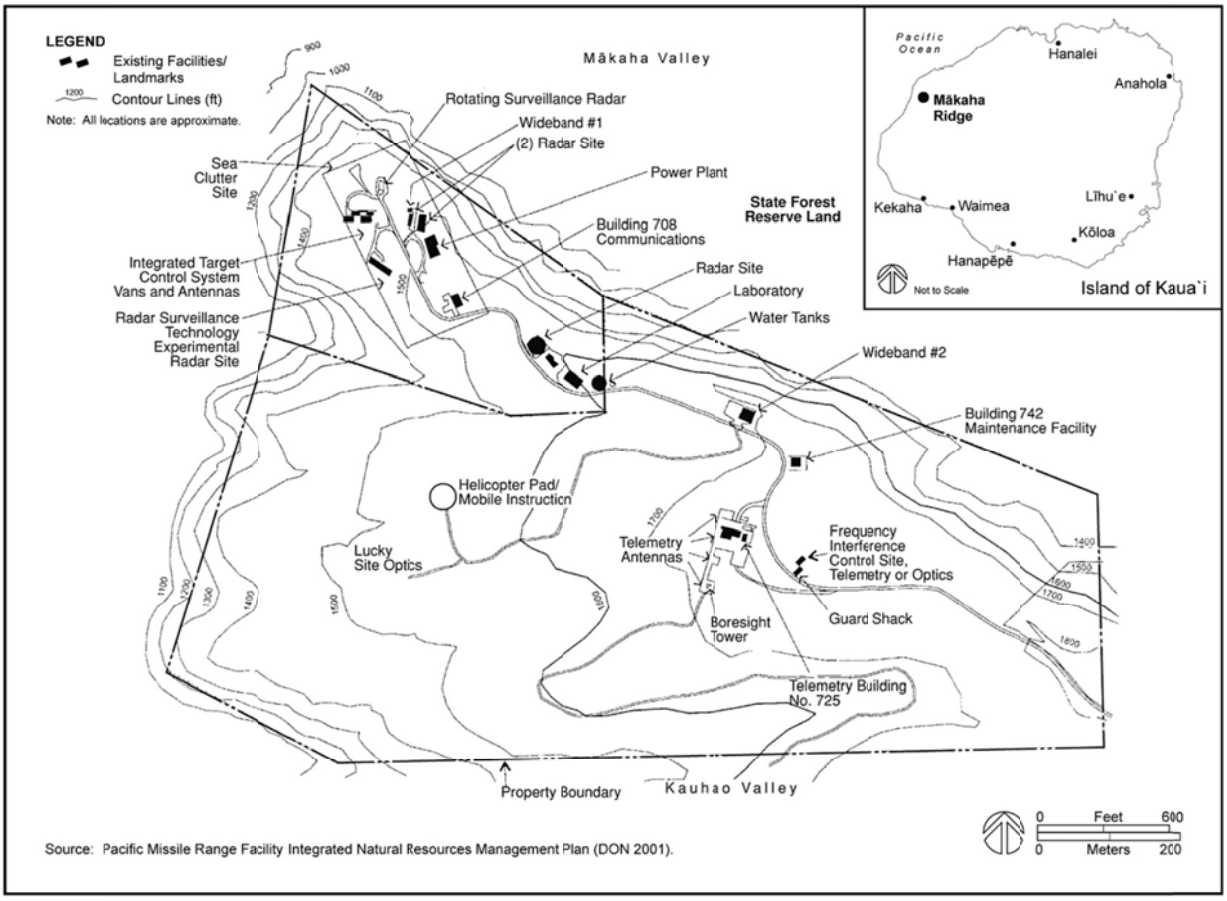

Figure 3. Map of Makaha Ridge site, Pacific Missile Range Facility, on the island of Kauai (Source: Commander Navy Region Hawaii 2010).

Kokee Sites

The Kokee sites of PMRF contain four Navy-operated and maintained buildings in which telemetry, tracking, communications, and command and control operations occur (Kokee Sites A through D, Figure 4). A Geophysical Observatory operated by the National Aeronautics and Space Administration (NASA) is also located at the Kokee sites (Site E, Figure 4). Kokee Site A accommodates tracking and command, training and administration, and logistics support. Site B contains a power plant and fuel storage facility. Site C consists of boresight equipment, operations and maintenance support, a microwave antenna, and radar, and site D contains a transmitter building and antenna support facilities (Commander Navy Region Hawaii 2010 pp. 5-1 – 5-3). Although some U.S. Air Force sites in Hawaii were joint based with Naval Station Pearl Harbor in January 2009, the Air Force site at Kokee was not included in this joint-basing effort. Lighting conditions at the Air Force site at Kokee thus continue to be the responsibility of the Air Force.

Kokee Site A contains only two exterior security lights operated via motion sensors; lights are off unless motion is detected. Site B has no exterior lights. Site C contains a guard shack with

an unshielded exterior security light that remains on at all times, and site D has no exterior lights. The NASA site (Site E) has four facility lights: two low wattage that remain on, and two unshielded lights turned on by personnel only when present at night.

Two lattice-support communication towers occur on the Kokee sites, both at Site E. Each tower has an unshielded steady-burning red light as per FAA and Commander Naval Air Systems Command requirements (Federal Aviation Administration 2000 p.13, Commander Naval Air Systems Command 2009 pp.3-4). No above-ground transmission lines occur on the PMRF Kokee sites. The sites contain a total of 0.03 of a mile of barbed wire fence, consisting of three-strand barbed wire atop chain link fence.

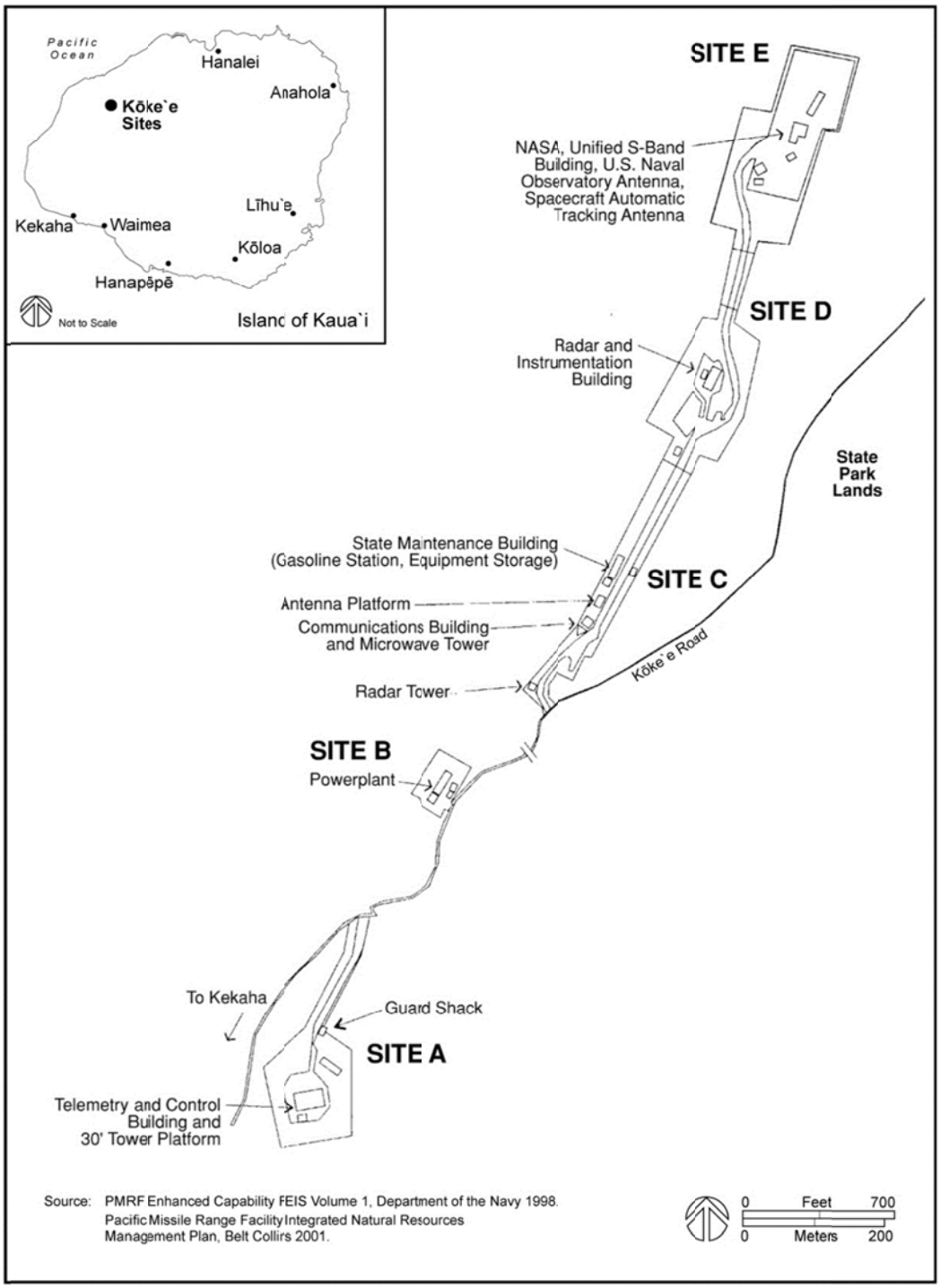

Figure 4. Map of Kokee Sites, Pacific Missile Range Facility, on the island of Kauai (Source: Commander Navy Region Hawaii 2010).

Kamokala Ridge Magazines

The Kamokala Ridge Magazines is located east of Barking Sands (Figure 1). Facilities at the site consist of two earth-covered magazines, 10 ordnance storage magazines excavated into the cliff face, and a missile assembly building. Ordnance is stored for the Navy, Hawaii Air National Guard, Department of Energy, and intermittently for other military commands with training and ordnance storage requirements (Commander Navy Region Hawaii 2010 pp. 6-1 – 6-2).

Per Navy Instruction regarding security lighting for conventional arms, ammunition, and explosives (Department of the Navy 2003), exterior lighting includes three floodlights on each of the two earth-covered magazines and a single incandescent bulb over the doorway of each of the 10 excavated magazines. This site includes 0.33 of a mile of barbed wire fencing, consisting of three-strand barbed wire atop chain link fence.

Port Allen

At Port Allen Boat Harbor, the Navy leases the west side of the pier and pier building from the State of Hawaii. This site provides berthing facilities for three weapons recovery boats and a building for warehousing and support facilities including communications, maintenance/repair, and engineering. Navy Seaborne Powered Targets (SEPTAR) boats are moored at Port Allen as required for training exercises.

Exterior lighting is required at the pier at Port Allen for Anti-Terrorism/Force Protection purposes (Department of the Navy 2007) and to minimize nighttime trip and fall hazards near the water. Eleven lights are mounted under the roof overhang on the west side of the building, and one light is mounted on the front of the building (the northwest corner). The light on the front of the pier building is owned and operated by the Navy. The eleven lights along the west side of the building are operated by Navy, but the light fixtures are State property. These lights are turned on each night for security camera lighting and safety purposes. Six higher-intensity lights are turned on only when personnel are working on docked boats on nights when fueling or upload/offload of equipment occurs. The site contains 0.05 of a mile of barbed wire fencing, consisting of three-strand barbed wire atop chain link fence.

Miolii Ridge

The Miolii Ridge site is comprised of three small 10-foot^2 reflector areas. No facilities occur at the site.

Conservation Measures

The following conservation measures were developed with the Service and the Navy to avoid or minimize impacts to listed species and one candidate species reviewed in this consultation and are considered part of the project description. These include minimization measures that have been implemented at PMRF prior to initiation of this consultation. For conservation measures to compensate for effects of the action, project funds will be requested by Navy via the CNIC INRMP funding process. Implementation of these projects will be contingent upon availability

of INRMP funds. Any changes to, modifications of, or failure to implement these conservation measures may result in the need to reinitiate this consultation.

Newell's Shearwater, Hawaiian Petrel, and Band-rumped Storm-petrel

At Barking Sands, all unnecessary night lighting is now turned off during the nocturnal seabird fledging period. Three of the eight areas determined in 2008 to have the potential to disorient nocturnal seabirds during over-flights of Barking Sands due to unshielded light had night lighting turned off completely during the nocturnal seabird fledging period (September through December) in 2009 through 2013. These areas included KTF facilities (excluding the launch pads and associated facilities), MOGAS, and the all-hands club. In addition, the overhead lighting at the stainless steel garage doors at Bldg 327 and exterior lighting at Bldg 420/422 was turned off.

At Barking Sands and Port Allen, all required night lighting is now full cutoff, except where non-vertical lighting is needed for Anti-Terrorism/Force Protection at the missile launch pads. Although several unshielded lights were identified that can be turned off completely at night to avoid impacts to nocturnally-migrating seabirds, exterior lights are needed for safety or Force Protection at other Barking Sands locations and at Port Allen. Prior to the 2011 nocturnal seabird fledging period, all exterior safety fixtures were realigned or replaced such that they are now full cutoff. Any Anti-Terrorism/Force Protection lighting with non-vertical lighting was fitted with green bulbs. At Port Allen, when higher-intensity Force Protection lighting is needed during boat onloads or offloads, a Biological Monitor will be present. The Biological Monitor will ensure that if a nocturnal seabird is attracted to the lights, they are turned off temporarily such that the bird can fly safely from the area.

For areas of PMRF where night lighting is required for Anti-Terrorism/Force Protection or personnel safety, PMRF's Environmental Coordinator has worked with the Base Operations Support contractor's electrical staff to carry out a Green Lights Project. All white lights > 175 watts were replaced with green bulbs in areas where non-vertical night lighting is required for Anti-Terrorism/Force Protection or safety, including the missile launch pads in the northern and southern sections of the base. The green lights used at PMRF are similar to those used by Poot et al. (2008) in their study on songbirds, shorebirds, and waterbirds at offshore gas platforms.

A. The first phase of the project began in February 2010 to procure sample lights in all ranges of wattage that would work in PMRF's existing exterior light fixtures (all that were not full cutoff fixtures). Field testing was conducted at Barking Sands to determine whether adequate light was produced by the green bulbs for Force Protection and safety.

B. Based on field testing, a decision point to replace white bulbs with green was reached for all fixtures > 175 watts and identified as required to remain on at night at Barking Sands. Replacement of white bulbs with green was completed on all lamps, fixed or portable, between 175 and 1000 watts, prior to the 2010 nocturnal seabird fledging season.

C. All green bulbs have remained in place year-around (i.e. not only during the autumn seabird fledging periods).

D. Fixtures providing light for launch facility ordnance security are all full cut-off and/or contain green bulbs.

E. Portable light carts used for Force Protection are now equipped with two green and two white lights; only the green lights are used during lower Force Protection Conditions (FPCON) status, while white lights are available for higher FPCON status.

For all new construction at all PMRF sites, including that by or for tenant or customer DoD commands or other federal agencies, construction during the nocturnal seabird fledging period (mid-September through mid-December) will be carried out only during the day. Dark-sky friendly lighting will be required for all construction. At Barking Sands, Makaha Ridge, Kokee, and Kamokala Ridge Magazines, for all future construction, lights will be used at night only where required for Force Protection or safety, and all newly-installed fixtures will be full cutoff, with bulbs shielded from above and around all sides. Green light bulbs will be used for fixtures with > 175-watt bulbs, including lighting at missile launch facilities in the northern and southern sections of the base, where compatible with Force Protection requirements.

PMRF supports a seabird collection station for the Save Our Shearwaters (SOS) program. SOS is housed by the Kauai Humane Society and collects birds that have either collided with structures, fallen out, or injured or killed due to exhaustion caused by light attraction. To increase PMRF personnel and visitor knowledge and awareness, the species identification and station instruction signage at the Barking Sands' SOS station were improved in 2009. In addition, a PMRF/SOS Banner donated by the SOS Program was erected inside the Main Gate entrance to Barking Sands.

At Barking Sands, Makaha Ridge, and Kokee, additional monitoring was conducted in 2010 at all communication towers, including scavenger trials, searcher efficiency trials, and carcass searches. Scavenger trials were conducted concurrently with carcass searches and searcher efficiency trials to more thoroughly assess the potential for bird strikes at PMRF communication towers. Additional tower monitoring, scavenger trials, and searcher efficiency trials will be conducted in conjunction with the Five-year INRMP updates for PMRF to continue to assess rates of nocturnal seabird tower strikes.

At Barking Sands, USDA Wildlife Services will continue to conduct base-wide predator control operations to benefit any downed seabirds. Lethal control of rats and owls will continue at Barking Sands. If mongooses should become established on the island of Kauai, lethal control of this species will be carried out as part of base-wide predator control operations. Live trapping of feral cats and dogs for pickup by the Kauai Humane Society at Barking Sands has been funded as a component of PMRF's INRMP. Lethal control of barn owls will be a continued focus for USDA APHIS Wildlife Services: between 2005 and 2010, Wildlife Services removed 112 barn owls from Barking Sands. The majority of barn owls at Barking Sands have been observed and removed at the wedge-tailed shearwater breeding colony in the Beach Cottages area.

Beginning in FY15 and continuing annually, the Navy will also request INRMP funding to conduct predator control at Makaha Ridge, including lethal control of non-native barn owls. The

control of barn owls at Makaha Ridge will benefit nearby colonies of seabirds that are threatened by this avian predator.

The Navy funded a project, in collaboration with the Hawaii DLNR Kauai Endangered Species Recovery Project (KESRP), to use a Remotely Piloted Air Vehicle (RPAV) and ornithological radar to map flight paths and document nesting locations of Hawaiian petrels and Newell's shearwaters on the island of Kauai. As part of this project, KESRP has been subcontracted to ground-truth colony locations based upon RPAV data. If the RPAV does not successfully identify colony locations, KESRP will undertake nest monitoring in currently-known colonies as part of this project. This work was funded by the Navy in FY13 at $250,000.

The Navy provided a full-time Endangered Seabird Field Assistant to KESRP for four months in 2012 (15 May through 15 September). This position was funded by the Navy at a total of $28,000. In the summer of 2013, the Navy also funded KESRP, at approximately $40,000, to conduct nest monitoring in currently-known Newell's shearwater colonies on the island of Kauai.

To aid in protection of nesting colonies of nocturnal seabirds on the island of Kauai, in 2015 and 2016, in addition to predator control operations at Makaha Ridge, the Navy will request funding to implement control of feral cats at Honopu in the ridge areas above the valley or at another site approved by USFWS. The seabird conservation site at Honopu is located within the DLNR Na Pali Kona Forest Reserve in the northwest of Kauai. The site is accessible via Kokee Road and Honopu Trail. Predator control at Honopu or another site approved by USFWS will be initiated as soon as possible following receipt of FY15 INRMP funds by NAVFAC Hawaii. Predator control will be conducted by qualified technicians, such as PMRF Environmental personnel, USDA Wildlife Services, or another contracted entity, and will include the following:

1. Kill traps will be spaced at approximately 500-foot intervals (i.e., every 150 meters) along trails, and will be mounted in boxes set approximately 1 foot above the ground to avoid risk of seabirds being caught in the traps;
2. Cage traps will be spaced at approximately 500-foot intervals (250 feet between kill traps) along trails, and will be checked at least once every 48 hrs;
3. Trail cameras will be placed to monitor for predator activity, and will be checked at least once per week; and
4. Leg hold traps will be deployed during daylight hours in response to cat detections.

The Navy will continue to assess nocturnal seabird conservation opportunities throughout 2015 and 2016 and will coordinate with USFWS on a regular basis to determine the most effective actions to benefit the species. During this time, the Navy will draft a PMRF Seabird Conservation Plan to describe the conservation actions that the Navy will implement through the foreseeable future, commensurate with the level of incidental nocturnal seabird take on the installation. Beginning in 2017, the Navy will begin to implement the actions agreed to via the PMRF Seabird Conservation Plan.

Hawaiian Hoary Bat

To avoid or minimize effects of base infrastructure operations and maintenance on Hawaiian hoary bats, for all current and future construction projects at PMRF that require clearing of trees prior to construction, including construction by or for tenant or customer DoD commands or other federal agencies, clearing will be conducted outside of the Hawaiian hoary bat pupping period (1 June through 15 September) to avoid the felling of potential pupping trees.

An experiment to assess the efficacy of the aluminum tags in preventing bat collisions with barbed wire will be carried out whereby some areas of barbed wire fencing will contain the aluminum tags and other sections of fencing will have no tags as a control treatment. The aluminum tags will be placed along the top of barbed wire fencing at all PMRF sites to provide visual and auditory cues to bats. Two aluminum plant tags will be placed on the top strand of barbed wire halfway between fence posts. The tags will be fastened in a manner that allows them to move about freely in the wind, such that the tags function as a visual cue. And, the tags will be spaced closely enough together that they are able to come into contact with each other and generate an auditory cue.

Prior to and as part of implementation of the study of the efficacy of metal tags in deterring bats from the barbed wire fencelines at PMRF, all fences will be monitored at least once per month on foot and/or by vehicle to quantify bat collisions with barbed wire. The monitoring will compare rates of bat collisions on the aluminum tag treatment versus control barbed wire fencing. Documentation of any entangled bats or evidence of entangled bats will include photographs, latitude/longitude coordinates, date, and time of discovery. Any bat fatalities or injuries will be reported to USFWS within 24 hours of discovery.

If the metal tag deterrents are found to be effective during the study, tags will be added to the entire length of the barbed wire fences at PMRF to avoid or minimize take of bats. If surveys of the barbed wire fencelines at PMRF indicate that take of Hawaiian hoary bats does occur on the installation, Navy will work with USFWS to formulate appropriate compensation for the level of take observed or estimated.

Additional bat population surveys will be conducted at PMRF for the Five-year INRMP Updates via SM2 Song Meter or similar detectors.

Hawaiian Goose

To decrease the potential attractiveness of the PMRF sites to Hawaiian geese in terms of food and nesting resources, PMRF environmental personnel have implemented multiple measures to educate installation personnel and visitors on the critical importance of not feeding Hawaiian geese on the base. To deter Hawaiian geese from all PMRF sites and to minimize additional nesting by geese at Barking Sands, the Navy has increased its communications work with base visitors and staff on the importance of not providing food or water to the birds. Additional signage was added at the Beach Cottages area and inside each cottage indicating the importance of not feeding the birds, and additional discussions have been held with HIANG personnel to ensure that geese are not fed or provided with water in that area of the base.

For all new construction at Barking Sands, including that for tenant or customer DoD commands or other federal agencies, concrete, asphalt, gravel, xeriscaping, or native vegetation, rather than lawn, will be installed in open areas surrounding buildings and parking areas to decrease attraction of Hawaiian geese to these areas.

To protect any Hawaiian goose nests initiated at Barking Sands, Wildlife Services will continue its current base-wide predator control work, including control of feral cats, barn owls, and other non-native predator species. If mongooses should become established on the island of Kauai, lethal control of this species will be carried out as part of the base-wide predator control operations. Funding for predator control work by USDA Wildlife Services at Barking Sands will continue to be included every year in annual funding requests for PMRF natural resource management. Beginning in FY15 and continuing annually, INRMP funding will also be requested to conduct predator control at Makaha Ridge.

The habitat at Barking Sands has been modified to decrease the attractiveness of sites to Hawaiian geese for foraging and nesting. Firstly, two holding ponds along the road adjacent to the south end of the airfield (created to contain drainage ditch floodwaters to keep the road from flooding) were filled, raising them to the elevation of the road and surrounding land. No standing water has occurred in the area after filling of the holding ponds. Secondly, watering of lawns at sites adjacent to the Barking Sands airfield has been ceased entirely, including at the HIANG complex, where Hawaiian goose nesting occurred in multiple years. Lastly, four native plant species that require no irrigation are being evaluated for replacing areas of grass on the base, particularly at and near the southern end of the airfield. Test plots of two of these species, beach morning glory (*Ipomoea pes-caprae*) and aki aki grass (*Sporobolus virginicus*), were planted at the ARDEL site in 2012. The number and species of birds present these sites are being monitored daily, relative to surrounding mowed grass areas, to assess effects on BASH risk if planted on the airfield.

Hawaiian geese at Barking Sands are found most frequently and in greatest numbers along Kinikini Ditch and on the southern end of the airfield. Plans are now being developed to conduct a pilot project to deter Hawaiian geese from the southern end of the airfield by physically blocking access from the Kinikini Ditch basin onto the airfield. This will be done via erection of a barrier within the ditch. Although the barrier will not preclude geese from flying directly onto the airfield, it will prevent geese from walking out of the ditch and onto the airfield which is the access route most often observed. Because geese have not been seen to either forage or attempt to nest on the airfield (i.e., the habitat does not appear to be attractive for these purposes), prevention of walking access at Kinikini Ditch may greatly decrease the number of geese on the airfield. Regular monitoring of geese on the airfield prior to and after construction of the barrier will be conducted to assess effectiveness of the barrier. This project was funded in FY13, and project planning has begun in FY14.

The Navy will continue to assess locations and types of habitat that appear to attract Hawaiian geese to specific areas of Barking Sands, based upon regular monitoring of nesting on the base. Additional habitat modifications will be assessed, and pilot projects will be carried out to determine the most effective methods of reducing Hawaiian goose BASH risk and hazing at the

PMRF airfield. The Navy will work with the Service to continue to identify potential habitat modifications and implement solutions. The Navy will draft a comprehensive Hawaiian Goose Management Plan that will enable the Navy to coordinate with the Service to clearly define conservation goals for Hawaiian geese at PMRF and describe the suite of habitat and population management actions that DON can take going forward to meet those goals.

Hawaiian Waterbirds

Lethal control of rats and barn owls will continue at Barking Sands. Trapping of feral cats and dogs for pickup by the Kauai Humane Society at Barking Sands has been funded as a component of PMRF's INRMP. If mongooses should become established on the island of Kauai, lethal control of this species will be carried out as part of base-wide predator control operations. Funding for predator control work by USDA Wildlife Services at Barking Sands will continue to be included every year in annual funding requests for PMRF natural resource management.

Signage has been placed along the road from north of Kinikini Ditch to the area south of the Kawaiele Wetlands and HIANG Complex indicating that vehicles should slow due to endangered waterbird crossings.

The Navy has received a Botulism Response Standard Operating Procedure (SOP) from the Service for use at PMRF in case of future botulism outbreaks on the island of Kauai.

Surveys of Hawaiian waterbird species will continue to be conducted at the Barking Sands oxidation pond. The pond has been surveyed regularly since March 2012, with an average of five surveys per month. Results indicate a mean of eight stilts and five coots per survey. One Hawaiian duck was observed on the pond between March and September, and no moorhens were observed using the oxidation pond. None of these species were observed nesting on the installation, including areas adjacent to the oxidation pond, but surveys will continue to determine whether any of these waterbirds species nest at the pond in the future.

Any nesting of Hawaiian waterbirds at PMRF will be reported to the USFWS Pacific Islands Fish and Wildlife Office within 24 hours of observation of the nest.

To compensate for hazing of Hawaiian ducks and Hawaiian stilts within PMRF's BASH Program, one or more of the following will be implemented: a) management of the sewage oxidation pond at Barking Sands for Hawaiian ducks and stilts; b) funding of the SOS Program on the island of Kauai for the conservation of waterbirds; c) funding of the predator control program at KPNWR to benefit nesting waterbirds.

STATUS OF THE SPECIES

Newell's Shearwater

Taxonomy and Species Description
The Newell's shearwater is a member of the genus *Puffinus* and utilizes open tropical seas and offshore waters for foraging, returning to land to breed atop forested mountain slopes. The Newell's shearwater is approximately 12 to 14 inches long, with a wingspan of 30 to 35 inches, and weighs approximately 14 ounces. Its plumage is glossy black above, and white below. It has a black bill that is sharply hooked at the tip. Its claws are well adapted for burrow excavation and climbing.

Historic and Current Distribution
Newell's shearwaters were once abundant on all of the main Hawaiian Islands. In 1995 the population estimate, based on at-sea surveys was 84,000 birds (Spear et al. 1995, p. 624), with approximately 90 percent of the population nesting on the island of Kauai. Newell's shearwaters also breed on several other Hawaiian islands, in mountainous terrain between 500-2,300 feet in elevation. This species is known to nest on the islands of Hawaii and Molokai, and may still nest on the island of Oahu. The occurrence on the island of Maui of injured, dead, or grounded adults in the summer, low numbers of radar-detected birds exhibiting Newell's shearwater-like timing of movements, and the presence of juveniles in autumn suggests that this species also nests on the island of Maui.

Recent ornithological radar surveys, combined with returns of downed birds to the Save Our Shearwaters (SOS) program, show an apparent decline of 75 percent in Newell's shearwater between 1993 and 2009 (Day et al. 2003a, Holmes et al. 2009), resulting in a current population estimate of 21,000, with 18,900 on the island of Kauai. Significant range reductions as well as an overall decline in distribution are documented, and at least three colonies documented as being active between 1980 and 1994 are now abandoned (Holmes et al. 2009). As with other long-lived species with low reproductive rates, population modeling has documented that the survival rate of breeding age adults has the biggest impact on the population (Griesemer and Holmes 2011).

Population models incorporating best estimates of Newell's shearwater breeding effort and success yielded a population decreasing at a rate of 3.2 percent annually (Ainley et al. 2001, p. 118). When threat factors resulting in Newell's shearwater mortality were included (predation, light attraction and collision), these models predicted a population decline of 30 to 60 percent over 10 years (Ainley et al. 2001, p. 122).

Life History
Most of the life history information for this species is based on studies of the Kauai population; life histories of birds on other Hawaiian islands may differ slightly. During their nine-month breeding season from April through November, Newell's shearwaters live colonially in burrows under ferns on forested mountain slopes. These burrows are used year after year and usually by the same pair of birds. A single egg is laid in late May or early June (Ainley et al. 1997a, pp. 13-15). Both sexes incubate and this period lasts approximately 45 days. Fledging occurs between

October and November. The Newell's shearwater needs an open downhill flight path to become airborne or combination of sustained wind and suitable topography.

Daily flights of breeding adults to and from the colonies occur only at night and just before dawn. On the island of Kauai, Newell's shearwaters were found to exhibit movement 20-80 minutes after sunset, whereupon they moved inland in a wave that peaked at 35-70 minutes after sunset (KESRP 2014). This peak of movement steadily decreased until 110 minutes after sunset, at which time few birds are seen. In the morning, Newell's shearwaters begin moving to sea approximately 100 minutes before the first measurable light and movement rates increase rapidly and peak an hour before sunrise (KESRP 2014).

Three age classes of Newell's shearwaters are recognized based on demographic factors and assumptions (from Ainley et al. 2001, p. 115): (1) young-of-year; (2) pre-breeding immature/adult (if recognizable); and (3) breeding adults. Only 46 percent of pairs that actively use a burrow actually breed in a given year on the island of Kauai (Ainley et al. 2001, p. 117). First breeding occurs at approximately six years of age (Ainley et al. 1997a, p. 17).

A study of reproductive success at one Newell's shearwater colony on the island of Kauai documented an average annual production of 0.66 young per pair (Ainley et al. 2001, p.117). No specific data exist on the longevity for this species, but other shearwaters may reach 30 years of age or more.

Habitat Description
On the island of Kauai, Newell's shearwaters breed at elevations between 528 and 3,960 feet. Newell's shearwaters usually nest where the terrain is vegetated by an open canopy of trees with an understory of densely matted uluhe ferns (*Dicranopteris linearis*). Some Newell's shearwaters nest in other types of habitat such as on the walls of Waimea Canyon, Kauai, where a forest canopy is absent. Burrows used by Newell's shearwaters are most commonly placed at the base of trees, where the substrate may be easier for the birds to excavate.

Threats, Recovery Strategy, and Ongoing Conservation Measures
The Newell's shearwater was listed as a threatened species in 1975 (USFWS 1983), pursuant to the Endangered Species Preservation Act of 1966. *The Hawaiian Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan* was published in 1983 (USFWS 1983). A species five-year review was completed September 27, 2011 pursuant to Section 4(c)(2) of the ESA. The review recommended up-listing the Newell's shearwater to endangered status due to precipitous decline in populations on the island of Kauai over the last two decades. Critical habitat has not been designated for the Newell's shearwater (USFWS 1983).

Threats to the Newell's shearwater and Hawaiian petrel have been steadily increasing. During the last 150 years, 75 percent of the forests in the main Hawaiian Islands were converted to agricultural, military, commercial or residential land uses, which led to a depletion of available nesting habitat for this species. The introductions of the mongoose (*Herpestes auropunctatus*), black rat (*Rattus rattus*), and Norway rat (*Rattus norvegicus*) have also played a primary role in the reduction of ground-nesting seabirds. Predation by feral cats (*Felis domesticus*) and barn

owls (*Tyto alba*) have also been observed. In addition, feral pigs (*Sus scrofa)* are known to collapse seabird burrows as well as consume or prey upon shearwater adults and young.

Another major threat is the species' attraction to light. Increasing urbanization and the accompanying artificial lights have resulted in substantial problems for fledgling Newell's shearwaters during their first flight to the ocean from their nesting grounds. When attracted to man-made lights, fledglings become confused and may suffer temporary night blindness. They often fly into utility wires, poles, trees, and buildings and fall to the ground, referred to as "fallout". Since 1979 the State's Division of Forestry and Wildlife (DOFAW) on the island of Kauai has supported the SOS program to collect "downed" Newell's shearwaters and Hawaiian petrels (i.e., birds that have either collided with structures or fallen out, or have been injured or killed due to exhaustion caused by light attraction). According to SOS files, over 33,000 seabirds were recovered to date (DOFAW 2008). The majority of the birds are Newell's shearwaters, which nest in greater numbers on the island of Kauai than Hawaiian petrels. The lower number of Hawaiian petrels recovered is thought to be a function of their population size on the island of Kauai, not due to differences in behavior or ability to detect structures in the dark.

The Draft Newell's Shearwater and Hawaiian Petrel Five-year Action Plan describes a recovery strategy that will 1) protect and enhance existing colonies, 2) create new colonies, 3) mitigate existing and new threats by a) implementing and monitoring prioritized management actions at the species level, and b) undertaking research and outreach to support these actions (Holmes et al. 2011). Actions identified to accomplish this strategy include conducting surveys for existing colonies, controlling threats at the highest priority colonies, and minimizing and monitoring man-made threats (e.g., light attraction and power line collisions).

DOFAW has been conducting auditory surveys for new areas containing nesting Newell's shearwaters through their KESRP research program and is developing colony ranking criteria to identify where the objectives of the five-year action plan can be implemented. The minimum conditions necessary to effectively implement colony management that would be expected to achieve a measureable increase in seabird survival and/or reproduction include species presence, access to the areas occupied by breeding seabirds, and landowner authorization and commitment to maintain the managed area in a manner that is consistent with seabird conservation. To date, management actions focused on increasing seabird survival and reproduction are being carried out at only two known nesting colonies occupied by Newell's shearwater (Hono o Na Pali Natural Area Reserve (NAR) and Upper Limahuli Valley Preserve). The State has developed a management plan for the Hono o Na Pali NAR that includes fencing and feral ungulate removal. A 400-acre portion of the privately-owned Upper Limahuli Preserve was fenced to create an ungulate free area for nesting Newell's shearwaters.

While some efforts to protect existing nesting colonies of Newell's shearwater have been implemented on the island of Kauai, they have been limited to constructing ungulate fencing around remaining areas of relatively intact habitat (e.g., Wainiha Valley, Upper Limahuli Valley, etc.). Habitat degradation due to feral ungulates is recognized as the primary threat to native ecosystems in Hawaii and the conservation and restoration of such areas is unsuccessful in the presence of ungulates (Hawaii Conservation Alliance 2005, p. 1). The only active control of cats

and/or rats within an area occupied by nesting Newell's shearwaters on the island of Kauai on private property in Upper Limahuli Valley and the State of Hawaii Hono o Na Pali NAR began in 2010 and 2012 respectively. Funding for seabird conservation work is provided in part through the Kauai Island Utility Cooperative (KIUC) Short-term Seabird Habitat Conservation Plan.

Efforts to reduce the level of light attraction and power line collisions began in the 1980's when KIUC began replacing unshielded street lights with full-cutoff (shielded) lights across the island as part of its normal maintenance program. All of the over 3,500 streetlights operated by KIUC are now shielded, as are the lights at the facilities it operates. In 2002 KIUC prepared an assessment of the power line segments originally identified by Ainley et al. (1995) as causing the most collisions (David and Day 2002). In 2007, KIUC began reconfiguring the lines along one of the "hotspot" areas near Kealia Beach by temporarily changing the uppermost electrical circuit from a vertical to a horizontal arrangement which eliminated three of four wire layers in the circuit and reduced the height by about 10 feet. KIUC has been coordinating with the Federal Highways Administration, Hawaii Department of Transportation, and Hawaii Department of Land and Natural Resources to identify and plan for the undergrounding of certain line segments that pose the most collision risk to seabirds.

DOFAW, in conjunction with the Service, is currently developing an island-wide HCP, known as the Kauai Seabird Habitat Conservation Program (KSHCP). This HCP will provide non-federal entities the opportunity to apply for incidental take of listed seabirds. KSHCP is developing a plan to assist landowners to avoid, minimize, and monitor take at their facilities. To offset take that cannot be avoided, applicants would combine funds to conduct landscape scale conservation actions to benefit listed seabirds. KSHCP is designed to accept multiple applicants in order to mitigate for the island-wide level of take; however given the number of entities believed to have on-going take and scope and scale of potential covered activities, some proportion of current seabird take on the island of Kauai is likely to continue unmitigated even after the completion of the KSHCP.

Hawaiian Petrel

Taxonomy and Species Description
The Hawaiian petrel is a medium-sized seabird in the Pterodromini clade (gadfly-petrels). The Hawaiian petrel is approximately 16 inches long and has a wing span of about three feet. It has a dark gray head, wings, and tail, and a white forehead and belly. The Hawaiian petrel has a stout grayish-black bill that is hooked at the tip, and feet that are pink and black. The Hawaiian petrel was formerly treated as a subspecies of *P. phaeopygia*, and was commonly known as the dark-rumped petrel (USFWS 1983, pp.1-2). The Hawaiian petrel was reclassified as a full species in 1993 because of differences in morphology and vocalization. In 1997 the evolutionary split was confirmed by genetic analyses.

Historic and Current Distribution
The Hawaiian petrel was once abundant on all of the main Hawaiian Islands, except Niihau. Today, Hawaiian petrels breed in high-elevation colonies: primarily on east Maui; Mauna Loa on

Hawaii; on Lanai; to a lesser extent on Kauai; and probably on Molokai, Lehua, and sea stacks off Kahoolawe.

Based on pelagic observations, the total population including juveniles and sub-adults was estimated at 20,000 with a breeding population of 4,500 to 5,000 pairs in 1995 (Spear et al. 1995, p. 629). There have been no total population estimates made since then. Approximately 1,430 breeding pairs are known to occur in the mountains of east Maui. Approximately 1,000 Hawaiian petrel burrows were found in Haleakala National Park, Maui (Bailey, pers. comm. 2011) and an additional 600 breeding pairs are thought to occupy unsurveyed areas of the Haleakala Crater Rim (SWCA 2011). In addition, approximately 55 breeding pairs occupy the Advanced Technology Solar Telescope (ATST) mitigation site (ATST 2010). The Auwahi Wind project biologists have detected an additional 33 active burrows at Kahikinui (Tetra Tech 2012). Ainley (SWCA 2011, Appendix 25, p. 2) estimated a declining Hawaiian petrel population of 600 breeding pairs nesting in the West Maui Mountains. The colony on Mauna Loa, Hawaii is estimated to be approximately 75 breeding pairs (Hu, pers. comm. 2008). Kauai populations are difficult to assess due to topography, and Day and Cooper (1995, p. iv) estimated there were between 1,400 and 7,000 individuals in 1993 on the island of Kauai. Ainley et al. (1997b, p. 28) estimated there were 1,600 breeding pairs of Hawaiian petrels on the island of Kauai. A breeding colony of the Hawaiian petrel was rediscovered on the island of Lanai in 2006, near the summit of Lanaihale. Although the petrel colony was historically known to occur, its status was unknown and thought to have dramatically declined until surveys were conducted in 2006 (Penniman, pers. comm. 2007). The nesting habitat used by the Hawaiian petrel colony on Lanai is delineated by the approximate area of the uluhe fern. Monitoring and research on this population is ongoing, and its size has not been estimated with statistical confidence, but the population appears to be similar in abundance to the Haleakala population, where the largest number of breeding birds is currently known to exist (Penniman, pers. comm. 2011).

Life History

Petrels nest on land and spend much of their time at sea where they are known to feed on squid, small fish, and crustaceans displaced to the surface by schools of tuna (Simons 1985). Hawaiian petrels have been tracked taking single trips exceeding 6,200 miles circumnavigating the north Pacific during the nestling stage. Hawaiian petrels have been recorded in the Gulf of Alaska. Annual survival rates for Hawaiian petrels range from 0.93, in years with no predation to an approximately 0.85 estimated survival under moderate predation at Haleakala (Simons 1984, p. 1070).

Like other procellariiformes, Hawaiian petrels are highly philopatric, returning to the same burrow and mate each year (Simons 1985, pp. 233-234). Beginning in mid-February to early-March, after a winter absence from Hawaii, breeding and non-breeding birds visit their nests regularly at night. From mid-March to mid-April, birds visit their burrows briefly at night on several occasions. In late April or early May, breeding birds return to lay and incubate their eggs (Simons 1985). Non-breeding birds visit the colony from February until late July (Simons and Hodges 1998, pp. 13-14). Information provided by Bailey and Duvall (December 9, 2010), confirmed by Fein's analysis of burrow camera data for the ATST site (Fein, pers. comm. 2009) indicates birds intermittently occupy their burrows during the day during this period as well.

Many non-breeders are young birds seeking mates and prospecting for nest sites, but some proportion is thought to be mature adults that will not breed.

The mean date of egg-laying recorded on Haleakala in 1980 and 1981 was May 8 (Simons 1985, p. 234). The percentage of years in which adult females laid eggs was estimated to be 89 percent (Simons 1985, p. 234). Fecundity (fledglings produced per egg laid) appears to be primarily dependent on rate of predation. Moderate predation is likely to depress fecundity to 0.49 (Simons 1985, p. 237), while no predation or predators present results in a much higher fecundity at 0.72 (Simons 1984, p. 1068). Hawaiian petrel nests are documented to also fail when abandoned by the breeding pair or when eggs are inadvertently crushed during incubation. Annual survival for juveniles at sea is 0.834 (Simons 1984, p. 1070).

Cooper and Day found that Hawaiian petrels flew inland to their nesting areas primarily between sunset and the point of complete darkness. In the morning hours, Hawaiian petrels first move to sea while it was completely dark, starting 60 minutes prior to sunrise, and movement rates increased rapidly until they peaked just after the point of complete darkness was crossed and movement continued at a decreasing rate until sunrise (Day and Cooper 1995, pp. 32-34). Peak fledging, when young seabirds make their first flight to sea, occurs between September 1 and December 1 (Penniman, 2011 pers. comm).

Habitat Description

On the islands of Hawaii and Maui, Hawaiian petrels nest in the cold, xeric environment above 8,000 feet. On the island of Kauai, there is evidence that Hawaiian petrels nest at lower elevations in densely vegetated rainy environments (Ainley et al. 1997b, p. 24). Hawaiian petrels are colonial and nest in burrows, crevices in lava, or under ferns. Burrows detected on Haleakala occur almost exclusively on lava substrates; burrows are located within existing crevasses or excavated in softer material adjacent to rock to boulder-sized lava fragments. Their burrows are generally 3 to 6 feet long (from entrance to nest chamber), although some may be as long as 30 feet (Simons and Hodges 1998, p. 14).

Threats, Recovery Strategies, and Ongoing Conservation Measures

The Hawaiian petrel was listed as endangered in 1967 (USFWS 1983), pursuant to the Endangered Species Preservation Act of 1966. The Hawaiian Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan was published in 1983 (USFWS 1983). A species Five-year review was completed September 30, 2011 pursuant to Section 4(c)(2) of the ESA. Critical habitat has not been designated for the Hawaiian petrel (USFWS 1983).

Hawaiian petrels were abundant and at one time, widely distributed. Their bones have been found in archaeological sites throughout the archipelago (Olson and James 1982a). This species has no natural terrestrial predators other than the Hawaiian short-eared owl, (*Asio flammeus sandwichensis*). Early Polynesian hunting, predation by introduced mammals such as Polynesian rats (*Rattus exulans*), dogs, and pigs, as well as habitat alteration caused initial decline of the Hawaiian petrel population and probably its extirpation from the island of Oahu (Olson and James 1982b, p. 634). The introduction of cats, mongoose, and two additional species of rats (*R. rattus* and *R. norvegiceus*) since Euro-American contact along with accelerating habitat loss has led to small relict colonies of Hawaiian petrels in high-elevation, remote locations. The primary

reason for the relatively large numbers of petrels and their successful breeding around Haleakala summit today is the fencing and intensive predator control maintained by Haleakala National Park since about 1982. If current elevated levels of cat predation continue, significant declines in the Park's relatively protected Hawaiian petrel population are likely (Bailey pers. comm., 2011). Elsewhere on the islands of Maui and in Hawaii, the Hawaiian petrel faces severe threats from non-native predators including rats, cats, mongoose, and introduced barn owls (*Tyto alba*). Ainley (SWCA 2011, Appendix 25, p. 2) modeled the declining population of 600 breeding pairs of Hawaiian petrels in the West Maui Mountains and found that predation impacts may render this relatively large population functionally extinct in 27 years (SWCA 2011, Appendix 24, p. 8). Other significant anthropogenic sources of Hawaiian petrel mortality are light attraction and collision with communication towers, power transmission lines and poles, fences, and other structures (Simons and Hodges 1998, pp. 21-22). Fallout of fledglings, making their first flight to the open ocean, is greatest during the week prior to and following the new moon between September 1 and December 1 (Penniman pers. comm. 2011). These problems are likely to be exacerbated by continuing development and urbanization throughout Hawaii. Predator control in key habitat areas, the establishment of bird salvage-aid stations, and light attraction studies have been initiated to help conserve the Hawaiian petrel.

The recovery goals for the Hawaiian petrel include: 1) protect and enhance existing colonies; 2) create new colonies; 3) mitigate new and existing threats by a) implementing prioritized management actions, and b) undertaking research and outreach to support these actions. Actions identified to accomplish these goals for Hawaiian petrel include conducting surveys for existing colonies, controlling threats at the highest priority colonies, and minimizing and monitoring terrestrial man-made threats (e.g., light attraction and power line collisions).

The KSHCP is being prepared to address adverse human impacts to seabirds on the island of Kauai. In addition, DOFAW's KESRP has been conducting auditory surveys for new areas containing nesting Hawaiian petrels and will use colony ranking criteria to identify areas where recovery actions can be most successful. The State has developed a management plan for the Hono o Na Pali NAR that includes fencing and feral ungulate removal. A 400-acre portion of the privately-owned Upper Limahuli Preserve has been fenced to create an ungulate free area known to contain nesting Hawaiian petrels. Efforts to control feral cats in the Preserve began in 2010; however the landowner does not have funds to sustain these efforts without continued funding obligated through habitat conservation plans or donations from private entities (Bogardus, pers. comm. 2011).

Several of these Hawaiian petrel nesting colonies are being protected from predators pursuant to the KIUC Short-term HCP. Efforts to conserve nesting colonies of Newell's shearwater also benefit Hawaiian petrel, but they have been primarily limited to constructing ungulate fencing around remaining areas of relatively intact habitat (Wainiha Valley, Upper Limahuli Valley, etc.). The only active control of cats and/or rats within an area occupied by nesting Hawaiian petrels on the island of Kauai on private land in Upper Limahuli Valley and in the State of Hawaii Hono o Na Pali NAR started in 2010 and 2012, respectively. The program at Upper Limahuli Valley has no secure funding source to continue the efforts beyond that which will be available through the KIUC Short-term HCP.

Conservation efforts to recover and release live downed seabirds through the SOS program also apply to Hawaiian petrels. Efforts underway to reduce the level of light attraction and power line collisions described for the Newell's shearwater also reduce threats to the Hawaiian petrel. The development of the KSHCP, described above, also pertain to Hawaiian petrels.

Band-rumped storm-petrel

Taxonomy and Species Description
The Band-rumped storm petrel is an intermediate in many respects between Wilson's and Leach's storm-petrels, and is blackish-brown overall with pale wing bars and a clear, curved white band across rump. The tail is slightly forked but this feature is difficult to discern at sea. The Band-rumped storm petrel is approximately 7.5 to 9 inches in length with a 1.5-foot wingspan.

Historic and Current Distribution
The band-rumped storm-petrel is found in several areas of the subtropical Pacific and Atlantic Oceans. In the Pacific, there are three widely separated breeding populations—one in Japan, one in Hawaii, and one in the Galapagos. Populations in Japan and the Galapagos are comparatively large and number in the thousands, while the Hawaiian birds represent a small, remnant population of possibly only a few hundred breeding pairs (Harrison et al. 1990). Band-rumped storm- petrels are most commonly found in close proximity to their respective breeding habitat on islands. The three populations in the Pacific are separated by long distances across the open ocean where birds are not found. Extensive at-sea surveys of the Pacific have revealed a broad gap in distribution of the band-rumped storm- petrel to the east and west of the Hawaiian Islands, indicating that the distribution of birds in the central Pacific around Hawaii is separated from other nesting areas. The available information indicates that distinct populations of band-rumped storm-petrels are definable and that the Hawaiian population is distinct based on geographic and distributional isolation from other band-rumped storm-petrel populations in Japan, the Galapagos, and the Atlantic Ocean. Loss of the Hawaiian population would cause a significant gap in the distribution of the band-rumped storm-petrel in the Pacific, and could result in the complete isolation of the Galapagos and Japan populations without even occasional genetic exchange. Therefore, the Hawaiian population is both discrete and significant, and constitutes a distinct population segment of the larger band-rumped storm-petrel species.

Life History and Habitat Description
The Band-rumped storm petrel is a small seabird and both sexes are alike in size and appearance. The species is long-lived (15-20 years) and probably does not breed until its third year (Ainley 1984). When not at nesting sites, adult band-rumped storm-petrels spend their time foraging on the open ocean (Crossin 1974; Ainley 1984). In the Hawaiian Islands, this species has been found to nest in remote cliff locations on the island of Kauai and Lehua Islet and in barren lava fields above 7,000 feet in elevation on the island of Hawaii (Banko et al. 1991; Wood et al. 2002; VanderWerf et al. 2007; Hu 2005, pers. comm.). Vocalizations of the species were heard in Haleakala Crater on Maui as recently as 2006; however, no nesting sites have been located on the island to date.

Threats, Recovery Strategies, and Ongoing Conservation Measures
The Hawaiian population of Band-rumped storm-petrel was identified as a candidate for listing in 1989 (USFWS 1989). The most recent candidate notice of review for the Hawaiian population of Band-rumped storm-petrel was completed on November 22, 2013 in accordance with Section 4(c)(2) of the ESA.

The significant reduction in numbers and range of the band-rumped storm-petrel is due primarily to predation by nonnative species introduced by humans, including the domestic cat (*Felis catus*), small Indian mongoose (*Herpestes auropunctatus*), common barn owl (*Tyto alba*), black rat (*Rattus rattus*), Polynesian rat (*R. exulans*), and Norway rat (*R.norvegicus*). These non-native predators occur throughout the main Hawaiian Islands, with the exception of the mongoose, which is not established on the island of Kauai. Attraction of fledglings to artificial lights, which disrupt their night-time navigation, resulting in collisions with buildings and other objects, and collisions with artificial structures such as communication towers and utility lines, are also threats. Erosion of nest sites caused by the actions of nonnative ungulates is a potential threat in some locations. Efforts are under way in some areas to reduce light pollution and mitigate the threat of collisions, as well as to control some of the nonnative predators in the Hawaiian Islands; however, the threats remain.

Hawaiian Hoary Bat

Taxonomy and Species Description
The Hawaiian hoary bat is medium-sized (0.5 to 0.8 ounces), with a wingspan of 10.5 to 13.5 inches, and is nocturnal, insectivorous with thick, rounded ears and a furry tail. "Hoary" refers to the white-tinged, frosty appearance of the bat's grayish brown or reddish brown fur. Although females are slightly larger than males, forearm lengths are similar in both genders. These bats are not colonial, and roost solitarily in tree foliage (USFWS 1998, pp. 8-10).

The Hawaiian hoary bat is classified under the Family Vespertilionidae of the Suborder Microchiroptera, and is one of three recognized hoary bat subspecies. The other two subspecies are *Lasiurus cinereus cinereus,* one of the most common and widespread bats in North America, and *Lasiurus cinereus vilosissimus*, which occurs in South America and the Galapagos (Shump and Shump 1982, pp. 1-5). Morphologically, the Hawaiian hoary bat may have diverged significantly from the North American form, as Hawaiian hoary bats are about 45 percent smaller. Climatic conditions necessary to support colonization of Hawaii by hoary bats from North America may have occurred historically (Bonaccorso and McGuire 2013). Also, preliminary genetic analysis indicates the Hawaiian hoary bat may be derived from the North American hoary bat. The low degree of genetic divergence, however, suggests subspecies classification may be appropriate (USFWS 1998, pp. 8-9).

Historic and Current Distribution
The Hawaiian hoary bat is endemic to the State of Hawaii where it is the only existing, native terrestrial mammal. The Hawaiian hoary bat is known to reside on the islands of Hawaii, Maui, Oahu, Lanai, Molokai and Kauai, with the largest populations likely on Hawaii and Kauai. There are no population estimates for the Hawaiian hoary bat and few historical or current records. Unsubstantiated population estimates across the State have ranged from hundreds to a

few thousand individuals (USFWS 1998, p. 14). Data are limited because no feasible method currently exists for surveying the abundance and distribution of solitary, tree-roosting bats. The Hawaiian hoary bat's distribution may be broader than indicated by the current limited information resulting from localized search efforts (USFWS 1998, p. 14).

Hawaiian hoary bats have been observed year-round in a wide variety of habitats and elevations below 7,500 feet, and a few sightings from limited surveys have been reported as high as 13,199 feet. Hawaiian hoary bats have been detected in both wet and dry areas of the island of Hawaii but seem to be more abundant on the drier leeward side (Jacobs 1994, p. 199) and generally less abundant in wet areas (Kepler and Scott 1990, p. 62). Three researchers examined spatial and temporal variation in occurrence patterns of bats in Hawaii, with conflicting conclusions about possible altitudinal or regional migration (Jacobs 1994, pp. 193-200; Menard 2001, pp. 1-149; Tomich 1986, pp. 1-30). However, recent vocalization data recorded over a period of five years (2007-2011) in 25 sample areas across the island of Hawaii indicate that bats concentrate in coastal lowland areas during the breeding season and migrate to highlands in the winter non-breeding season (Gorresen et al. 2013).

Life History and Habitat Description

A comprehensive life history assessment for the Hawaiian hoary bat is lacking. Furthermore, the existing information on population status and habitat ecology is often conflicting. Hawaiian hoary bats roost in a variety of tree species, both native and non-native, during the day and forage in a wide range of habitat types during the night (USFWS 1998, pp. 12-13). There is no information on the Hawaiian hoary bat's average life span, age at first reproduction, and survivorship, or on how age and reproductive condition affect its food habits, habitat selection, home range size, and movement patterns.

A few studies have documented Hawaiian hoary bats in a wide range of locations and habitat types on the island of Hawaii. Bats observed along 611 miles of forest bird survey transects and incidentally elsewhere on Hawaii during 1976-1983, at elevations from sea level to 10,007 feet, were more frequently associated with non-native vegetation (64 percent), such as tall eucalyptus and other exotic plants, than with native vegetation (19 percent) (Kepler and Scott 1990, p. 61). Visual observations and echolocation detections at 22 sites in southeast Hawaii, however, found no significant differences in bat activity among native or non-native vegetation types (Reynolds *et al.* 1998, pp. 153-157). In addition, 57 percent of all bat activity was noted at open sites, forest edges, lava flows, volcanic pit craters, residential and agricultural clearings, and roads. Foraging bats at 14 survey sites over a range of altitudes were more frequently associated with native vegetation (44 percent) than non-native (16 percent) or mixed (9 percent) vegetation (Jacobs 1993, p. 22). Bats were detected most often in native mesic koa-ohia forest vegetation at 13 sites in, and adjacent to, Hakalau Forest National Wildlife Refuge (Cabrera 1996, p. 238). A significant associate between occupancy and mature forest cover has been observed across the island of Hawaii (Gorresen et al. 2013). All reports of bat occurrences may be biased to varying degrees by sampling efforts concentrated along roads and forest edges.

Roosting habitat for the Hawaiian hoary bat is sparsely documented. However, Dr. Frank Bonaccorso's current research project utilizing radio-tracking with more than 30 Hawaiian hoary bats, revealed that all the bats roosted in trees and all roosted more than 20 feet off the ground

(Bonaccorso 2009, pers. comm.). North American hoary bats roost 10 to 16 feet above the ground, mostly in hardwood trees (Shump and Shump 1982, p. 3). Hawaiian hoary bats have been observed in a wide variety of trees, including native species (*Metrosideros polymorpha*; *Pandanus tectorius*; *Styphelia tameiameiae*), Polynesian-introduced species (*Aleurites moluccana*), and post-contact introduced species (*Syzygium cumini*) (USFWS 1998, p. 13). Bats also have been occasionally observed in fern clumps, low scrub, rock crevices, macadamia nut orchards, and buildings (Tomich 1986, pp. 11-24).

Hawaiian hoary bats forage in a variety of open and vegetated habitats, including open fields, lava flows, open-ocean in bays near shore, and streams and ponds. Hawaiian hoary bats on Hawaii forage in both relatively closed habitats near vegetation (such as clearings in lowland mesic ohia forest or town parks) as well as in open habitats and forest edges (Jacobs 1993; Tomich 1974, pp. 10–13). Foraging generally occurs three to 492 feet above the ground or open water, three to 50 feet above the ground in closed forest habitats, and up to 100 feet and more above tree canopy (USFWS1998, p. 10).

As with other life history parameters, little is known about the breeding biology of Hawaiian hoary bats. Females of most temperate, autumn-breeding, insectivorous bat species become pregnant in the spring by delayed ovulation and fertilization, and young are cared for exclusively by the female. The breeding cycle of the Hawaiian hoary bat on the island of Hawaii consists of pregnancy (April to June), with pups born in May or June; lactation (June through early August and possibly to September); post-lactation, after pups have fledged (September to December); and pre-pregnancy (January to March) (Menard 2001, p. 35). Like North American hoary bats, Hawaiian hoary bat females are believed to give birth to two young at a time. North American hoary bat pups cling to the mother at the roost tree during the day, where she leaves them hanging on a twig while she forages at night (Shump and Shump 1982, p. 3), and Hawaiian hoary bats are presumed to behave similarly. Female North American hoary bats adjust their foraging behavior to meet the increasing energy demands of pregnancy and lactation (Barclay 1989, pp. 31-37). Because newborn bats cannot thermoregulate very well in tree-foliage roosts, the mother's foraging activity may be constrained by the need to roost periodically with her young to keep them warm. Thus, foraging behavior changes with reproductive condition, and females with non-volant young may forage at different times of night and perhaps in different habitats than other bats. Preliminary evidence indicates that pregnant and lactating female Hawaiian hoary bats on Hawaii may prefer roosting in lowland areas rather than in the cooler highlands, perhaps because the warmer lowland environment promotes faster juvenile growth (or, alternatively, because insect food sources may be more readily available) (Menard 2001, pp.52-105).

Threats, Recovery Strategy, and Ongoing Conservation Measures

The Hawaiian hoary bat was listed as endangered species in 1970 (USFWS 1970), pursuant to the Endangered Species Preservation Act of 1966. The recovery plan for the Hawaiian hoary bat was published in 1998 (USFWS 1998). A species five-year review has been conducted on in 2011 pursuant to Section 4(c)(2). Critical habitat has not been designated for the Hawaiian hoary bat.

The major threats to the Hawaiian hoary bat are assumed to be the same as those that threaten many bat species in general (Harvey *et al.* 1999, p. 13; USFWS 1998, p. 15). Bats have the slowest reproductive rate and the longest life-span of all mammals of their size (Barclay and Harder 2003, pp. 209-256). Thus, any mortality of breeding-age adults, particularly females, constrains the recovery of the subspecies. The main factor limiting recovery is thought to be habitat loss, primarily the availability of roosting sites as suitable roosting habitat is particularly important to pregnant and lactating females and non-volant young (USFWS 1998, p. 15). Other possible threats identified in the recovery plan may include: roost disturbance, predation by native hawks and non-native feral cats, pesticide use (either directly or by impacting prey species), and alteration of prey availability due to introduction of non-native insects. In addition, occasional instances of Hawaiian hoary bat mortality due to collisions with vehicles and structures have been documented (Kepler and Scott 1990, p. 60; Menard 2001, p.136; Tomich 1986, pp. 11-30). Clearing of vegetation in areas where there are non-volant bat pups may result in the injury or death of those young. Hoary bats also may be impaled on barbed wire in the continental United States (Anderson 2002; Wisely 1978, p. 53) and in Hawaii (Burgett 2009, pers. comm.; Jeffrey 2007, pers. comm.; Marshall 2008, pers. comm.).

The overall recovery strategy for the Hawaiian hoary bat is to rely on research that can provide information on the subspecies' abundance and distribution, life history, and habitat associations. The primary recovery goal should be to conduct research essential to the conservation of the Hawaiian hoary bat. Research should focus on developing standardized survey and monitoring protocols for determining abundance and distribution, roosting habitat associations, basic life history biology, and food habits. Other recovery goals are to protect and manage current populations by identifying and managing threats, including protection of key roosting and foraging areas; conduct a public education program; evaluate progress towards recovery; and revise recovery criteria as necessary (USFWS 1998, pp. 18-20).

The Service, Hawaii Department of Land of Land and Natural Resources – Division of Forestry and Wildlife (DOFAW), and Bat Conservation International (BCI, a nonprofit conservation and education organization) are stakeholders in a public-private Hawaiian Hoary Bat Research Cooperative (Cooperative) which collaboratively prioritizes and funds management-oriented research on the Hawaiian hoary bat's abundance, distribution, and habitat requirements. Major stakeholders include private landowners, agricultural and commercial forestry interests, environmental groups, local governments, and Federal and State agencies. Most of the Cooperative's current funding is provided by the Service's Cooperative Endangered Species Conservation Fund (Section 6 of the Endangered Species Act) grants to the State. The Cooperative awarded funding to the U.S. Geological Survey – Biological Resources Division for telemetry research in years 2004 to 2007, to complete baseline surveys to document Hawaiian hoary bat movements on the island of Hawaii. The Cooperative secured other funding to continue this research through 2009. The Service is also working with several private landowners in the state to develop Habitat Conservation Plans for the Hawaiian hoary bat. All may provide conservation benefits to the population as a whole as well as provide essential information regarding policy and management decisions.

Hawaiian Goose

Taxonomy and Species Description
The Hawaiian goose is a medium-sized goose, with an overall length of approximately 25-27 inches. The plumage of both sexes is similar (USFWS 2004, p.4). This species is adapted to a terrestrial and largely non-migratory lifestyle in the Hawaiian Islands with limited freshwater habitat (USFWS 2004, p.iii). Adaptations to a terrestrial lifestyle include increased hindlimb size, decreased forelimb size, and reduced webbing between the toes compared to other species of *Branta* (Miller 1937, Olson and James 1991). Compared to the related Canada goose (*Branta canadensis*), Hawaiian goose wings are reduced by about 16 percent in size and their flight is weak (USFWS 2004, p.21). Hawaiian geese are capable of inter-island and high altitude flight; however, they do not migrate from the archipelago (Banko et al. 1999, p.9).

Historic and Current Distribution
It is speculated that Hawaiian geese were once widely distributed among the main Hawaiian Islands; however, subfossil evidence has not been found on Oahu or Niihau (USFWS 2004, p.6). The fossil record indicates the prehistoric (prior to 1778) range of Hawaiian geese was much greater than was observed after colonization by Europeans (Banko et al. 1999). However, it is difficult to estimate Hawaiian goose population numbers, either pre-Polynesian or pre-European contact because there is a limited understanding of species composition, or even the gross structure, of the vegetation prior to the arrival of the Polynesians (USFWS 2004, p.7). By 1952, approximately 30 Hawaiian geese remained on Hawaii Island (Smith 1952). The release of captive-bred Hawaiian geese, which began in 1960, helped save the species from imminent extinction (USFWS 2004, p.2-3). As a result of such programs, wild populations of Hawaiian geese now occur on four of the main Hawaiian Islands. As of 2012, the statewide population of wild Hawaiian geese was estimated to have reached 2,457-2,547 individuals; the wild populations on the islands of Hawaii, Maui, Molokai and Kauai were estimated to have 543, 416, 77, and 1,421-1,511 individuals, respectively (NRAG unpublished data).

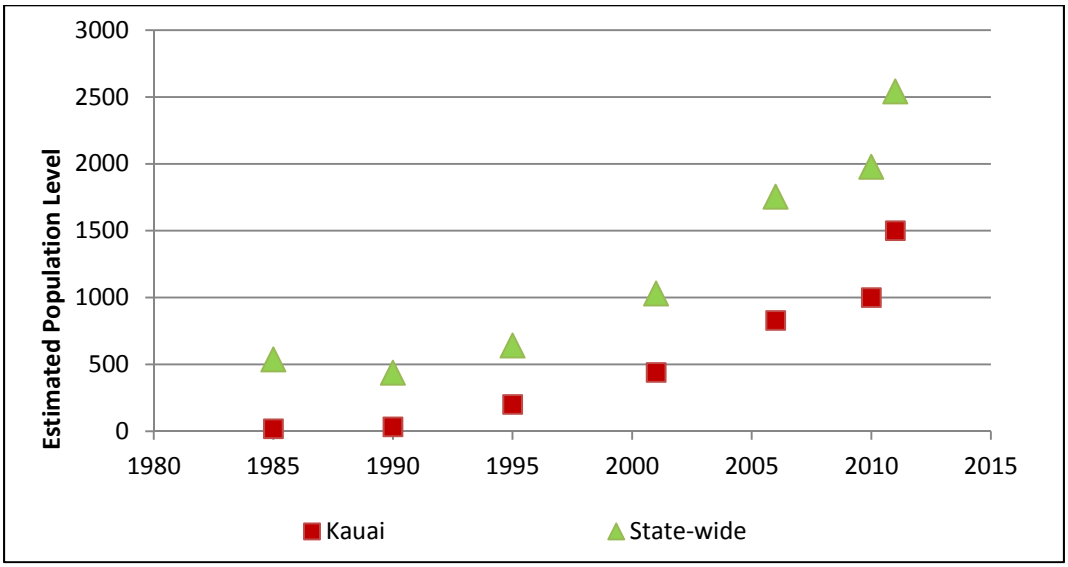

Figure 6. Hawaiian goose population estimated state-wide and on the island of Kauai from 1995 to 2011 (Data provided by NRAG 2011).

Hawaiian geese use shrublands and grasslands and human-altered habitats ranging from coastal to alpine environments (Banko 1988, Banko et al. 1999). On the islands of Hawaii and Maui, Hawaiian geese nest, raise their young, forage, and molt in grassy shrublands and sparsely vegetated lava flows. Some populations on these islands move seasonally from montane foraging grounds to lowland or mid-elevation nesting areas. On the island of Kauai, Hawaiian geese are primarily found utilizing lowland habitats such as coastal wetlands at Hanalei National Wildlife Refuge (NWR), with the exception of the Na Pali Coast (USFWS 2004, pp.15-19) and areas near and in the Makaha Ridge Tracking Station (Marshall, pers. comm. 2012).

In April 2011, Hawaii Governor Neil Abercrombie issued an emergency proclamation (referred to as the "Governor's Proclamation"), that suspended State endangered species and environmental compliance laws for Hawaiian geese at the Kauai Lagoons Resort. The purpose was to allow the Hawaii Department of Land and Natural Resources – Division of Forestry and Wildlife (DOFAW) to act quickly in translocating the Hawaiian goose population at Kauai Lagoons to sites on other islands to reduce the potential for aircraft collisions at the adjacent Lihue Airport. The translocation effort is being conducted under a regulation (50 C.F.R.§17.21(c)(3)(iv)) that allows State employees to take listed species if that species constitutes a "demonstrable but non-immediate threat to human safety." The Governor's Proclamation is effective for five years (beginning in April 2011 and ending in April 2016), during which time DOFAW plans to translocate all Hawaiian geese at Kauai Lagoons, which is estimated to be more than 400 individuals constituting approximately 40 percent of Hawaiian geese on the island of Kauai. This translocation effort will dramatically change the density and distribution of Hawaiian geese on all of the Hawaiian Islands. Although details of how many geese will be sent to each site are still unknown, it is anticipated that more than half will be translocated to the island of Hawaii, approximately 50 to Maui, and the remaining population to Molokai. Further details of the translocation effort can be found in the Hawaiian Goose Translocation Plan developed by DOFAW (DOFAW 2012).

Life History

Hawaiian geese have an extended breeding season with eggs reported from all months except May, June and July, although the majority of birds in the wild nest between October and March (Banko et al. 1999, p.4). Nesting peaks in December and most goslings hatch from December to January (Banko et al. 1999). On the island of Kauai, Hawaiian geese frequently nest earlier (Marshall, pers. comm. 2012). Hawaiian geese nest on the ground, in a shallow scrape in the dense shade of a shrub or other vegetation. A clutch typically contains three to five eggs, and incubation lasts for 29 to 31 days. Once hatched, the young remain in the nest for one to two days (Banko et al. 1999, pp. 16-17). Fledging of captive birds occurs at 10 to 12 weeks, but may be later in the wild. During molt, adults are flightless for a period of four to six weeks, generally attaining their flight feathers at about the same time as their offspring. When flightless, goslings and adults are extremely vulnerable to predators such as cats, dogs, and mongoose. From June to September, family groups join others in post-breeding flocks, often far from nesting areas. Hawaiian geese reach sexual maturity at 1 year of age, but usually do not form pair bonds until the second year. Females tend to nest near their natal nesting area, while males more often disperse (Banko et al. 1999).

Habitat Description
The current distribution of wild Hawaiian geese has been highly influenced by the location of release sites for captive-bred birds (Banko et al. 1999). Hawaiian geese are known to occupy various habitat and vegetation community types ranging from coastal dune vegetation and non-native grasslands (such as golf courses, pastures and rural areas) to sparsely vegetated low- and high-elevation lava flows, mid-elevation native and non-native shrubland, cinder deserts, native alpine grasslands and shrublands, and open and non-native alpine shrubland-woodland community interfaces (Banko et al. 1999, pp.4-6). On the island of Kauai, Hawaiian geese also utilize a number of coastal wetland areas including taro loi (Marshall, pers. comm. 2012). Hawaiian geese are browsing-grazers; the composition of their diet depends largely on the vegetative composition of their surrounding habitats and they appear to be opportunistic in their choice of food plant as long as they meet nutritional demands (Banko et al. 1999, pp.6-8; Woog and Black 2001, p. 324). Hawaiian geese may exhibit seasonal movements to grasslands in periods of low berry production and wet conditions that produce grass with a high water content and resulting higher protein content. The sites used by Hawaiian geese for nesting range from coastal lowland to subalpine zones and demonstrate considerable variability in physiognomic features (Banko et al. 1999, pp.4-5). However, the distribution of Hawaiian goose nesting sites has been influenced by the location of release sites of captive-bred individuals (Banko 1988). Historical reports from the island of Hawaii indicate that Hawaiian geese bred and molted primarily in the lowlands during winter months and moved upslope in the hotter and drier summer months (Henshaw 1902, Munro 1944, Banko 1988). Reproductive success is relatively low in upland habitats on the islands of Hawaii and Maui and higher in lowland habitat on Kauai (Banko et al. 1999, Telfer 1995, 1996).

Threats, Recovery Strategy, and Ongoing Conservation Measures
Approximately 30 Hawaiian geese remained in the wild in 1952 (USFWS 2004, p.2). The Hawaiian goose was named Hawaii's State bird on May 7, 1957 (USFWS 2004, p.46) and captive-breeding efforts began in the 1960s (USFWS 2004, p.2). The Hawaiian goose was federally listed as endangered in 1967 (USFWS 2004, p.3). The Service has not designated critical habitat for the Hawaiian goose (USFWS 2004, p.3). The Hawaiian goose is also listed as endangered by the State of Hawaii (USFWS 2004, p.iii). Although the number of wild Hawaiian geese has substantially increased since 1952, the Hawaiian goose remains one of the most endangered geese in the world (USFWS 2004, p.3).

The current threats to Hawaiian goose recovery are: 1) predation by introduced mammals (especially mongooses, cats, rats, dogs and feral pigs); 2) insufficient nutritional resources due to habitat degradation; 3) limited availability of suitable habitat due to habitat loss, fragmentation and degradation, especially low-land habitat; and 4) human-caused disturbance (including habituation to humans) and mortality (especially death due to vehicle collisions). Additional factors that may be affecting Hawaiian goose recovery but require further research include: 1) behavioral problems associated with small population sizes, captive-bred birds and loss of genetic diversity; and (2) avian disease and parasites (USFWS 2004, p.27-28; Marshall, pers. comm. 2012). It is believed that Hawaiian geese are doing well on the island of Kauai due to greater availability of lowland habitat as well as the lack of an established mongoose population (Banko et al. 1999, USFWS 2004). However, the recent capture of two mongooses on the island of Kauai, one of which is believed to be a juvenile, is a great concern as the mongoose is the

most serious Hawaiian goose egg predator (Banko 1988, Black and Banko 1994, Baker and Baker 1995). The establishment of a mongoose population on the island of Kauai would have future implications in the recovery of Hawaiian geese.

The Service published a Draft Revised Recovery Plan for the species in 2004 and initiated a Five-year Review in 2009. The overall goal of the Service's "Draft Revised Recovery Plan for the Nene or Hawaiian Goose *(Branta sandvicensis)*" is to remove the Hawaiian goose from the Federal list of endangered and threatened wildlife and plants (delisting). The plan establishes a framework within which recovery actions are undertaken to ensure the long-term survival of the Hawaiian goose and to control or reduce the threats to the species to the extent that it is no longer in danger of extinction and warrants delisting. The interim goal is to accomplish increases in population sizes and geographic distribution of Hawaiian geese concomitant with control of threats sufficient to consider reclassification or downlisting of this endangered species to threatened status. To reach the recovery goal, there must be multiple self-sustaining Hawaiian goose populations on the islands of Hawaii, Maui Nui (Maui, Molokai, Lanai, & Kahoolawe) and Kauai, for at least 15 years. Additionally, the threats to the species must be reduced to allow for the long-term viability of these populations, and sufficient suitable habitat must be identified, protected and managed in perpetuity on each of these islands such that the species no longer meets the definition of endangered or threatened under the ESA (USFWS 2004, p.49-50).

With the exception of the island of Kauai, most wild populations of Hawaiian geese are not self-sustaining (Marshall, pers. comm. 2012). The Service defines "self-sustaining" as maintaining or increasing established population levels without additional releases of captive-bred Hawaiian geese, although habitat manipulation, such as predator control or pasture management, may need to be continued. Consideration for delisting can occur once all of the downlisting criteria have been met, and all population levels have shown a stable or increasing trend (from downlisting levels) for a minimum of 15 additional years (i.e., at least 30 years) (USFWS 2004, p.vi). Captive releases have been an important part of the Hawaiian goose recovery strategy and a major factor in saving the Hawaiian goose from extinction and reestablishing it throughout Hawaii (USFWS 2011). However, DOFAW and the Service recently discontinued captive propagation of Hawaiian geese in 2011. Birds from the island of Kauai may be used for future translocation efforts to bolster existing populations and increase state-wide distribution, but because Kauai birds have the lowest genetic diversity of all captive and wild population (Rave 1995), this practice could increase genetic problems (USFWS 2011). In order for Hawaiian goose populations to survive, they must have relatively predator-free breeding areas and sufficient food resources; human-caused disturbance and mortality must be minimized and genetic and behavioral diversity maximized. At the same time, Hawaiian geese are highly adaptable, successfully utilizing a gradient of habitats, ranging from highly altered to completely natural, which bodes well for the recovery of the species (USFWS 2004, pp. iv-vi).

Hawaiian Moorhen

Taxonomy and Species Description
The Hawaiian moorhen is an endemic subspecies of the common moorhen (*Gallinula chloropus*). It is a dark gray bird with a black head and neck, and white feathers on their flanks and on their undertail coverts. They have a distinctive red frontal shield, and their bill tip is

yellow with a red base. Their legs and feet are greenish and without lobes. The Hawaiian moorhen usually measures about 13 inches in length and 11 to 16 ounces in mass, with males typically larger and heavier than the female (Bannor and Kiviat 2002, online p. 2). Both sexes are similar and have chicken-like cackles and croaks. The Hawaiian moorhen is similar to the moorhen on the mainland in appearance. In Hawaiian legend, these birds were thought to have brought fire from the gods to the Hawaiian people.

Historic and Current Distribution

No historical population estimates are available for the endemic Hawaiian moorhen, prior to the first biannual waterbird count by DOFAW in 1977. Because they are such secretive birds, it is difficult to conduct population surveys for this species. It is believed that they were common on the main Hawaiian Islands, except Lanai and Kahoolawe, in the 1800s but radically declined by the mid-1900s. Surveys from the 1950s through the 1960s estimated only 57 individuals (Engilis and Pratt 1993). Currently, Hawaiian moorhen inhabit the islands of Kauai and Oahu (USFWS 2011, p. 37). The State attempted a reintroduction of six Hawaiian moorhen (three females and three males) on May 18, 1983, to the island of Molokai at Kakahaia NWR. At least two birds were present in January 1984, but there have been no confirmed sightings since 1985 (USFWS 2011, p. 40).

Hawaiian moorhen generally occur in wetland habitats below 410 feet in elevation on the islands of Kauai and Oahu, although there have been reports from Keanae Peninsula on Maui and from the island of Hawaii. On the island of Kauai, the largest populations occur in the Hanalei and Wailua river valleys, Waiakalua Reservoir, and Wilcox Ponds (USFWS 2011, p. 40). Hawaiian moorhen also occur in the irrigation canals on the Mana Plain of western Kauai and in taro fields. On the island of Oahu, the species is widely distributed with most birds found between Haleiwa and Waimanalo; small numbers occur at Pearl Harbor and the leeward coast at Lualualei Valley.

Biannual waterbird counts indicate the statewide population of Hawaiian moorhen is stable with an average of 287 birds over 10 years (1998 to 2007), but count numbers are extremely variable between summer and winter surveys (USFWS 2011). While these surveys numbers provide a rough idea of population trends, the counts are thought to be underestimates because of the species' cryptic behavior, and an accurate population estimate is not available. Standard survey methods in these counts include visual and aural detection. Recent research conducted by DesRochers et al. (2008) in 2005 through 2007 has shown that passive surveys of cryptic waterbirds underestimate numbers of individuals present in the wetlands. Alternatively, broadcasting vocalizations of cryptic waterbirds to elicit responses increases detection. On average his research has shown that broadcasting calls increased Hawaiian moorhen detection by 30 percent on the island of Oahu and 56 percent on the island of Kauai.

Life History

Hawaiian moorhen nest year-round but most activity occurs from March through August (USFWS 2011, p. 34). It is believed that the nesting phenology is related to water levels and late succession wetland vegetation. The Hawaiian moorhen usually lays an average of five to six eggs with the incubation period ranging from 19 to 22 days (USFWS 2011, p. 43). Re-nesting and multiple broods during one season have been observed (Byrd and Zeillemaker 1981). Platform nests are constructed in dense vegetation over water or near the waters' edge. The

particular species of emergent plant used for nest construction is not as important as stem density and vegetation height (USFWS 2011, p. 43). Hawaiian moorhen are a precocial species; chicks are covered with down and are able to walk, but are dependent on parents for several weeks. The lifespan of this species is unknown; however, a common moorhen was recaptured after 10.5 years (USFWS 2011).

Habitat Description
Hawaiian moorhen are the most secretive of the native waterbirds, preferring to forage, nest and rest in dense late succession wetland vegetation. Most birds feeding along the waters edge or in open water will quickly seek cover when disturbed. The preferred habitat for Hawaiian moorhen are lowland freshwater habitats; declines have been observed in ponds where freshwater was converted to saltwater (Engilis and Pratt 1993). Key habitat features include interspersed dense stands of robust late succession vegetation near open water, floating or barely emergent mats of vegetation, and water depth less than three feet (USFWS 2011, pp. 45). Hawaiian moorhen are opportunistic feeders and their diet likely varies with habitat, but includes algae, grass seeds, insects, snails, introduced fishes, crustaceans, mollusks, emergent grasses, and wetland plants (USFWS 2011, p. 44).

Threats, Recovery Strategy, and Ongoing Conservation Measures
The Hawaiian moorhen was listed as an endangered species in 1967 (USFWS 1970), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released on May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4(c)(2) of the Act which requires five-year review after listing. Critical habitat has not been designated for the Hawaiian moorhen (USFWS 2011).

General Threats and Conservation Needs for all Endangered Hawaiian Waterbirds
Threats and conservation needs are addressed as a combined assessment for all four species of Hawaiian waterbirds: the Hawaiian moorhen, Hawaiian coot, Hawaiian duck, and Hawaiian stilt. We are evaluating the threats and conservation needs on these four species of Hawaiian waterbirds jointly because they share common issues.

The primary causes of the decline of the Hawaiian waterbirds are the loss of wetland habitat, predation by introduced animals, over-hunting in the late 1800s and early 1900s, disease, and environmental contaminants. A significant amount of Hawaii's wetlands have been lost due to human activities, including filing and draining for agriculture, houses, hotels, and golf courses. The Service estimates that 22,475 acres of wetlands existed within the coastal plains of Hawaii in the 1780s. In 1990, the Service estimated that only 15,474 acres remained; a loss of 31 percent (USFWS 2011). The majority of the wetlands that remain are degraded by altered hydrology, invasive species, human encroachment, and contaminants.

In addition to wetland loss, invasion by non-native habitat-modifying plants results in alteration of wetland plant communities and degradation of wetlands. Species such as California grass (*Urochloa mutica*), water hyacinth (*Eichornia crassipes*), Indiane fleabane (*Pluchea indica*) and red mangrove (*Rhizophora mangle*) present a serious threat by outcompeting more desirable species and eliminating open water habitats. Unmanaged vegetation significantly reduces open

water, shallow water, bare ground, and exposed mudflat habitat. All of these habitats are under serious threat without management to control these aggressive plant species (USFWS 2011).

Introduced predators are considered a primary factor limiting Hawaiian waterbird populations. Small Indian mongoose, feral cats, and feral dogs are all presently found within wetlands and pose a serious threat to Hawaiian waterbird reproductive success. All three of these predatory Species are known to take eggs, young birds, and even adults (USFWS 2011). Both cats and dogs are of particular concern because of the close proximity of many of Hawaii's wetlands to urban areas. Other species, such as the cattle egret (*Bubulcus ibis*), American bullfrog (*Rana catesbeiana*), and rats have been observed congregating around nesting waterbirds just prior to chicks hatching (Woodside 1997, pers. comm.). Oahu National Wildlife Refuge Complex (NWRC) staff have documented predation of waterbird chicks by the cattle egret and the black-crowned night heron (*Nycticorax nycticorax*). A bullfrog was documented preying upon a Hawaiian moorhen chick at the Refuge (Viernes 1995, 55:37). More recently, the "Key Predators" study of 2003 to 2004 on James Campbell NWR provided the first multiple observations of Hawaiian stilt chick predation by bullfrogs, which accounted for 45 percent of chick losses over the study period (Eijzenga 2005).

The most prevalent disease affecting Hawaiian waterbirds is avian botulism type C. Avian botulism is caused by a neurotoxin produced by a common bacterium (*Clostridium botulinum*). Normally unharmful and dormant, these spores release toxins only when certain conditions occur, including warm temperatures, high pH, low dissolved oxygen, and stagnant waters. Birds usually acquire the disease by eating invertebrates containing the toxin. Typical signs in birds include weakness, lethargy, and inability to hold up the head or to fly (Rocke and Friend 1999). Botulism can occur in any area with standing fresh or brackish water frequented by waterbirds.

Avian botulism outbreaks are common in Hawaii and are a significant cause of waterbird mortality (Pratt and Brisbin 2002, p. 36). One of the first outbreaks in Hawaii occurred on the island of Oahu at Kaelepulu pond, which is also known as Enchanted Lake, in Kailua in 1952. Since then, avian botulism outbreaks have been documented at Hanalei NWR on the island of Kauai, Aimakapa pond at Kaloko Honokohau National Historical Park on the island of Hawaii, Ohiapilo pond in Molokai, and at Kealia Pond NWR on the island of Maui (Pratt and Brisbin 2002, p. 36). At Hanalei NWR, over 300 sick or dead birds with suspected or confirmed avian botulism type C were found between December 2011 and April 2012. Of these, 82 percent were endangered species (55 percent Hawaiian duck, 19 percent Hawaiian coot, 4 percent Hawaiian moorhen, 4 percent Hawaiian stilt, and less than 1 percent Hawaiian goose) and 18 percent were native non-endangered, migratory, or feral/introduced birds. In February 2012 at the Lanai Sewage Treatment Plant, over 60 deaths were reported during an outbreak, mostly Hawaiian coot (USFWS unpublished data).

The possibility of West Nile virus or avian influenza reaching the Hawaiian Islands from the U.S. continent or Asia is a recent concern. The impact these two diseases may have on the Hawaiian waterbirds is not known at this time, but they could have deleterious impacts if they reach the Hawaiian Islands.

Environmental contaminants in wetlands are of concern to Hawaiian waterbirds because the general diet of these birds makes them susceptible to toxins accumulated in the food chain (Ratner 2000, p. 1-2). In 1988, a fuel spill in Pearl Harbor caused direct mortality and nest abandonment of Hawaiian waterbirds at the Honouliuli Unit of Pearl Harbor NWR (J. Leinecke 1993, pers. comm.). In 1996, an oil spill in Pearl Harbor imperiled the Hawaiian stilt as well as marine fisheries. Urban encroachment has the potential to negatively affect waterbirds' habitats via flushing of household and industrial products into water-collecting systems (storm drains and roadside ditches) which lead to streams, wetlands, and the ocean.

Preventing wetland loss, managing existing wetland habitat, and predator control at primary nesting sites are necessary actions to increase Hawaiian waterbird populations. As described in the Recovery Plan for Hawaiian Waterbirds, recovery of the Hawaiian waterbirds focuses on the following objectives: (1) increasing population numbers to a statewide baseline level; (2) establishing multiple, viable breeding populations throughout each species' historical range; and (3) establishing a network of wetlands on the main islands that are protected and managed for waterbirds (USFWS 2011).

Protection of a wetland implies that the wetland is secure from development. Management of a site implies adequate dedicated funding to implement science-based techniques to meet the life history requirements of endangered Hawaiian waterbirds. This includes a written management plan; adequate staffing, personnel with expertise in wetlands habitat management, secure water sources; managed water levels; control of invasive vegetation and fish; control of introduced predators; waterbird population monitoring; removal of mallard-Hawaiian duck hybrids; minimized human disturbance; and monitoring and control of avian diseases and environmental contaminants (USFWS 2011).

The recovery strategy for the Hawaiian waterbirds relies on a combination of protection and management of core and supporting wetlands to maintain self-sustaining breeding populations. Core wetlands are defined as areas that provide habitat essential for the larger populations of Hawaiian waterbirds that comprise the bulk of the numbers prescribed for recovery. It is crucial for wetlands in these sites to be secure from conversion to non-wetland condition and to have sufficient enduring management to recover Hawaii's waterbirds. Supporting wetlands are additional areas that may not support the bulk of waterbird populations but provide habitat important for smaller waterbird populations or that provide habitat needed seasonally by segments of the waterbird populations during part of their life cycle (USFWS 2011). In addition to the overall strategy for Hawaiian waterbirds, recovery of the Hawaiian moorhen also includes reestablishing populations on at least two additional islands (Maui, Molokai, Lanai, or Hawaii) (USFWS 2005, p. 74).

A variety of conservation measures have been implemented to protect Hawaii's endangered waterbirds. Efforts directly benefitting the Hawaiian waterbirds include a long-term hunting ban, protection of habitat through establishment and management of federal and State refuges and sanctuaries, and predator control. Conservation partnerships with private landowners protect and preserve core and supporting wetlands. Actions that inform conservation of the species include a biannual waterbird survey conducted by DOFAW since the mid-1950s, population monitoring, and research (USFWS 2011).

Hawaiian Coot

Taxonomy and Species Description
The Hawaiian coot was considered a subspecies of the American coot (*Fulica americana*), but is now considered a distinct species (USFWS 2011, p. 19). Adults have a black head, a slate gray body with white undertail feathers, and a prominent white frontal shield and bill; feet are lobed rather than webbed and are greenish-gray. No reliable measurements of total length or size are available; however, the Hawaiian coot is slightly smaller in body size than the American coot which averages 13 to 17 inches in total length and 15 to 30 ounces in mass (Pratt and Brisbin 2002, p. 34).

Historic and Current Distribution
The Hawaiian coot historically occurred on all of the main Hawaiian Islands except Lanai and Kahoolawe. Coots have typically been most numerous on the islands of Oahu, Maui, and Kauai (USFWS 2011, p. 19). Population estimates prior to the 1950s are not available; however, estimates from the late 1950s and early 1960s indicated a population of fewer than 1,000 birds. Hawaiian coots currently occur in coastal plain wetlands usually below 1,320 feet (400 meters) elevation on all the main Hawaiian Islands except for Kahoolawe; however, breeding is restricted to relatively few sites. Biannual waterbird counts conducted by DOFAW suggest that the statewide Hawaiian coot population averages approximately 2,000 birds with short-term population fluctuations and long-term slightly increasing population trend (USFWS 2011, p. 21-22). While not all wetlands are surveyed, the counts are considered a fairly accurate minimum population size. About 80 percent of the population detected in the surveys occur on the islands of Kauai (Hanalei, Huleia, Opaekaa), Oahu (coastal wetlands and reservoirs such as Lake Wilson and Nuuanu Reservoir, Kahuku Point and along the windward shore), and Maui (Kanaha and Kealia Ponds, Nuu Pond) (USFWS 2011). The remaining 20 percent of the population occurs in coastal ponds and playa wetlands, including breeding populations on the islands of Hawaii, Lanai, and Molokai.

Life History
Life history and breeding biology are poorly documented. Nesting habitat includes freshwater and brackish ponds, irrigation ditches, and taro fields. Floating nests are constructed of aquatic vegetation and found in open water or anchored to emergent vegetation. Open water nests are usually composed of mats of bulrush (*Schoenoplectus* spp.), water hyssop (*Bacopa monniere*) and Hilo grass (*Paspalum conjugatum*). Nests in emergent vegetation are typically platforms constructed from buoyant stems of species such as bulrush (*Schoenoplectus* spp.). Nesting occurs primarily from March through September, although some nesting occurs in all months of the year. The timing of nesting appears to correspond with seasonal weather conditions (USFWS 2011). Nest initiation is tied to rainfall as appropriate water levels are critical to nest success. Clutch size range from three to ten eggs, and precocial young hatch after a 25-day incubation period. There is no information on the lifespan and survivorship of this species; however, banding records indicate oldest American coot was at least 22 years old (USFWS 2011).

Habitat Description
The species is somewhat gregarious and uses freshwater and brackish wetlands, including agricultural areas (*e.g.*, taro fields) and aquaculture ponds. Hawaiian coot generally occur in lowland (below 1,320 feet in elevation) wetland habitats with suitable emergent plant growth interspersed with open water, especially freshwater wetlands, but also freshwater reservoirs, cane field reservoirs, sewage treatment ponds, taro loi, brackish wetlands, and limited use of saltwater habitats. However, on the island of Kauai, some birds occur in plunge pools above 4,900 feet in elevation and on the island of Hawaii, stock ponds up to 6,600 feet in elevation. The species typically forages in water less than 12 inches deep, but will dive in water up to 48 inches deep. Compared to Hawaiian moorhens, Hawaiian coots prefer to forage in more open water. Logs, rafts of vegetation, narrow dikes, mud bars, and artificial island are utilized for resting. Ephemeral wetlands support large numbers during non-breeding season.

Hawaiian coots are generalists and feed on land, grazing on grass adjacent to wetlands, or in the water. They have been observed grazing from the surface of the water, or foraging by diving to obtain food resources. Food items include seeds and leaves, snails, crustaceans, insects, tadpoles, and small fish. The species will travel long distances, including between islands, when local food sources are depleted.

Some important habitats are located in National Wildlife Refuges and State sanctuaries and these sites receive management attention. However, other important habitats are not protected. These mostly include wetlands facing development or those used for agriculture or aquaculture. Examples include: playa lakes on the island of Niihau; Opaekaa marsh and Lumahai wetlands on the island of Kauai; Kahuku prawn farms, Laie wetlands, Ukoa, Punahoolapa, and Waihee marshes, Haleiwa and Waialua lotus fields, and Waipio wetlands on the island of Oahu; Paialoa and Ooia playa fishponds on the island of Molokai; and Opaeula, and Loko Waka ponds on the island of Hawaii (USFWS 2011, pp. 62-75).

Threats, Recovery Strategy, and Ongoing Conservation Measures
The Hawaiian coot was listed as an endangered species on October 13, 1970 (USFWS 1970), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released on May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4(c)(2) of the ESA which requires five-year review after listing. Critical habitat has not been designated for the Hawaiian coot (USFWS 2011).

The threats to, and conservation needs of, Hawaiian waterbirds outlined above in the “Status of the Species” section for the Hawaiian moorhen apply to the Hawaiian coot.

A variety of conservation measures have been implemented to protect Hawaii’s endangered waterbirds. Efforts directly benefitting the Hawaiian coot include a long-term hunting ban, protection of habitat through establishment and management of Federal and State refuges and sanctuaries, and predator control. Actions that inform conservation of the species include a biannual waterbird survey conducted by DOFAW since the mid-1950s, population monitoring, and research.

Hawaiian Duck

Taxonomy and Species Description
The Hawaiian duck is one of two extant endemic duck species (Family: Anatidae) found in Hawaii from at least 13 species of endemic Hawaiian waterfowl known from the fossil record, including extinct giant flightless ducks (Olson and James 1991, Burney et al. 2001), descendants of migratory ducks that evolved here in the islands over hundreds of thousands to millions of years and became unique Hawaiian species (Rhymer 2001). The Hawaiian duck is closely related to but genetically and morphologically distinct from the mallard (*A. platyrhynchos*) (Fowler et al. 2008). Both sexes of the Hawaiian duck are mottled brown and may resemble a small female mallard.

Adult males have darker heads, with distinctive brown chevrons on the breast, flank and back feathers, and olive-colored bills (Engilis et al. 2002). Adult females are similar but are smaller than males on average and slightly lighter in color, with plainer, buff colored chin and back feathers.

Historic and Current Distribution
In the early 1900s, Hawaiian ducks were common in the coastal marshes of all the main Hawaiian Islands except for Lanai and Kahoolawe (Munro 1944). By the mid-1900s, the species had been reduced to 500 birds on the island of Kauai and a few isolated pairs on other islands (Schwartz and Schwartz 1953). In the mid-1950s, the State of Hawaii began a captive propagation and release program for the Hawaiian duck. From 1958-1990, 757 captive-bred Hawaiian ducks were released on the islands of Oahu (326), Maui (12), and Hawaii (419) to re-establish the species within its former range (Giffin 1983). The Hawaiian duck release program was complicated by the problem of interbreeding with feral mallards (ornamental or farm ducks that escaped or were released into the wild). Recent genetic sampling indicates the Kauai population to be predominantly true Hawaiian ducks, and Oahu and Maui populations to be predominantly mallards and mallard-Hawaiian duck hybrids, elevating the importance of Kauai in persistence of the species (Fowler et al. 2009).

Although the Hawaiian duck population is estimated to be about 2,200 individuals, with 2,000 true Hawaiian duck on the islands of Kauai and Niihau and 200 on parts of the island of Hawaii; this was based on State biannual count data which do not include remote wetlands and streams (Engilis et al. 2002, p. 11) where an estimated 50-80 percent of Hawaiian duck are believed to reside on the island of Kauai (Schwartz and Schwartz 1953, Swedberg 1967). State biannual counts may provide an index for wetlands, and long-term trends suggest Hawaiian duck are increasing on the island of Kauai but decreasing on other islands due to hybridization with feral mallards (USFWS 2011).

However, count data have peaked at 524 for the all-island survey and 459 for Kauai in January 2004 (DOFAW unpublished data 1986-2006), and recent banding activities over a 13 month period at the Hanalei NWR have resulted in 675 Hawaiian ducks banded, and resighting activities indicate that >75 percent of birds on the Refuge are not currently banded (C. Malachowski unpublished data). Together, these data indicate the State count data is biased seriously low. Furthermore, counts on Oahu, Maui, and Hawaii Island are confounded by the

difficulty in distinguishing Hawaiian ducks from mallards and hybrids in the field. There is currently no credible population estimate for Hawaiian ducks at any scale.

Life History
The Hawaiian duck is one of the least studied of the Hawaiian birds. Its breeding ecology is largely unknown. Although some pairs nest in lowland habitats on the island of Kauai, Hawaiian ducks have also been observed nesting along stream banks and in the upper Alakai swamp (USFWS 2011). Nesting occurs year round, but most activity occurs between March-July on Hawaii Island (Giffin 1983) and December-May on the island of Kauai (Swedberg 1967). The Hawaiian duck usually nest on the ground in herbaceous and/or woody vegetation in wetland-associated uplands. Generally six to ten eggs are laid, precocial ducklings hatch after 26-30 days of incubation, and ducklings attain flight after 65-70 days of protection and rearing usually by the lone female (Swedberg 1967, Giffin 1983).

Habitat Description
Hawaiian ducks are found from sea level to 9,900 feet elevation. The Hawaiian duck occurs in a wide variety of natural and artificial wetland habitats including freshwater marshes, flooded grasslands, montane stock ponds, streams, forest swamplands, taro loi, lotus (*Nelumbo nucifera*) farms, irrigation ditches, reservoirs, and mouths of larger streams (USFWS 2011). Since 2006-2007, significant wetland habitat improvements have been made for Hawaiian ducks at Hanalei and Huleia NWRs on the island of Kauai with the intent of providing optimal foraging, loafing, and breeding habitat. Watershed protection and management is beneficial to the Hawaiian duck because of the species' elevational range and use of wetland habitats from the coastal plain to mountain top.

Hawaiian ducks move between feeding and breeding habitats, and are known to fly between the islands of Kauai and Niihau. The species typically forages in water less than six inches deep. Hawaiian ducks are opportunistic and their diet includes snails, aquatic insects, earthworms, grass seeds, green algae, and seeds and leaves of wetland plants. The Hawaiian duckling diet has never been studied. However, mallard ducklings eat mainly animal foods for the first 25 days of life (aquatic insects especially chironomids, small crustaceans, and mollusks) spending 65-80 percent of daylight feeding. After 20-30 days, seeds become more prominent in the mallard duckling diet (Drilling et al. 2002). Hawaiian ducks are usually found alone or in pairs and are wary, especially when nesting or molting, although during the winter they may gather in larger numbers to exploit abundant food resources (USFWS 2011).

Threats, Recovery Strategies, and Ongoing Conservation Measures
The Hawaiian duck was listed as an endangered species in 1967 (USFWS 1970), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978 and revised in 1985. The first draft of the second revision was released on May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to section 4(c)(2) of the ESA which requires five-year review after listing (USFWS 2011). Critical habitat has not been designated for the Hawaiian duck (USFWS 2011).

The threats to, and conservation needs of, Hawaiian waterbirds outlined above in the "Status of the Species" section for the Hawaiian moorhen apply to the Hawaiian duck.

However, the greatest current threat to the Hawaiian duck is hybridization with non-native mallards introduced to Hawaii for farming, sport hunting, and pond beautification (USFWS 2011, Uyehara et al. 2007). This is especially problematic on the islands of Oahu and Maui where most of the individuals are mallard-Hawaiian duck hybrids. In addition to the overall conservation needs outlined below, recovery of the Hawaiian duck includes removing the threat of hybridization with feral mallards on the islands of Kauai, Niihau, Oahu, and Hawaii; and reestablishing Hawaiian duck populations on the islands of Maui and Molokai (USFWS 2011). It is likely that feral pigs and goats (*Capra hircus*) significantly reduce the suitability of nesting habitat for Hawaiian ducks along montane streams.

A variety of conservation measures have been implemented to protect Hawaii's endangered waterbirds. Efforts directly benefitting the Hawaiian duck include a long-term hunting ban, protection of habitat through establishment and management of federal and State refuges and sanctuaries, predator control, release of captive-bred Hawaiian ducks, and restrictions on importation of mallards. Additional conservation actions include public service announcements and an outreach and communications plan to raise public awareness about the hybridization issue facing the Hawaiian duck. Actions that inform conservation of the species includes population monitoring, refinement of a field key to distinguish Hawaiian ducks from mallard-Hawaiian duck hybrids (Fowler et al. 2009), and research on movements and habitat use (USFWS 2011).

Hawaiian Stilt

Taxonomy and Species Description
The Hawaiian stilt is part of a superspecies complex of stilts (Family: Himantopus), and is considered a distinct subspecies of the black-necked stilt (*Himantopus mexicanus*) (USFWS 2011, p. 45). Hawaiian stilts are slender wading birds, black above (except for the forehead), white below, and with distinctive long, pink legs. Sexes are distinguished by the color of the back feathers (brownish female, black male) as well as by voice, which is lower in females. Downy chicks are well camouflaged, tan with black speckling. Immature birds have a brownish back and white patches on their cheeks (Hawaii Audubon Society 2005, p. 49). The total length of adult Hawaiian stilt is about 16 inches with the mass of males and females averaging 199 ± 13.8 grams (n=42) and 206.2 ± 21.7 g (n=43), respectively (Robinson et al. 1999, p. 16).

Historic and Current Distribution
Hawaiian stilt were historically known from all of the major Hawaiian Islands, except Lanai and Kahoolawe (USFWS 2011, p. 46). Hawaiian stilt are now found on all of the main Hawaiian Islands except Kahoolawe. No historical estimate of Hawaiian stilt population size is available, but by the early 1940s, the statewide population was estimated to be between 200 and 1,000 birds (USFWS 2011, p. 46). However, these population estimates did not account for the Hawaiian stilt present on Niihau and are therefore considered underestimates. DOFAW has conducted biannual waterbird surveys since the 1950s. Though Hawaiian stilt census data show high year-to-year variability in the number of stilts observed (USFWS 2011, p. 47), long-term census data indicate that statewide populations have been relatively stable or slightly increasing. Currently, this trend has continued and the statewide Hawaiian stilt population is considered to be stable to increasing with an average of approximately 1,500 birds over the 10 year period of

1998 to 2007 (USFWS 2011, p. 47). Because Hawaiian stilts readily disperse between islands they are considered a homogenous meta-population (USFWS 2011, p. 50).

Life History
Hawaiian stilts prefer to nest on freshly exposed mudflats interspersed with low growing vegetation (USFWS 2011, p. 57). Nesting has also been documented on low relief islands (natural and man-made) in fresh or brackish ponds, man-made floating nest structures, floating wooden platforms, and cleared level areas near foraging habitats. The nest itself is a simple scrape on the ground. They have also been observed using grass stems and rocks for nesting material (Coleman 1981). Hawaiian stilts are territorial with average inter-nest distances varying from 53 to 262 feet and are semi-colonial (USFWS 2011, p. 57).

The nesting season normally extends from mid-February through August (Robinson et al. 1999). Peak nesting varies among years and re-nesting can occur after loss of a clutch (Robinson et al. 1999). Hawaiian stilt usually lay three to four eggs that are incubated for approximately 24 days (Coleman 1981; Chang 1990). Chicks are precocial, leaving the nest within 24 hours of hatching. Adults with three-day old chicks have been observed to move 0.3 of a mile from the nest site (Reed and Oring 1993). Young may remain with both parents for several months after hatching (Coleman 1981). Little is known about the lifespan or survivorship of the species, however, several banded wild Hawaiian stilts survived 15 to 17 years (USFWS 2011, p. 59).

Habitat Description
Hawaiian stilts use a variety of aquatic habitats but are limited by water depth and vegetation cover. Hawaiian stilts are known to use ephemeral lakes, anchaline ponds, prawn farm ponds, marshlands and tidal flats. Foraging habitat for Hawaiian stilt is early successional marshland or other aquatic habitat with a water depth less than 9 inches and perennial vegetation that is limited and low-growing. Native low-growing wetland plants associated with stilt nesting areas include water hyssop (*Bacopa monnieri*), sea purslane (*Sesuvium portulacastrum*), and the sedges makaloa (*Cyperus laevigatus*) and kaluha (*Bolboschoenus maritimus*). They use taro (*Colocasia esculenta*) ponds in the early stages of planting and do not frequent closed canopy taro patches (USFWS 2011, p. 59).

Hawaiian stilt are opportunistic feeders. They eat a wide variety of invertebrates and other aquatic organisms available in shallow water and mudflats. Specific organisms taken include water boatmen (Corixidae), beetles (Coleoptera), possibly brine fly (*Ephydra riparia*) larvae, polychaete worms, small crabs, Mozambique tilapia (*Tilapia mossambica*), western mosquito fish (*Gambusia affinis*), and tadpoles (*Bufo* spp.) (USFWS 2011, p. 59). Ephemeral ponds provide an immediate and short term food supply with the emergence of invertebrates (USFWS 2011, p. 60).

Threats, Recovery Strategy, and Ongoing Conservation Measures
The Hawaiian stilt was listed as an endangered species on October 13, 1970 (USFWS 1970), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released on May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4(c)(2) of the ESA which requires a five-year

review after listing. Critical habitat has not been designated for the Hawaiian stilt (USFWS 2011).

The threats to, and conservation needs of, Hawaiian waterbirds outlined above in the "Status of the Species" section for the Hawaiian moorhen apply to the Hawaiian stilt.

A variety of conservation measures have been implemented to protect Hawaii's endangered waterbirds. Efforts directly benefitting the Hawaiian stilt include a long-term hunting ban, protection of habitat through establishment and management of Federal and State refuges and sanctuaries, and predator control. Actions that inform conservation of the species include a biannual waterbird survey conducted by DOFAW since the mid-1950s, population monitoring, and research.

ENVIRONMENTAL BASELINE

The environmental baseline describes the status of the species and factors affecting the environment of the species or critical habitat in the proposed action area during the consultation process. The baseline usually includes State, local, and private actions that affect a species at the time the consultation begins. Unrelated Federal actions that have already undergone formal or informal consultation are also a part of the environmental baseline. Federal actions within the action area that may benefit listed species or critical habitat are also included in the environmental baseline. The environmental baseline describes the species' health at a specified point in time, and it does not include the effects of the action under review in this consultation.

The action area of a project is defined by regulation as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). As indicated in the Project Description, the action area for this project includes the facilities, sites, and all related infrastructure at Barking Sands, the Mana Plain (specifically, the area of the plain surrounding Barking Sands), Makaha Ridge, Kokee, Kamokala Ridge, Port Allen, and Miolii Ridge. In addition, the action area includes seabird conservation site(s) along the Na Pali Coast.

Newell's Shearwater, Hawaiian Petrel, and Band-rumped Storm petrel

An estimated 90 percent of the Newell's shearwater population is thought to nest on the island of Kauai (18,900 individuals). Adult Newell's shearwaters do not nest at PMRF sites, but do use the area to transit between their ocean foraging areas and their high elevation, montane nesting sites. While the PMRF sites at Makaha Ridge and Kokee occur at elevations similar to that of nesting colonies, the species do not breed at these sites (Department of the Navy 2014, KESRP unpublished data). Fledgling Newell's shearwaters also fly through the PMRF sites on their first trip to the sea. As described above, fledgling Newell's shearwaters are attracted to brightly lit areas and become disoriented by them.

At Barking Sands, over the recent seven year period of 2007 to 2013, a total of 34 Newell's shearwaters were recovered (SOS Database, Department of the Navy 2014). Six of the downed

Newell's shearwaters resulted in mortality. The other 25 birds were captured and subsequently turned in to the SOS program (SOS Database). A total of five Newell's shearwaters and one band-rumped storm petrel were downed at Barking Sands from 2011 to 2013, the period following exterior lighting modifications such as realignment, replacement with full cut-off fixtures, and operational changes (SOS Database, Department of the Navy 2014). In regards to observations of seabird fallout at locations other than Barking Sands, only one Newell's shearwater was recovered near PMRF facilities at Port Allen; however, the bird was recovered on the State-operated side of the pier near a light. There have been no observations of seabird disorientation or fallout at Makaha Ridge, Kokee, and Kamokala sites where there are lower wattage lamps and daily presence of Navy personnel.

Spear et al. (1995) estimated from at-sea densities that the world population of Hawaiian petrels was 19,000 with at least 1,600 pairs nesting on the island of Kauai (Ainley et al. 1997a, p. 28). Adult Hawaiian petrels do not nest at PMRF sites, and their use of the Barking Sands area is likely less than that of Newell's shearwaters because most Hawaiian petrels are thought to nest in the northwest region of the island of Kauai. A small number of fledgling Hawaiian petrels might also fly through the area on their first trip to the sea. Prior to 2000, 11 Hawaiian petrels were recovered at Barking Sands, but none have been discovered since that time (SOS Database). Hawaiian petrels constitute less than 0.9 percent of birds recovered by the SOS program since 1979 and those recovered on PMRF comprise three percent of the total number of Hawaiian petrels recovered by SOS to date (SOS Database). Since 2007, no Hawaiian petrel fallout has been observed at Barking Sands.

Evidence of extant nesting populations of band-rumped storm-petrels in the Hawaiian Islands is based on auditory detection of adult birds during breeding season surveys and by retrieval of fledglings in the fall. Fledglings have been retrieved on the island of Kauai, providing additional evidence of nesting colonies within the Hawaiian archipelago (Harrison *et al*. 1990). Kauai likely has the largest population of band-rumped storm-petrels in the Hawaiian Islands (Harrison *et al*. 1990). Wood *et al*. (2002) estimated there were 171-221 nesting pairs on the island of Kauai. As with the Newell's shearwater and Hawaiian petrel, the band-rumped storm-petrel is susceptible to light attraction and collision with objects such as guyed towers and antennas. Since 2007 two band-rumped storm petrels were recovered and subsequently turned in to the SOS program; one in 2008 and one in 2011 (Department of the Navy 2014).

Surveys using ornithological radar have not been conducted specifically at PMRF, but surveys were conducted in 2008 at Kekaha (approximately five miles south of PMRF Main Base) and detected an average of 21.2 seabird targets per hour (KESRP 2008). Species cannot be identified using this technique, so the proportion of each of the three species observed in the vicinity of PMRF is unknown.

As stated above, predation by nonnative predators such as feral cats, barn owls, and rats has been regularly observed, even in the most remote areas of the island of Kauai, including the Na Pali Coast. Recent population models have estimated that Newell's shearwaters in this region could be declining at a rate of at least 9.4% per year (Griesemer and Holmes 2011), and similar rates of decline have been estimated for Hawaiian petrels breeding in colonies absent of predator control (Griesemer 2013, Simons 1984).

Honopu Valley and Makaha Ridge are located in an area of the Na Pali coast with high traffic rates of listed seabirds. The proposed seabird conservation site at Honopu Valley holds large concentrations of nesting Newell's shearwater and band-rumped storm petrels (Figure 5). The colony is recognized by KESRP as a high priority endangered seabird colony (Banfield et al. 2013), and the site could represent an important refuge for these species in the future. Makaha Ridge occurs nearby Nualolo Aina and Nualolo Kai seabird colonies, where barn owls have been observed targeting Newell's shearwater and band-rumped storm petrels (Wood et al. 2002, Banfield et al. 2013). It is likely that barn owls are also impacting Hawaiian petrels in this area of the Na Pali Coast, since Hawaiian petrels regularly transit over these sites.

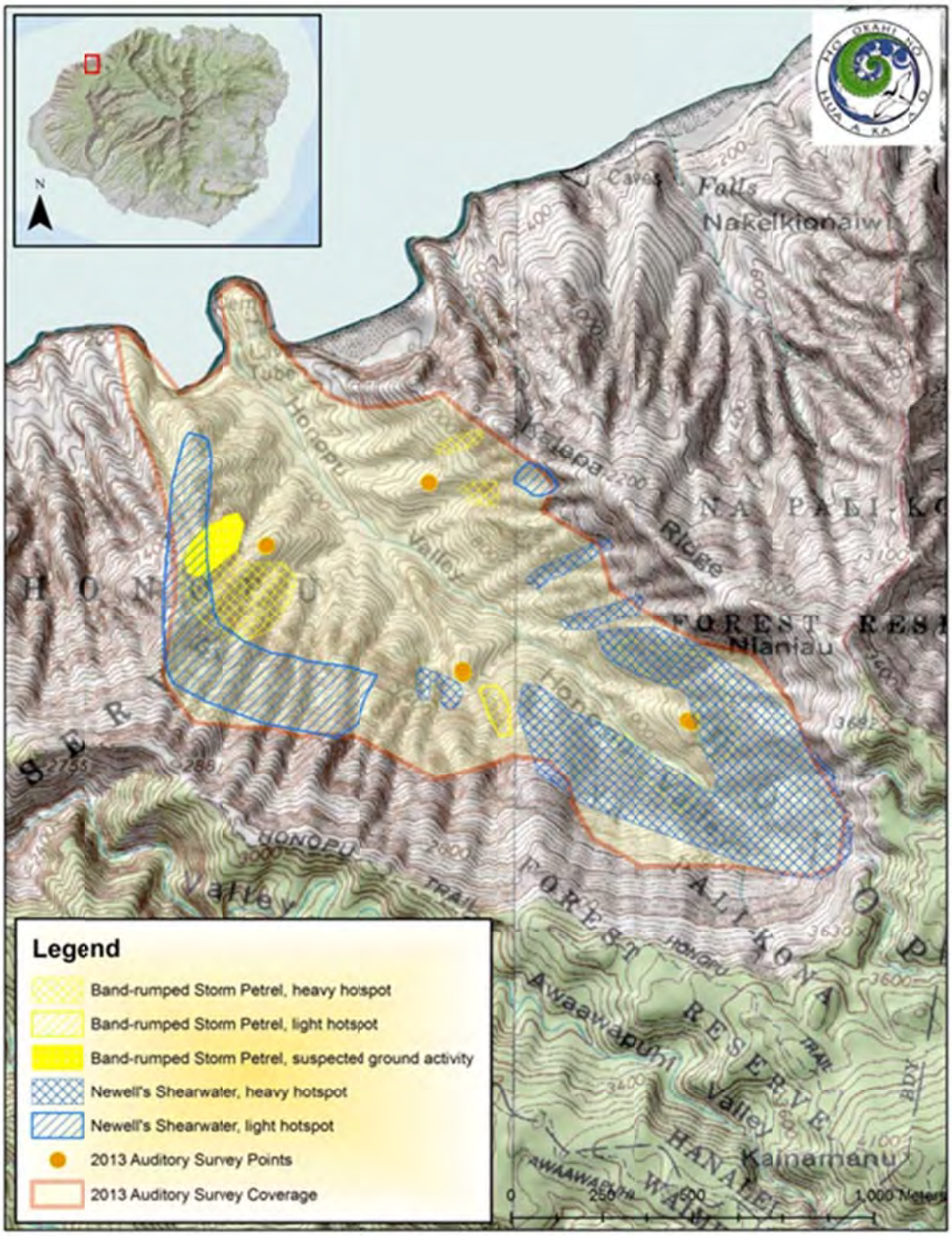

Figure 5. KESRP auditory survey coverage and seabird distribution in Honopu Valley in 2013 from Banfield et al. 2013. *Hotspot light* defined by KESRP as localised aerial activity – sporadic calling and/or aerial activity. *Hotspot heavy* defined by KESRP as localised aerial activity – continuous calling and/or aerial activity.

Previous Consultations in the Project Area
In a biological opinion in March 2011 and amendment in October 2011, the Service issued a non-jeopardy biological opinion for the Pacific Missile Range Facility Intercept Test Support (Service File 2010-F-0430 and 2010-F-0460), which addressed the effects from the Aegis Ashore Intercept Test Support construction and operations activities at Barking Sands on the Newell's shearwater, Hawaiian petrel, and band-rumped storm petrel, for a period of three years through the completion of these biological and conference opinions. The biological opinion amendment authorized the take of up to ten Newell's shearwaters, one Hawaiian petrel, and one band-rumped storm-petrel over the permit term as a result of collision with the boresight towers or due to attraction and fallout from lighting associated with the project. Also, the biological opinion amendment authorized the take of up to five Newell's shearwaters eggs and/or chicks, one Hawaiian petrel eggs and/or chicks, and one band-rumped storm-petrel egg and/or chick over the permit term as a result of the injury or mortality of breeding adults. Because of the minimization and mitigation measures implemented through the biological opinion, anticipated reduction in ongoing take from these measures, and implementation of conservation measures to offset unavoidable take (i.e. predator control within existing seabird breeding colonies and radar surveys to help assess population trends on the island of Kauai), the Service concluded that the issuance of the incidental take permit was not likely to jeopardize survival and recovery in the wild of the Newell's shearwater, Hawaiian petrel, or band-rumped storm petrel.

In April 2011, the Service issued a non-jeopardy biological opinion for the Kauai Island Utility Cooperative Short-term Seabird Habitat Conservation Plan and Incidental Take Permit (Service File 2011-F-0113, Permit No. TE234201-0), that addressed effects from the operation of existing and new electrical utility facilities on the Newell's shearwater and Hawaiian petrel, until 2016 for the entire island of Kauai. The biological opinion authorized the take of up to 162 adult, sub-adult, or fledgling Newell's shearwaters annually over the permit term as a result of attraction to, or collision with, KIUC facilities, as well as the take of up to 18 eggs and/or chicks as a result of the mortality of breeding adults. The annual take of up to two adult, sub-adult, or fledgling Hawaiian petrels was also authorized. Because of the minimization and mitigation measures implemented through the HCP, anticipated reduction in ongoing take from these measures, and implementation of conservation projects to offset unavoidable take (i.e. predator control within existing seabird breeding colonies), the Service concluded that the issuance of the incidental take permit was not likely to jeopardize survival and recovery in the wild of the Newell's shearwater or Hawaiian petrel.

In October 2011, the Service issued a non-jeopardy biological opinion for the Pacific Missile Range Facility Advanced Hypersonic Weapons System (Service File 2011-F-0385), that addressed the effects from one-time operation of existing launch facilities, Kauai Test Facility, on the Newell's shearwater and Hawaiian petrel through mid-November 2011. The biological opinion amendment authorized the take of up to four Newell's shearwaters and one Hawaiian petrel over the permit term due to attraction and fallout from lighting associated with the project. Because of the minimization and mitigation measures implemented through the biological opinion, anticipated reduction in ongoing take from these measures, and implementation of conservation projects to offset unavoidable take, the Service concluded that the issuance of the incidental take permit was not likely to jeopardize survival and recovery in the wild of the Newell's shearwater or Hawaiian petrel.

In September 2013, the Service received acoustic monitoring data from KIUC, providing evidence of a higher than anticipated number of seabird collisions with utility facilities. As a result of this information the Service notified KIUC of their likely exceedance of their authorized take level of Newell's Shearwater (Service File 2013-TA-0456). The Service is currently working with KIUC to identify and implement immediate minimization and mitigation actions.

Hawaiian Hoary Bat

As stated above, our understanding of Hawaiian hoary bat distribution and abundance is limited. However, the distribution may be broader than indicated by the limited information resulting from the localized monitoring efforts.

Observations of Hawaiian hoary bats have occurred at Barking Sands at the oxidation pond in the southern area of the base and over open ocean near the Nohili Ditch outfall. In 2000, a group of four bats was observed at the oxidation pond, and five bats were seen foraging near the Nohili Ditch outfall (Commander Navy Region Hawaii 2010).

In 2010 and 2011, the Navy contracted U.S. Geological Survey (USGS) Pacific Island Ecosystem Research Center biologists to survey for bat occurrence at Barking Sands, Kamokala Magazines, Makaha Ridge, and Kokee sites. Sampling was conducted during 486 station-nights at 12 point-location stations at these sites using Anabat II Bat Detectors and SM2 Song Meter Digital Field Recorder Platforms. At Barking Sands, seven stations were sampled in an area spanning south of KTF to the oxidation pond. Two stations were sampled at Makaha Ridge, two at Kokee, and one at Kamokala Magazines (U.S. Geological Survey 2011).

Monitoring results showed bat occurrence at all four PMRF sites. At Barking Sands, bat detectability was greater than 0.75 between September and December. Detectability and call activity was highest during that period and dropped between February and May. Detection data between September and December indicated that Barking Sands may be used by adult bats for "fall swarming" in preparation for mating. Detectability and call activity were much lower at Kamokala Ridge, with no evidence of fall swarming activity, and followed the same seasonal pattern (U.S. Geological Survey 2011).

At Makaha Ridge and Kokee sites, the seasonal pattern was different than Barking Sands and Kamokala. Detectability and call activity were highest between March and April, and bat detectability was 1.0 during this period. Overall, detectability and bat call activity remained relatively consistent year round with a higher rate at Barking Sands (U.S. Geological Survey 2011).

Hawaiian Goose

Since their reintroduction to the island of Kauai, Hawaiian geese have been infrequent visitors on Mana Plain and at Barking Sands. However, over the past three years, numbers of Hawaiian geese at Barking Sands have increased, likely in conjunction with an effort by the State of Hawaii to translocate geese to Kokee State Park on the west side of the island, upland of Barking

Sands (Commander Navy Region Hawaii 2010). After translocation to Kokee, Hawaiian geese have been observed flying down into lower elevation habitats on Mana Plain and PMRF. In July 2012, as many as 32 Hawaiian geese were observed at one time at the PMRF airfield. Hawaiian geese are also attracted to the adjacent Kinikini Ditch and State-managed Kawaiele Waterbird Sanctuary that occur just east of the base. In July 2012, a record high of 91 Hawaiian geese were observed near Kawaiele Wetlands, within sight of the PMRF runway.

Despite USDA-WS efforts to haze Hawaiian geese from areas near the airfield at PMRF, in December 2009, a pair initiated a nest near the HIANG administration building. In a biological opinion issued on 24 December 2009 (Service File 2010-F-0096), the Navy consulted with the Service pursuant to section 7 of the ESA to translocate the Hawaiian goose family group from PMRF Main Base to Kilauea National Wildlife Refuge on the north shore of Kauai. The translocation was conducted by Hawaii DLNR DOFAW personnel under the existing 6(c), (16 U.S.C. 1535(c)) agreement with the Service.

In addition, another nest was initiated in January 2011, also within the HIANG complex fence; this nest failed during the incubation period. Two Hawaiian goose nests were laid during the 2011-2012 breeding season (both in December 2011), one within the HIANG complex fence and one within the fenced area of the sewage oxidation ponds in the southern portion of Barking Sands. At least one male goose (identified via field-readable numbered leg band) successfully nested at PMRF during both the 2009-2010 and 2011-2012 breeding seasons. Three nests occurred in the 2012 – 2013 breeding season with one pair nesting at HIANG and two nests at the oxidation pond. The same number of nests occurred in 2013-2014 season; one at the beach cottages (this pair formerly nested at HIANG) and two nests at the oxidation pond (one in same location as 2012 and one new nest).

The Navy conducts a variety of ongoing conservation actions designed to benefit Hawaiian geese at Barking Sands. To reduce human interactions with Hawaiian geese PMRF implements a public education campaign informing base residents and visitors about appropriate behavior around Hawaiian geese. Educational signs illustrate the dangers of feeding, touching or otherwise harassing Hawaiian geese. In addition, PMRF has installed signs along roadways where Hawaiian geese are known to occur in an effort to reduce the potential for car collisions.

The Navy also implements a year-round predator control program at Barking Sands, including control of feral cats, barn owls, and other non-native predators. The removal of these invasive predators provides benefits to Hawaiian geese, resulting in a safe location to loaf, forage, molt, and breed. Barking Sands represents the only site on Mana Plain that has predator control.

Hawaiian geese occur at both Kokee and Makaha Ridge sites, however, no hazing of geese are conducted at these sites. At the PMRF Kokee sites, Hawaiian geese may fly over or forage at the installation. Some of the Hawaiian geese that were released at Kokee State Park have moved to upland areas of managed grass. One Hawaiian goose was observed flying over the PMRF Kokee site in 2006. Additionally a delivery vehicle struck one Hawaiian goose at the Kokee site in 2011. At Makaha Ridge, six Hawaiian geese are regularly observed at or near PMRF facilities (Commander Navy Region 2010).

Previous Consultations in the Project Area
In September 2012, the Service issued a non-jeopardy biological opinion for Pacific Missile Range Facility, Bird Aircraft Strike Hazard Program (Service File 2012-F-0409), that addressed effects from increased hazing of the Hawaiian goose, until conclusion of these biological and conference opinions. The biological opinion for increased hazing of the Hawaiian Goose authorized the take of up to 20 adult Hawaiian geese and one Hawaiian goose of any age as a result of harassment, and up to 50 eggs or goslings as a result of nest failure, abandonment, or reduced fledgling success from harassment of adults. Because the conservation measures implemented through the term of the biological opinion including public education, habitat alteration, and predator control were anticipated to avoid, minimize, and offset adverse impacts to Hawaiian geese, the Service concluded that the issuance of the incidental take permit was not likely to jeopardize survival and recovery in the wild of the Hawaiian goose.

Hawaiian Waterbirds

Hawaiian moorhen, Hawaiian coot, Hawaiian duck, and Hawaiian stilt regularly utilize wetland areas adjacent to PMRF including Kawaiele Waterbird Sanctuary and Mana Plains Forest Reserve as well as degraded aquatic habitat. These species frequent PMRF and are commonly observed in the agricultural drainage ditches and sewage oxidation pond in the southern section of the base. In March 2012, as many as 18 Hawaiian stilts and 14 Hawaiian coots were observed at the oxidation pond. Hawaiian moorhen and Hawaiian duck occur almost exclusively in the agricultural ditches. None of the Hawaiian waterbirds have been observed nesting at PMRF, including areas adjacent to the oxidation pond.

A variety of conservation actions are conducted by the Navy at Barking Sands that will benefit Hawaiian waterbirds. Education signs were installed along roadways indicating vehicles should slow in an effort to reduce potential for vehicle collisions with waterbirds. A year round predator control program has been implemented to control feral cats, rats, barn-owls, and other non-native predators. The control of predators provides waterbirds a safe location to loaf, forage, molt, and breed. On the Mana Plain, Barking Sands is the only area with an active program to control waterbird predators.

EFFECTS OF THE ACTION

Newell's Shearwater, Hawaiian Petrel, and Band-rumped Storm Petrel

As noted above, listed seabirds are negatively affected by increasing urbanization and the accompanying artificial lights, particularly for fledglings during their first flight to the ocean from their nesting grounds. When attracted to manmade lights, fledglings become confused and may suffer temporary night blindness. They often fly into utility wires, poles, trees, and buildings and fall to the ground. Other significant anthropogenic sources of mortality include collision with communications towers, power transmission lines and poles, fences, and other structures (Simons and Hodges 1998, pp. 18-19).

Collision with narrow-profile structures such as transmission lines and towers is well-documented for Hawaii's listed seabirds, particularly on the island of Kauai. Listed seabirds are nocturnal and fly over 30 miles per hour, making it difficult for them to detect and avoid wires and antennas (Cooper and Day 2003, p. 64). Recent surveys using vertical radar to estimate flight altitude show site-specific variation in altitude, and calibration between human-made visual observations and automated vertical radar detections of birds indicates large discrepancies in flight altitude estimation (David, pers. comm. 2008). Likewise, Day and Cooper (2004, p. 3) have stated there is considerable among-site variation in flight altitudes.

This section addresses the potential effects to listed seabirds from light attraction, collisions with communication towers and electrical distribution lines and poles, and conservation measures associated with the proposed action.

PMRF Lighting

The Navy has been implementing an array of lighting practices to minimize risk of seabird light attraction to all PMRF facilities. Although the lights in several key areas at Barking Sands are turned off (the most effective practice to avoid attraction of seabirds to facilities), many of the facilities at PMRF require lighting for safety or operations. Lights that cannot be turned off due to safety and/or operational purposes have been shielded, realigned, or replaced with full cutoff fixtures. Such modifications to lighting may reduce impacts to listed seabirds by approximately 40 percent (Reed *et al*. 1985, p. 380), but does not completely eliminate the threat. Anti-Terrorism/Force Protection lights at all six launch pads and three missile assembly areas were fitted with green bulbs; however, the efficacy of this practice is currently being tested.

The Service anticipates that the proposed project will result in a minimal amount of seabird attraction to artificial night lighting, particularly from the operational use of Anti-Terrorism/Force Protection lighting associated with the launch areas. The number of nights during the three-month nocturnal seabird fledging period that Force Protection lighting at launch pads will be turned on is not likely to exceed a total of 30 nights. And, the lighting at each launch location during the period from 2011 to 2013, which included the implementation of the full suite of take avoidance and minimization measures, is presumed to be representative of the lighting conditions at launch pads at PMRF in the foreseeable future.

Based on the number of listed seabirds recovered at PMRF by SOS during the period of 2011-2013, the Service estimates up to three fledgling Newell's shearwaters per year, one Hawaiian petrel every 10 years, and two band-rumped storm petrels every 10 years may be taken by the proposed project due to attraction to artificial lights. Downed birds that are recovered and placed in SOS aid stations will be collected by SOS personnel for rehabilitation and/or release, and if they cannot be salvaged, the birds will be euthanized. To date, the number of birds processed through the SOS program that survive and return to breed is unknown.

PMRF Communication Towers and Electrical Distribution Lines

The Service provided the Navy with a search protocol for conducting carcass searches to estimate the number of avian fatalities attributable to communication towers at PMRF. Surveys were conducted to assess the threat to listed seabirds of collision with the communication towers

sites at PMRF. During 2008, from October to December, searches for birds were performed every three to four days under each communication tower at Barking Sands, and a search efficiency trial was conducted to assess the potential for searchers to miss carcasses or downed birds during searches, following the Service's protocols. In 2010, in addition to the 14 towers at Barking Sands, the surveys were expanded to the two towers at Makaha Ridge and two towers at Kokee sites. The search protocols from 2008 were repeated and a scavenger trail was conducted to estimate the carcasses or downed birds that may have been missed in 2008 due to removal of birds by scavengers (e.g. cats). While carcasses and feather spots of zebra doves (*Geopelia striata*) have been found in surveys, to date no mortality of listed seabirds due to collision with communication towers at PMRF has been observed.

In addition to communication towers, the facilities at Barking Sands include approximately 7 miles of 12 kV electrical distribution lines and poles. Line heights are at or below vegetation levels have been shown to significantly reduce the potential for seabird collisions with powerlines (Ainley et al. 1995, KESRP unpublished data). No downed birds recovered by SOS have been associated with the electrical distribution structures at PMRF (SOS Database), and vegetation at PMRF is within the range of height of distribution lines. Therefore, the Service anticipates that the vegetation will likely shield seabirds from collision with electrical distribution facilities on the installation.

Although no mortalities of listed seabirds have been observed at communication towers or distribution lines at PMRF, the Navy will continue to conduct tower monitoring, scavenger trials, and searcher efficiency trials at PMRF to assess rates of listed seabird collision in conjunction with Five-year INRMP Updates. Additionally, the Navy will develop search protocols to monitor for seabirds under electrical distribution lines.

Beneficial Effects of Conservation Measures
The implementation of lighting practices to minimize seabird attraction by the Navy at PMRF will likely reduce the attraction of listed seabirds. In 2010, prior to full implementation of all lighting practices mentioned in the paragraph above, a total of 12 Newell's shearwater were recovered at PMRF (SOS Database, Department of the Navy 2014). Following the implementation of these take avoidance and minimization practices from 2011 to 2013, a total of only five Newell's shearwaters and one band-rumped storm petrel were downed at Barking Sands. Further assessment is required to assess whether the green lighting techniques are successful in reducing listed seabird attraction and fallout on PMRF; however, the lighting practices that are most effective in reducing seabird fallout will continue to be implemented annually during the seabird fledging period (Department of the Navy 2014).

Predator control at Barking Sands sites will benefit listed seabirds that are downed due to artificial light attraction. The trapping and removal of cats, owls, rats, and dogs will minimize predation of downed seabirds, improve discovery by on site personnel, and collection by the SOS program.

The control of predators at seabird colonies on the Na Pali Coast of the island of Kauai will carry out in-part recovery objectives identified in the PIFWO recovery strategy for Newell's shearwater and Hawaiian petrel, including to: 1) protect and enhance existing colonies, and 2)

mitigate existing threats by implementing and monitoring prioritized management actions at the species level (USFWS 1983; Holmes et al. 2011). Predation of federally listed seabirds by nonnative feral cats and barn owls has been documented in nearly all seabird colonies on the Na Pali Coast. The predator control will increase seabird survival and reproduction which could potentially expand breeding distribution of Newell's shearwater, Hawaiian petrel, and band-rumped storm petrel. A suite of management actions, in addition to the conservation measures described in the project description will be identified in the PMRF Seabird Conservation Plan.

Beginning in 2015, benefits to offset annual impacts to the listed species will occur from conducting predator control at Honopu Valley and Makaha Ridge, an area of the Na Pali Coast with high concentrations of seabirds (Figure 5). The Service anticipates that survival and reproduction will increase for seabirds nesting in the upper slopes and cliffs in these areas from the removal cats and barn owls. Based upon modeling, predator control for Newell's shearwaters can result in up to a 7% increase in growth rate for colonies receiving management, including cat and barn owl control (Griesemer and Holmes 2011).

Additionally, the proposed action will also provide protocols for predator control implementation and monitoring that are applicable to recovery of listed seabirds. Because the majority of seabirds are breeding in cliffs in the area of the Na Pali Coast between Honopu and Makaha Ridge, direct nest site management is difficult. Barn owl control will be carried out from finger ridge(s) and cat control will be conducted along the accessible rim trails of valley(s). Development of strategic control methodologies through adaptive management will refine management tools for application in other areas where seabird management occurs.

Given the combination of conservation measures described in the paragraphs above, the Service anticipates that these measures will minimize take of listed seabirds, and provide benefits to offset take of listed seabirds and provide a net recovery benefit in excess of take. The funding provided by PMRF via INRMP funding requests to accomplish off-site seabird mitigation is currently at $58,500 for 2015 and increasing annually (Commander Navy Region Hawaii 2010).

Hawaiian Hoary Bat

Studies indicate that Hawaiian hoary bats give birth between June and August and pups may remain dependent for up to seven weeks after birth (Menard 2001, p. 35). Young bat pups cling to the mother at the roost tree during the day, and she leaves them in the tree while she forages at night, similar to the North American hoary bats (Shump and Shump 1982, p. 3). These nonvolant pups are particularly susceptible to disturbance during this life stage. If trees with dependent, non-volant pups are trimmed, cut, or cleared, during the bat pupping season, it is likely that the action will result in injury or mortality.

Current and future construction projects at PMRF may involve clearing of woody vegetation. To avoid and minimize effects of base infrastructure, operations, and maintenance on Hawaiian hoary bats, all trimming or removal of woody plants greater than 15 feet tall will be conducted outside of the Hawaiian hoary bat pupping season of June 1 to September 15 to avoid impacting bat pups.

In Hawaii, there are numerous documented instances of Hawaiian hoary bats becoming entangled in barbed wire fences (Burgett 2009, pers. comm.; Jeffrey 2007, pers. comm.; Mansker 2008, pers. comm.; Marshall 2008, pers. comm.). It is presumed Hawaiian hoary bats "turn off" their echolocation upon capturing an insect. If a bat has just captured an insect, especially a large moth or beetle, it must masticate the insect while in flight which can take several seconds and leaves the bat vulnerable to collision with objects that it cannot see or hear. When foraging Hawaiian hoary bats fly at speeds of between 5 and 10 m per second. Without being able to emit sound effectively while masticating, Hawaiian hoary bats do not sense barbed wire strands and thus become entangled in the barbed wire (Bonaccorso 2009, pers. comm.). Determining the number of bat mortalities due to barbed wire can be difficult. Many barbed wire fences are in remote areas and are not checked regularly. In wet areas, bat carcasses may decompose before they are discovered. However in arid areas, it is presumed the bat carcasses become unattractive to predators as a result of mummification and thus remain on the fences for a considerable amount of time.

At the five PMRF sites, a total of 6.88 miles of fencing is topped with three stands of barbed wire, atop chain-link fence. Because of the spacing between the barbed wire stands, we have determined that each strand acts independently from the others. Therefore, the Service evaluated the impacts from the barbed wire as a total of 20.64 miles of barbed wire. USGS has estimated that bat mortalities associated with barbed wire is approximately 1.3 bats killed per 100 miles per year. We calculated a potential mortality rate of 0.27 bats per year throughout the foreseeable future based on the USGS mortality rate of 0.013 bats killed per mile multiplied by the total miles of barbed wire fence.

As described in the "Threats, Recovery Strategy, and Ongoing Conservation Measures" section, bat life history and ecology is needed to reduce mortality to bats. If Hawaiian hoary bats are aware of the presence of fences, it is likely they would be able to avoid becoming entangled in the barbed wire. Therefore, the proposed conservation measure will contribute to the conservation and recovery efforts of the bats by evaluating a deterrent method. If successful, bat deterrents could be widely used across the range of the species thereby protecting bats from mortality associated with barbed wire fencing. If deterrents are effective, then the use of the deterrents would allow for the use of barbed wire fencing for conservation purposes to keep ungulates out of sensitive areas thereby increasing recovery efforts for other species.

Hawaiian Goose

Fewer than 10 Hawaiian geese hazings were conducted by USDA-WS at PMRF airfield in 2005 and 2006. Since that time, the number of Hawaiian geese at Barking Sands has increased substantially, and by 2009 over 600 Hawaiian geese hazings were conducted at PMRF. More than 800 hazings were carried out in 2013 with the number of hazing events peaking in September (229 events) and October (238 events) (Department of the Navy 2014). There is no data to indicate how many total birds are impacted by this level of hazing; it is likely that individual birds may be hazed several times. Given the increase in Hawaiian goose numbers at Barking Sands since 2005, the Navy and USDA-WS have determined that as many as 1,200 total Hawaiian goose hazing events per year (conducted by USDA-WS and/or PMRF Air Operations or Environmental personnel) may occur throughout the foreseeable future.

Hazing operations are designed to reduce the risk of collision between aircraft and Hawaiian geese. While the primary purpose of hazing is to protect aircraft and human safety, hazing also reduces the potential for Hawaiian geese to be injured or killed after colliding with aircraft. Although no incidents of collisions have occurred to date, it is anticipated that ongoing hazing activities reduce the impact of air traffic on flying Hawaiian geese.

Hazing activities will be conducted in a manner that will minimize and avoid adverse impacts to Hawaiian geese. The conservation measures outlined in the project description will ensure that hazing operations are carried out by individuals trained in non-lethal harassment techniques. PMRF will continue a Hawaiian goose educational campaign, which has implemented a variety of techniques to inform residents and visitors on Barking Sands about responsible interactions with the species (i.e., no feeding, watering, touching, etc.). Additionally, PMRF has committed to identifying and implementing additional habitat modification measures that may reduce the attractiveness of Barking Sands to Hawaiian geese, thereby making hazing operations less likely to be required in the future. A suite of habitat management actions, in addition to the conservation measures described in the project description will be identified in the comprehensive Hawaiian Goose Management Plan.

The implementation of PMRF's ongoing predator control program will reduce the potential for Hawaiian geese to be preyed upon by invasive species, such as feral cats, dogs and potentially mongoose. Live traps are used for predator control throughout Barking Sands and checked at least once every 48 hours. No Hawaiian geese have been caught live traps over the past 12 years at PMRF.

The Navy will conduct increased hazing prior to the Hawaiian goose nesting season in an attempt to prevent Hawaiian geese from nesting on PMRF. Although Barking Sands is not considered essential Hawaiian goose breeding habitat, it remains the only site on Mana Plain that has consistent predator control. Consistent and effective hazing will force Hawaiian geese to move away from Barking Sands to breed. Hawaiian geese that are precluded from nesting at Barking Sands may be forced to nest in sub-optimal habitats on Mana Plain that are not protected and therefore may be subjected to higher rates of egg and gosling predation in these areas. Therefore, it is anticipated that Hawaiian goose pairs that are hazed away from PMRF and establish nests in sub-par habitats may experience a loss of reproductive success for that breeding season. It is unknown how many pairs of Hawaiian geese would attempt to nest at Barking Sands if hazing was not conducted. However, during the 2011 Hawaiian goose breeding season, PMRF personnel observed approximately five pairs of Hawaiian geese that appeared to be exhibiting nesting behavior; therefore, they focused hazing efforts on these birds in order to deter them from breeding on the base.

Hawaiian geese are often observed loafing and foraging at Barking Sands runway and other locations throughout the base. Although Barking Sands may be used by Hawaiian geese for these activities, the availability of foraging and loafing habitat is not a limiting factor for the Hawaiian goose in this part of their range. Birds that are hazed away from Barking Sands have adequate foraging and loafing habitat throughout Mana Plain and western Kauai. Therefore, it is anticipated that hazing is a temporary action, and will not result in a decline in adequate foraging or loafing habitat for non-breeding Hawaiian geese. Although there is an energetic cost

associated with being forced to fly to other locations to forage or roost, it is not anticipated this will result in any reduction in fitness or survivorship of non-breeding Hawaiian geese.

The birds will be hazed using non-lethal methods outlined in these biological and conference opinions. Neither USDA-WS nor Navy staff will attempt to haze Hawaiian geese that have succeeded in laying a nest. Personnel will observe birds prior to hazing actions to determine whether a nest is present. Brooding adults (i.e., adults with an observed active nest or goslings) will not be hazed at any time. However, despite these avoidance measures, it is possible that some breeding adults with active nests may not be identified as such and therefore breeding adults may inadvertently be hazed. Hazing of adults with active nests may lead to nest abandonment (Banko 1988, Marshall pers. comm. 2012). It is unknown how often breeding adults are hazed and there are no available data on the comparative success of nests from undisturbed adults at Barking Sands verses adults that are harassed. However, it is anticipated that some breeding adults may experience hazing activities and this disturbance may lead to the loss of active nests. To date, a total of six Hawaiian goose nests or broods have been observed at Barking Sands: one in December 2009, one in January 2011, two in 2012, and two in 2013. All of these nests and broods were found after the fact, so it is possible that some or all of the adults experienced some level of hazing prior to nest or brood discovery.

Despite the inclusion of training and best management practices, it is possible that hazing operations at Barking Sands may result in the death or injury to individual Hawaiian geese. Hazed Hawaiian geese may become disoriented or stressed, causing them to collide with fences or other man-made structures. These incidents have not been documented at Barking Sands, and it is anticipated that very few, if any, Hawaiian geese will be injured or killed due to hazing activities at Barking Sands.

Mortality due to vehicle collision is a threat to Hawaiian geese at Barking Sands, Kokee, and Makaha Ridge sites. In 2011, one Hawaiian goose was struck by a vehicle at the Kokee site by a contractor visiting the site in a delivery truck. At PMRF, the Navy has installed signage near roadways to warn drivers to be wary of birds in areas where Hawaiian waterbird strikes have occurred (Department of the Navy 2014). Although Hawaiian geese have been regularly struck in wildlife areas of Hawaii where vehicle traffic is continuous and high, such as at Haleakala National Park with an average of 558 vehicles visiting the park per day from 2001 to 2011 (USFWS 2012), the Service anticipates that collisions will be a rare occurrence at PMRF sites due to the lower volume of traffic. In addition, signs will minimize potential for Hawaiian geese collisions at PMRF.

Hawaiian Waterbirds

A total of three Hawaiian duck and 12 Hawaiian stilt hazings were conducted by USDA-WS at PMRF airfield between 2005 and 2011. In most years during that period, no endangered Hawaiian waterbirds were hazed: one duck and eight stilt hazings occurred in 2006, and two ducks and four stilts were hazed in 2011. However, in 2012 the number of Hawaiian duck and Hawaiian stilt hazings substantially increased to 126 and 34, respectively. The reason for the increase in hazing events was likely a combination of an increase in these species accessing the airfield via Kinikini agricultural ditch and a change in USDA-WS personnel conducting the

hazings. Over the same duration (2005 to 2011), no Hawaiian moorhens or Hawaiian coots have been hazed at PMRF airfield. The Navy and USDA-WS have determined that as many as 200 total Hawaiian waterbirds may be hazed per year (conducted by USDA-WS and/or PMRF Air Operations or Environmental personnel) throughout the foreseeable future.

The USDA-WS conducts hazing of Hawaiian waterbirds to minimize the risk of collision with aircrafts to protect aircraft and human safety. Hazing reduces the risk of Hawaiian waterbirds being injured or killed from collisions with aircraft. Despite no incidents of collisions have occurred to date, it is anticipated that ongoing hazing activities reduce the impact of air traffic on Hawaiian waterbirds.

Hawaiian waterbird species are common in agricultural ditches and oxidiation pond at PMRF, where hazing does not occur. PMRF's ongoing predator control program will reduce the potential for these species to be preyed upon by invasive species, such as feral cats, dogs and potentially mongoose. No Hawaiian waterbirds have been caught in live traps over the past 12 years, and traps are checked once every 24 hours. Also, it is not anticipated that hazing actions at the airfield are causing Hawaiian moorhen, Hawaiian coots, and Hawaiian ducks to breed in areas outside of PMRF (i.e., forcing them to nest in sub-optimal habitat that is not protected by an active predator control program) because there have been no observations of Hawaiian waterbirds nesting at PMRF.

While Hawaiian stilts have also not been documented nesting at PMRF, as stated above, the species has been observed nesting in a variety of habitats. It is possible hazing operations may preclude Hawaiian stilts from nesting in the cleared level areas at the Barking Sands airfield. Therefore, it is anticipated that Hawaiian stilt pairs that are hazed away from PMRF and establish nests in sub-par habitats may experience a loss of reproductive success for that breeding season. The number of pairs of Hawaiian stilt that would attempt to nest at Barking Sands in the absence of hazing is unknown. Given the availability of wetland habitat in surrounding areas of Kawaiele Waterbird Sanctuary and Mana Plains and that no hazings of Hawaiian stilts occurred in most years between 2005 and 2012, the Service anticipates a minimal number would be precluded from nesting at PMRF.

Although Hawaiian waterbirds utilize agricultural ditches, the oxidation pond, and other areas at PMRF to loaf and forage, the availability of such habitat is not a limiting factor Hawaiian waterbirds in this part of their range. Adequate foraging and loafing habitat exists in wetland areas adjacent to PMRF in the Mana Plain for birds that are hazed away from PMRF. Thus, it is not anticipated that hazing will result in a loss of adequate foraging or loafing habitat for Hawaiian waterbirds. Also, it is not anticipated that the energetic cost to fly to other locations to loaf and forage will result in any reduction in fitness or survivorship of Hawaiian waterbirds.

It is possible that hazing operations at Barking Sands may result in the death or injury to individual Hawaiian waterbirds, should hazed waterbirds become disoriented or stressed, causing them to collide with fences or other man-made structures. Training in hazing and best management practices are conducted by USDA-WS and PMRF Environmental personnel, and collision incidents with fences and manmade structures have not been documented at Barking Sands. Therefore, it is anticipated that very few, if any, Hawaiian waterbirds will be injured or

killed due to hazing activities at Barking Sands. However, at Barking Sands, Kokee, and Makaha Ridge sites, mortality due to vehicle collision is a threat to Hawaiian waterbirds in addition to the effects of hazing. Since 2012, a total of three Hawaiian moorhen and two Hawaiian coots have been struck by vehicles along the main roadway of PMRF. The Navy has installed signage near roadways to warn drivers to be wary of birds in the areas where strikes have occurred (Department of the Navy 2014). The Service anticipates that the vehicle signs will minimize potential for Hawaiian waterbird collisions and that few collisions will occur due to the low volume of traffic at PMRF sites.

Hazing of Hawaiian waterbirds will be conducted in a manner that will minimize and avoid adverse impacts to these species. Only non-lethal methods, outlined in these biological and conference opinions will be conducted by USDA-WS and/or PMRF Air Operations and Environmental personnel. It is anticipated that take will be offset by conservation measures, including management of the sewage oxidation pond for Hawaiian waterbirds, funding waterbird conservation in the SOS program, and funding predator control at KPNWR.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur within the area of action subject to consultation. Future Federal actions will be subject to the consultation requirements established in section 7 of the ESA and, therefore, are not considered cumulative for the proposed action.

It is reasonable to expect that development on the island of Kauai will continue to increase. Increased development may increase the density of mammalian predators adversely affecting listed Hawaiian seabirds. Development may also increase lighting levels and transmission/communication lines in the area, resulting in additional impacts to seabird species. Pursuant to the ESA, these impacts would be assessed in biological opinions and minimized and mitigated to the maximum extent practicable via development and implementation of Habitat Conservation Plans. For example, the Kauai Seabird Habitat Conservation Program has been in development since 2007 and is being designed to minimize and mitigate for lighting and collision impacts to Hawaiian seabirds on the island of Kauai.

Fences with multiple strands of barbed wire that support agriculture and ranching in the vicinity of the action area for this project may impact bats. If the bat deterrents that will be evaluated due to implementation of the proposed project are determined to be successful at reducing bat mortality due to barbed wire fences, the bat deterrents could be applied to other ranching activities in the area.

DOFAW has initiated the restoration of a 105-acre wetland and coastal upland on Mana Plain, next to the existing Kawaiele Waterbird Sanctuary. Both sites are located on the State's Mana Plain Forest Reserve [TMK (4) 1-2-2; por. 1], and are immediately adjacent to Barking Sands. The purpose of the project is to provide essential wetland habitat for federally endangered waterbirds, including the Hawaiian duck, Hawaiian stilt, Hawaiian coot, and Hawaiian moorhen. DOFAW is aware that PMRF is concerned the newly restored area may attract Hawaiian geese

and Hawaiian waterbirds to the area, thereby increasing BASH hazards at PMRF. Plans for the restoration project include measures to deter loafing and breeding Hawaiian geese, including vegetated berms, no irrigated grasses, low water depths in created ponds, etc. However, in a letter to DOFAW, dated June 22, 2012, the Service acknowledged that despite these measures, some Hawaiian geese are likely to be attracted to the site (2012-TA-0346). It is anticipated the Hawaiian goose and Hawaiian waterbird population on Mana Plain and this wetland will increase over the next decade, likely resulting in increased Hawaiian goose and Hawaiian waterbird flights and visitation to Barking Sands.

CONCLUSION

After reviewing the current status of the Newell's shearwater, Hawaiian petrel, Hawaiian hoary bat, Hawaiian goose, Hawaiian moorhen, Hawaiian coot, Hawaiian duck, and Hawaiian stilt, the environmental baseline of these species in the proposed action area, and the effects of the proposed action, including cumulative effects, it is the Service's biological and conference opinions that the PMRF base-wide infrastructure, operations, and maintenance will adversely affect these species, but will not jeopardize their survival and recovery in the wild. Critical habitat has not been designated for these species; therefore, none will be affected.

The adverse effects of the proposed action are not likely to jeopardize the Newell's shearwater, Hawaiian petrel, and band-rumped storm petrel because (a) PMRF lighting practices will minimize seabird fallout and (b) predator control for seabird colonies will offset incidental take and provide a net benefit to the status of these species as a whole. As discussed in environmental baseline, nonnative predators are significantly impacting seabird populations along the Na Pali Coast. Barn owl control at Makaha Ridge, feral cat control at Honopu Valley, and other nesting colony protection measures will decrease seabird mortalities and increase survival and reproduction in an area of the Na Pali Coast with large concentrations of listed seabirds.

The adverse effects of the proposed action are not likely to jeopardize the Hawaiian Hoary bat because incidental take will be avoided and minimized and conservation measures will offset any incidental take that occurs on the installation. To avoid impacts to Hawaiian hoary bat pups, tree trimming or removal of woody plants greater than 15 feet tall will be conducted outside of the Hawaiian hoary bat pupping season. Bat collisions with barbed wire fence will be minimized by research on deterrents. Conservation measures that contribute to the recovery of the Hawaiian hoary bat, such as studies of bat habitat associations on Kauai, will be implemented should any take occur at PMRF.

The adverse effects of the proposed action are not likely to jeopardize the Hawaiian goose, because the conservation measures are anticipated to avoid, minimize, and offset the adverse effects. Hazing activities will be conducted in a manner that will minimize and avoid adverse impacts to Hawaiian geese, including non-lethal techniques carried out by trained personnel. Habitat modifications will decrease the attractiveness of sites to Hawaiian geese for foraging and nesting. Additionally, a suite of conservation measures will benefit Hawaiian geese populations including public education to deter interaction with geese, signs for vehicles to minimize potential for collision, and predator control.

The adverse effects of the proposed action are not likely to jeopardize the Hawaiian moorhen, Hawaiian coot, Hawaiian duck, and Hawaiian stilt because as discussed in the above environmental baseline, the numbers of these birds hazed at airfields has been historically low and conservation measures are anticipated to avoid, minimize, and offset the adverse effects. The loss of low numbers of these species will have a minimal impact on the status of the species as a whole. Signs near roadways will minimize potential for vehicle collision with Hawaiian waterbirds. Restoration of sewage oxidation pond for foraging and loafing habitat, funding waterbird conservation in the SOS program, and predator control will increase reproduction and survival of these Hawaiian waterbirds.

For the conference opinion the adverse effects of the proposed action are not likely to jeopardize the band-rumped storm petrel, (a) PMRF lighting practices will minimize seabird fallout and (b) predator control for seabird colonies will offset incidental take and provide a net benefit to the status of these species as a whole. As discussed in environmental baseline, nonnative predators are significantly impacting seabird populations along the Na Pali Coast. Barn owl control at Makaha Ridge, feral cat control at Honopu Valley, and other nesting colony protection measures will decrease seabird mortalities and increase survival and reproduction in an area of the Na Pali Coast with large concentrations of listed seabirds.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including, breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Navy and NNSA so that they become binding conditions for the exemption in section 7(o)(2) to apply. If the Navy and NNSA (1) fail to assume and implement the terms and conditions or (2) fail to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Navy and NNSA must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement and reporting requirements below [50 CFR 402.14(i)(3)].

Amount or Extent of Take Anticipated

Based on the analysis presented in these biological and conference opinions, the Service anticipates the following incidental take may occur for as long as PMRF infrastructure, operations, and maintenance are active and in place.

Newell's Shearwater
Up to an average of three (3) fledgling Newell's shearwaters per year and a maximum of nine (9) fledgling Newell's shearwaters in one year may be taken in the form of injury or death due to attraction and fallout from lighting associated with the project.

Hawaiian Petrel
Up to an average of one (1) fledgling Hawaiian petrel every ten years and a maximum of two (2) fledgling Hawaiian petrels in one year may be taken in the form of injury or death due to attraction and fallout from lighting associated with the project.

Band-rumped Storm Petrel
Up to an average of two (2) fledgling band-rumped storm petrels every ten years and a maximum of four (4) fledgling band-rumped storm petrels in one year may be taken in the form of injury or death due to attraction and fallout from lighting associated with the project.

Hawaiian Hoary Bat
Up to an average of one (1) Hawaiian hoary bat every three years and a maximum of three (3) Hawaiian hoary bats in one year may be taken in the form of injury or death due to entanglement on barbed-wire fences.

Hawaiian Goose
Up to an average of two (2) Hawaiian geese per year and a maximum of four (4) geese in one year may be taken in the form of injury of death due to collision with fences, other manmade structures, or vehicles as a result of hazing activities. Ten (10) eggs or goslings may also be incidentally taken indirectly in the form of injury or mortality due to nest failure or abandonment of two (2) nests (5 eggs per nest) as a result of inadvertent hazing of nesting adults. And, fifty (50) eggs or goslings may be taken indirectly in the form of injury or mortality due to nest failure or reduced breeding success of ten (10) nests laid in sub-optimal, unprotected habitats of Hawaiian geese which were precluded from nesting at PMRF as a result of hazing activities.

Hawaiian Moorhen
Up to an average of two (2) Hawaiian moorhen per year and a maximum of four (4) moorhens in one year may be taken in the form of injury of death due to collision with fences, other manmade structures, or vehicles as a result of hazing activities.

Hawaiian Coot
Up to an average of one (1) Hawaiian coot per year and a maximum of two (2) coots in one year may be taken in the form of injury of death due to collision with fences, other manmade structures, or vehicles as a result of hazing activities.

Hawaiian Duck
Up to an average of one (1) Hawaiian duck per year and a maximum of two (2) ducks in one year may be taken in the form of injury of death due to collision with fences, other manmade structures, or vehicles as a result of hazing activities.

Hawaiian Stilt
Up to an average of one (1) Hawaiian stilt per year and a maximum of two (2) stilts in one year may be taken in the form of injury of death due to collision with fences, other manmade structures, or vehicles as a result of hazing activities. Twenty (20) eggs or chicks may be taken indirectly in the form of injury or mortality due to nest failure or reduced breeding success of five (5) nests (4 eggs per nest) laid in sub-optimal, unprotected habitats of Hawaiian stilts which were precluded from nesting at PMRF as a result of hazing activities.

The Migratory Bird Treaty Act (MBTA) of 1918 as amended (16 USC 703-712) prohibits the take of migratory birds. The MBTA provides no process for authorizing incidental take of MBTA-protected birds. The Service will not refer the incidental take of any migratory bird species for prosecution under the MBTA, if such take is in compliance with the terms and conditions (including amount and/or number) specified in the Incidental Take Statement.

Effect of the Take

The Service determines that this level of anticipated take is not likely to jeopardize the survival or recovery of the Newell's shearwater, Hawaiian petrel, band-rumped storm petrel, Hawaiian hoary bat, Hawaiian goose, Hawaiian moorhen, Hawaiian coot, Hawaiian duck, or Hawaiian stilt. No critical habitat has been established for these species, so none will be affected.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take:

1. The Navy and NNSA will minimize direct and indirect effects of lighting to the Newell's shearwater and Hawaiian petrel at PMRF. The Navy will implement conservation actions to assist in stabilization of Newell's shearwater and Hawaiian petrel on the island of Kauai.

2. The Navy and NNSA will minimize Newell's shearwater and Hawaiian petrel mortality through on the ground activities by developing a Service approved search protocol, training personnel about listed seabird fallout and methods for searching for downed birds, and conducting searches for downed listed seabirds at all facilities on the installation with lighting and under communication towers and electrical distribution lines.

3. The Navy and NNSA will minimize direct and indirect effects of clearing of woody vegetation through avoidance of activities during pup rearing period. Entanglement on

barbed-wire fences to the Hawaiian hoary bat will be minimized through development and implementation of deterrents and offsetting any losses through conservation actions.

4. The Navy and NNSA will minimize direct and indirect effects of hazing operations to the Hawaiian goose, Hawaiian moorhen, Hawaiian coot, Hawaiian duck, or Hawaiian stilt associated with BASH operations at PMRF. Road signage will minimize potential for vehicle collision with Hawaiian waterbirds. Conservation measures to restore habitat and conduct predator control will increase reproduction and survival.

The prohibitions against taking the band-rumped storm-petrel found in section 9 of the ESA will not apply until the species is listed. However, the Service advises the Navy and NNSA to consider implementing the following reasonable and prudent measures. If this conference opinion is adopted as a biological opinion following a listing designation, these measures, with their implementing terms and conditions, will be nondiscretionary.

1. The Navy and NNSA will minimize direct and indirect effects of increased lighting to seabirds at PMRF.

2. The Navy and NNSA will minimize band-rumped storm-petrel mortality through on the ground activities by developing a project-specific search protocol, training personnel about listed seabird fallout and methods for searching for downed birds, and conducting searches for downed listed seabirds at all facilities on the installation with lighting and under communication towers and electrical distribution lines.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Navy and NNSA must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and specified reporting requirements. These terms and conditions are nondiscretionary. In order to implement the reasonable and prudent measure above, the Navy and NNSA will monitor incidental take as described in Appendix B for monitoring communication towers. The Navy and NNSA will also follow the protocols to report downed wildlife in Appendix B, Attachments 1 and 3, when any carcass of a listed species is found injured or dead.

Because the amount of incidental take anticipated for Newell's shearwater, Hawaiian petrel, band-rumped storm petrel, Hawaiian hoary bat, Hawaiian goose, and Hawaiian waterbirds are expressed in terms of the average number of individuals that may be taken, the following formula will be used to calculate average take for these species:

$$R_p = \frac{b_p}{p}$$

Whereby "b_p" is the total take of the species since date of BO issuance, including seabird take from fallout and seabird fatality estimates calculated using methodologies of Appendix B, "p" is

the take assessment period expressed as the total number of years since date of BO issuance, and "R_p" is the average take of the species per year over the take assessment period.

The amount of incidental take anticipated for Hawaiian petrel, band-rumped storm petrel, and Hawaiian hoary bat are expressed in terms of the average number of individuals that may be taken over a period longer than one year (e.g., one every ten years). The following describes the annual accrual of incidental take for these species that will be used in combination with the calculated average take (above) to determine if the amount or extent of take is exceeded. For Hawaiian petrel, the amount of anticipated incidental take will begin with 1 fledgling in year 1, accrue in increments of 0.1 fledgling per year, and result in 2 fledglings by year 11, etc. (not to exceed 2 fledglings in one year). For band-rumped storm petrel, the amount of anticipated incidental take will begin with 2 fledglings in year 1, accrue in increments of 0.2 fledgling per year, and result in 4 fledglings by year 11, etc. (not to exceed 4 fledglings in one year). For Hawaiian hoary bat, the amount of anticipated incidental take will begin with 1 bat in year 1, accrue in increments of 0.33 bat per year, and result in 2 bats by year 6, etc. (not to exceed 3 bats in one year).

- The Service will be notified by telephone and email within 24 hours upon the discovery of an injured or dead Newell's shearwater, Hawaiian petrel, band-rumped storm petrel, Hawaiian hoary bat, Hawaiian goose, Hawaiian moorhen, Hawaiian coot, Hawaiian duck, or Hawaiian stilt. This includes notification for listed or candidate species turned into the SOS aid station by Navy personnel or members of the public. The Navy and NNSA will provide the Service a written notification, summarizing the event, within 30 days.

- The Service will be notified by telephone and email within 24 hours upon the discovery of an abandoned Hawaiian goose nest or listed Hawaiian waterbird nest. The Navy and NNSA will provide the Service a written notification, summarizing the event, within 30 days.

- Access to any of the PMRF sites will be provided by the Navy and NNSA to the Service with 24 hour notification so that they may independently monitor for downed seabirds and retrieve reported carcasses.

- The Navy and NNSA will submit annual reports detailing the implementation of the above Conservation Measures used to minimize impacts and compensate for effects of the action. Annual reports will also summarize survey and monitoring results, BASH hazing efforts, and levels of take of all ESA-listed species. The first report will be submitted at the end of the first fiscal year following the issuance of these biological and conference opinions and continue annually throughout the life of the project.

- Conservation measures are outlined within this document pages 17-20. Any failure by the Navy and NNSA to implement conservation measures to offset incidental take of listed seabirds, including predator control in 2015 and 2016 as well as the measures that will be identified in the PMRF Seabird Conservation Plan, will result in the need to reinitiate this consultation.

- Should take of listed species occur and the carcass recovered, the Service may request that the carcass be shipped to Honolulu for necropsy and species verification. Otherwise, the depository designated to receive specimens of the listed species that are found is the B.P. Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii, 96817 (telephone: 808/847-3511). If the B.P. Bishop Museum does not wish to accession the specimens, contact the Service's Division of Law Enforcement in Honolulu, Hawaii (telephone: 808/861-8525; fax: 808/861-8515) for instructions on disposition.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service recommends that the Navy and NNSA undertake the following conservation measures:

1. Assist with island- and State-wide efforts to assess and minimize the effects of communications towers, power transmission lines, lighting, and other threats to listed seabirds posed by infrastructure.

2. The Navy and NNSA will consider listed seabirds when scheduling missile tests, and will avoid testing during the seabird fledging season whenever possible.

3. The Navy and NNSA should contribute funds to ongoing Hawaiian hoary bat research aimed at increasing our understanding of migration and resource use patterns on the island of Kauai. As stated in the Recovery Plan for Hawaiian hoary bats, the overall recovery strategy for the Hawaiian hoary bat is to utilize research that provides information on the subspecies' abundance and distribution, life history, and habitat associations. With currently available information being limited, even the most basic management actions cannot be undertaken with any certainty of benefit. Therefore, the studies conducted to examine migration and resource use will help us understand habitat use and increase our ability to make wise conservation decisions to benefit the Hawaiian hoary bat on the island of Kauai.

4. The Navy and NNSA should continue efforts to identify another site on Mana Plain that can be restored and managed for the benefit of Hawaiian geese and Hawaiian waterbirds, which will provide an alternate protected location and likely draw Hawaiian geese and Hawaiian waterbirds away from Barking Sands.

5. The Navy and NNSA should develop in coordination with the Service and fund an outpalnting project for *Panicum niihauense* into the critical habitat unit at Barking Sands.

REINITIATION STATEMENT

This concludes formal section 7 consultation on this action. As required in 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by this action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the band-rumped storm-petrel is listed. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the project and no further section 7 consultation will be necessary.

After the listing of the band-rumped storm-petrel as endangered/threatened and/or designation of critical habitat for the band-rumped storm-petrel and any subsequent adoption of this conference opinion, the Navy and NNSA shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect the species or critical habitat in a manner or to an extent not considered in this conference opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the species or critical habitat that was not considered in this conference opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided in this conference opinion does not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the project will be reviewed to determine whether any take of the band-rumped storm-petrel has occurred. Modifications of the opinion and incidental take statement may be appropriate to reflect that take. No take of the band-rumped storm-petrel may occur between the listing of the species and the adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation.

We appreciate your efforts to conserve protected species. If you have any questions concerning these biological and conference opinions, please contact Adam Griesemer of the USFWS Pacific Islands Fish and Wildlife Office at (808) 792-9400.

Sincerely,

Loyal Mehrhoff
Field Supervisor

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APPENDIX A: Air Operations and Environmental Positions Covered for Hazing/BASH Operations Under this Biological Opinion

Air Operations Personnel:
Air Operations Officer
Aviation Safety Officer
Airfield Manager
Assistant Airfield Manager
Air Operations Chief
Transient Line 1
Transient Line 2
Transient Line 3
Transient Line 4
Transient Line 5
Transient Line 6
Transient Line 7
Transient Line 8
Transient Line 9
Transient Line 10
Transient Line 11

Environmental Personnel:
Environmental Coordinator
Natural Resources Biologist
Range Complex Sustainment Coordinator
Range Complex Sustainment Coordinator

Appendix B. Carcass search protocol provided by USFWS to be used for monitoring for nocturnal seabird fallout at communication towers at PMRF.

1.0 STANDARDIZED CARCASS SEARCHES

Carcass searches will be conducted to estimate the number of avian fatalities attributable to the broadcast towers. An estimate of the total number of carcasses will be made by adjusting for removal bias (affected by scavenging) and searcher efficiency bias (affected by detection) (see Sections 2.0 and 3.0). The methods, timing, and duration of the carcass searches are described below.

1.1 Methods

Personnel trained in proper search techniques ("the searchers") will conduct carcass searches at the broadcast tower location pursuant to timing specified by the carcass scavenging trials, but no less than two times per week. Boundaries of square plots will be delineated along each broadcast tower. A strip transect design is appropriate for this study, providing almost 100 percent coverage of the search area. Each search plot will be split into four quadrants, with each searched sequentially. This facilitates the searchers ability to stay on transect lines and maximize searching efficiency (Gritski pers. comm. 2006).

Important factors considering in developing this monitoring plan include tower dimensions, target species size, and vegetation structure. Because most carcass searches to date have been associated with wind power projects, we use standards developed for that industry. When carcass searches are conducted for wind turbines, plot size typically extends outward from the base of a wind turbine a minimum distance equal to the turbine height.

The subject towers are variable in height. If the results from the initial carcass surveys show that the plot size is too large or small, the area will be adjusted accordingly pending approval by the Service. Geographic Positioning System (GPS) locations of the search plot corners will be included in initial data collection. Transects will be set at approximately 6 meters (19.7 feet) apart, depending on the habitat type, and the searcher will walk along each transect at a rate of 45-60 m per minute searching both sides out to 3 m (10 feet) for downed birds and bats. Search area and speed may be adjusted by habitat type, after evaluation of the first searcher efficiency trial, if needed. The applicant may request approval from the Service to revise the search protocol. Since equipment cabinets and other structures associated with the towers will obstruct transects, the areas with equipment will be searched such that those areas have 100% coverage.

If a carcass of a listed species is found, searchers will follow the Downed Wildlife Protocol (**Attachment 1**), and carcasses will be left in place and moved only if directed by the Service. If directed to move the carcasses, searchers will deliver carcasses to Service Law Enforcement who will send them to a forensics lab for future reference and necropsy.

All carcasses found during the standardized carcass searches will be recorded and identified by a unique number. A copy of the data sheet for each carcass will be kept with the carcass at all times. For each carcass found, searchers will record species, sex and age when possible, date and time collected, location, condition and any comments that may indicate cause of death (**Attachment 2**). Searchers will record the condition of each carcass found, using the following condition categories:

- Intact – a carcass that is completely intact, is not badly decomposed and shows no sign of being fed upon by a predator or scavenger
- Scavenged – an entire carcass that shows signs of being fed upon by a predator or scavenger, or portions of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.)
- Feather Spot – 10 or more feathers at one location indicating predation or scavenging or 2 or more primary feathers

Searchers will photograph each carcass as found and establish GPS points, with point accuracy provided. A detailed map of the search area will then be created showing the location of the broadcast towers and associated facilities, the study area, and any carcasses located.

The searchers may discover carcasses incidental to formal carcass searches (e.g., predation or while driving within the project area). For each incidentally discovered carcass, the searcher will identify, photograph, and record data for the carcass as would be done for carcasses found during formal scheduled searches.

Any injured native birds found on the facility site will be carefully captured by a trained project biologist or technician and transported to a local wildlife rehabilitator. All project staff and consultants will be trained on how to handle any downed wildlife or carcasses found anywhere within the project area. Furthermore, a Downed Wildlife Incident Report (**Attachment 3**) will be completed for any injured or killed animal found.

1.2 Important Considerations

Important factors to consider in developing the monitoring plan include target species size and the type of vegetative cover being surveyed. The Hawaiian petrel and Hawaiian goose are relatively large birds. Downed individuals should be detectable compared to smaller bird species and most bats.

2.0 CARCASS SCAVENGING TRIALS

"Carcass scavenging or removal" is the disappearance of a carcass from the search area due to scavenging. This may serve as a potential source of bias associated with fatality rate estimation. Scavengers may preclude detection of carcasses or make it problematic to identify remains and determine cause of death. Thus, seasonal differences in scavenging rates (i.e., changes in scavenger population density) and possible differences in the size of animal being scavenged are typically taken into account when estimating fatality. Additionally, the timing of fatality searches must be conducted at a frequency that minimizes loss due to scavenging.

The objective of the carcass scavenging trials is to document the length of time avian carcasses remain in the search area and subsequently determine the frequency of carcass searches within the search plots. Carcass scavenging trials will be conducted during each season in the vicinity of the search plots. Carcass scavenging rates will be used to adjust carcass surveys for removal bias. Removal rates will be determined for each season.

Carcasses used in the trials may include representatives of the seabirds if legally available and permitted by the Service and DOFAW. Navy will coordinate with the Service to follow appropriate protocols in using carcasses during carcass scavenging trials. Carcasses of legally

obtained wedge-tailed shearwaters, commercially available adult game birds, or cryptically colored chickens will be used to simulate seabirds.

To avoid confusion with broadcast tower-related fatalities, planted carcasses will not be placed in fatality monitoring search plots. Planted carcasses will be placed in the vicinity of the broadcast towers but not so near as to attract scavengers to the search plots. The planted carcasses will be located randomly within the carcass scavenging trial plots.

Carcasses will be placed in a variety of postures to simulate a range of natural conditions. For example, birds will be: 1) placed in an exposed posture (e.g., thrown over the shoulder), 2) hidden to simulate a crippled bird (e.g., placed beneath a shrub or tuft of grass) and, 3) partially hidden. Trial carcasses will be marked discreetly for recognition by searchers and other personnel. Trial carcasses will be left at the location until the end of the carcass scavenging trial.

Carcasses will be checked as follows, although actual intervals may vary. Carcasses will be checked for a period of 28 days to determine removal rates; however, total number of searcher days will be adjusted according to observed scavenging rates. Carcasses will be checked approximately every day for the first 7 days, and then on day 10, day 14, day 21, and day 28. This schedule may vary depending on the initial removal rate observed, weather, and coordination with the other survey work. At the end of the 28-day period, any remaining trial carcasses and scattered feathers will be removed. Each trial will use as many bird carcasses as are available; the target is 10-20 carcasses.

3.0 SEARCHER EFFICIENCY TRIALS

The objective of searcher efficiency trials is to estimate the percentage of bird fatalities that searchers are able to find. Searcher efficiency will be estimated by habitat type and season. Estimates of searcher efficiency will be used to adjust carcass counts for detection bias. Searcher efficiency trials will be conducted on the fatality monitoring search plots in all habitat types.

Searcher efficiency trials will be conducted in each season as defined above, during the period in which the fatality monitoring occurs. Trials will be spread throughout the year to incorporate the effects of environmental variables such as weather and scavenger populations. Key elements of these trials include:

- At least three trials will be conducted in each season.
- Each trial will use a variable number of carcasses so that the searcher will not know the total number of trial carcasses being used in any trial.
- For each trial, birds will be used according to their availability.
- Wedge-tailed shearwater will be the primary species used for searcher efficiency trials.
- Personnel conducting searches will not know in advance when trials are conducted; nor will they know the location of the trial carcasses.
- Carcasses will be placed in a variety of postures to simulate a range of conditions. For example, birds will be: 1) placed in an exposed posture (thrown over the shoulder), 2) hidden to simulate a crippled bird and 3) partially hidden.

- Each non-domestic carcass will be discreetly marked and located with GPS at the planted site so that it can be identified as an efficiency trial carcass after it is found.
- The number and location of the efficiency trial carcasses found during the carcass search will be recorded.

If new searchers are brought into the search team, additional detection trials will be conducted to ensure that detection rates incorporate searcher differences.

4.0 SAMPLING INTENSITY AND DURATION

Search efforts will begin in mid-October and end in mid-December. Each tower will be checked twice per week, with no greater than three days between surveys. This will be very useful in increasing the efficiency of the study since scavenging rate detections will determine the appropriate search frequency. If scavenging is high, search frequency needs to be high (see Arnett 2005).

However, based on Service recommendations, carcass searches will be conducted approximately two times per week or no longer than 3 days apart during the initial scavenging trial. Once data from the initial scavenging trial has been evaluated, the frequency of carcass searches will be adjusted accordingly for effectiveness and efficiency for the remainder of the fall 2008 survey season, as approved by the Service. Additional surveys may be conducted after climatic conditions/events, such as storm events, fog, or moonless nights, as these events could increase the likelihood of collisions with broadcast towers.

Changed circumstances such as hurricanes, major storms, fire, and other such events may affect the timing of the surveys. If the broadcast towers are not accessible as a result of storm events or road conditions, and/or staff safety is questionable, the surveys will continue as soon as is safely possible. The Navy will coordinate with the Service on such changed circumstances as soon as possible.

5.0 ANALYTICAL METHODS FOR FATALITY ESTIMATES

Estimates of avian fatalities during the life of the broadcast towers are based on the following:

(1) The number of carcasses located during standardized searches for which the cause of death is attributed to the broadcast towers; carcasses found within survey plots are assumed to be the result of the broadcast tower unless other obvious indicators exist.

(2) Carcass scavenging rates expressed as the estimated average time a carcass is expected to remain in the study area and be available for detection by the searchers during the entire survey period.

(3) Searcher efficiency expressed as the proportion of planted carcasses found by searchers.

The following sections describe how the avian fatalities will be quantified.

5.1 Fatality calculations

The estimate of total fatalities is based on the number of fatalities found within the survey plots, confirmed to be attributed to the broadcast towers, and adjusted for the probability that the

observer found the carcass and the time that the caresses remained to be found (i.e., was not scavenged). Calculations are based on Young et al. (2003) and are presented below.

5.1.1 Number of carcasses

The average number of carcasses per search period is calculated using:

$$\bar{c} = \frac{\sum_{i=1}^{k} c_i}{k}$$

where c_i is the number of carcasses found at broadcast tower i, and k is the number of broadcast towers searched.

Total number of carcasses found is calculated by:

$$C = k * \bar{c}$$

5.1.2 Searcher Efficiency

Searcher efficiency (p) was calculated as the proportion of the carcasses found by observers divided by the total number of carcasses available to find.

$$p = \frac{p(1-p)}{n}$$

5.1.3 Scavenging rate

The average number of days that a carcass remained on site is calculated using:

$$\bar{t} = \frac{\sum_{i=1}^{k} t_i}{k}$$

where t_i is the number of days each carcass remained on the study area and k is the number of carcasses evaluated.

5.1.4 Mortality estimate

The estimated total number of fatalities is calculated by

$$m = \frac{N * I * C}{k * \bar{t} * p}$$

where N is the total number of broadcast towers, I is the time between searches (days), C is that total number of carcasses during the study period, k is the number of broadcast towers searched, $\bar{t}$ is the mean length of time a carcass remained on the plot, and p is the searcher efficiency.

6.0 RESULTS

Fatality rates will be calculated on the project as a whole. Each season's percent searcher efficiency will be applied to the observed direct take (carcasses found, if any, during searches) to quantify adjusted take (direct and unobserved direct take combined). Variance will not be calculated pursuant to Service recommendation.

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Attachment 1

Downed Wildlife Protocol

DOWNED WILDLIFE PROTOCOL *

Downed birds (any seabirds, and or Hawaiian short-eared owl) considered here may be dead or injured at discovery. All need immediate attention by the discoverer.

A ***prioritized*** Contact List of Service and Division of Forestry and Wildlife (DOFAW) Staff follows, prioritized from first to last to contact. It is essential for you to actually speak with a person and not to rely on voicemail as "a contact"; however you may leave a message and then contact the next person in the listing.

DEAD BIRD:

- Leave in place, the Service or DOFAW will do site and circumstantial assessment, make photographs, and measurements before securing and removing bird.

- Contact Service about find; Call list for Service staff, in order for calling:
    1. Adam Griesemer 808-285-8261 or 808-822-2175
    2. Law Enforcement 808-861-8525

INJURED BIRD:

Equipment necessary to have available for response:

- Pet carriers (medium) – 2 available at minimum
- Cardboard small animal (rat/rabbit/hamster) carriers – 2 minimum
- Pieces of artificial turf/outdoor carpeting to place on floors of pet carriers
- Non-tippable shallow dog water-bowls for water; water
- Gloves
- Tent stakes (6)

Procedure

1. Gently pick up and place bird into carrier equipped with turf/carpet. Place only 1 bird in a carrier.
2. Mark exact spot of find(s) with tent stake(s).
3. Place the bird in the SOS aid station at PMRF, or transport to Kauai Humane Society if the bird was picked up after the SOS aid station was checked for the day.
4. DO NOT feed birds, provide water in bowl.
5. Notify the Service within 24 hours by telephone, using call list above, and by email - adam_griesemer@fws.gov.

Attachment 2

Avian Fatality Survey Form

Page ____ of ____

Downed Wildlife Survey

Location: _____ **Observer:** _____ **Date:** _____

Start Time: _____ **End Time:** _____

Environmental Conditions:

Cloud Cover:____ (0=about 25%, 1=26-50%, 2=51-75%, 3=76-100%) **Temperature:**_____

Precipitation:____Rain____Fog____Other____ (0=None, L=light, M=Moderate, H=Heavy, Other= Hail, Snow)

Wind:_____ 0=<1 mph, 1=1-3 mph (leaves barely move), 2=3-7 mph (leaves rustle, small twigs move),
3=8-12 mph (sm. Twigs move), 4=13-18 mph (sm. Branches move) 5=12-24 mph (lg. Branches move trees sway)

Vegetation: Ave. ht. _____**(cm); Ave. vigor** _____ **(G** = Green, **M** = Mixed, **B** = Brown);
Cover _____% (% ground obscured by plant cover), record details in comments

Tower No.	Species	Sex	Age	Remains	Dir. From Tower	Dist. From Tower	UTM N	UTM E	Approx. Carcass Age	Photo nmbrs	Vegetation Type	Comments

Species: 4-letter code
Sex: sex of animal if known (**M** = Male, **F** = Female); **Age: A** = Adult, **S** = Subadult, **J** = Juvenile
Remains: E=Entire body, **W**=Wing, **F**=Feathers/Fur, S=feather spot (10 or more, or 3 primaries),**B**=Bones, **O**=Other (add to Comments)
Dir. From Tower: Compass direction of carcass from Tower base
Dist. From Tower: Distance (meters) of carcass from Tower
Carcass age: Approximate age in days of carcass remains
Comments: Print notes as needed

Attachment 3

Downed Wildlife Incident Report

Location	
Date and Time Identified	
Species	
Probably Cause of Injury/Death	
Action Taken	
Other Comments	
Name of Observer	

Biological Opinion of the U.S. Fish and Wildlife Service for the Proposed Base-wide Infrastructure, Operations, and Maintenance Activities at the Pacific Missile Range Facility, Island of Kauai, Hawaii

Photo Credits: Rocket launch at Barking Sands, COMNAVREGHI 2010; Newell's shearwater, Tracy Anderson, Save Our Shearwaters Program.

August 20, 2018
(01EPIF00-2015-F-0227)

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

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In Reply Refer To:
01EPIF00-2014-F-0066
01EPIF00-2015-F-0227

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Subject: Reinitiation of Formal Consultation on Proposed Base-wide Infrastructure, Operations, and Maintenance Activities at the Pacific Missile Range Facility (PMRF) on Kauai, Hawaii

Dear Mr. Johnson and Ms. Lacy:

This document transmits the U.S. Fish and Wildlife Service's (Service or USFWS) biological opinion addressing the subject action, as revised, and its effects on the threatened Newell's shearwater (*Puffinus auricularis newelli*). The U.S. Department of the Navy (Navy) and the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) formally requested reinitiation of formal consultation on the subject action on April 9, 2015 in light of changes to the project description and higher than anticipated take levels of the shearwater that were addressed in the original biological opinion, dated September 9, 2014, for this action. Your request for reinitiation of formal consultation was received on April 9, 2015. This biological opinion was prepared in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C 1531 et seq.).

This biological opinion is based on: (1) information the Service received on May 1, 2018 in the April 2018 Navy and NNSA revised biological assessment (BA) prepared for the reinitiation of formal consultation on the subject action; (2) information cited in the Service's 2014 biological opinion (Service file no. 01EPIF00-2014-F-0066) on the original project description; (3) email and letter correspondence between the Service, Navy and the NNSA regarding changes to the project

description; (4) site visits conducted by the Service on September 15, 2015 to Kokee Sites, and on November 23, 2015 to Barking Sands and Makaha Ridge; (5) the *Hawaiian Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan* (USFWS 1983); and (6) other literature cited herein (see the Literature Cited section below). A complete decision record of this consultation is on file at the Service's Pacific Islands Fish and Wildlife Office in Honolulu, Hawaii.

Consultation History

September 9, 2014: The Service issued a biological opinion (Service file no. 01EPIF00-2014-F-0066) addressing PMRF Base-wide Infrastructure, Operations, and Maintenance Activities. The Consultation History section of that biological opinion is herein incorporated by reference.

October 23, 2014: The Service received an email from the Navy indicating take of 10 Newell's shearwaters at PMRF Barking Sands between the nights of October 16 and October 22, 2014. The Incidental Take Statement accompanying the biological opinion anticipated an average take of three fledgling shearwaters per year with a maximum take per year of nine fledgling shearwaters.

November 12, 2014: The Service formally advised the Navy and the NNSA of the need to: reinitiate formal consultation to revise analyses of take impacts to the Newell's shearwater based on higher than anticipated take levels; update measures under the proposed action to further avoid and minimize take impacts; develop protocols to insure preparedness for the seabird fledgling season; and develop additional conservation measures under the proposed action to provide conservation benefits to the Newell's shearwater commensurate with increased take impacts.

April 9, 2015: The Service received a letter from the Navy requesting reinitiation of formal consultation on PMRF Base-wide Infrastructure, Operations, and Maintenance Activities for purposes of addressing higher than anticipated take of the Newell's shearwater and revision of conservation measures under the proposed action for the Newell's shearwater.

April 16, 2015: Formal consultation was reinitiated effective this date.

July 23, 2015: The Service sent a letter to the Navy indicating that, although additional details were forthcoming, there was sufficient information to reinitiate formal consultation as of April 16, 2015. The letter also estimated the issuance date for a new biological opinion as August 31, 2015. In addition, the Service informed the Navy that it was necessary to update the status of the species and environmental baseline analyses in the opinion for the Newell's shearwater due to new information regarding increased impacts to the species caused by collisions with utility structures.

August 14, 2015: The Service received a letter and enclosure from the Navy describing proposed conservation measures for the Newell's shearwater; and draft guidelines for implementing those conservation measures at the PMRF.

August 20, 2015: Adam Griesemer of the Service met with Cory Compora, April Teekell, and John Nelson of the Navy (via a conference call) to discuss the Navy's August 14, 2015 letter. The Service informed the Navy that we were preparing a letter regarding the change in project description and updating the schedule for completion of the reinitiated consultation.

September 23, 2015: The Service sent a letter notifying the Navy that removal of conservation measures from the project description that provide reproductive benefits to the Newell's shearwater population is a change in the project description. The Service requested a joint meeting to discuss this change, the information needs arising from the change, and to identify collaboratively an updated schedule for addressing information needs for completing the consultation.

October 2, 2015: Adam Griesemer of the Service was notified via telephone by Zena Wetzel (a contract biologist for the Navy) that a dead Newell's shearwater was found near the Kokee Site C communication tower during monitoring surveys.

December 15, 2015: Mary Abrams, David Tessler, Aaron Nadig, and Adam Griesemer of the Service met with Aaron Poentis, Tamara Conkle, Cory Compora, Cynthia Nojima, April Teekell, and John Nelson of the Navy to discuss changes to the project description, information needs arising from this change, and to identify collaboratively an updated schedule for addressing information needs for completing the consultation.

March 25, 2016: The Service initiated a new evaluation addressing the effects of the proposed action on the Newell's shearwater based on the Navy's letter to the Service addressing additional information on the project description, including revised conservation measures that avoid and minimize impacts to the Newell's shearwater from project night lighting, and follow-up on the Service's suggestions regarding appropriate conservation measures for the Newell's shearwater.

August 29, 2016: Cory Campora of the Navy met with Aaron Nadig of the Service via telephone to discuss the schedule for completion of the reinitiated consultation. The Service and Navy agreed that once the draft biological opinion was completed, they would meet again to discuss the proposed action and updating the schedule.

July 26-27, 2017: Adam Griesemer, Aaron Nadig, Mary Abrams, Larry Salata, and Eric Hein of the Service met with Kelly Ebert, Tamara Conkle, Cory Campora, Frans Juola, and April Teekell of the Navy to discuss the Service's analyses informing the draft biological opinion such as the Service's deterministic population model, changes to the PMRF project description and conservation measures, interagency coordination, and action items necessary to complete the consultation.

August 28, 2017: Kelly Ebert of the Navy emailed the Service to provide notification of the Navy's intent to revise their biological assessment to include contributions to the Hawaiian Seabird Conservation Account managed by the Service and administered by the National Fish and Wildlife Foundation.

May 1, 2018: The Service received from the Navy a revised biological assessment for inclusion in the Navy and NNSA's reinitiation of formal consultation on the subject action.

July 26, 2018: The Service sent the Navy the draft biological opinion and requested comments.

August 3, 2018: Kelly Ebert of the Navy emailed the Service that the Navy would not finish comments on the draft BO until an unknown time the following week.

August 8, 2018: The Navy sent the Service their comments on the draft BO.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Navy's PMRF provides integrated range services for multiple Department of Defense (DoD) and NNSA activities. PMRF is the largest instrumented multi-environment weapons test range in the U.S. and includes land, sea, and air zones. The range services accommodate training, tactics development, and evaluation for air, surface, and subsurface weapons systems for DoD and other U.S. departments and agencies, foreign military forces, and private industry. PMRF maintains facilities and provides services to support Pacific Fleet underwater, surface, and air training exercises and other activities designed by the Chief of Naval Operations. The scope of the proposed action considered in this biological opinion includes all current and ongoing base infrastructure, operations, and maintenance activities at all terrestrial PMRF sites on the island of Kauai, including activities of tenant and customer DoD commands and other Federal agencies. The PMRF Main Base is located at Barking Sands, which has training and Research, Development, Test, & Evaluation (RDT&E) activity areas for tracing and surveillance radars, data processing, communications networks, and an airfield. In addition to the main base at Barking Sands, PMRF is comprised of support facilities on Kauai at Makaha Ridge (secondary range), Kokee (tracking radars, telemetry, communications, command, and control), Kamokala Ridge (munitions storage), Port Allen (pier for weapons recovery and Navy Seaborne Powered Targets (SEPTAR) boats), and Milolii Ridge (reflectors) (COMNAVREGHI 2010).

Although the Kauai Test Facility (KTF) previously included an area on Mount Kahili as a communications repeater site, the site is no longer used by KTF and all NNSA-owned telemetry and data acquisition equipment was removed. Mount Kahili will not be addressed further in this document.

The term of the proposed action is 50 years.

Components of the Proposed Action

i. *PMRF Main Base – Barking Sands*

Barking Sands is the principal operations area for PMRF and supports surface, subsurface, air, and space activities (COMNAVREGHI 2010). Tracking and surveillance radars, data processing, and other communications networks are contained within RDT&E activity areas. Nohili Ditch and Kinikini Ditch separate Barking Sands into three zones: north, central, and south (Figure 1).

The northern third of Barking Sands, north of Nohili Ditch, comprises KTF, an area managed and operated by NNSA's Sandia National Lab (SNL) for missile assembly and launch operations and associated support activities, administration, and services. SNL operates Sandia's Strategic Target System (STARS) and rail-launched sounding rocket launches from KTF. Within the NNSA *Work For Others* program, SNL also conducts missile launches for DoD components, including the Missile Defense Agency (MDA). KTF personnel conduct test operations to support materials research, components development, advanced re-entry vehicle technologies, water entry and recovery systems, and missile defense testing (www.sandia.gov/locations/ktf). Access to KTF, including the Nohili Dune area (the western boundary of KTF), is controlled and limited at all times. Polihale State Park, to the north of KTF, provides beach dune, camping, and surfing

activities to the public. Temporary closures of State of Hawaii access roads and beach areas at Polihale occur during missile launches from KTF.

In addition to housing KTF, the northern third of Barking Sands contains U.S. Army/MDA Terminal High Altitude Area Defense (THAAD) missile launch facilities, a 50K launch pad (capable of supporting a 50,000 pound maximum design load launcher), and the Aegis Ashore Test Center. As at KTF, beach and dune areas to the west of the THAAD, 50K, and Aegis launch facilities are off-limits to all PMRF personnel and visitors except for security personnel conducting patrols. Prior to missile launches from any launch pad, the Navy carries out security patrols to ensure no human presence in the Ground Hazard Area during launch activities (COMNAVREGHI 2010). During pre-launch and other patrols, security all-terrain vehicles (ATVs) are driven in non-vegetated areas between the high tide line and beach berm, and pickup trucks are driven only on existing dirt roads. Any security ATV entering the beach area is required to cross the berm only on designated permanent paths indicated by signage.

The central third of Barking Sands, delineated by Nohili Ditch on the north and Kinikini Ditch on the south (Figure 1), contains a 6,000-foot runway and associated air operations facilities. In addition to the runway, these facilities include a helicopter landing pad, main hangar, and administrative buildings. The airfield supports C-5 and C-17-type cargo aircraft, tactical aircraft, and helicopters. Operations support aircraft consist primarily of C-26 airplanes, which are used for logistics and range surveillance, and S-61 helicopters used for personnel transfer, logistics, surveillance, and target recovery. Daily touch-and-go practices of cargo airplanes also occur at the airfield. In addition to air operations facilities, the central third of Barking Sands supports base administration, base services, range operations, ordnance maintenance, and fuel supply facilities. The U.S. Army and Hawaii Air National Guard (HIANG) also maintain facilities and carry out missions in this section of the installation.

The southern third of Barking Sands, south of Kinikini Ditch (Figure 1), contains a housing area, personnel support facilities, and additional base operations facilities. Just to the south of Kinikini Ditch lies a recreational beach cottage area consisting of 19 cottages. The cottages are available for short-term rentals to active duty and retired military and their families and to DoD employees and contractors working on the installation. The cottages are adjacent to the beach, and the beach on this section of Barking Sands is open to use by military personnel and their families and beach cottage visitors. A breeding colony of Wedge-tailed Shearwaters (*Ardenna pacifica*) occurs in and adjacent to the beach cottage area. The southern third of the base also contains a housing area consisting of approximately 70 units (primarily single-family homes and duplexes), and personnel support facilities that include a Navy Exchange, fitness center, youth center, soccer field, movie theater, and all-hands club. A man-made oxidation pond is located in this section of the base, providing the only surface water on Barking Sands outside of the agricultural drainage ditches. Finally, this southern section of Barking Sands contains communications facilities, an antenna array, and launch facilities, although on a small spatial scale relative to the northern third of the base (COMNAVREGHI 2010). Barking Sands is surrounded by or contains a total of 6.3 miles of barbed wire fencing, consisting of 3-strand barbed wire atop chain link fence.

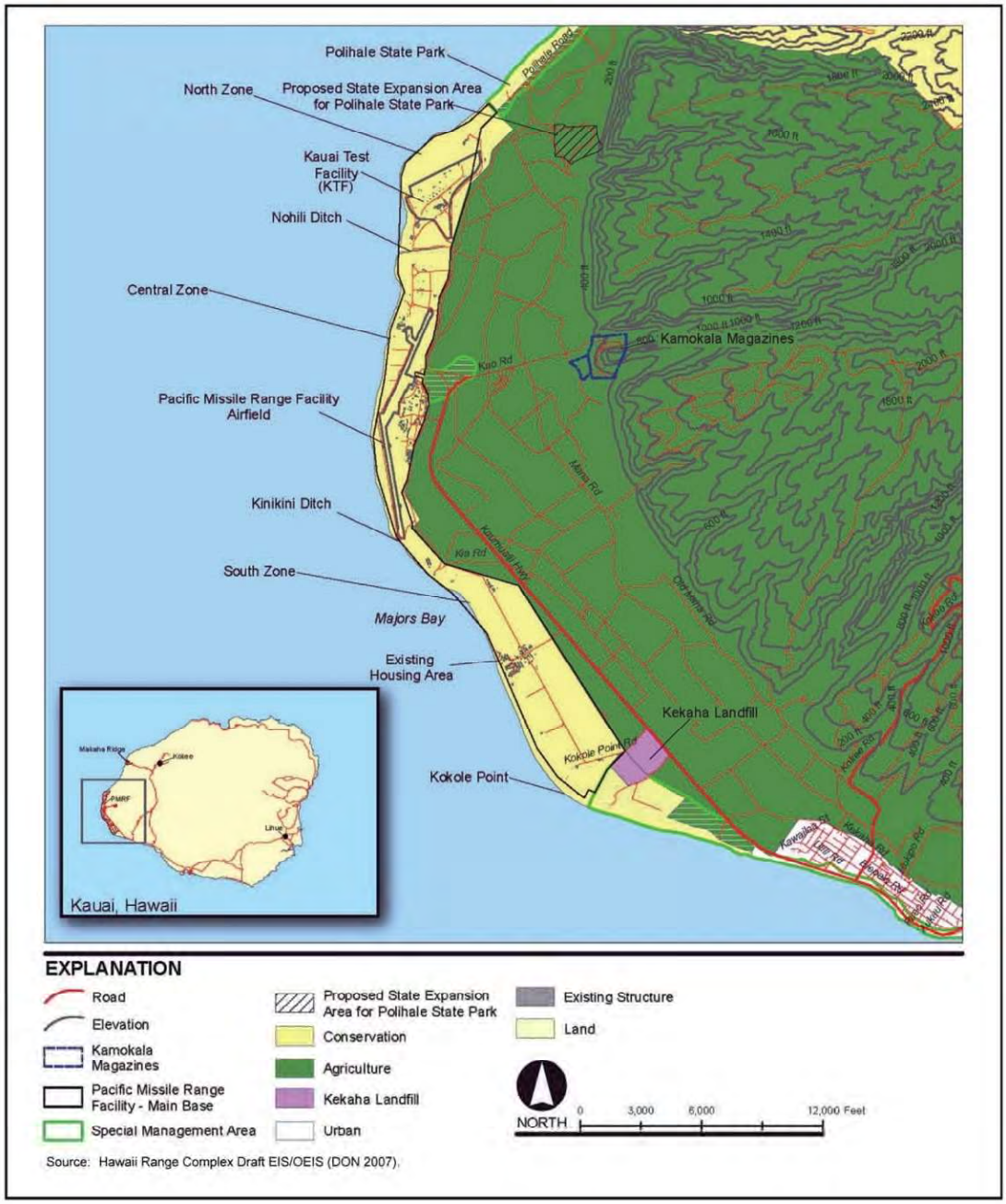

Figure 1. Map of the PMRF on Kauai (Source: COMNAVREGHI 2010).

a) Barking Sands Lighting

Night-lighting at Barking Sands is associated with base administration, maintenance, personnel support infrastructure, and missile assembly and launch facilities. Anti-Terrorism/Force Protection-lighting is used intermittently at Barking Sands missile assembly and launch facilities to protect personnel and assets prior to launch activities. Currently, three missile assembly areas and five launch pads are located in the northern section of Barking Sands, and a launch pad is located in the southern section of Barking Sands at Kokole Point. The total number of nights per year during which Force Protection lighting is required on these launch pads for all missile launch activities by all supported DoD commands and other Federal agencies is currently approximately 90-120 nights.

Duration of each event ranges from approximately three days to four weeks, and event schedules are spread out throughout the calendar year. Thus, the number of nights during the three-month nocturnal seabird fledging period (mid-September through mid-December) that require lighting at launch pads is not likely to exceed a total of 30 days.

b) Barking Sands Communication Towers and Transmission Lines

Fourteen communication towers are located at Barking Sands (Figure 2). In compliance with Federal Aviation Administration (FAA) and Commander, Naval Air Systems Command requirements regarding airfield obstruction-lighting, a subset of the communication towers at Barking Sands have aircraft obstruction-lighting at the top of the structure; this lighting consists of two steady-burning, unshielded red bulbs (DON 2018). The height and lighting of all communication towers at Barking Sands are presented in Table 1.

Table 1. General locations, heights, and lighting conditions of communication towers at Barking Sands, PMRF, as of September 2008.

Building/Site	**Type of Tower or Antenna**	**Tower Height**	**Aircraft Obstruction-Lighting**
Bldg 564	Metro tower	96 ft	2 red bulbs
Bldg. 515	Calibration lab antennas (2)	80 ft	2 red bulbs
Bldg. 556	Pyramid spiral antenna	40 ft	2 red bulbs
Bldg. 396	Aircraft beacon tower	66 ft	none
North Gate	HI Telephone microwave tower	165 ft	2 red bulbs
Bldg. 1100	Boresight tower	150 ft	2 red bulbs
North of Kokole Point	WWVH/U.S. National Institute of Standards and Technololgy radio antennas (2)	90 ft	none
North of Kokole Point	WWVH/U.S. National Institute of Standards and Technololgy radio tower	45 ft	none
Bldg. 851	Radial curtain antenna tower	110 ft	none
Bldg. 852	Radial curtain antenna tower	110 ft	none
Bldg. 853	Radial curtain antenna tower	110 ft	none
Bldg. 854	Radial curtain antenna tower	110 ft	none
Bldg. 822	Communications tower	110 ft	2 red bulbs
Bldg. 850	U.S. Coast Guard/Differential Global Positioning System tower	200 ft	2 red bulbs

In addition to communication towers, structures with narrow profiles exceeding 26 feet in height at Barking Sands include 121 electrical distribution line poles spread over a distance of approximately 7 miles. Unlike poles supporting 69 kilovolt (kV) transmission lines that run along the main roads of Kauai and stand 70 to 85 feet tall, the poles on Barking Sands support 12 kV distribution lines and are 45 feet in height. This height is within the range of heights of the kiawe trees (*Prosopis*

pallida) that dominate the non-native habitat on the base, including roadside habitat, that grow from 30 to 60 feet tall (COMNAVREGHI 2010 p. 3-51, http://www.ctahr.hawaii.edu/forestry/trees/CommonTreesHI/CFT_Prosopis_pallida.pdf). In addition, distribution lines on 45-ft poles throughout Barking Sands are configured in a horizontal plane, rather than stacked vertically, such that the vertical profile is equivalent to that of a single line. All existing communication towers and power lines at Barking Sands are in use, and there is no plan for removal of any towers or lines at this time.

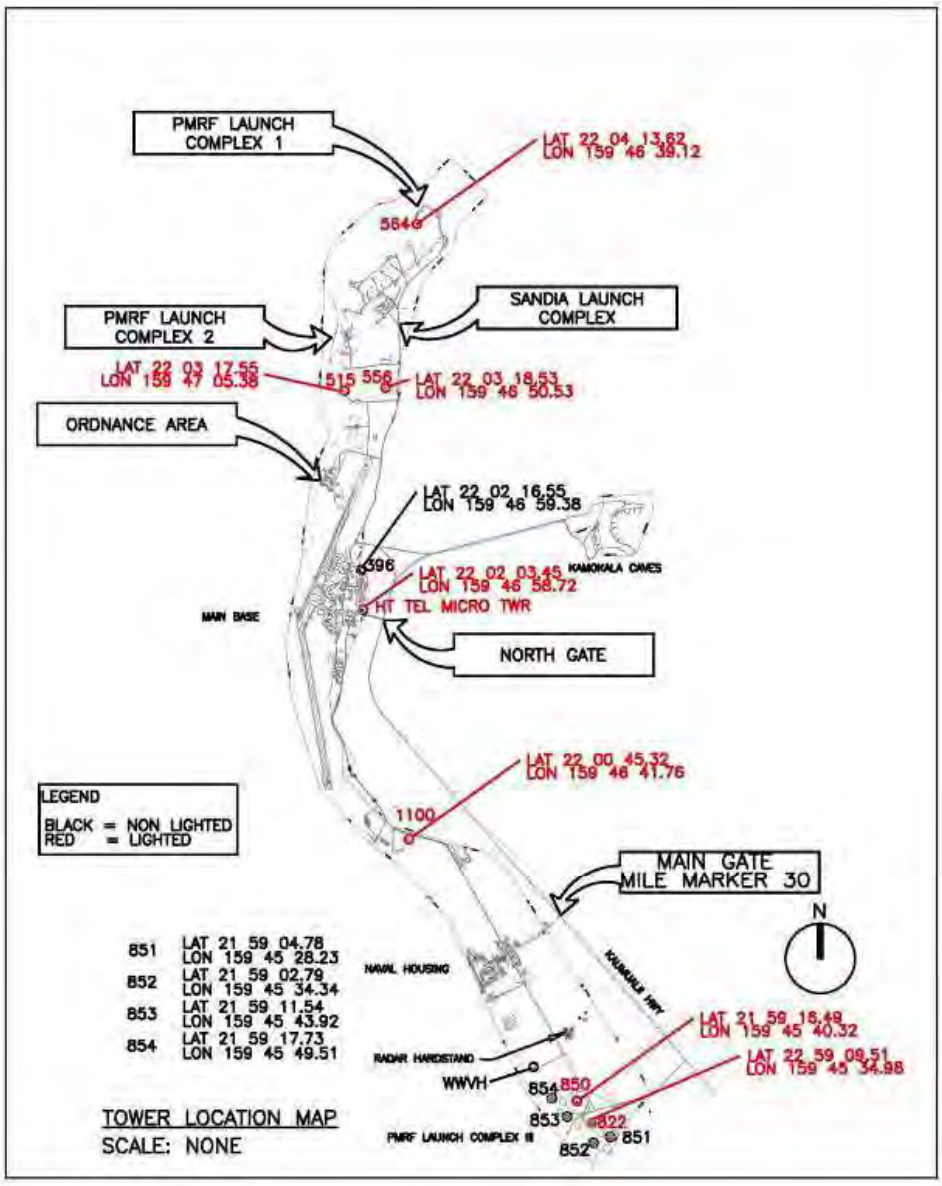

Figure 2. Locations of communication towers at Barking Sands, PMRF. Towers indicated by red font contain aircraft obstruction-lighting, consisting of two steady-burning unshielded red bulbs. Towers indicated by black font do not have lighting.

c) Barking Sands Air Operations and Bird-Aircraft Strike Hazard Program

Barking Sands air operations facilities in the central portion of the installation include a 6,000-foot runway, four helicopter landing pads, main hangar, and administrative facilities. The airfield supports military aircraft including, but not limited to, large cargo aircraft, tactical aircraft, and helicopters. Operations support aircraft consist of C-26 airplanes used for logistics and range surveillance, and S-61 helicopters used for personnel transfer, logistics, surveillance, and target recovery. Daily touch-and-go practices of cargo airplanes also occur at the airfield. Although field carrier landing practices (FCLPs) have not been conducted at the Barking Sands airfield, the potential exists for this training to occur. FCLPs are practices and tests of landing tactical aircraft at a land-based airfield for pilots who will land tactical aircraft on aircraft carriers. Pilots who are in the process of being assigned to aircraft carriers forward-deployed in the western Pacific normally conduct FCLP training on the west coast of the mainland U.S. The airfield at Barking Sands would be used for FCLP training and testing only if a pilot were unable to test on the mainland U.S. prior to travel to the western Pacific due to scheduling reasons.

To minimize the risk of aircraft collisions with birds and other wildlife, the Commander, Naval Installations Command (CNIC) contracts United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Wildlife Services (WS) to implement an integrated wildlife control operation within the Bird Aircraft Strike Hazard (BASH) zone at Barking Sands. Control methods include lethal techniques for introduced species such as zebra doves (*Geopelia striata*), spotted doves (*Spilopelia chinensis*), mynas (*Acridotheres tristis*), bulbuls (*Pycnonotus* spp.), and manakins (*Lonchura* spp.). Lethal control is conducted via shooting in high probability bird-strike zones along the runways and taxiways. With non-listed species that are federally protected under the Migratory Bird Treaty Act (MBTA), USDA-WS conducts non-lethal control, including non-lethal trapping/relocation and hazing by personnel on foot or in vehicles. MBTA-protected species managed at Barking Sands include, but are not limited to, Laysan albatrosses (*Phoebastria immutabilis*), great frigatebirds (*Fregata minor*), and Pacific golden plovers (*Pluvialis fulva*). PMRF Air Operations maintains a Migratory Bird Permit for management of MBTA-protected species within the BASH zone. Newell's shearwaters are not hazed and personnel authorized to conduct BASH operations are trained in seabird preparedness in the event staff discover grounded seabirds.

d) Makaha Ridge Tracking Station

The Makaha Ridge Tracking Station serves as PMRF's secondary missile tracking and surveillance station (COMNAVREGHI 2010, pp. 4-1 – 4-2). Structures at the site consist of eight buildings and two antennas attached to telephone poles (Kleidosty Pacific 2016, p.30-31) (Figure 3). Tracking and surveillance activities occur inside the buildings at Makaha Ridge, including a Frequency Interference Control building, telemetry building, communications building, laboratory, power plant, maintenance facility, and guard shack. Access to Makaha Ridge Tracking Station is limited to assigned personnel and visitors on official business (COMNAVREGHI 2010, pp. 4-1 – 4-4).

Exterior security lights on buildings at Makaha Ridge are currently unshielded or partially shielded by roof overhangs. In compliance with FAA and Commander, Naval Air Systems Command requirements, the two antennas at this site each have steady-burning, unshielded red bulbs (DON 2018). Transmission lines at the Makaha Ridge site consist of 12 kV distribution lines at a height

of 45 feet along a total distance of 0.6 miles. Makaha Ridge contains 0.17 miles of barbed wire fencing, consisting of three-strand barbed wire atop a chain link fence.

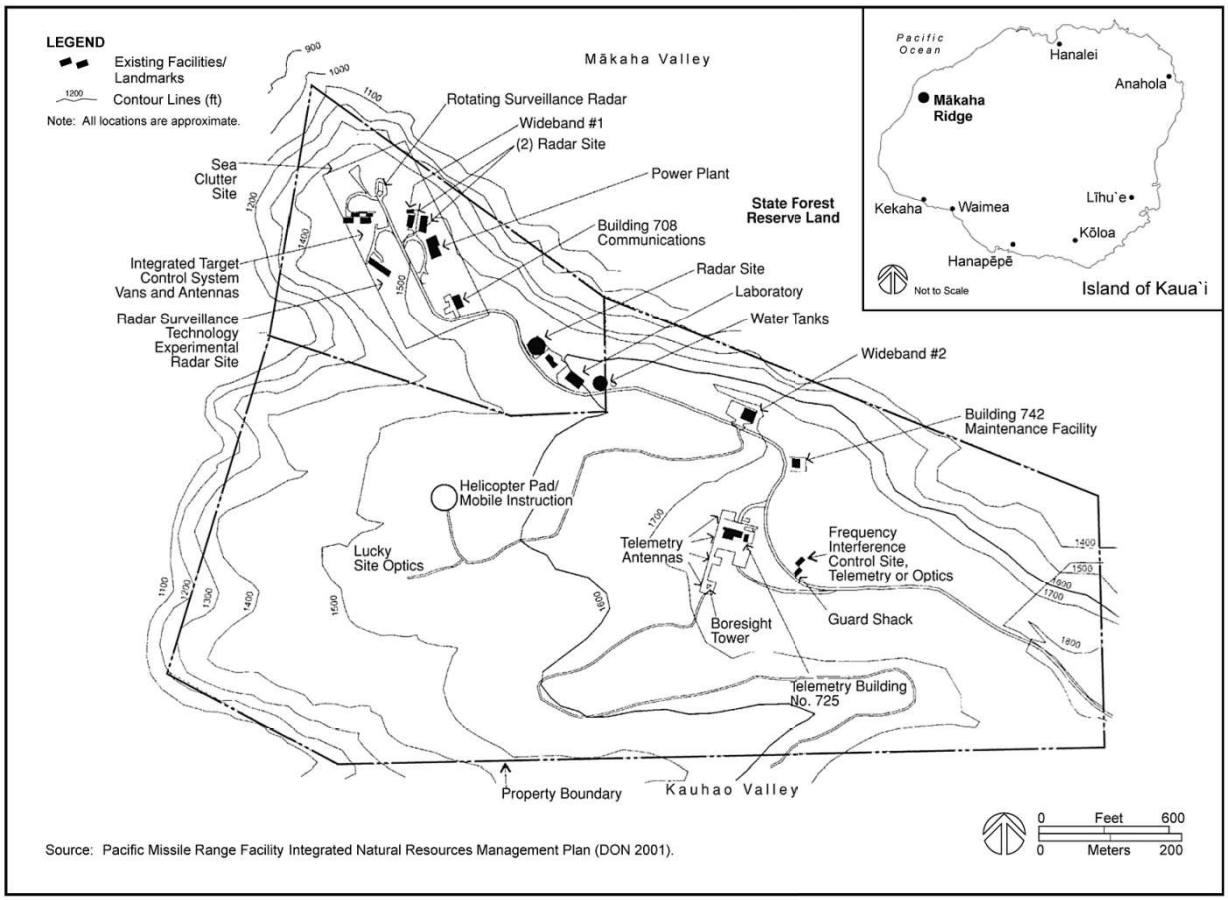

Figure 3. Map of Makaha Ridge site, PMRF, Kauai (Source: COMNAVREGHI 2010).

e) Kokee Sites

The PMRF Kokee sites contain four Navy-operated and maintained buildings in which telemetry, tracking, communications, and command and control operations occur (Kokee Sites A through D, Figure 4). A Geophysical Observatory operated by the National Aeronautics and Space Administration (NASA) is also located at the Kokee sites (Site E, Figure 4). Kokee Site A accommodates tracking and command, training and administration, and logistics support. Site B contains a power plant and fuel storage facility. Site C consists of boresight equipment, operations and maintenance support, a microwave antenna, and radar, and site D contains a transmitter building and antenna support facilities (COMNAVREGHI 2010, pp. 5-1 – 5-3). Although the US Air Force Station (USAF) and the PMRF Kokee sites are both located in northwestern Kauai in Kokee State Park (Figure 5), the sites are the not the same and the USAF is responsible for compliance for their operations at the Kokee Air Force station as described in the USAF Biological Assessment (USAF 2016).

Kokee Site A contains only two exterior security lights operated via motion sensors; lights are off unless motion is detected. Site B has no exterior lights. Site C contains a guard shack with an unshielded exterior security that was turned off beginning in October 2015, and site D has no

exterior lights. The NASA site (Site E) has four facility lights: two low wattage lights that remain on and two unshielded lights turned on by personnel as needed on infrequent occasions where they must be present at night. No above-ground transmission lines occur on the PMRF Kokee sites. The sites contain a total of 0.03 miles of barbed wire fence, consisting of three-strand barbed wire atop a chain link fence.

Two lattice-support communication towers are at Kokee Site C. Each tower has an unshielded steady-burning red light as per FAA and Commander, Naval Air Systems Command requirements. The communication towers are each 110 feet in height. Approximately 100 feet of each tower is exposed above the surrounding vegetation level. Communication Tower 764 has 28 guy wires.

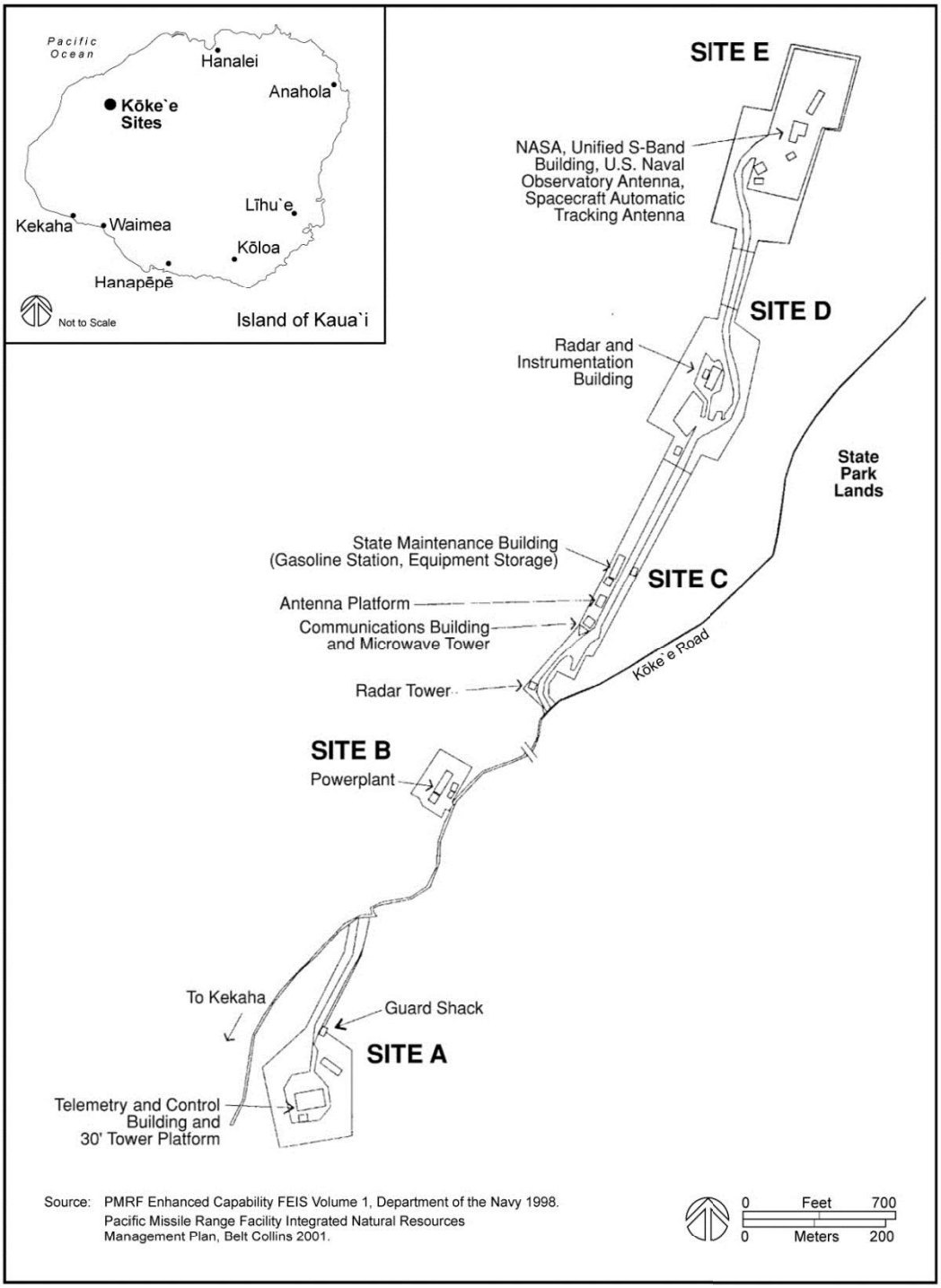

Figure 4. Map of PMRF Kokee Sites on Kauai (Source: COMNAVREGHI 2010).

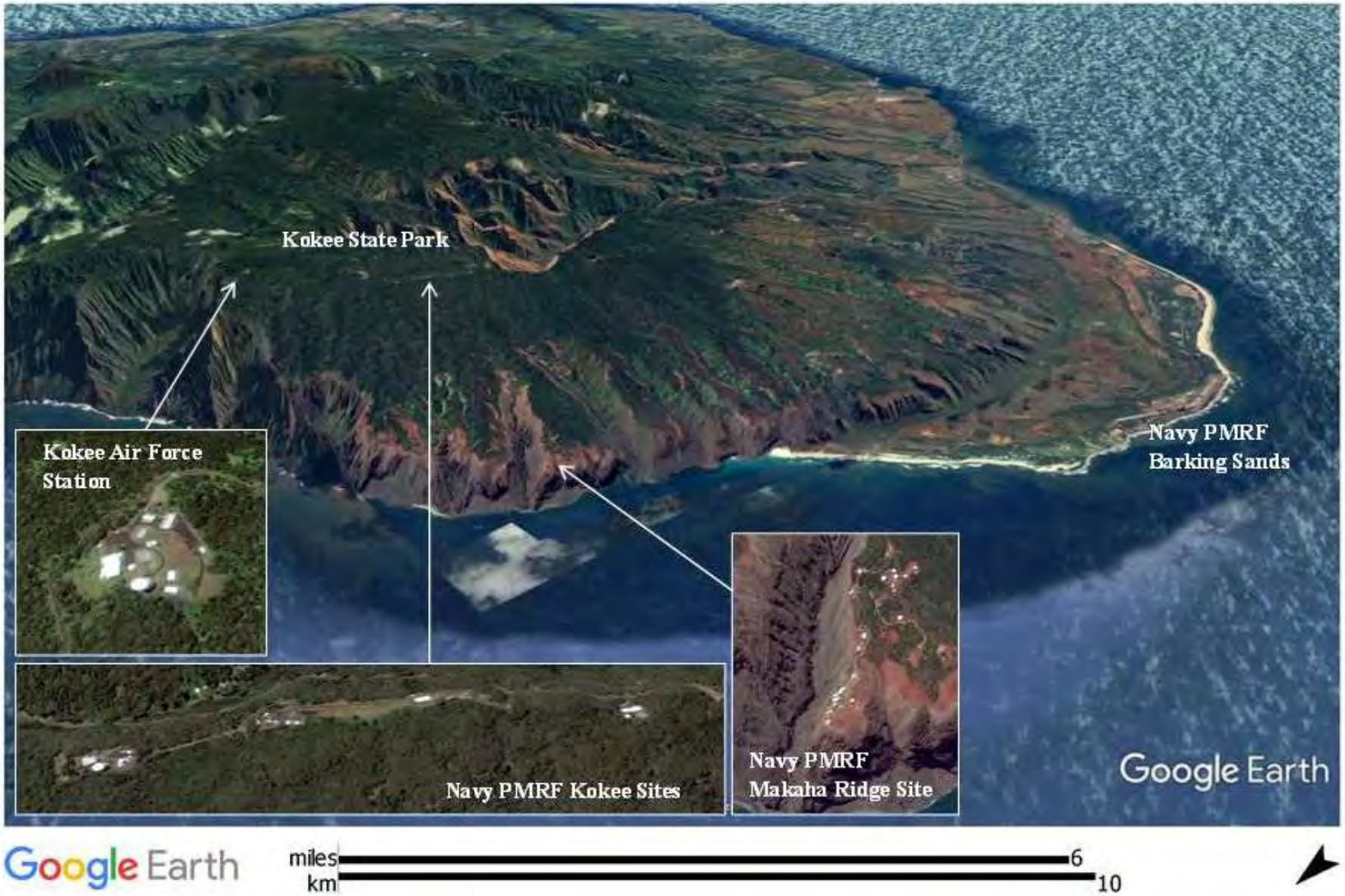

Figure 5. Three-dimensional view of Kauai with approximate locations of PMRF Kokee Sites and Kokee Air Force Station in Kokee State Park, PMRF Makaha Ridge Site, and PMRF Barking Sands. White shapes in zoomed views are buildings. Imagery from Google Earth, data SOEST/UHM and USGS, 2016 Digital Globe.

f) Kamokala Ridge Magazines

The Kamokala Ridge Magazines are located east of Barking Sands (Figure 1). Facilities at the site consist of two earth-covered magazines, 10 ordnance storage magazines excavated into the cliff face, and a missile assembly building. Ordnance is stored for the Navy, HIANG, DOE, and intermittently for other military commands with training and ordnance storage requirements (COMNAVREGHI 2010, pp. 6-1 – 6-2).

Per Navy instruction regarding security lighting for conventional arms, ammunition, and explosives (DON 2003), exterior lighting includes three floodlights on each of the two earth-covered magazines and a single incandescent bulb over the doorway of each of the 10 excavated magazines. This site includes 0.33 miles of barbed wire fencing, consisting of three-strand barbed wire atop a chain link fence.

g) Port Allen

At Port Allen Boat Harbor, the Navy leases the west side of the pier and pier building from the State of Hawaii. This site provides berthing facilities for three weapons recovery boats and a building for warehousing and support facilities including communications, maintenance/repair, and engineering.

Exterior lighting is required at the pier at Port Allen for Anti-Terrorism/Force Protection purposes (DON 2007) and to minimize nighttime trip and fall hazards near the water. Eleven lights are mounted under the roof overhang on the west side of the building, and one light is mounted on the front of the building (the northwest corner). The light on the front of the pier building is owned and operated by the Navy. The eleven lights along the west side of the building are operated by Navy, but the light fixtures are State property. These lights are turned on each night for security camera lighting and safety purposes. Six higher-intensity lights are turned on only during rare/infrequent occasions when personnel are working on docked boats on nights when fueling or upload/offload of equipment occurs. The site contains 0.05 miles of barbed wire fencing, consisting of three-strand barbed wire atop a chain link fence.

h) Miolii Ridge

The Miolii Ridge site is comprised of three, small 10-foot 2 reflector areas. No facilities are located at the site.

ii. Conservation Measures to Minimize Impacts of the Proposed Action

The following mitigation measures were developed by the Navy through consultation with the Service, are considered part of the proposed action, and are intended by the Navy to minimize adverse impacts to the Newell's shearwater that are directly related to the proposed action. These include measures that have been implemented at PMRF prior to initiation of this consultation.

a) Nocturnal Seabird Protection Program. The following measures are described as the nocturnal seabird protection program:

- All unnecessary exterior lighting will be turned off during moonless nights and shoulder nights during the seabird fledgling season. For example, in the 2016 seabird fledgling season, this measure was implemented during the seven nights prior to and eight nights following the September 30th new moon, the 10 nights prior to and eight nights following the October 30th new moon, and the eight nights prior to and two nights following the November 29th new moon;
- Full cut-off fixtures will be used where security or safety concerns require night lighting;
- Staff will patrol to confirm any exposed lights during the night are truly required and meet the shielding requirements;
- Base-wide predator control will be implemented to enhance survival and minimize the risk of predation to any downed seabirds on the installation;
- Monitoring will be implemented for downed seabirds on the installation during the seabird fledging season;
- Support will continue for a seabird collection station at the Main Gate entrance to Barking Sands for the SOS program;
- Recovered downed seabirds found at PMRF and will be placed in the seabird collection station at Barking Sands or transported to Kauai Humane Society, where the SOS program is housed; and
- Brochures will be distributed at Barking Sands to further increase personnel and visitor awareness of on-base seabird protection measures.

b) Early Planning and Scheduling

The installation commander has issued a notice (PACMISRANFAC NOTICE 10570 dated September 15, 2017) that gave guidance on measures to be implemented to reduce/eliminate risk to protected seabirds during the fledging season. Over the past 8 years, 93 percent of Newell's shearwater fallout has occurred between 12 October and 8 November (DON 2018). A calendar has been developed to overlay the moon phases with the shearwater fledging season to identify potential periods of higher risk such as nights of dark moon phases within the historical peak fallout period during previous fledging seasons. The Navy will minimize risk by scheduling non-time sensitive night operations outside the peak of the seabird fledging season to the extent practicable. It is estimated that operations would not be able to avoid the dark moon phases during the fledging season an average of once per year. In the future, there may be more flexibility in scheduling operations outside the dark moon phases as planning for operations can occur more than two years in advance.

c) Night-time Lighting Inspection

The Navy will conduct a night-time lighting inspection prior to the start of the seabird fledging season to confirm that the minimization measures regarding lighting are being followed and to identify potential risks that may not have been previously identified and addressed.

d) Parking Lot Lighting

During the seabird fledging season, lighting in the Aegis Ashore parking lot and other parking lots will be turned off with the exception of the shielded light at the Public Works parking lot,

and would only be temporarily lit for safety or special uses. Back-in parking will be required in parking lot stalls facing the ocean.

e) Interior Lighting

The Crash Fire Garage door is usually kept open to minimize response times in case of emergency. The Navy will reduce the interior garage lighting to the minimum required for fire crews to perform their work during the seabird fledging season. For other facilities such as hangars, exterior lighting will be minimized and bay doors will be kept closed as much as possible during the seabird fledging season.

f) Guideline for Implementation of Conservation Measures

Based on an analysis of seabird fallout trends over the past few years, the Navy has identified the change in personnel involved in implementing conservation actions as a contributing factor to the unexpectedly high fallout during the 2014 fledging season. The Navy has prepared draft guidelines to provide clarity and continuity in implementing biological opinion-associated conservation measures. These guidelines will clarify roles and responsibilities, point of contact information, minimum coordination and communication strategies, and documentation and reporting procedures for successful implementation of the biological opinion-associated conservation measures. In addition, a schedule describing the type of training and coordination planned, the target audience, and sample training materials will be maintained in the appendices of the guideline document. The document is a guideline instead of a traditional Standard Operation Procedure because it is intended to be a living document that can be adapted to maximize effectiveness as the program evolves.

g) Command Duty Officer Smartbook for Environmental Response

Additional guidance materials have been added to the Command Duty Officer (CDO) binder to provide immediate guidance to the CDO on duty.

h) Conservation Measures Pursuant to ESA Section 7(a)(1).

The following conservation measures were developed by the Navy through consultation with the Service to fulfill the Navy's ESA Section 7(a)(1) responsibilities for having an impact on Newell's shearwater.

The Remotely Piloted Air Vehicle (RPAV) Project
Navy has funded a project, in collaboration with the Hawaii Department of Land and Natural Resources (DLNR) Kauai Endangered Species Recovery Project (KESRP), to use a RPAV and ornithological radar to map flight paths and document nesting locations of Hawaiian Petrels (*Pterodroma sandwichensis*) and Newell's shearwaters on Kauai. As part of this project, KESRP has been subcontracted to ground-truth colony locations based upon RPAV data. If the RPAV does not successfully identify colony locations, KESRP will undertake nest monitoring in currently-known colonies as part of this project. This work was funded by the Navy in FY13 at $250,000.

KESRP Field Assistant
The Navy provided a full-time Endangered Seabird Field Assistant to the Hawaii DLNR KESRP for four months in 2012 (15 May through 15 September). This position was funded by the Navy at a total of $28,000. The Navy also funded KESRP in the summer of 2013 to conduct nest monitoring in currently-known Newell's shearwater colonies on Kauai at a funding level of approximately $40,000.

Seabird Conservation Account
The Navy proposes to contribute to the Hawaiian Seabird Conservation Account managed by the Service and administered by the National Fish and Wildlife Foundation in exchange for transfer of liability of further compensatory mitigation actions and to receive credits to offset the anticipated impacts to Newell's shearwater from the proposed action. Funds will be used to contribute to conservation of the species through management of seabird breeding colonies. Management may include removal of non-native predators, such as rats (*Rattus spp.*), feral cats (*Felis catus*), pigs (*Sus scrofa*), and barn-owls (*Tyto alba*), and restoration of occupied seabird breeding habitat. Partners implementing the management will demonstrate effectiveness through monitoring to detect the number of predators present and the number removed at the seabird breeding colony(ies) receiving the management.

In 2022, the Navy will coordinate with the Service to reevaluate their action of contributing to the Hawaiian Seabird Conservation Account and the effectiveness of the management implemented at the seabird breeding colony(ies). The Navy's contributions are anticipated to support, annually, management for 30 breeding pairs in 2018 and expanding management to affect 50 breeding pairs by 2022. Unless the Navy and Service reinitiate consultation based on the 2022 evaluation, the Navy's funding contributions to the Hawaiian Seabird Conservation Account will continue in years after 2022 at a level supporting, annually, the management of 50 breeding pairs.

iii. Annual Reporting on Conservation Measures

The Navy will submit annual reports detailing the implementation of the above Conservation Measures used to minimize the effects of the action. Annual reports will also summarize survey and monitoring results and levels of take of all ESA-listed species. The first report will be submitted at the end of the first fiscal year following BO issuance.

Action Area

The action area of a project is defined by regulation as all areas [likely] to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). The action area for this action (Figure 6) includes the main base of PMRF, known as Barking Sands, and all of Mana Plain, which surrounds Barking Sands, because this area is likely to be subject to above ambient light and noise levels associated with launches and aircraft operations. In addition to Barking Sands and the surrounding Mana Plain, the action area (Figure 6) is also comprised of several smaller sites located at Makaha Ridge, Kokee, Kamokala Ridge, and Port Allen that will also be subject to above ambient noise and light levels caused by Navy operations. Lastly, the action area also includes the western region of the island, from

Waimea Canyon through the Na Pali coast (Haena, Kokee, and Polihale State Parks), which constitutes the areas affected by the action. Air operations and missile launch operations produce noise and/or are visible within the action area. The action area, encompassing the region west of Haena to Port Allen, constitutes approximately 40% of Kauai.

Details of the sites which encompass the action area are provided below, in part, based on descriptions found in the draft BA, current conditions sections of the 2010 PMRF INRMP (COMNAVREGHI 2010). Additional details including maps and pictures of each PMRF site are provided in the 2010 PMRF INRMP.

Barking Sands is located along the Mana Plain on the western coastline of Kauai (Figure 6). The base is approximately 7 miles long and 0.5 miles wide, encompassing approximately 2,060 acres. Barking Sands is bordered to the north by Polihale State Park and to the south by Kokole Point. Barking Sands is bordered to the east by agricultural lands, which continue across the Mana Plain to the mountains of central Kauai. Barking Sands is bordered to the west by the Pacific Ocean, with a coastline dominated by sand beaches, beach barrier dunes, and beach strand vegetation. The Nohili Dunes provide the highest elevation at Barking Sands, approximately 100 feet. The drainage ditches constitute most of the surface water within Barking Sands.

Mana Plain extends across coastal leeward Kauai (Figure 6) and is bordered by Puu Ka Pele Uplands to the east, including Makaha Ridge, Na Pali coastline to the north, and Pacific Ocean to the west and south. Mana Plain once contained expansive wetland habitats that supported a variety of native plant and wildlife species. Prior to its drainage and conversion to agricultural lands during the 1900s, approximately 1,700 acres of permanent, semi-permanent, and seasonal wetlands were present on Mana Plain.

Makaha Ridge is a finger ridge of the Na Pali coast which occurs on the west-northwest side of Kauai to the northeast of Barking Sands (Figure 6). The elevation at Makaha Ridge ranges from 1,460 feet at the cliff faces to 1,850 feet at the eastern perimeter. The site covers 244 acres and lies approximately 7 miles north of Barking Sands within State of Hawaii forest reserve areas. Steep slopes surround the station to the south, west, and north. Water drainage paths exist at the site; however, there are no perennial surface water features.

The Kokee sites of PMRF (Figure 6) occur along Kaunuohua Ridge near the northwestern terminus of Waimea Canyon. Kokee State Park borders the sites on all sides, and forested areas extend within the property boundaries. The Kokee sites are located on five small parcels that total 16 acres of land, which range in elevation from 3,710 to 3,800 feet. No surface water resources occur at the sites.

The Kamokala Ridge Magazines is located approximately 1.5 miles east of Barking Sands covering 89 acres on the western side of the ridge (Figure 6). Elevation of the site ranges from 240 to 320 feet. The ridge is located on the western edge of the Puu Ka Pele, an upland area with numerous valleys that are characterized by rock outcrops and lowland dry vegetation. The Mana plain extends to the west of Kamokala Ridge. There are no perennial surface water features at the site.

The PMRF Port Allen site is located in the town of Port Allen (Figure 6) on the southern shore of Kauai. At this site, the Navy leases the west side of the pier and west side of the pier building from the State of Hawaii. The total area of the leased site is 1.0 acre. Because the Navy does not have jurisdiction over the lighting conditions on the east side of the pier, owned and operated by the State of Hawaii, the action area is restricted to the Navy-leased property on the west side of the building and pier.

The Na Pali Coast in northwestern Kauai extends from Haena to Polihale State Park (Figure 6). The elevation along the coast ranges from sea level to 3,700 feet in Kokee. The Na Pali region is characterized as a coastal cliff formation with numerous upland finger ridges, precipitous cliffs, and deeply incised valleys. The elevation in the rim areas ranges from approximately 2,700 to 3,600 feet.

Waimea Canyon is located in the western region of Kauai (Figure 6) and is bordered by Puu Ka Pele uplands and Na Pali Coast to the west, Makaweli uplands to the south, and the Alakai High Plateau to the north. The elevation in Waimea Canyon ranges from approximately 100 feet up to 3,700 feet at the canyon rim. The Waimea Canyon is characterized by near vertical cliffs and dramatic valleys. Several streams flow into the Waimea River in the Waimea Canyon, including Poomau, Waiahulu, Koaie, and Waialae streams.

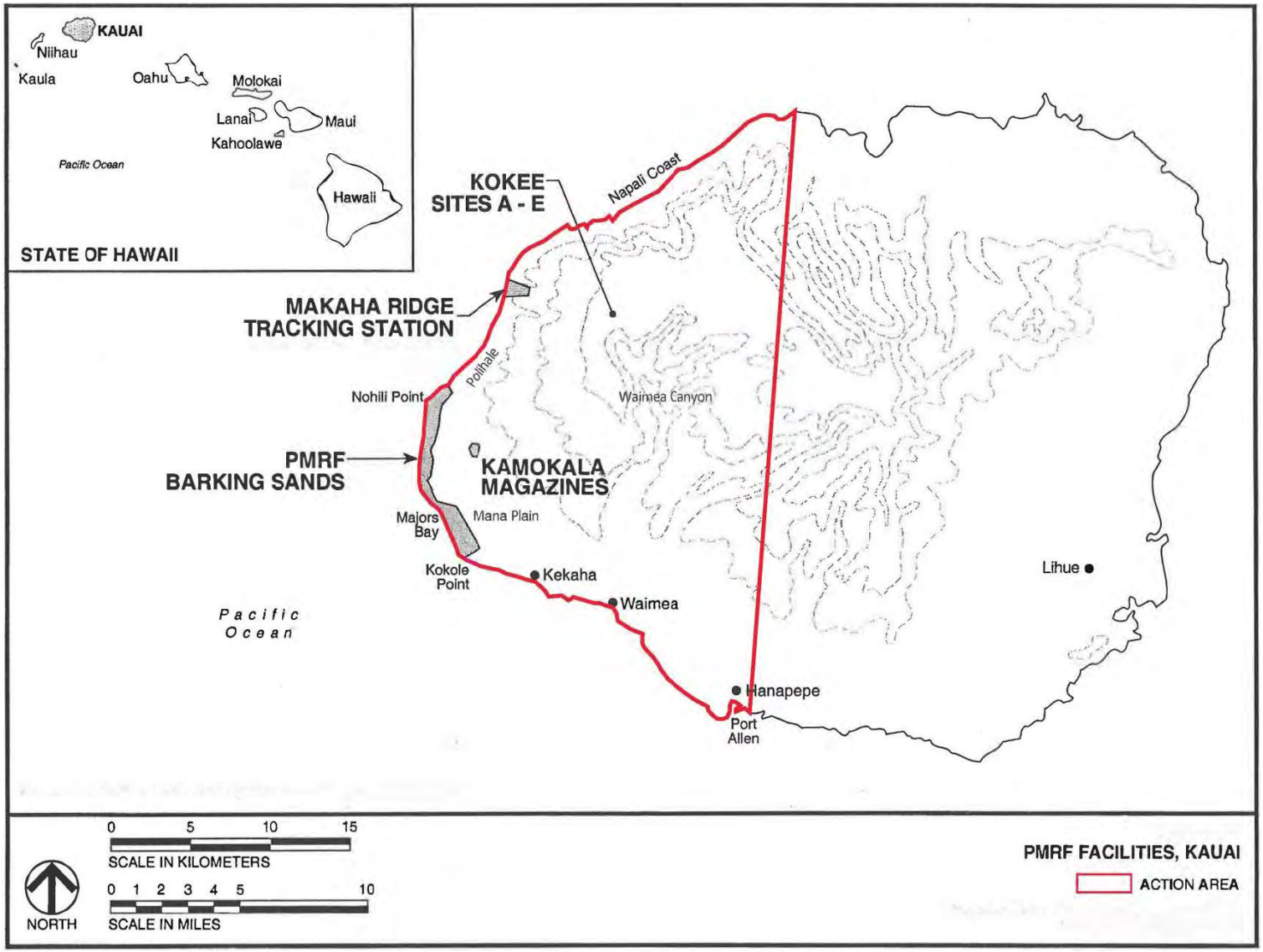

Figure 6. Map of action area for the proposed action on Kauai. Action area encompasses the area within the red border. (Source: COMNAVREGHI 2001).

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on four components: (1) the *Status of the Species*, which evaluates the Newell's shearwater range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the Newell's shearwater in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the Newell's shearwater; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the Newell's shearwater; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the Newell's shearwater.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the Newell's shearwater's current status, taking into account cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the Newell's shearwater in the wild.

The jeopardy analysis in this biological opinion places an emphasis on consideration of the range-wide survival and recovery needs of the Newell's shearwater and the role of the action area in the survival and recovery of the Newell's shearwater as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

STATUS OF THE NEWELL'S SHEARWATER

i. *Listing Status, Taxonomy, and Species Description*

The Newell's shearwater was listed as a threatened species in 1975 (USFWS 1983), pursuant to the Endangered Species Preservation Act of 1966. *The Hawaiian Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan* was published in 1983 (USFWS 1983). Species five-year reviews on Newell's shearwater were completed in 2011 and 2017. Each of the reviews recommended up-listing the Newell's shearwater to endangered status primarily due to precipitous declines in the global population over the last two decades. Critical habitat has not been designated for the Newell's shearwater (USFWS 1983).

The Newell's shearwater taxonomically belongs to the *Puffinus* genus, in the *Procellariidae* family and *Procellariiformes* order, along with 20 other extant shearwaters ranging throughout the Indian, Atlantic, and Pacific oceans (Gill and Donsker 2016). Shearwaters are characterized by exhibiting a "shearing" flight pattern, dipping from side to side on stiff, straight wings with few wing beats. Genetic analyses conducted by Martíinez-Gómez *et al.* (2015) confirmed the taxonomic status of Newell's shearwaters (P. *auricularis newelli*) as a subspecies alongside the Townsend's shearwater (*P. auricularis auricularis*). These two subspecies comprise *P.*

auricularis. The two subspecies exhibit minor differences in plumage patterns and breeding chronology (Martíinez-Gómez *et al.* 2015, p. 1026). The Townsend's shearwater is endemic to the Revillagigedo Archipelago located off the coast of Mexico and south of Baja California Peninsula. The Townsend's shearwater's range and distribution has been significantly contracted to a single island with less than 100 breeding pairs remaining (Martíinez-Gómez *et al.* 2015, p. 1032; and BirdLife International 2016a).

The Newell's shearwater is approximately 12 to 14 inches long, with a wingspan of 30 to 35 inches (Berger 1972, p. 46), and weighs approximately 14 ounces (Ainley *et al.* 1997, p. 15). Its plumage is glossy black above, and white below (Ainley *et al.* 1997, p. 15). The Newell's shearwaters' maneuverability is characterized by fast, directional, and a low-to-water flight pattern, due to high wing-loading. A Newell's shearwater wing-loading averages about 60 N [newtons]/m2 (± 5.3 SD) with a low aspect ratio (10.3 ± 0.45 SD); significantly different from other shearwaters or petrels (Spear *et al.* 1995; Warham 1977). Observations of Newell's shearwaters transiting over land show a distinct flight pattern characterized by an almost frantic flapping style with the wings held straight (KESRP 2017). It has a dark gray to brown bill that is sharply hooked at the tip (Ainley *et al.* 1997, p. 15). Its claws are well adapted for burrow excavation and climbing.

ii. Historic and Current Distribution

The Newell's shearwater is believed to have colonized, historically, many of the southeastern Hawaiian Islands, including Hawaii, Maui, Molokai, Oahu, and Kauai (USFWS 1983, p. 2; Pyle and Pyle 2009, p.3). Newell's shearwaters were thought to be extinct after 1908, due largely to habitat loss and predation, but in 1954 a specimen was collected on the island of Oahu (King and Gould 1967) and in 1967 a breeding colony was found on Kauai (Sincock and Swedberg 1969). Although no Newell's shearwater breeding colonies have been identified on the island of Oahu, downed Newell's shearwaters have been recovered throughout the island since the 1950s (Pyle and Pyle 2009, p.3). Three fragmented breeding areas were identified in the Puna District on the southeast island of Hawaii in 1993, based on nocturnal calling, visual detections of birds in flight, and two Newell's shearwater carcasses found along the highway; however no active burrows were found (Reynolds and Ritchotte 1997, p. 31). Currently, research staff at Haleakala National Park on Maui Island consistently report Newell's shearwater ground calling within Kipahulu Valley and along the northern slope of Mount Haleakala near Koolau Gap, indicating a breeding site (NPS 2012, p. 18). However, due to sensitive resources in the area and the difficult terrain, no ground surveys have been conducted in these locations (NPS 2012, p. 19). In 2015, acoustic song meters were placed at 41 sites in remote areas of Haleakala National Park to detect potential new seabird breeding colonies (McKown and Savage 2015, p. 1). Song meters detected Newell's shearwater ground calls in low numbers (averaging 2 ground calls per survey night) at five of the 41 sites, with only one site recording regular activity during the 30-day study period (McKown and Savage 2015, p. 15). The song meters in this study were programmed to record 1 out of every 5 minutes, for 5 hours starting at sunset, then record 1 out of every 10 minutes for the 5 hours preceding sunrise (McKown and Savage 2015, p. 3). This schedule amounted to an hour and a half of data each night. Additional longer-term acoustic and ground surveys are needed to evaluate the extent, distribution, and viability of Newell's shearwater on Maui and Hawaii islands.

While some knowledge gaps remain concerning its distribution, the Newell's shearwater has experienced a significant breeding range contraction and currently, all known extant breeding colonies with documented burrows are located on the island of Kauai (Figure 7). Estimates indicate 90 percent of the global population resides on Kauai (Ainley *et al.* 1997; Griesemer and Holmes 2011).

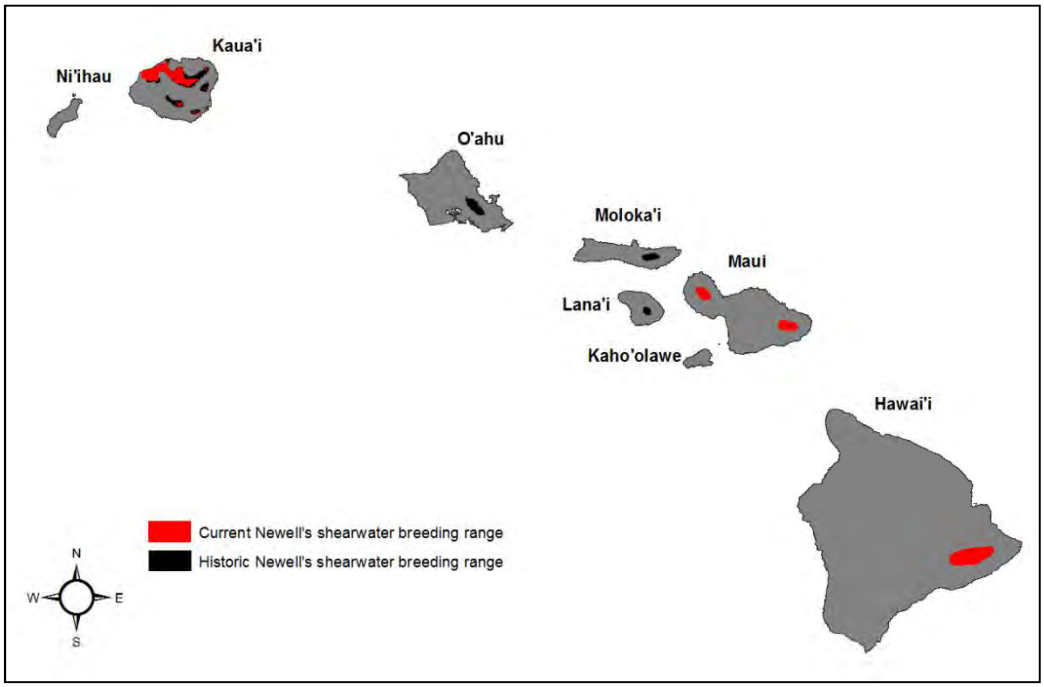

Figure 7. A comparison of the historic and current breeding range for the Newell's shearwater. Map shows current breeding range contraction from the historic breeding range for the Newell's shearwater within the Hawaiian Archipelago. While the Newell's shearwater may breed on Hawaii and Maui islands, the only known extant breeding colonies with documented burrows of Newell's are located on the island of Kauai.

Of the Newell's shearwater breeding on the island of Kauai, 104 breeding pairs were being monitored and an additional 64 burrows in Upper Limahuli Preserve were monitored in 2015 but could not be identified to species (i.e., burrows were either Newell's or petrels) (Raine *et al.* 2016a, 2016c). The majority of the monitored shearwaters (82 breeding pairs) in 2015 were concentrated within the Upper Limahuli Preserve (ULP), enclosed by an ungulate exclusion fence. Auditory surveys documented several additional areas of concentrated shearwater ground-calls indicating breeding activity within Lumahai Valley and Laau Mountain in montane habitat and within Honopu Valley along the Na Pali coast (Banfield *et al.* 2013). However, due to inaccessible and difficult terrain, no numbers or estimates exist for shearwaters breeding in these locations.

Based on historic and current distribution of breeding sites, Newell's shearwaters prefer breeding habitat in montane wet (e.g., Hono o Na Pali colony) to lowland wet and wet cliff (e.g., Upper Limahuli colony) habitat of 200m to 1,000m in elevation, steep to moderate slopes with thick native understory of uluhe fern (*Dicranopteris linearis*) and open canopy of dispersed ohia trees (*Metrosideros polymorpha*) (Troy *et al.* 2014, p. 325). The preference for montane forested

habitat beneath dense uluhe fern helps to conceal shearwater burrows from predators while dispersed ohia trees may provide a take-off point for shearwaters to regain flight (Troy *et al.* 2014, p. 318). The Newell's substrate preference includes rocky volcanic soils with a moderate amount of fine soil particles and suitable drainage to prevent burrow flooding (Troy *et al.* 2014, p. 324). Recent seabird surveys have resulted in the first confirmed Newell's shearwater burrows (n=3) along the Na Pali coast, in dry cliff habitat (Raine and Banfield 2015a, p. 11).

iii. Life History

Newell's shearwaters have a long lifespan (up to 36 years), do not reproduce until 6 years of age, lay one egg per year, and offspring require significant parental investment (Ainley *et al.* 2001). As with other k-selected species[1], these traits of long lifespans and low reproduction at high energetic cost define the life strategy of a species that has evolved in a stable, predictable environment, i.e. the succession of ecosystem development in the Hawaiian Islands following a period of volcanic eruptions.

Newell's shearwater breeding season begins in late March/early April when adults and sub-adults arrive to inland breeding colonies, followed by a 2-4 week exodus when breeding adults forage to build-up reserves (Raine and McFarland 2013a, p. 2; Raine and Banfield 2015a, p.2). The incubation period begins in May and continues through July, and the chick provisioning stage occurs in late July through September (Raine and McFarland 2013a, p. 2). Both sexes equally incubate the egg (Ainley *et al.* 1997, p. 10). The fledging or late chick rearing stage, when young leave the nest for the first time occurs in September through December (DOFAW 2018; Raine and McFarland 2013a, p. 2). Adults travel from breeding to feeding areas and return to feed their chicks irregularly every one to three nights throughout the chick rearing stage (Ainley *et al.* 1997). Newell's shearwaters, similar to other birds in the Order Procellariiformes, exhibit strong natal philopatry, with breeding pairs returning to the same burrow to breed each year (Bried *et al.* 2003, p. 242).

Ainley *et al.* (2001, p. 117) documented higher than expected numbers of active shearwater burrows with no egg or nestling signs present (11%-22%), indicating no breeding attempt was made. Monitoring data of shearwater colonies indicate at least 10% or more of activity within breeding colonies is comprised of non-breeding birds or sub-adults (<6 years old) prospecting for mates or excavating burrows during the breeding season (Raine *et al.* 2016a, 2016c). Ainley *et al.* (1997, p. 11) suggested shearwaters on Kauai begin returning to their breeding habitat as sub-adults at 2-3 years of age. The full shearwater breeding season is treated as March 1 to January 1 to cover the entire period when shearwaters may transit to and from the ocean and inland breeding sites (Travers *et al.* 2016, p. 5). All transit over land occurs in darkness, with a peak over land passage during the year coinciding with the late incubation and chick rearing stages (Travers *et al.* 2013, p. 35). Fledglings leaving the nest for the first time exhibit strong phototropic behavior and rely on ambient light from the moon to navigate to open ocean (Telfer *et al.* 1987, p. 410).

[1] K-selected species are those characterized by long lifespans and low reproduction at high energetic cost due to their evolution in stable environments.

Newell's shearwaters are pelagic, spending much of their time foraging over deep waters where 96 percent of their diet consists of cephalopods, primarily the Ommastrephidae family of flying squid with the remaining 4 percent consisting of flying fish (*Exocoetus* sp.) (Ainley *et al.* 2014, p. 70). Newell's shearwaters likely specialize in feeding over yellowfin tuna (*Thunnus albacares*), as both flying squid and flying fish are important in the diet of yellowfin tuna.

iv. *Current Population Demographics*

At-sea surveys conducted in the central and eastern tropical Pacific between 1980 and 1994 (Spear *et al.* 1995) estimated the total Newell's shearwater population at 84,000 (95% CI = 57,000-115,000) including juveniles and sub-adults. An updated assessment based on survey data collected by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA-NMFS) Southwest and Pacific Islands Fisheries Science Centers from 1998 to 2011, estimated the total Newell's shearwater population at 27,011 (95% CI = 18,254-37,125) including juveniles and sub-adults (Joyce 2013). Given 90 percent of the global population resides on Kauai (Ainley *et al.* 1997; Griesemer and Holmes 2011), the estimated population of Kauai is 24,310 individuals (USFWS 2017b, p. 113). The percentage of the population that is breeding age (6 years of age or older) is estimated at 0.637 (Ainley *et al.* 2001, p.115), equaling an adult population size of 15,485 (approximately 7,500 pairs).

Annual survivorship and juvenile/sub-adult survivorship of the Newell's shearwater has not been studied in the field (i.e., estimated from banding efforts and recapture). Population viability modeling efforts estimate Newell's shearwater adult survivorship at 0.905 (Ainley *et al.* 2001, p. 116) to 0.920 (Griesemer and Holmes 2011, p. 20; USFWS 2017b) and juvenile/sub-adult survivorship at 0.333 (Ainley *et al.* 2001, p. 116) based on long-term survivorship data of related species. The likelihood of Newell's shearwater adults (≥ 6 years of age) to breed in any one year was estimated to vary between 0.60 and 0.50 (Ainley *et al.* 2001, p. 118), which is markedly lower than the breeding probability (0.82) of other Procellariidae species. Based on a five-year monitoring study of a single Newell's shearwater colony on Kauai the annual reproductive success of shearwaters was estimated at 0.66 fledglings per breeding pair (Ainley *et al.* 2001, p. 117).[2] In comparison, the Manx shearwater, a closely related species with an extensive range and a stable global population has a reproductive success of 0.70 (Brooke 1990; and Ainley *et al.* 2001, p. 117).

Based on Newell's shearwater population parameters, SOS data, and carcass searches under power lines, Ainley *et al.* (2001) estimated the global population of Newell's shearwaters are declining at least 5.9 percent per year (λ=0.941). Ainley *et al.* (2001, p. 118) found that the main factor limiting the population growth rate of the Newell's shearwater was the extremely low breeding probability (0.547), which is associated with individual fitness and habitat quality. Ainley *et al.* (2001) suggested that the low breeding probability could be the result of high mate loss due to predation or other threats affecting individual fitness. Indeed, adults that lose a mate due to predation cannot obtain a new one quickly and have been observed not to breed the

[2] Reproductive success is defined as the number of chicks fledged from active burrows (Ainley et al. 2001).

following season (Ainley *et al*. 2001, p. 118). The purpose of the Ainley *et al.* (2001) population demographic study was to evaluate the status of Newell's on Kauai. The study sampled an average of 65 burrows for seven seabird seasons, 1981–1985 and 1993–1994. The colony sampled was in a natural state (i.e., receiving no conservation management actions) and the sample was not constrained to only experienced breeders, but rather sought to maximize the total number of burrows monitored each season (Ainley *et al.* 2001, p. 112).

Ornithological radar data was first used to monitor populations of Newell's shearwaters and Hawaiian petrels on Kauai in 1992-1993 (Day *et al.* 2003, p. 670), based on methods developed to monitor marbled murrelet (*Brachyramphus marmoratus*) populations in the Pacific Northwest (Cooper *et al*. 2001). Radar has been used to monitor the summer movement patterns of Newell's shearwaters and provide an accurate estimate of birds as they transit through the detection area at 13 sites throughout the island (Day and Cooper 1995; Raine *et al.* 2017). Day *et al.* (2003) reported a mean annual rate of 11.2 percent decline in the Newell's shearwater population between 1993 and 2001, based on the analyses of ornithological radar data.

A subsequent study using visual observations, species-specific timing of petrel and shearwater movements, and radar data analysis showed an appreciable reduction in the number of shearwaters transiting to and from montane breeding colonies from 1993 to 2013 (Raine *et al.* 2017), updating the analyses presented in Day *et al.* (2003). Radar surveys were conducted in coastal areas of known seabird flyways in May through mid-July, during the incubation and early chick-rearing stage. Therefore, these radar data are a conservative index of breeding activity. The overall mean for shearwaters across all 13 radar sites surveyed in 1993 was 524 ± 207 targets/h and in 2013 was 34 ± 9 targets/h, representing a mean decrease of 94% between the two periods ($t = 2.37$, $P = 0.03$; Raine *et al.* 2017). All of the 13 sites showed a large decrease in movement rates over the entire period, with movement rates at 12 (92%) out of 13 sites showing statistically significant declines (Raine *et al.* 2017). Based on the radar data (Raine *et al.* 2017) as a proxy for the breeding population, the Newell's shearwater population on the island of Kauai declined, annually, at a mean rate of 12.5 percent over the 20-year period. This updated rate of decline of the Newell's shearwater population is comparable to the mean annual rate of -11.2 percent between 1993 and 2001 reported by Day *et al.* (2003, p. 673).

Ainley *et al.* (2001) had documented 14 shearwater breeding colonies distributed across Kauai (Figure 8). Several of these formerly large Newell's shearwater colonies in Kalaheo, Kaluahonu, and Makaleha on the island of Kauai have declined dramatically in recent decades to near extirpation (Raine *et al.* 2017). No population data exists for Newell's breeding on other islands.

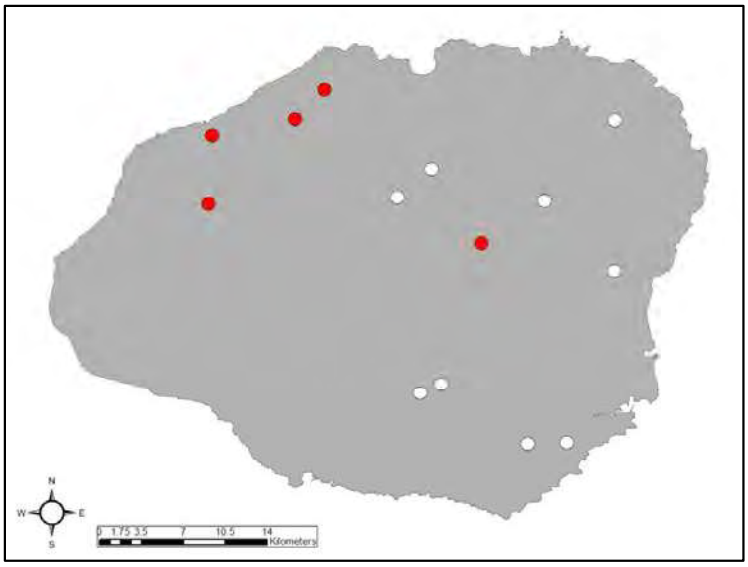

Figure 8. Map of Kauai showing Newell's shearwater breeding colony locations (n=14) (Ainley *et al.* 2001); unfilled circles (n=9) represent colonies near extirpation (<5 burrows).

In two breeding colonies on Kauai, ULP and Hono o Na Pali Natural Area Reserve (NAR), efforts are currently underway to curtail the population decline through the removal of predators. The reproduction output of the 104 monitored Newell's shearwater pairs breeding within these areas are measured in terms of their reproductive success.[3] Since 2011, the reproductive success of Newell's shearwater pairs within ULP has increased by 27 percent, from 0.692 to 0.882 in 2011 and 2015, respectively (Raine *et al.* 2016a, p. 16). This increase appears to be a direct result of the ungulate exclusion fence completed in 2010 and intensive predator control that began in 2011. Indeed prior to these conservation efforts, surveys at ULP documented a 0.545 reproductive success rate (Table 2). Newell's are less prevalent than petrels within Hono o Na Pali Natural Area Reserve (NAR) and have not been as successful in reproducing (Table 2) due primarily to predation by cats, rats and feral pigs, despite the ungulate exclusion fencing and predator control. In addition to the reproductive success rates from Newell's burrows listed in Table 2, there were an additional 162 burrows at ULP and Hono o Na Pali NAR monitored in 2015 that could not be identified to species (i.e., burrows were either used by Newell's shearwaters or petrels).

Table 2. Reproductive success rates for Newell's shearwater breeding pairs (*n*) monitored each year (2010–2015) at Upper Limahuli Preserve and Hono o Na Pali Natural Area Reserve's Pohakea site.

Year	**2010 (*n*)**	**2011 (*n*)**	**2012 (*n*)**	**2013 (*n*)**	**2014 (*n*)**	**2015 (*n*)**
ULP	0.545 (11)	0.692 (15)	0.682 (34)	0.784 (46)	0.840 (59)	0.882 (82)
Hono o Na Pali NAR-Pohakea	no data	no data	no data	0.571 (8)	0.375 (20)	0.667 (22)

[3] Reproductive success in Procellariformes, also commonly referred to in scientific literature as breeding success, is the percentage of eggs laid that result in young fledged (Warham 1996).

v. *Threats*

Primary threats to the Newell's shearwater include artificial nighttime lighting (Reed *et al.* 1985; Cooper and Day 1998), collisions with power infrastructure (Cooper and Day 1998; Podolsky *et al.* 1998), predation by introduced predators (Raine and Banfield 2015b, 2015c), and changes to breeding habitat due to introduced invasive plants (Troy *et al.* 2014). These threats to the Newell's shearwater have been steadily increasing.

Artificial light sources collectively are a significant mortality factor associated with Newell's shearwaters (Ainley *et al.* 2001; Troy *et al.* 2011). Upward projecting nighttime lighting interferes with the shearwaters ability to navigate to and from their breeding sites. Shearwaters, primarily fledglings and sub-adults are disoriented by nighttime lighting and will circle light sources until they become exhausted and fall to the ground, where these birds are vulnerable to being killed by feral cats, dogs, or vehicles (Travers *et al.* 2013, p. 81). They often fly into utility wires, poles, trees, and buildings and fall to the ground; this phenomenon is referred to as "fallout". Once these seabirds fall to the ground, they are unable to regain flight unless they have access to an area with sufficient take-off conditions to allow enough air to move under their wing to provide lift (Ainley *et al*. 2015, p.32). Since 1979, the State's Division of Forestry and Wildlife (DOFAW) on Kauai with financial assistance from the Kauai Island Utility Cooperative (KIUC) (beginning in 2003) has supported the Save our Shearwaters (SOS) program to collect "downed" Newell's shearwaters and Hawaiian petrels (*i.e*., birds that have either collided with structures or fallen out, or have been injured or killed due to exhaustion caused by light attraction). Over a 37-year period (1979-2016), the SOS program documented a total of 30,552 Newell's shearwaters recovered, injured or killed due to artificial nighttime lighting (DOFAW 2018). In the 1980s through 1990s, an average of 1,247 Newell's shearwaters were processed by the SOS program each year, where carcasses were documented or injured birds were rehabilitated and released (DOFAW 2018).

Adults and sub-adults are subject to collisions with power lines while flying between their nesting colonies and at-sea foraging areas (Cooper and Day 1998, p. 18; Podolsky *et al.* 1998, p. 21). Nestlings are indirectly affected as they rely on provisioning from both parents in order to survive, thus the loss of either parent results in nestling fatality. In 1993, in a single breeding season Podolsky *et al.* (1998, p. 30) documented deaths of at least 70 breeding adults and 280 sub-adult shearwaters over the summer months, in addition to 340 fledgling deaths in the autumn months, all as a result of collisions with power lines on Kauai. However, this study covered only the eastern and southern portions of the island (Podolsky *et al*. 1998, p. 30).

Based upon recent information collected from passive acoustic song meters (n=51) by KIUC Underline Monitoring Program, the Service has conducted modeling to extrapolate the amount of documented take (i.e., collisions with power lines) to the entire power system on Kauai (USFWS 2017b). The Service estimates that 1,800 Newell's shearwater mortalities are occurring per year as a direct result of power line strikes under the KIUC Short-Term Habitat Conservation Plan (STHCP) and Incidental Take Permit (ITP), using the rounded average of 2014 and 2015 strikes from scenarios IV, VB, and VIA selected in the USFWS Newell's Shearwater Landscape

Strategy Appendix 2 (2017b, p. 123)[4] This number is substantially greater than what was anticipated at the time the ITP was issued. The KIUC Short-Term Habitat Conservation Plan and Incidental Take Permit authorized the annual take of up to 162 Newell's shearwaters and 2 Hawaiian petrels (adults and sub-adults) from 2011 to 2016.

Introduced predators, particularly cats, rats, feral pigs, mongoose (*Herpestes auropunctatus*), and barn owls, are a severe threat to the continued existence of the Newell's shearwater. Adults, sub-adults, and young are susceptible to predation by these introduced predators (Raine and McFarland 2013b; Raine and Banfield 2015a, p. 38). These non-native predators occur throughout the Hawaiian Islands, with the exception of the mongoose, which has not established a breeding or viable population on Kauai (KISC 2018).

Another threat to the Newell's shearwater is habitat loss due to invasive vegetation. Invasive plants alter the three-dimensional structure of Hawaiian forests (Asner *et al.* 2008) as well as disrupt other ecological processes. A vegetation shift in areas of Kauai away from native understory to invasive vegetation, including but not limited to strawberry guava (*Psidium cattleianum*) and ginger (*Hedychium gardnerianum*) has been associated with at least one abandoned Newell's shearwater colony on Kauai (Troy *et al.* 2014). Extreme weather events such as hurricanes Iniki (1992) and Iwa (1982) have caused significant disruptions in forest habitat and, coupled with colonization of invasive plants, have resulted in permanent habitat loss for forest birds (Pratt 1994). In addition, areas of degraded habitat have facilitated the spread of invasive mammalian predators (Raine *et al.* 2016b, 2016c, 2016d). For example, in a heavily degraded habitat Ainley *et al.* (2001) counted 30 dead Newell's shearwater sub-adults and adults due to predation in one season (Ainley *et al.* 2001, p. 121).

Other threats include climate change and its affects to both seabird adult survivorship and recruitment (Sandvik *et al.* 2012) by generally affecting food availability (Oro 2014). Research by Spear *et al.* (2007) and Ainley *et al.* (2014) also indicate that Newell's shearwaters forage readily with yellowfin tuna and may be vulnerable to fishery interactions.

vi. <u>*Survival and Recovery Needs*</u>

For purposes of this biological opinion, the "survival condition" of the Newell's shearwater in the wild represents the level of reproduction, numbers, and distribution necessary to support a persistent population in the Hawaiian Archipelago that is fully protected by the ESA. For purposes of this biological opinion, the "recovery condition" of the Newell's shearwater is that where the threats to the species have been addressed such that the protections of the ESA are no longer necessary to insure the survival condition of the Newell's shearwater in the wild.

The recovery plan (USFWS 1983) for the Newell's shearwater does not contain recovery criteria; rather general goals are listed that require revision due to a substantial amount of new information. For example, the recovery plan (USFWS 1983, p. 22) calls generically for reducing

[4] KIUC activities are also likely to cause take of Hawaiian petrels; however, updated estimates of annual petrel take levels are not described in this biological opinion.

annual SOS collected, lighting related fallout of Newell's shearwaters to less than 100 birds, and for developing efficient predator control methods to protect nesting sites.

In 2017, the Service finalized the *Newell's Shearwater Landscape Strategy* (USFWS 2017a). The Newell's Shearwater Landscape Strategy (USFWS 2017a) focuses on managing and enhancing extant colonies in areas with minimal light impacts, mitigating threats at the colony, and those encountered while in transit to the colony, and creating new colonies through social attraction and translocation (USFWS 2017a).

This strategy expands on actions completed by KIUC under the STHCP, including a predator-exclusion fencing feasibility study (Young and VanderWerf 2014) and the 2013–2014 Kauai island-wide auditory surveys to locate new shearwater and petrel colonies (Banfield *et al.* 2013; Raine and Banfield 2015b). The strategy describes general tools (i.e., manual predator control, ungulate and predator-exclusion fences) as well as translocation and social attraction activities to protect or augment existing breeding colonies and/or create new breeding colonies. Removing terrestrial predators (e.g. feral cats) that depress shearwater survival and establishing predator-free breeding habitat is required to successfully restore seabird colonies (Buxton *et al.* 2014; Jones and Kress 2012). On Kauai, repeated access into the colony to conduct intensive predator control in open systems can degrade sensitive vegetation, while predator ingress and predation remains constant. In montane habitat, manual predator control should be conducted as an incremental step towards the goal of constructing a predator exclusion fence culminating with predator removal or eradication.

Predator fencing is the most effective tool against mammalian depredation at the colony, particularly for indigenous species that are highly sensitive to predation (Young *et al*. 2013; Norbury *et al*. 2014). Within the current range of Newell's shearwater, topography, streams, and remoteness limit the number of sites and size of areas that can be protected with predator exclusion fences. Preliminary surveys of eight sites known to have Newell's shearwater populations identified three as suitable for predator fencing; the other five were eliminated because of topography or streams (Young and VanderWerf 2014). The KESRP continues to survey areas for Newell's shearwater activity so active sites suitable for predator fencing, in addition to those identified in the Newell's Shearwater Landscape Strategy, could be identified in the coming years. At a minimum, the two sites recommended by Young and VanderWerf (2014) with identified Newell's shearwater burrows should be fenced. The third site identified in this study was found to have only Hawaiian petrel burrows. Other sites located independently by KESRP and verified as occupied and suitable for fencing should be fenced. These sites should be protected using manual predator control until the fences are complete. To increase recruitment once fences are complete, social attraction should be a component of the project (see below).

The strategy prioritizes management efforts to occur in colonies already receiving conservation management actions under the existing KIUC STHCP, by relying on the concept of a 'no light conservation zone' or NLCZ to define an area which contains very little artificial nighttime lighting or light impingement. The NLCZ is based on the belief that artificial nighttime lighting is the primary factor constraining the distribution of Newell's shearwater breeding colonies and therefore colonies located in the NLCZ are more viable and should receive conservation actions.

The NLCZ encompasses the northwest corner of Kauai and includes coastal areas as well as mountainous steep terrain with a relatively small human population, resulting in minimal artificial nighttime lighting in the area. The NLCZ contains very little nighttime lighting currently, unfortunately there are no county ordinances or other mechanisms to support or require the continued existence of an NLCZ into the future. The strategy also calls for generally minimizing the effects from artificial nighttime lights and power lines.

In addition to this isolated area there is a need to generally address light attraction. Many sources of lights have already been modified to minimize attraction of fledging Newell's shearwaters, but a standard island-wide study is needed at regular intervals to identify new locations of concern for light attraction and those that might be out of compliance. A study is also needed to test the various types of LED bulbs available against the existing low pressure sodium bulbs to assess which is most suitable for seabirds. The results of this study should be used to determine which lighting configuration has the least impact on Newell's shearwaters and inform future recommendations on retrofitting lights, targeting the highest impact lights first. In the interim, problematic lights should be removed, turned off during the fledging season, reduced in intensity, or fitted with shields to direct the light toward the ground to minimize impacts.

The strategy does not comment on any elements (e.g., habitat requirements, genetic representation, and population resiliency) that would contribute to and define the long-term health needs of the Newell's shearwater population.

Population viability modeling efforts conducted by the Service defined Newell's shearwater adult survivorship at 0.92, based on a boxplot assessment and linear regression of adult survivorship data from proxy Procellariformes (USFWS 2017b, p. 122). Because the Newell's reproductive strategy has evolved to have a high adult survivorship, adult mortality is particularly harmful to the population. Left unchecked low adult survivorship (or conversely high adult mortality) will serve to depress the colony population to unsustainable numbers thereby increasing the vulnerability of these populations to invasive predators and other stochastic events (e.g., hurricanes damaging breeding habitat or climate shifts altering food availability).

The survival and recovery needs of the Newell's shearwater are described in the succeeding paragraphs based on components from the recovery plan and landscape strategy documents highlighted above, as well as the best currently available scientific information. The survival condition of the Newell's shearwater is the biological factors necessary for a persistent population. The survival condition of the Newell's shearwater will need to include over a generation time (i.e., 7-8 years), an annual and stable breeding probability of 0.80 and consistently high reproductive success levels of at least 0.85 fledglings per breeding pair, per season. In order to achieve these biological factors, immediate actions need to be taken to protect occupied breeding habitat from invasive predators by constructing predator-exclusion fences and concurrently increasing predator removal efforts around the two extant and accessible breeding colonies on Kauai (Upper Limahuli and within Hono o Na Pali). Once a predator exclusion fence is constructed and predators are eliminated within the fence, management efforts should incorporate social attraction techniques using acoustic and visual/olfactory cues (Buxton and Jones 2012) to lure prospecting non-breeders and sub-adults into the protected breeding

habitat. Current telemetry data shows that the Hono o Na Pali and Upper Limahuli colonies are minimally affected by power line collisions and artificial nighttime lighting based on actual flight paths (n = 9) to and from foraging areas and breeding habitat (Raine *et al*. 2016e, p. 24). The main land-based threats to the Hono o Na Pali and Upper Limahuli colonies are introduced predators and invasive vegetation.

Maintaining the ecological life-support systems (i.e., habitat requirements) for the two largest Newell's shearwater breeding colonies is critical to the long-term survival. Management of breeding habitat within predator exclusion fences should include invasive vegetation control during the non-breeding season to support a native understory and canopy and biosecurity measures to prevent introductions of invasive flora and fauna. The size of the predator exclusion fences in montane forested habitat will be dictated to some extent by the terrain, however each exclusion fence should contain the extant colony, anticipate and minimize erosion, and be large enough (≥10 ha) to encompass enough breeding habitat to sustain at least 1,500 active breeding pairs and small enough to be adequately maintained in perpetuity. Given these habitat requirements, the minimum "range-restricted" population necessary to retain the species potential for recovery is 3,000 breeding pairs (two colonies with 1,500 pairs each).

Survival of the Newell's shearwater cannot be predicated solely on the existence of two neighboring breeding colonies on a single island. The survival needs of the Newell's shearwater include reducing adult mortality occurring range wide due to the attraction to artificial lights and collisions with power lines. The data gathered from Travers *et al*. (2014) and Travers *et al*. (2015) have vastly improved our knowledge of the scope of the impact of power line collisions and have identified the power line segments, of those surveyed, that have the greatest impact on seabirds. Lines along Power Line Trail in the north central region of the island were responsible for 75 percent of the documented strikes in 2014 (Travers *et al*. 2015). This stretch of lines should be prioritized to be buried, lowered in height, modified such that the top lines are removed, re-directed after appropriate studies to assess minimization effectiveness, or made visible in some manner (e.g., through the use of lasers or bird diverters, both of which are being tested by KESRP). As additional stretches of lines are monitored each year, other high-impact zones will be identified and appropriate avoidance or minimization methods should be implemented. Reducing the impact of power lines is critically important to ensuring the continued existence of Newell's shearwater on Kauai.

The SOS program on Kauai is designed to reduce mortality of fledglings and adults that have been grounded (i.e., unable to regain flight) due to the attraction to artificial lights or collisions with power lines. The continuation of the SOS program is a clear step to reduce adult mortality.

In summary, the recovery condition of the Newell's shearwater is the necessary survival condition plus specific measures to adequately address the specific threats contributing to the species range-wide endangerment. Specific measures needed to achieve a recovery condition include the elimination or minimization of all three high collision-risk power lines (the Power Line Trail, Kilauea, and the Central Region segments) on the island of Kauai. The recovery condition will need to include the creation or active management of at least two additional healthy shearwater colonies on Kauai and two healthy shearwater colonies on Maui. For example, the two additional colonies on Kauai could be any of those identified by Young and

VanderWerf (2014), or other colonies located independently by KESRP. For the purposes of this biological opinion, a healthy Newell's shearwater breeding colony is defined as containing a: (1) minimum of 1,500 breeding pairs or active burrows, based on long-term monitoring data on the Manx shearwater (Fraser *et al*. 2013; Brooke 1990; BirdLife International 2016b); (2) suitable breeding habitat, including predator-free or low levels of predator presence adequate to sustain in perpetuity a minimum of 1,500 breeding pairs; (3) flyway corridors to and from the colony where there are none or minimal artificial lighting and power line threats; and (4) a colony-population growth rate, λ equal to or greater than one, sustained over at least a generation. Protecting and augmenting any existing Newell's shearwater colonies on Maui will ensure genetic representation and redundancy, allowing the Newell's shearwater to maintain an adaptability and evolutionary capacity over time.

New management actions that have occurred in the last five years include:

- Completion of the 3-hectare predator exclusion fence in 2015, at the Nihoku conservation unit within Kilauea Point National Wildlife Refuge. Newell's shearwater nestling translocations began in 2016 and will continue over four years with the goal of establishing a new Newell's shearwater breeding colony within a fully protected predator-free area on Kauai;
- Predator control efforts to benefit Newell's shearwaters that began in June 2016 and are expected to continue for 2-4 years, within a discrete area ($\leq$ 1 hectare) in Hono o Na Pali Natural Area Reserve, funded by the American Bird Conservancy; and
- Construction of two 1.8-hectare predator-exclusion fences (one each for Newell's shearwater and Hawaiian petrels) in West Maui to protect unoccupied Newell's shearwater breeding habitat. Upon completion of the fence in 2013, social attraction techniques including installation of artificial burrows, decoys, and auditory broadcasts calls have been implemented at the site, along with native vegetation restoration efforts. In June 2016, two prospecting Newell's shearwater adults were recorded on remote cameras (Craig 2016, p. 28).

Recommendations for Future Actions:

- Maintain support and oversight of the two 1.8-hectare Makamakaole Seabird Predator-Proof Fences in West Maui, constructed by First Wind, Inc. and maintained by Kaheawa Wind Power LLC, specifically to create a new Newell's shearwater breeding colony within a predator-free area on Maui. Efforts at this site should be focused on restoring native montane habitat, since this site was previously used for agricultural purposes;
- Conduct additional acoustic surveys within remote areas of Haleakala National Park in southeast Maui, to identify the areas of Newell's breeding habitat and the relative colony population size;
- Construct a predator exclusion fence to fully enclose the entirety of Upper Limahuli colony, followed by efforts to eradicate terrestrial predators and control barn owls;
- Construct a predator exclusion fence to protect the Pohakea colony within Hono o Na Pali NAR; followed by eradication of terrestrial predators within the fence, efforts to reduce barn owl predation, and social attraction techniques to expand the colony;

- Construct a predator exclusion fence along the ridgeline surrounding the Upper Manoa Valley colony, followed by eradication of terrestrial predators within the fence, efforts to reduce barn owl predation, and social attraction techniques to expand the colony;
- Construct an ungulate exclusion fence to protect the Honopu seabird colony to manage depredation by pigs and habitat damage from pigs and goats. The area of Honopu where the ungulate fence would be installed is located within the DLNR State Parks in northwestern Kauai;
- Construct a predator exclusion fence along the edge of the Kalalau Valley, followed by eradication of terrestrial predators within the fence, efforts to reduce barn owl predation, and social attraction techniques;
- Implement erosion control measures, best management practices (e.g., area closures) and native vegetation restoration to prevent damage to sensitive montane habitat, caused by continual access into seabird colonies; and
- Reduce impacts of high collision rate power line segments at the Power Line Trail, the Waimea Canyon, the Kilauea area, and line segments within the Central region including Lihue to Kilohana Crater to Power Line Trail.

ENVIRONMENTAL BASELINE FOR THE NEWELL'S SHEARWATER

This section describes the following: the relationship of the Newell's shearwater population in the action area to the range-wide population; current status of the Newell's shearwater in the action area and the factors influencing that condition; and the role of the action area in its survival and recovery. The recovery plan (USFWS 1983) for the Newell's shearwater does not contain recovery units; therefore, this section provides the Service's characterization of the role of the action area to the survival and recovery of the species.

i. Relationship of the Shearwater Population in the Action Area to the Range-wide Population

Adult Newell's shearwaters do not nest at Barking Sands, but do use the area to transit between their ocean foraging areas and their high elevation, montane nesting sites. Newell's shearwaters transit over the Makaha Ridge and Kokee PMRF sites and Newell's shearwater colonies occur nearby these sites in the northwestern fork of Waimea Canyon and along the Na Pali Coast (DON 2018, KESRP unpublished data) (Figure 9).

Based on statistical analyses of Newell's shearwater calling data from KESRP auditory surveys (Appendix 2), Newell's shearwater population size in the action area was estimated at 35% (8,508 individuals) of the Kauai population. Of these individuals, 5,420 (63.7%) are assumed to be adults (Ainley *et al.* 2001). An estimated 90 percent of the Newell's shearwater population is thought to nest on Kauai (24,310 individuals). Thus, the population in the action area comprises approximately 31.5% of the Newell's shearwater range-wide population.

ii. Current Condition of the Newell's Shearwater Population in the Action Area

The primary threats to the entire population of Newell's shearwater are also factors which effect the condition of the population in the action area: artificial nighttime lighting, collisions with power lines, predation by introduced predators, and changes to breeding habitat due to introduced invasive plants. Fledgling Newell's shearwaters fly through the PMRF sites on their first trip to the sea. As described above, fledgling Newell's shearwaters are attracted to brightly lit areas and become disoriented by them. A total of 48 downed Newell's shearwaters were recovered at Barking Sands over the period of 2007 to 2017. Power lines are present in the lowland coastal areas of the action area. The power lines obstruct seabird flyway corridors to and from montane breeding colonies, presenting a risk of collision to transiting seabirds. Predation by non-native predators such as feral cats, barn owls, and rats has been regularly observed in extant breeding colonies in the action area, even in the most remote locations, including the Na Pali Coast (Banfield *et al.* 2013).

Surveys using ornithological radar have not been conducted specifically at PMRF Barking Sands, but surveys have been conducted in Kekaha, approximately five miles south (Raine *et al.* 2017, Day *et al.* 2003). The mean movement in the Kekaha area in 1993 was 54.0 targets/h and in 2013 was 3.6 targets/h (KESRP 2013). As a proxy for the breeding population, the radar data indicates the Newell's shearwater population transiting through the Kekaha area declined at a mean annual rate of 12.7 percent over the 20-year period, similar to the decline of the Kauai population.

In the town of Waimea, ornithological radar surveys have also been conducted, and are considered the best estimate of movement rates of breeding Newell's shearwaters in the Waimea Canyon and Na Pali coast areas. Based on the analyses of ornithological radar data, Day *et al.* (2003) estimated a mean decrease in shearwater movement of 72.4% between 1993 and 2001 in the Waimea area. In 2015, an average of 386.7 seabird targets per hour was detected during three radar surveys in the Waimea area (KESRP 2015). Each survey consisted of four, 30-minute sampling sessions (Raine, pers.comm. 2016). Hawaiian petrels were not visually detected flying over the monitoring site by observers positioned outside radar trucks during the radar surveys (Raine, pers.comm. 2016). The seabird nesting colonies in Waimea Canyon in the northern forks of the Canyon nearest the PMRF communication towers are exclusively occupied by Newell's shearwaters. Based on these observations, the movement rate detected in Session II of the radar survey is composed almost entirely of Newell's shearwaters and represents an accurate reflection of Newell's shearwater movement in the area near the Navy's communication towers at the PMRF Kokee Site. This situation is unique from other radar sites on Kauai, where Session II represents predominately Hawaiian petrel movement and Sessions III & IV reflect Newell's shearwater movement (Raine, pers.comm. 2016).

The Service conducted population modeling to estimate the decline of the Newell's shearwater population in the action area caused by past and ongoing light attraction/fallout, predation, and power line mortalities (Appendix 2). Deterministic matrix modeling followed methodologies in Griesemer and Holmes (2011) and Ainley *et al.* (2001). The model outputs indicate the population of the Newell's shearwater in the action area is declining at a rate of 10.3% per year. This decline in the Newell's shearwater population in the action area is comparable to the mean annual rates of decline indicated by ornithological radar data for the Kekaha area (-12.7%). This

rate of decline is also within the range of annual declines reported in stochastic Newell's shearwater population models which incorporated variability in mortality and climate change (USFWS 2017b, p 159).

iii. Role of the Action Area in the Survival and Recovery of the Newell's Shearwater

The population of Newell's shearwaters using the action area is demographically significant. As discussed above, the Newell's shearwater population transiting the action area comprises approximately 31.5% of the range-wide population. Safe passage of shearwaters across the action area as they transit to and from breeding areas is essential to the survival and recovery of the Newell's shearwater.

Newell's shearwater colonies in the Na Pali coast portion of the action area are high priority endangered seabird colonies for implementation of conservation actions: in particular, the Hono o Na Pali NAR, Upper Limahuli Preserve, and Honopu seabird colonies (Banfield *et al.* 2013; Raine and Banfield 2015d). Due to the low threat of seabird/power line collisions to shearwater breeding sites along the Na Pali coast (USFWS 2017b), these breeding sites represent an important refuge for this species. Maintaining or enhancing the capability of these breeding areas to successfully support breeding Newell's shearwaters is essential to the conservation of this species.

Figure 9. Newell's shearwater breeding distribution in the action area (KESRP 2016, unpublished data). *Hotspot light* defined by KESRP as localized aerial activity – sporadic calling and/or aerial activity. *Hotspot heavy* defined by KESRP as localized aerial activity – continuous calling and/or aerial activity.

iv. Previous Consultations in the Action Area

In March of 2011, the Service issued a non-jeopardy biological opinion (Service file no. 01EPIF00-2010-F-0430 and 01EPIF00-2010-F-0460) for the PMRF Intercept Test Support action, which addressed the effects of Aegis Ashore Intercept Test Support construction and operation activities at Barking Sands on the Newell's shearwater, Hawaiian petrel, and the band-rumped storm petrel for a period of three years; that biological opinion was amended in October of 2011. The incidental take statement accompanying the amended biological opinion authorized the take of up to ten Newell's shearwaters, one Hawaiian petrel, and one band-rumped storm-petrel over the 3-year term of the action as a result of collision with the boresight towers or due to attraction and fallout from lighting associated with the project. The incidental take statement accompanying the amended biological opinion also authorized the take of up to five Newell's shearwater eggs and/or chicks, one Hawaiian petrel egg and/or chick, and one band-rumped storm-petrel egg and/or chick over the 3-year term of the action as a result of predator control activities at shearwater breeding sites. The no-jeopardy conclusion relied in large part on provisions in the proposed action for minimization and mitigation of take impacts, including predator control within existing seabird breeding colonies and radar surveys to help assess seabird population trends on Kauai.

In April of 2011, the Service issued a non-jeopardy biological opinion for the Kauai Island Utility Cooperative Short-term Seabird Habitat Conservation Plan (STHCP) and Incidental Take Permit (Service file no. 01EPIF00-2011-F-0113, Permit No. TE234201-0), that addressed effects from the operation of existing and new electrical utility facilities on the Newell's shearwater and Hawaiian petrel, until 2016 for the entire island of Kauai. The Incidental Take Permit authorized the take of up to 162 adult, sub-adult, or fledgling Newell's shearwaters annually over the 5-year permit term as a result of attraction to, or collision with, KIUC facilities, as well as the take of up to 18 eggs and/or chicks as a result of the mortality of breeding adults. The annual take of up to two adult, sub-adult, or fledgling Hawaiian petrels was also authorized. Because of the minimization and mitigation measures implemented through the HCP; anticipated reduction in ongoing take from these measures; and implementation of conservation projects to offset unavoidable take (i.e. predator control within existing seabird breeding colonies), the Service concluded that the issuance of the Incidental Take Permit was not likely to jeopardize the continued existence of the Newell's shearwater and the Hawaiian petrel in the wild.

In October of 2011, the Service issued a non-jeopardy biological opinion for the PMRF Advanced Hypersonic Weapons System (Service file no. 01EPIF00-2011-F-0385), which addressed the effects from one-time operation of existing launch facilities at the Kauai Test Facility on the Newell's shearwater and the Hawaiian petrel from October through mid-November of 2011. The incidental take statement accompanying the biological opinion authorized the take of up to four Newell's shearwaters and one Hawaiian petrel over the two-month term of the action caused by seabird attraction and fallout from lighting associated with the project. Because of the minimization and mitigation measures implemented under the proposed action, an anticipated reduction in ongoing seabird take as a result of these measures, and implementation of conservation projects to offset unavoidable take, the Service concluded that the proposed action was not likely to jeopardize the continued existence of the Newell's shearwater and the Hawaiian petrel in the wild.

In September of 2014, the Service issued a non-jeopardy biological opinion (Service file no. 01EPIF00-2014-F-0066) for the PMRF Base-wide Infrastructure, Operations, and Maintenance Activities and their effects on the Hawaiian stilt (*Himantopus mexicanus knudseni)*, Hawaiian moorhen (*Gallinula chloropus sandvicensis*), Hawaiian coot (*Fulica alai*), Hawaiian duck (*Anas wyvilliana*), Hawaiian goose (*Branta sandvicensis*), Hawaiian hoary bat (*Lasiurus cinereus semotus*), band-rumped storm-petrel, Hawaiian petrel, and the Newell's shearwater. The incidental take statement accompanying the biological opinion authorized the take of up to an average of three Newell's shearwater per year through the foreseeable future. The no-jeopardy conclusion for the Newell's shearwater relied in large part on provisions in the proposed action for lighting minimization and predator control measures at seabird breeding colonies to offset the impacts of incidental take and to provide a net conservation benefit to the species as a whole.

In February of 2017, the Service issued a non-jeopardy biological opinion (Service file no. 01EPIF00-2016-F-0497) for the USAF Pacific Air Forces Regional Support Center Proposed Continuing Operations at Kokee Air Force Station and Microwave Antenna Site and their effects on the Newell's shearwater, Hawaiian petrel, and band-rumped storm petrel. The incidental take statement accompanying the biological opinion authorized the take of up three Newell's shearwaters per year, two Hawaiian petrels per year, and two band-rumped storm petrels every 10 years over the life of the project. The no-jeopardy conclusion for the Newell's shearwater, Hawaiian petrel, and band-rumped storm petrel relied in large part on provisions in the proposed action for barn owl control within seabird breeding colonies to offset the impacts of the incidental take.

EFFECTS OF THE ACTION

i. Exposure Analysis Approach

The Service has developed an analysis framework for section 7 consultations that incorporates the general structure, primary concepts, and nomenclature of the U.S. Environmental Protection Agency's ecological risk assessment framework (USFWS 2005). Factors causing adverse effects are referred to as "stressors" and factors causing beneficial effects are referred to as "benefits". Under this approach, the Service determines the effects of the action on listed species and critical habitat by evaluating the location, timing, duration, frequency, and intensity of listed species or critical habitat exposure to each stressor and benefit, and the likely effects of such exposure on the reproduction, numbers, and distribution of the listed species and on the recovery support function of critical habitat.

Using this framework, the proposed action is likely to involve the following stressors: seabird light attraction, seabird collisions with communication towers, and seabird collisions with electrical distribution lines and poles. The proposed action also includes benefits in the form of conservation measures to reduce seabird exposure to artificial lighting during the Newell's shearwater fledging season, reduce predation in nesting colonies during Newell's shearwater breeding season, and restore breeding habitat.

ii. PMRF Lighting

As noted above, listed seabirds are negatively affected by increasing urbanization and the accompanying artificial lights, especially fledglings during their first flight to the ocean from the breeding colony site. When attracted to artificial lights, fledgling seabirds become confused and may suffer temporary night blindness. They often fly into utility wires, poles, trees, and buildings and fall to the ground. The timing of this impact on Kauai is primarily between September 15 and December 15. Adult Newell's shearwaters can also be attracted to lights located near their breeding grounds and affected in a similar manner; however, most shearwater groundings due to lighting involve fledglings (DOFAW 2018). The timing of this impact on Kauai is just prior to breeding (late March /early April) until the chicks fledge (early November).

At PMRF a total of 49 downed Newell's shearwaters were recovered over the 9-year period from 2007 to 2017 (DOFAW 2018, DON 2018).[5] The only incidents of Newell's shearwater fallout at or near PMRF facilities in the action area other than Barking Sands were as follows: the recovery of one bird at Port Allen on the State-operated side of the pier near a light; and the recovery of another shearwater at the Kokee PMRF Site C communications building. There have been no observations of seabird disorientation or fallout at PMRF facilities at Makaha Ridge and Kamokala where there are lower wattage lamps used and a daily presence of Navy personnel.

The Navy has been implementing an array of lighting practices to minimize the risk of seabird light attraction at all PMRF facilities. Although the lights in several key areas at Barking Sands are turned off (the most effective practice to avoid attracting seabirds to facilities) some of the facilities at PMRF require lighting for safety or operations. Lights that cannot be turned off due to safety and/or operational purposes have been shielded, realigned, or replaced with full cutoff fixtures. Such lighting modifications may reduce impacts to listed seabirds by approximately 40 percent (Reed *et al.* 1985, p. 380), but do not completely eliminate the threat.

Since 2010, following modifications of exterior lighting such as realignment, replacement with full cut-off fixtures, and operational changes (DON 2014), a total of 32 Newell's shearwaters were downed at Barking Sands (DOFAW 2018, DON 2018). This includes two larger fallout events: 12 Newell's shearwaters were downed in 2010 and 11 Newell's shearwaters were downed in 2014. Of those downed recently in 2014, six were downed and recovered near the hangar building and five of the 11 died before SOS personnel arrived to pick up the birds. Incorrect positioning of two of four exterior floodlights at the hangar building may have attracted the shearwaters to the building. However, one of the six birds downed at the hanger in 2014 had struck the side of the building when no exterior lights were on, suggesting interior lighting likely attracted the bird.

Under the proposed action, the Navy will implement several conservation measures to reduce adverse lighting impacts to listed seabirds. The Navy will continue to annually inspect night-

[5] Two additional Newell's shearwaters were found grounded and dead under a communication tower at Kokee Site C at PMRF likely due to collision with the tower. The Navy's biological assessment included these two Newell's shearwaters in the fallout summary (DON 2018, p. 21).

time lighting prior to the start of the seabird fledgling season to confirm implementation of light minimization measures and identify any potential lighting risk that was not previously identified or addressed. The Navy's written *Guideline for Implementation of Conservation Measures* (DON 2015) should increase and maximize the capability of base personnel to salvage and transfer downed seabirds to the SOS program in a timely and appropriate manner throughout the seabird fledging season. In addition, the Navy will, to the extent practicable, minimize seabird fallout risk by scheduling non-time sensitive night operations outside of the peak seabird fledging season.

The Service anticipates that the proposed project is likely to result in a low amount of seabird attraction to artificial night lighting from the use of interior and exterior lighting for operations and safety, particularly the use of exterior Anti-Terrorism/Force Protection lighting associated with the launch areas. The number of night-time operations that the Navy will not be able to avoid during the dark moon phase of the seabird fledging season is estimated to average one per year. While the Navy has renewed their commitment to lighting minimization measures at the PMRF, such as keeping exterior lighting correctly positioned and shielded and the bay doors of the hangar closed as much as possible, the operational use of facilities and launches at Barking Sands during dark moon phases are likely to continue to cause take of seabirds. Historical fallout patterns at PMRF indicate a single fallout event can produce over 10 birds downed (e.g., 2010 and 2014). For these reasons, the Service presumed the lighting conditions during the period from 2014 to 2015 (when night-time operation of lighting resulted in one year with low fallout and one year with a larger fallout event) is representative of lighting conditions over the 50 year period. Therefore, the Service estimates up to 7 fledgling Newell's shearwaters per year are likely to be downed due to attraction to artificial light at Barking Sands.

Photo 1. PMRF Barking Sands at night-time as viewed from PMRF Makaha Ridge site on November 23, 2015. Photo by Adam Griesemer, USFWS.

iii. PMRF Communication Towers and Electrical Distribution Lines

As discussed above, seabird collision with narrow-profile structures such as transmission lines and towers is well-documented for Hawaii's listed seabirds, particularly on Kauai. Listed seabirds are nocturnal and fly over 30 miles per hour, making it difficult for them to detect and avoid wires and antennas (Cooper and Day 2003, p. 64). Transmission lines and towers are a stressor source to Newell's shearwaters by obstructing their flyway corridors to and from montane breeding areas. Recent surveys using vertical radar and visual observation to estimate seabird flight altitude show site-specific variation in altitude. In low elevation non-mountainous areas shearwater flight height averages 49.5 ± 25.8 meters above ground (Travers *et al.* 2014, p. 22). In contrast, during an eight-day study at a high elevation mountainous area (along a Power Line Trail segment), a total of 323 shearwaters and Hawaiian petrels were observed transiting with 43.2% observed flying through or colliding with a power line segment at a height of approximately 88 meters above ground [78 m above the surrounding 10 m high vegetation) (Travers *et al.* 2013, p. 73; Travers *et al.* 2014, p. 26)].

The facilities at Barking Sands include approximately 7 miles of 12 kV electrical distribution lines and poles. Line heights that are at or below vegetation levels have been shown to significantly reduce the potential for seabird collisions with power lines (Ainley *et al.* 1995, Travers *et al.* 2013, Travers *et al.* 2014). No downed seabirds found by Navy personnel or recovered by the SOS program (DOFAW 2018) have been associated with the electrical distribution structures at PMRF, and vegetation at PMRF is within the range of height of distribution lines. For those reasons, the Service anticipates that vegetation cover is likely to shield seabirds from collision with electrical distribution facilities on the PMRF.

Under the proposed action, existing communication towers on the PMRF will continue to be maintained and operated. These towers create a potential for Newell's shearwaters to collide with the towers while flying between their nesting grounds in the mountains and feeding grounds at sea. The timing of this threat extends from late March / early April when Newell's shearwaters occupy their nesting grounds, just prior to breeding, until early December when the last shearwater chicks of the season fledge and fly to the sea. During the non-breeding season, Newell's shearwaters remain at sea the entire time, therefore, they are not likely to collide with a communication tower or antennae, or any other structure on land during this time.

In 2008, the Service provided the Navy with a search protocol for conducting carcass searches for downed seabirds to estimate the number of avian fatalities attributable to collisions with communication towers at PMRF. Surveys were then conducted using this search protocol. From October to December of 2008, searches for downed seabirds were performed every three to four days under each communication tower at Barking Sands, and a search efficiency trial was conducted to assess the potential for searchers to miss carcasses or live birds during searches following the Service's protocol. In 2010, the 2008 protocol surveys were expanded to the two antennas at Makaha Ridge and two communication towers at the Kokee sites in addition to the 14 towers at Barking Sands. A scavenger trail was conducted to estimate the number of carcasses or downed seabirds that may have been missed in 2008 due to removal of birds by scavengers (e.g., cats). In 2015, the surveys were repeated for all the towers. Searches of the communication towers at Kokee Site C in both 2010 and 2015 were conducted in open space within accessible search areas (Kleidosty Pacific 2011, p.2; Kleidosty Pacific 2016, p. 33). At

Barking Sands, to date, no mortality of listed seabirds due to collision with communication towers have been observed. However, at Kokee Site C, two adult Newell's shearwaters were found grounded and dead under Tower 764: one during the 2015 surveys (Kleidosty Pacific 2016) and one during a Navy site visit to the communication tower in 2017 (DON 2017).

In addition to the above, the Service considered the following information to assess seabird collision risk for purposes of this analysis: (1) the location of communication towers in relation to Newell's shearwater breeding colonies, including proximity and elevation; (2) the area of the tower exposed and height above the vegetation level; and (3) the results of studies of seabird collisions with utility structures conducted on Kauai. In considering the study results, we also evaluated the sufficiency of carcass searching in relation to the vegetation and topography of the area surrounding towers.

Information pertaining to seabird collision risk suggests a very low likelihood of collision with communication towers located at Barking Sands. The communication towers are located near sea level and approximately 10 miles from the nearest known Newell's shearwater breeding colony (Figure 9). The towers are exposed approximately 140-170 feet in height (~43 to 52 meters[6]) above the vegetation level. Studies conducted at power lines located along Kaumualii Highway to the north of Barking Sands suggest that Newell's shearwaters are less likely to fly at power line height (Travers *et al.* 2016). In addition, low numbers of Newell's shearwaters were observed transiting in this area (Travers *et al.* 2016). The towers at Barking Sands are positioned in open grass fields in a relatively flat coastal plain which facilitates carcass detection.

Information regarding seabird collision risk for towers at Kokee Site C suggests a high likelihood of collision. The site is located at an elevation of 3,700 feet, near multiple Newell's shearwater breeding colonies, the nearest located less than 1 mile away in the north fork of the Waimea Canyon. The two communication towers at the PMRF Kokee C site are 110 feet in height (~33 meters). Approximately 100 feet (~30 meters) of the tower is exposed above the surrounding vegetation level (~10-16 feet, 3-5 meters). Tower 764 has 21 guy wires which greatly increases the exposure area of the tower. Utility collision monitoring studies on Kauai have found that strike rate increases with exposure height at high elevation utility structures (e.g., Power Line Trail) as evidenced by a significant positive relationship between strike rate and power line exposure height (n=20, Spearman's rho (rs)=0.577, p=0.015) (Travers *et al.* 2014). The dense vegetation and topography surrounding the towers at Kokee Site C limits the accessible searchable area around towers and severely reduces the effectiveness of discovering seabirds that collide with the tower or guy wires and descend into the vegetation. During collision-passage studies conducted at the Power Line Trail on Kauai in forested areas with vegetation similar to that found surrounding the PMRF Kokee site, researchers have detected hundreds of seabird strikes with power lines using song meters, yet as of 2016 had recovered only three grounded and dead seabirds (Hawaiian petrels) on the Trail (Travers *et al.* 2013, Travers *et al.* 2014, Travers *et al.* 2015). These results indicate that carcass recovery alone is not a good predictor of seabird line collisions in this type of terrain and vegetation.

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[6] Units are expressed in feet as well as meters in the Effects of the Action, Section D for the purpose of describing units consistently between the Service's assessment of seabird collision risk and tower fatality model.

a) Kokee Communication Tower Fatality Model

Due to the seabird collision risk associated with communication towers at Kokee Site C, the Service developed a collision model to estimate Newell's shearwater fatalities at this site. The collision model (Appendix 1) is based on a template modified from Sanzenbacher and Cooper 2013, incorporating updated seabird movement rates for Waimea (as described in the Environmental Baseline, section *ii*) and tower characteristics. For purposes of this analysis, these estimates are considered as effects that are reasonably certain to occur because information regarding seabird collision risk for towers at Kokee Site C suggests a high likelihood of collision which cannot be detected through current ground survey monitoring methods.

Movement rates were defined as the average of Newell's shearwater movement rates as measured by radar surveys conducted in the summer of 2015. We were not able to account for seasonal variation in movement patterns in our fatality estimates due to the limited information available.

Information on collision-avoidance behavior exhibited by Newell's shearwaters (i.e., birds that completely alter their flight paths horizontally and/or vertically to avoid flying through the space occupied by a structure) suggests that avoidance responses are high based on observations of seabird interactions with power lines on Kauai (Travers *et al.* 2014, Travers *et al.* 2015, Cooper and Day 1998). Based on this information, for purposes of the model, the Service considered 99% of seabirds flying through the airspace near communication towers (including airspace above and around the tower) avoid a collision fatality (i.e., 99% avoidance rate).[7] Using this information, the Service model estimated between 50 adult Newell's shearwater fatalities per year are likely to occur due to their collisions with the communication towers at the Kokee Site (Table 3 and Appendix 1). Including the presence of guy wires at Tower 764 increased the exposure area of the tower, resulting in a fatality estimate higher than at Tower 763.

In addition, using information on population demographics, the Service estimated the number of Newell's shearwater chicks or eggs that are likely to be killed per year as a result of its parent colliding with a communication tower. This results in up to seven Newell's shearwaters chicks or eggs that are likely to be killed per year, assuming that 60% of adults killed in the action area would have been breeding and 46% of breeding attempts would have resulted in a chick fledgling in the nest (i.e., breeding probability of 60% and reproductive success of 46%; Appendix 2).

Table 3. Fatality Model Estimates for the Kokee Towers Site based on 99% avoidance

Movement Rate	Tower 764	Tower 763	Total
2015 Average	42.89	7.14	50.03

[7] See Appendix 1 for full description of tower collision model. The 99% avoidance described in this section refers to the annual fatality probability which is applied as a percentage to the product of exposure rate, vertical interaction probability, and horizontal interaction probability.

iv. *Population Modeling of Impacts from PMRF Lighting and Communication Towers*

For purposes of this analysis, the Service relied on deterministic modeling to calculate Newell's shearwater population assessment metrics for growth rate and population loss (Appendix 2). This population model provided an estimate of decline that would be associated with additional seabird fallout and additional seabird/tower collision mortalities due to PMRF activities, absent any mitigation of these impacts given the current condition of the species in the action area. In other words, this population model teases out the additional decline and population loss that would be caused by the proposed action in the absence of beneficial effects of predator management funded by proposed Navy contributions to NFWF (*See* Effects of Action, section *vi* for description of beneficial effects). Because the proposed action duration is a 50 year period, impacts were modeled over that time period. For purposes of this analysis, these estimates constitute the best available scientific information and are considered effects that are reasonably certain to occur, absent mitigation of these effects, because of factors delineated in: (1) the Status of the Species section; (2) the Environmental Baseline section; and (3) information contained in this section regarding past and ongoing fallout at PMRF facilities and seabird collision fatalities at Kokee Site C.

The "Environmental Baseline with PMRF Activities" model projected the additional decline due to the effects of (a) additional seabird fallout due to light attraction and (b) additional seabird/tower collision mortalities likely to be caused by PMRF activities over the 50-year term of the proposed action on the Newell's shearwater population occurring in the action area (approximately 8,500 individuals). The baseline rate of decline in the population in the action area was also projected over the 50-year period in the "Environmental Baseline" model.

To model the per year estimate of additional seabird fallout and seabird/tower collision mortalities caused by PMRF activities, the Service followed deterministic modeling methodologies described in Griesemer and Holmes (2011) and Ainley *et al.* (2001). Per year estimates were expressed as a proportion of the number of individuals in the respective age class in the current action area population. The fledgling loss due to fallout equaled 1% (7 fledglings of 750 total fledglings from breeding colonies). The mortality of 50 adults due to tower collisions equaled 0.92% of the adult population as estimated in the Environmental Baseline section in this biological opinion, section *i* (5,420). The additional fledgling fallout losses reduced reproductive success by a rate of 0.44% per year (approximately 1% of 46% reproductive success) while the additional seabird/tower collisions reduced adult survival by a rate of 0.92% per year. These mortality rates were held constant (i.e., kept the same) when projected over the 50-year project term.

Based on the findings of the Environmental Baseline with PMRF Activities model, which added the adverse effects of the proposed action on the Newell's shearwater to the Environmental Baseline estimates, light attraction fallout and seabird collision fatalities likely to be caused by PMRF lighting and communication towers increased the annual decline of the Newell's shearwater Environmental Baseline condition from -10.3% to -11.0% (a decrease in the growth rate from a λ of 0.897 to 0.890).

The Environmental Baseline with PMRF Activities model also calculated the total (accumulated) take of Newell's shearwaters that is likely to occur over a 50-year period of implementing the action. The accumulated adverse effect of PMRF activities over a 50-year period of

implementing the action is likely to result in the loss of 450 adults and 63 egg/chicks caused by PMRF communication towers and the loss of 63 fledglings due to PMRF lighting. The number of Newell's shearwaters taken per year is anticipated to decrease each year, because as years pass in the implementation of the proposed action, the Newell's shearwater population in the action area is anticipated to decline by 11% and the proportion of individuals affected by the action in each respective age class (fledgling, sub-adults, and adults) of the action area population remains the same. For example, the number of adult seabird collision fatalities (50 individuals in the first year, see Effects of the Action, section *iii,a*) decrease by 11% per year with the action area population (i.e., fatalities continue to equal 0.92% of the action area adult population). The estimated number of indirect mortalities (7 chicks or eggs in the first year) due to the loss of these breeding adults also continues to decrease by 11% per year with the action area population. In addition, the number of fledgling seabird mortalities due to fallout (7 in the first year) decreases with the action area population. Thus, the proposed action results in less mortality per year as years pass in its implementation due to the decreasing population trend of the population in the action area.

v. *Summary of the Total Take of Newell's Shearwater due to Proposed Action*

The total anticipated take of Newell's shearwaters as a result of PMRF lighting and communication towers over the 50 year term of the action, is shown below and in Table 4.

Over the 50 year project term, up to an average of seven (7) fledgling Newell's shearwaters per year and a total maximum of 63 fledgling Newell's shearwaters are likely to be killed or injured as a result of attraction and fallout from lighting associated with the proposed action (*See* Effects of the Action, section *ii*, pg. 41 & section *iv*, pg. 45).

In addition, over the 50 year term, up to an average of fifty (50) adult Newell's shearwaters per year and a total maximum of 450 adult Newell's shearwaters are likely to be killed or injured due to collision with communication towers associated with the proposed action (*See* Effects of the Action, section *iii*, a, pg. 44 & section *iv*, pg. 45).

Finally, over the 50 year term, up to seven (7) Newell's shearwater eggs/chicks per year and a total maximum of 63 eggs/chicks are likely to be killed as a result of a parent colliding with a communication tower as a result of the proposed action (*See* Effects of the Action, section *iii*,a, pg. 44 & section *iv*, pg. 45).

Table 4. Annual estimate of take and total (accumulated) take of Newell's shearwater that is likely to occur over the 50-year period of the proposed action. The 50-year take estimate denoted by the asterisk (*) are calculated from results of the Environmental Baseline with PMRF Activities model which indicates the number of Newell's shearwater taken per year is anticipated to decrease at the same rate of decline as the population in the action area.

		Annual	**50-year***
PMRF lighting	Fledglings	7	63
PMRF Communication Towers	adults & sub-adults	50	450
	eggs/chicks	7	63

vi. *Beneficial Effects of Conservation Measures*

The implementation of lighting practices to minimize seabird attraction by the Navy at PMRF will likely reduce the attraction of listed seabirds, but does not completely eliminate the threat as discussed above (See Effects of the Action, section *ii*, pg. 42). In order to offset the total anticipated take over the project duration as described in the previous section, the Navy and NNSA will provide funding to support management activities for predator and ungulate removal at an existing Newell's shearwater colony on Kauai where current management does not exist or is insufficient to adequately enhance the reproductive success of the Newell's shearwater. The Navy and NNSA will direct funds to the Hawaiian Seabird Conservation Account, developed by the NFWF and administered by the Service for the management of Newell's seabird breeding colonies on Kauai. The Navy's contributions are anticipated to support, annually, management for 30 breeding pairs in 2018 and build to 50 breeding pairs by 2022, and then continue annually in years after 2022 at the same level unless the Navy and Service reinitiate consultation and this conservation measure is no longer deemed necessary.

a) Population Modeling of Benefits from Colony Management

The Service used the following approach to calculate the benefit of the proposed funding of colony management for purposes of off-setting the accumulated total losses of Newell's shearwaters equal to 63 fledglings injured or killed, 450 adults injured or killed, and 63 eggs/chicks killed (i.e., the maximum take) due to the proposed action over the 50 year action.

In order to determine the increase in fledgling production from implementing predator management at nesting colonies for the purposes of this analysis, the Service relied on deterministic modeling (the "Predator Management" model, Appendix 2), building on methodologies in the Environmental Baseline with PMRF Activities model above (*See* Effects of the Action, section *iv*). The Service determined that the deterministic model used in this analysis is the appropriate tool to clearly illustrate (1) the Navy's impacts to the Newell's shearwater population within the action area and (2) the beneficial effect of predator management to offset these impacts as a result of Navy funding contributions to NFWF.

In the Environmental Baseline with PMRF Activities model, we added threats that decreased demographic parameters to define the current condition in the action area and Kauai population, respectively. In the Predator Management model, we added predation to one meta-population in the action area then added predator control which removed a proportion of the decrease due to predation in the parameters.

The Predator Management model was developed to estimate the beneficial effect of PMRF's proposed predator management at breeding sites on the population in the action area (Appendix 2). We expressed the effect of management as a change in the number of fledglings produced by the breeding pairs that would be directly affected by the management. We considered management that decreased predation by removing predators, including feral cats, feral pigs, rats, and barn-owls. We expressed the efficacy of the management by decreasing predation of individuals and nests proportionally (considering that management would be 70-90% effective in reducing predation) such that 80% management efficacy meant that out of 20 burrows with

chicks or eggs depredated in the absence of management, predator removal would reduce the number of depredated burrows to 4 (20 percent of 20 burrows)(Appendix 2).

The proposed conservation measure will provide funding to protect a nesting area with the capacity to support at least 50 breeding pairs. Based on experience in the field, protecting such an area with sufficient predator management will likely result in a gradual increase in the number of pairs and requisite funding to support further expanding the predator management as the colony grows in size. The Service anticipates the predator management as a result of the Navy's contributions to NFWF is likely to achieve a targeted increase in shearwater reproductive success (and resulting fledgling production) at established or new breeding areas that are protected and managed. Predator control at 80% effectiveness for 50 breeding pairs over 50 years would provide a reproductive benefit of 1,476 fledglings to the Kauai population (Appendix 2). Although it is anticipated that the population at the nesting area receiving management will not reach 50 breeding pairs until the year 2022, the continuing growth of the colony beyond 50 pairs (in years 2023 to 2068) will likely provide additional benefits in excess of these modeled estimates. The Service anticipates this management will likely offset the losses due to PMRF activities and the additional decline of the shearwater population occurring in the action area caused by the additional seabird fallout due to light attraction and additional seabird/tower collision mortalities likely due to PMRF activities over the 50-year term of the proposed action.

Non-native predators are significantly impacting Newell's shearwater populations in the action area as described in the Environmental Baseline section in this biological opinion. The predator management funded by Navy contributions will reduce predation in a nesting colony(ies) addressing a major threat to the continued existence of the Newell's shearwaters breeding in that colony(ies).

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur within the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Future state, local, or private actions that are reasonably certain to occur in the action area are listed below.

- KIUC submitted a permit renewal request to the Service for its STHCP and ITP, prior to its expiration in May of 2016, to cover the period until the Service renders a decision on their Long-term HCP, which is currently under development. In the interim, the Service estimates that 1,800 Newell's shearwater mortalities are occurring per year as a direct result of power line strikes under the KIUC STHCP and ITP, using the rounded average of 2014 and 2015 strikes from scenarios IV, VB, and VIA selected in the USFWS Newell's Shearwater Landscape Strategy Appendix 2 (2017b, p. 123). Based on coordination with KIUC in February 2018, the Service anticipates receiving a revised

draft Long-term HCP by the end of 2018 that will propose minimization and mitigation measures to address these take impacts.

- State and local governmental entities together with other private entities are expected to apply for a State incidental take license and a Federal incidental take permit in 2018, to address ongoing and future take of Newell's shearwaters within the action area caused by the use of artificial nighttime lighting. The state-sponsored Kauai Seabird HCP is anticipated to seek authorization for an approximate annual *lethal* take of up to 30 shearwaters and *non-lethal* take of 45 shearwaters. This state-sponsored HCP is being developed to address a stressor responsible for an aspect of the environmental baseline conditions for Newell's shearwaters within the action area.

CONCLUSION

After reviewing the current status, the Environmental Baseline, the Effects of the Action, and the Cumulative Effects, it is the Service's Biological Opinion that the proposed action discussed herein is not likely to jeopardize the continued existence of the Newell's shearwater. As stated in the Effects section above, the adverse effects of the proposed action over the 50 year term of the action are likely to result in anticipated take in the form of injury or death for up to 63 Newell's shearwater fledglings as a result of attraction and fallout from lighting, 450 Newell's shearwater adults due to collision with communication towers as well as the death for up 63 eggs/chicks as a result of a parent colliding with a communication tower. The beneficial effects of the seabird mitigation will offset the anticipated loss of the fledglings, adults, and eggs/chicks as well as any additional decline of the population in the action area. Overall, taken all these effects together, there will not be a significant change in the reproduction, numbers, or distribution of the Newell's shearwater that will reduce appreciably the likelihood of both the survival and recovery of these species in the wild.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including, breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Navy and NNSA in order for the exemption in section 7(o)(2) to apply. In order to monitor the impact of incidental take, the Navy and NNSA must report the progress of the action and its impact on the listed species to the Service as specified in this incidental take statement and reporting requirements below [50 CFR 402.14(i)(3)].

Amount or Extent of Take Anticipated

Based on the analysis presented in this biological opinion, the Service anticipates the following incidental take may occur for as long as PMRF infrastructure, operations, and maintenance are active and in place.

Newell's Shearwater
Over the 50 year project term, up to an average of seven (7) fledgling Newell's shearwaters per year and a total maximum of sixty-three (63) fledgling Newell's shearwaters are likely to be taken in the form of injury or death due to attraction and fallout from lighting associated with the project.

Over the 50 year project term, up to an average of fifty (50) adult Newell's shearwaters per year and a total maximum of four hundred fifty (450) adult Newell's shearwaters are likely to be taken in the form of injury or death due to collisions with communication towers associated with the project.

Over the 50 year project term, up to seven (7) Newell's shearwater chicks or eggs per year and a total maximum of sixty-three (63) Newell's shearwater chicks or eggs are likely be taken in the form of injury or mortality as a result of its parent colliding with a communication tower.

The Migratory Bird Treaty Act (MBTA) of 1918 as amended (16 USC 703-712) prohibits the purposeful take of migratory birds without a permit. However, incidental take of birds is no longer considered a violation of MBTA (DOI M-Opinion 37050, https://www.doi.gov/sites/doi.gov/files/uploads/m-37050.pdf); thus, incidental take statements under ESA no longer convey incidental take authority under MBTA to species covered by both acts.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the effect of take on Newell's shearwater:

(1) The Navy and NNSA will minimize the potential for death or injury of Newell's shearwater due to lighting at PMRF.

(2) The Navy and NNSA will minimize the potential for death or injury of Newell's shearwater due to collisions with PMRF communication towers.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Navy and NNSA must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and specified reporting requirements. These terms and conditions are nondiscretionary.

1. Minimize impacts of PMRF lighting on the survival and reproduction of Newell's shearwater.

    1.1. The Navy will schedule non-time sensitive night operations outside the peak of the fledging season to the extent practicable.
    1.2. Navy will schedule operations planned to occur during peak fledging season to avoid dark moon phases to the extent practicable.
    1.3. The Navy will train personnel about listed seabird fallout and methods for searching for downed birds, and conduct searches for downed listed seabirds at all facilities with lighting.
    1.4. The Service will be notified by telephone and email within 24 hours upon the discovery of an injured or dead Newell's shearwater at PMRF. This includes notification for Newell's shearwaters turned into the SOS aid station by Navy personnel or members of the public. The Navy and NNSA will provide the Service a written notification, summarizing the event, within 30 days. The Navy and NNSA will also follow the protocols to report downed wildlife in Appendix 3, Attachments 1 and 3, when any carcass of a listed species is found injured or dead.
    1.5. Access to any of the PMRF sites will be provided by the Navy and NNSA to the Service with 24 hour notification so that they may independently monitor for seabirds and retrieve reported downed seabird carcasses.
    1.6. The Navy and NNSA will submit annual reports detailing the implementation of the above Terms and Conditions used to minimize impacts of the action. The first report will be submitted by January 30th, one and half months after the end of the first seabird season following the issuance of this biological opinion and continue annually throughout the life of the project. Annual reports will summarize survey and monitoring results, and levels of take of Newell's shearwater. Because the amount of incidental take anticipated for Newell's shearwater are expressed in terms of the average number of individuals that may be taken, the following formula will be used to calculate average take for these species, whereby "b_p" is the take of the species since date of the biological opinion issuance, "p" is the take assessment period expressed as the total number of years since date of the biological opinion issuance, and "R_p" is the average take of the species per year over the take assessment period:

$$R_p = \frac{b_p}{p}$$

    1.7. Should take of listed species occur and the carcass be recovered, the Service may request that the carcass be shipped to Honolulu for necropsy and species verification. Otherwise, the depository designated to receive specimens of the listed species that

are found is the B.P. Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii, 96817 (telephone: 808/847-3511). If the B.P. Bishop Museum does not wish to accession the specimens, contact the Service's Division of Law Enforcement in Honolulu, Hawaii (telephone: 808/861-8525; fax: 808/861-8515) for instructions on disposition.

2. Minimize impacts of communication towers on the survival and reproduction of Newell's shearwater.

2.1. The Navy will assess what measures can be implemented at Kokee communication tower 764 and implement effective measures to the maximum extent feasible.

2.2. The Navy and NNSA will monitor incidental take as described in Appendix 3 for monitoring communication towers. In addition to the ground based carcass searches as described in Appendix 3, the Navy will monitor using other methodologies as approved by the Service and report the number of seabird collisions with communication towers at Kokee Site C.

2.3. The Service will be notified by telephone and email within 24 hours upon the discovery of an injured or dead Newell's shearwater at PMRF. This includes notification for Newell's shearwaters turned into the SOS aid station by Navy personnel or members of the public. The Navy and NNSA will provide the Service a written notification, summarizing the event, within 30 days. The Navy and NNSA will also follow the protocols to report downed wildlife in Appendix 3, Attachments 1 and 3, when any carcass of a listed species is found injured or dead.

2.4. Access to any of the PMRF sites will be provided by the Navy and NNSA to the Service with 24 hour notification to allow independent monitoring for seabirds and to retrieve reported downed seabird carcasses.

2.5. The Navy and NNSA will submit annual reports detailing the implementation of the above Terms and Conditions used to minimize impacts of the action. The first report will be submitted by January 30th, one and half months after the end of the first seabird season following the issuance of this biological opinion and continue annually throughout the life of the project. Annual reports will summarize survey and monitoring results, and levels of take of Newell's shearwater. Because the amount of incidental take anticipated for Newell's shearwater are expressed in terms of the average number of individuals that may be taken, the following formula will be used to calculate average take for these species, whereby "b_p" is the take of the species since date of the biological opinion issuance, "p" is the take assessment period expressed as the total number of years since date of the biological opinion issuance, and "R_p" is the average take of the species per year over the take assessment period:

$$R_p = \frac{b_p}{p}$$

2.6. Should take of listed species occur and the carcass be recovered, the Service may request that the carcass be shipped to Honolulu for necropsy and species verification. Otherwise, the depository designated to receive specimens of the listed species that are found is the B.P. Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii, 96817 (telephone: 808/847-3511). If the B.P. Bishop Museum does not wish to accession

the specimens, contact the Service's Division of Law Enforcement in Honolulu, Hawaii (telephone: 808/861-8525; fax: 808/861-8515) for instructions on disposition.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs all Federal agencies to use their authority to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term "conservation recommendations" has been defined as suggestions from the Service regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's 7(a)(1) responsibility for the species.

The Service recommends that the Navy and NNSA undertake the following conservation recommendations:

- Assist with island- and State-wide efforts to assess and minimize the effects of communications towers, power transmission lines, lighting, and other threats to Newell's shearwaters posed by infrastructure.

REINITIATION NOTICE

This concludes formal section 7 consultation on this action. As required in 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species in a manner or to an extent not considered in this biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by this action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We appreciate your efforts to conserve protected species. If you have any questions concerning this biological opinion, please contact Mary Abrams of the USFWS Pacific Islands Fish and Wildlife Office at (808) 792-9400.

Sincerely,

Mary M Abrams

Digitally signed by Mary M Abrams
Date: 2018.08.20 08:35:54 -10'00'

Mary Abrams
Field Supervisor

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APPENDIX 1. Estimated average fatality rates of Newell's shearwater for communication towers at the PMRF Kokee Site, Kauai, based on radar data collected in summer of 2015.

Movement Rates		**Tower 764**	**Tower 763**	**Notes / References**
A	Movement rate during peak hours (average targets/hour)	386.70	386.70	KESRP 2015
B	Total movement rate during peak hours (targets/6.5 hours)	2,513.55	2,513.55	(A x 6); 6.5 peak hours of movement
C	Daily movement rate (targets/day)	2,840.31	2,840.31	(B x 1.13); 1 (6.5 peak hours) + 0.13 (mean proportion of birds moving during off-peak hours of night)
D	Flock size (Mean birds/target)	1.02	1.02	
E	Daily movement rate (birds/day)	2,897.12	2,897.12	(C x D)
F	Mortality domain (days/year)	231.00	231.00	Breeding phenology adults present week 14-46 (33 weeks x 7 days)
G	Annual movement rate (birds/year)	669,234.20	669,234.20	(E x F)
Tower Characteristics				
H	Height of tower exposed above tree line (m)	30.53	30.53	Tree height is approximately 3-5m. Exposed tower is height of tower minus tree height
I	Tower width at base (m)	9.14	9.14	Estimate of tower width at base is 30 feet
J	Exposed area of tower above tree line (m^2)	279.15	279.15	(I x H)
K	Height of highest guy wire exposed above tree line (m)	30.53	0.00	Guy wires anchored at top of Tower 764
L	Guy wire distance from pole exposed above tree line (m)	45.79	0.00	Estimate of maximum distance
M	Area occupied by guy wires (m^2) both sides	1,398.03	0.00	Area to the left and right of tower in profile (A = ((1/2)b x h) x 2)
Horizontal Interaction Probability				
N	Maximum cross-sectional of exposed area of tower (m^2)	1,677.18	279.15	(J + M)
O	Cross-sectional sampling area of radar above tree line and below tower height (m^2)	91,584.0	91,584.0	(3,000m x H)
P	Probability of NESH intersecting tower	0.018313	0.003048	(N/O)
Vertical Interaction Probability				
Q	Proportion of birds flying above treeline and below overall tower height (~33.5m)	0.350	0.350	Travers et al. 2014, p.41, ~ % of birds flying below 35m at powerlines with similar exposure height to Kokee comm.towers
Exposure Rate				
R	Annual exposure rate	4,289.49	713.94	(G x P x Q)
Annual Fatality Probability				
S	90% Avoidance (R x 0.10)	428.95	71.39	
T	95% Avoidance (R x 0.05)	214.47	35.70	
U	**99% Avoidance (R x 0.01)**	**42.89**	**7.14**	

APPENDIX 2.

Newell's Shearwater Population Modeling to Inform the Biological Opinion for the Pacific Missile Range Facilities Base-wide Infrastructure, Operations, and Maintenance Activities.

APPENDIX 3.

Carcass search protocol provided by USFWS to be used for monitoring for nocturnal seabird fallout at communication towers at PMRF.

1.0 STANDARDIZED CARCASS SEARCHES

Carcass searches will be conducted to estimate the number of avian fatalities attributable to the broadcast towers. An estimate of the total number of carcasses will be made by adjusting for removal bias (affected by scavenging) and searcher efficiency bias (affected by detection) (see Sections 2.0 and 3.0). The methods, timing, and duration of the carcass searches are described below.

1.1 Methods

Personnel trained in proper search techniques ("the searchers") will conduct carcass searches at the broadcast tower location pursuant to timing specified by the carcass scavenging trials, but no less than two times per week. Boundaries of square plots will be delineated along each broadcast tower. A strip transect design is appropriate for this study, providing almost 100 percent coverage of the search area. Each search plot will be split into four quadrants, with each searched sequentially. This facilitates the searchers ability to stay on transect lines and maximize searching efficiency (Gritski pers. comm. 2006).

Important factors considering in developing this monitoring plan include tower dimensions, target species size, and vegetation structure. Because most carcass searches to date have been associated with wind power projects, we use standards developed for that industry. When carcass searches are conducted for wind turbines, plot size typically extends outward from the base of a wind turbine a minimum distance equal to the turbine height.

The subject towers are variable in height. If the results from the initial carcass surveys show that the plot size is too large or small, the area will be adjusted accordingly pending approval by the Service. Geographic Positioning System (GPS) locations of the search plot corners will be included in initial data collection. Transects will be set at approximately 6 meters (19.7 feet) apart, depending on the habitat type, and the searcher will walk along each transect at a rate of 45-60 m per minute searching both sides out to 3 m (10 feet) for downed birds and bats. Search area and speed may be adjusted by habitat type, after evaluation of the first searcher efficiency trial, if needed. The applicant may request approval from the Service to revise the search protocol. Since equipment cabinets and other structures associated with the towers will obstruct transects, the areas with equipment will be searched such that those areas have 100% coverage.

If a carcass of a listed species is found, searchers will follow the Downed Wildlife Protocol (**Attachment 1**), and carcasses will be left in place and moved only if directed by the Service. If directed to move the carcasses, searchers will deliver carcasses to Service Law Enforcement who will send them to a forensics lab for future reference and necropsy.

All carcasses found during the standardized carcass searches will be recorded and identified by a unique number. A copy of the data sheet for each carcass will be kept with the carcass at all times. For each carcass found, searchers will record species, sex and age when possible, date and time collected, location, condition and any comments that may indicate cause of death

(**Attachment 2**). Searchers will record the condition of each carcass found, using the following condition categories:

- Intact – a carcass that is completely intact, is not badly decomposed and shows no sign of being fed upon by a predator or scavenger
- Scavenged – an entire carcass that shows signs of being fed upon by a predator or scavenger, or portions of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.)
- Feather Spot – 10 or more feathers at one location indicating predation or scavenging or 2 or more primary feathers

Searchers will photograph each carcass as found and establish GPS points, with point accuracy provided. A detailed map of the search area will then be created showing the location of the broadcast towers and associated facilities, the study area, and any carcasses located.

The searchers may discover carcasses incidental to formal carcass searches (e.g., predation or while driving within the project area). For each incidentally discovered carcass, the searcher will identify, photograph, and record data for the carcass as would be done for carcasses found during formal scheduled searches.

Any injured native birds found on the facility site will be carefully captured by a trained project biologist or technician and transported to a local wildlife rehabilitator. All project staff and consultants will be trained on how to handle any downed wildlife or carcasses found anywhere within the project area. Furthermore, an Avian Injury/Mortality Form (**Attachment 3**) will be completed for any injured or killed animal found.

1.2 Important Considerations

Important factors to consider in developing the monitoring plan include target species size and the type of vegetative cover being surveyed. The Hawaiian petrel and Hawaiian goose are relatively large birds. Downed individuals should be detectable compared to smaller bird species and most bats.

2.0 CARCASS SCAVENGING TRIALS

"Carcass scavenging or removal" is the disappearance of a carcass from the search area due to scavenging. This may serve as a potential source of bias associated with fatality rate estimation. Scavengers may preclude detection of carcasses or make it problematic to identify remains and determine cause of death. Thus, seasonal differences in scavenging rates (i.e., changes in scavenger population density) and possible differences in the size of animal being scavenged are typically taken into account when estimating fatality. Additionally, the timing of fatality searches must be conducted at a frequency that minimizes loss due to scavenging.

The objective of the carcass scavenging trials is to document the length of time avian carcasses remain in the search area and subsequently determine the frequency of carcass searches within the search plots. Carcass scavenging trials will be conducted during each season in the vicinity of the search plots. Carcass scavenging rates will be used to adjust carcass surveys for removal bias. Removal rates will be determined for each season.

Carcasses used in the trials may include representatives of the seabirds if legally available and permitted by the Service and DOFAW. Navy will coordinate with the Service to follow appropriate protocols in using carcasses during carcass scavenging trials. Carcasses of legally obtained wedge-tailed shearwaters, commercially available adult game birds, or cryptically colored chickens will be used to simulate seabirds.

To avoid confusion with broadcast tower-related fatalities, planted carcasses will not be placed in fatality monitoring search plots. Planted carcasses will be placed in the vicinity of the broadcast towers but not so near as to attract scavengers to the search plots. The planted carcasses will be located randomly within the carcass scavenging trial plots.

Carcasses will be placed in a variety of postures to simulate a range of natural conditions. For example, birds will be: 1) placed in an exposed posture (e.g., thrown over the shoulder), 2) hidden to simulate a crippled bird (e.g., placed beneath a shrub or tuft of grass) and, 3) partially hidden. Trial carcasses will be marked discreetly for recognition by searchers and other personnel. Trial carcasses will be left at the location until the end of the carcass scavenging trial.

Carcasses will be checked as follows, although actual intervals may vary. Carcasses will be checked for a period of 28 days to determine removal rates; however, total number of searcher days will be adjusted according to observed scavenging rates. Carcasses will be checked approximately every day for the first 7 days, and then on day 10, day 14, day 21, and day 28. This schedule may vary depending on the initial removal rate observed, weather, and coordination with the other survey work. At the end of the 28-day period, any remaining trial carcasses and scattered feathers will be removed. Each trial will use as many bird carcasses as are available; the target is 10-20 carcasses.

3.0 SEARCHER EFFICIENCY TRIALS

The objective of searcher efficiency trials is to estimate the percentage of bird fatalities that searchers are able to find. Searcher efficiency will be estimated by habitat type and season. Estimates of searcher efficiency will be used to adjust carcass counts for detection bias. Searcher efficiency trials will be conducted on the fatality monitoring search plots in all habitat types.

Searcher efficiency trials will be conducted in each season as defined above, during the period in which the fatality monitoring occurs. Trials will be spread throughout the year to incorporate the effects of environmental variables such as weather and scavenger populations. Key elements of these trials include:

- At least three trials will be conducted in each season.
- Each trial will use a variable number of carcasses so that the searcher will not know the total number of trial carcasses being used in any trial.
- For each trial, birds will be used according to their availability.
- Wedge-tailed shearwater will be the primary species used for searcher efficiency trials.
- Personnel conducting searches will not know in advance when trials are conducted; nor will they know the location of the trial carcasses.

- Carcasses will be placed in a variety of postures to simulate a range of conditions. For example, birds will be: 1) placed in an exposed posture (thrown over the shoulder), 2) hidden to simulate a crippled bird and 3) partially hidden.
- Each non-domestic carcass will be discreetly marked and located with GPS at the planted site so that it can be identified as an efficiency trial carcass after it is found.
- The number and location of the efficiency trial carcasses found during the carcass search will be recorded.

If new searchers are brought into the search team, additional detection trials will be conducted to ensure that detection rates incorporate searcher differences.

4.0 SAMPLING INTENSITY AND DURATION

Search efforts will begin in mid-October and end in mid-December. Each tower will be checked twice per week, with no greater than three days between surveys. This will be very useful in increasing the efficiency of the study since scavenging rate detections will determine the appropriate search frequency. If scavenging is high, search frequency needs to be high (see Arnett 2005).

However, based on Service recommendations, carcass searches will be conducted approximately two times per week or no longer than 3 days apart during the initial scavenging trial. Once data from the initial scavenging trial has been evaluated, the frequency of carcass searches will be adjusted accordingly for effectiveness and efficiency for the remainder of the fall 2008 survey season, as approved by the Service. Additional surveys may be conducted after climatic conditions/events, such as storm events, fog, or moonless nights, as these events could increase the likelihood of collisions with broadcast towers.

Changed circumstances such as hurricanes, major storms, fire, and other such events may affect the timing of the surveys. If the broadcast towers are not accessible as a result of storm events or road conditions, and/or staff safety is questionable, the surveys will continue as soon as is safely possible. The Navy will coordinate with the Service on such changed circumstances as soon as possible.

5.0 ANALYTICAL METHODS FOR FATALITY ESTIMATES

Estimates of avian fatalities during the life of the broadcast towers are based on the following:

(1) The number of carcasses located during standardized searches for which the cause of death is attributed to the broadcast towers; carcasses found within survey plots are assumed to be the result of the broadcast tower unless other obvious indicators exist.

(2) Carcass scavenging rates expressed as the estimated average time a carcass is expected to remain in the study area and be available for detection by the searchers during the entire survey period.

(3) Searcher efficiency expressed as the proportion of planted carcasses found by searchers.

The following sections describe how the avian fatalities will be quantified.

5.1 Fatality calculations

The estimate of total fatalities is based on the number of fatalities found within the survey plots, confirmed to be attributed to the broadcast towers, and adjusted for the probability that the observer found the carcass and the time that the caresses remained to be found (i.e., was not scavenged). Calculations are based on Young *et al.* (2003) and are presented below.

5.1.1 Number of carcasses

The average number of carcasses per search period is calculated using:

$$\bar{c} = \frac{\sum_{i=1}^{k} c_i}{k}$$

where c_i is the number of carcasses found at broadcast tower i, and k is the number of broadcast towers searched.

Total number of carcasses found is calculated by:

$$C = k * \bar{c}$$

5.1.2 Searcher Efficiency

Searcher efficiency (p) was calculated as the proportion of the carcasses found by observers divided by the total number of carcasses available to find.

$$p = \frac{p(1-p)}{n}$$

5.1.3 Scavenging rate

The average number of days that a carcass remained on site is calculated using:

$$\bar{t} = \frac{\sum_{i=1}^{k} t_i}{k}$$

where t_i is the number of days each carcass remained on the study area and k is the number of carcasses evaluated.

5.1.4 Mortality estimate

The estimated total number of fatalities is calculated by

$$m = \frac{N * I * C}{k * \bar{t} * p}$$

where N is the total number of broadcast towers, I is the time between searches (days), C is that total number of carcasses during the study period, k is the number of broadcast towers searched, $\bar{t}$ is the mean length of time a carcass remained on the plot, and p is the searcher efficiency.

6.0 RESULTS

Fatality rates will be calculated on the project as a whole. Each season's percent searcher efficiency will be applied to the observed direct take (carcasses found, if any, during searches) to quantify adjusted take (direct and unobserved direct take combined). Variance will not be calculated pursuant to Service recommendation.

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Attachment 1

Downed Wildlife Protocol

DOWNED WILDLIFE PROTOCOL *

Downed birds (any seabirds, and or Hawaiian short-eared owl) considered here may be dead or injured at discovery. All need immediate attention by the discoverer.

A ***prioritized*** Contact List of Service and Division of Forestry and Wildlife (DOFAW) Staff follows, prioritized from first to last to contact. It is essential for you to actually speak with a person and not to rely on voicemail as "a contact"; however you may leave a message and then contact the next person in the listing.

DEAD BIRD:

- Leave in place, the Service or DOFAW will do site and circumstantial assessment, make photographs, and measurements before securing and removing bird.

- Contact Service about find; Call list for Service staff, in order for calling:
    1. Adam Griesemer 808-285-8261 or 808-822-2175
    2. Law Enforcement 808-861-8525

INJURED BIRD:

Equipment necessary to have available for response:

- Pet carriers (medium) – 2 available at minimum
- Cardboard small animal (rat/rabbit/hamster) carriers – 2 minimum
- Pieces of artificial turf/outdoor carpeting to place on floors of pet carriers
- Non-tippable shallow dog water-bowls for water; water
- Gloves
- Tent stakes (6)

Procedure

1. Gently pick up and place bird into carrier equipped with turf/carpet. Place only 1 bird in a carrier.
2. Mark exact spot of find(s) with tent stake(s).
3. Place the bird in the SOS aid station at PMRF, or transport to Kauai Humane Society if the bird was picked up after the SOS aid station was checked for the day.
4. DO NOT feed birds, provide water in bowl.
5. Notify the Service within 24 hours by telephone, using call list above, and by email - adam_griesemer@fws.gov.

Attachment 2

Avian Fatality Survey Form

Page ____ of ____

Downed Wildlife Survey

Location: _____	**Observer:** _____	**Date:**	_____
	Start Time: _____	**End Time:**	_____

Environmental Conditions:

Cloud Cover:____ (0=about 25%, 1=26-50%, 2=51-75%, 3=76-100%) **Temperature:**_____

Precipitation:____Rain____ Fog____Other____ (0=None, L=light, M=Moderate, H=Heavy, Other= Hail, Snow)

Wind:_____ 0=<1 mph, 1=1-3 mph (leaves barely move), 2=3-7 mph (leaves rustle, small twigs move),
3=8-12 mph (sm. Twigs move), 4=13-18 mph (sm. Branches move) 5=12-24 mph (lg. Branches move trees sway)

Vegetation: Ave. ht. _____(cm); **Ave. vigor** _____ (G = Green, M = Mixed, B = Brown);
Cover _____% (% ground obscured by plant cover), record details in comments

Tower No.	Species	Sex	Age	Remains	Dir. From Tower	Dist. From Tower	UTM N	UTM E	Approx. Carcass Age	Photo nmbrs	Vegetation Type	Comments

Species: 4-letter code
Sex: sex of animal if known (**M** = Male, F = Female); **Age: A** = Adult, **S** = Subadult, J = Juvenile
Remains: E=Entire body, **W**=Wing, **F**=Feathers/Fur, S=feather spot (10 or more, or 3 primaries),**B**=Bones, **O**=Other (add to Comments)
Dir. From Tower: Compass direction of carcass from Tower base
Dist. From Tower: Distance (meters) of carcass from Tower
Carcass age: Approximate age in days of carcass remains
Comments: Print notes as needed

Attachment 3

Avian Injury / Mortality Form

Report Date:

Species (common name):

Date Found:

Time Found:

Age:

Bands:

Found by:

Documented by:

GPS Coordinates:

Location Found (including closest structure & distance to structure):

Condition of Specimen (include a description of general condition, as well as any visible injuries):

Probable Cause of Injury or Mortality and Supportive Evidence (attach photos and map, next page):

Action Taken (include notifications, reporting dates and times):

Additional Comments:

Appendix 2:

Newell's Shearwater Population Modeling to Inform the Biological Opinion for the Pacific Missile Range Facilities Base-wide Infrastructure, Operations, and Maintenance Activities.

Photo Credit: Newell's shearwater, Tracy Anderson, Save Our Shearwaters Program.

Prepared By:

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1.0 INTRODUCTION

The primary purpose of this modeling assessment was to estimate the effects on the Newell's shearwater population likely to be caused by the Pacific Missile Range Facility (PMRF) Base-wide Infrastructure, Operations, and Maintenance Activities over the 50-year term of the biological opinion, absent the predation management actions proposed by the U.S. Department of the Navy (Navy). This modeling assessment differs from the stochastic and geographic assessments developed by the Service (USFWS 2017a) which inform Newell's shearwater strategic habitat conservation on the island of Kauai. This assessment is not meant to comprehensively analyze the variability of all major threats to Newell's shearwater and their potential range of effects on the species population viability as in USFWS (2017a), rather it assesses only the impacts of fallout and tower collision mortalities likely to be caused by PMRF activities on the Newell's shearwater population in the consultation action area. The action area spans the western region of Kauai (as described in the biological opinion), therefore this assessment focuses on a meta-population of shearwaters breeding within the Kauai (island-wide) population. Although this assessment uses a deterministic modeling approach, the stochastic and geographic analyses in USFWS (2017a) informed selection of inputs (demographic parameters) to model the current condition of the Newell's shearwater population in the action area and the Kauai population.

A secondary purpose of this assessment was to estimate the beneficial effects of predator management in nesting colonies specific to PMRF's proposed predation management actions. The effects of different predators on nesting colonies were partitioned based on approaches used in the Service's mitigation efficacy calculator (USFWS 2017a). The assessment was further defined to a meta-population (a sub-set of pairs breeding in colonies within the action area population) for the purposes of scaling management to the number of breeding pairs that will be supported by predator management funded by the Navy.

The objectives of this modeling assessment were the following: 1) estimate the additional decline associated with seabird fallout and seabird tower collisions likely to be caused by PMRF activities on the Newell's shearwater population occurring in the action area; 2) calculate the total (accumulated) take in terms of additional seabird fallout and additional seabird tower collisions likely to be caused by PMRF activities over 50-years; and 3) determine the increase in fledgling production from implementing predator management at nesting colonies as discussed in the biological opinion.

2.0 METHODS

The Service relied on deterministic demographic modeling to calculate Newell's shearwater population assessment metrics for growth rate, population loss, and endpoints (e.g., timing to population extinction). Deterministic population modeling was performed in PopTools v3.2 (Hood 2011) using stage-based Lefkovitch matrices. The stage-based matrices were based on survival (juvenile, sub-adult, and adult), fecundity, and an age of first breeding of six years old (Ainley *et al.* 2001), as illustrated in Figure 1.

$$N_t \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & F_a \\ S_0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & S_1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & S_2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & S_3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & S_4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & S_5 & S_a \end{bmatrix}$$

Figure 1. Population matrix of stage-based model. Nt is the stage-specific population size at time t, S is the age specific survival at ages 0, 1, 2, 3, 4 ,5 and adult (6+), and F is fecundity (proportion of females in population, breeding probability, and reproductive success).

2.1 Modeling Scenarios

The first modeling scenario was developed for the purposes of comparing model projections of population decline to trends in breeding activity garnered from ornithological radar monitoring data (i.e., to check if the projection of the baseline for the Kauai population makes biological sense).[1] This served as a method to corroborate our selection of demographic parameters and our characterization of threats to the Kauai population and action area population (*See* section 2.3). A model of the current condition of Kauai Newell's shearwater population was developed for this scenario.

The second modeling scenario was developed to project the additional decline likely to be caused by impacts from PMRF lighting and communication towers over the 50-year term of the proposed action on the Newell's shearwater population occurring in the action area due to the effects of (a) additional seabird fallout due to light attraction and (b) additional seabird/tower collision mortalities. In order to estimate this decline, we first developed a model to assess the current condition of the population in the action area (the Environmental Baseline), then added the impacts of the additional seabird fallout and tower collisions to the current condition. Thus, two models of population projections were considered in this second scenario, including "Environmental Baseline" and "Environmental Baseline with PMRF Activities."

The third modeling scenario was developed to estimate the beneficial effect of PMRF's proposed predator management at breeding sites on the population in the action area. We expressed the effect of management as a change in the number of fledglings produced by the breeding pairs that would be directly affected by the management. We considered management that decreased predation by removing predators, including feral cats (*Felis catus*), pigs (*Sus scrofa*), rats (*Rattus spp.*), and barn-owls (*Tyto alba*). We expressed the efficacy of the management by decreasing predation of individuals and nests proportionally (considering that management would be 70-90% effective in reducing predation) such that 80% management efficacy meant that out of 20 burrows with chicks or eggs depredated in the absence of management, predator removal would reduce the number of depredated burrows to 4 (20 percent of 20 burrows). One meta-population

[1] Radar has been used to monitor the summer movement patterns of Newell's shearwaters in coastal areas of known seabird flyways in May through mid-July, during the incubation and early chick-rearing stage, which provides a conservative index of breeding activity.

at breeding sites in the action area equal to 50 breeding pairs was considered for this scenario as discussed in the biological opinion. We produced one management model for this scenario:

> (i) "Predator Control" decreasing predation by feral cats, pigs, and rats (70-90% efficacy) for 50 breeding pairs.

Although predator management was ongoing in 2017 at two Newell's shearwater breeding sites under management of the Kauai Island Utility Cooperative (KIUC), no long-term mitigation or minimization measures have been approved by the Service for inclusion in a long term HCP and associated Incidental Take Permit (ITP). Therefore, all of the scenarios and management models considered in this assessment could not and did not assume ongoing or long-term colony management by KIUC HCP.

2.2 Modeling Approach

To model the above the scenarios, we adjusted demographic parameters of a Growth model[2]; the growth of the population in the absence of predation by non-native predators, fallout, power line, and tower collisions (i.e., threats). In Scenario 1 and Scenario 2, we added threats that decreased demographic parameters to define the current condition in the Kauai population and the action area population, respectively. In Scenario 3, we added predation management to one meta-population in the action area as discussed in the biological opinion (one meta-population equal to 50 breeding pairs) which removed a proportion of the decrease in the parameters due to predation.

We determined that adjustments from a growth model, rather than a stable population model, are appropriate for this assessment, based on lambdas (λ) (i.e., model output) produced using monitoring data from the Upper Limahuli nesting colony. The data suggests the potential for Newell's shearwater population to achieve a high breeding probability and reproductive success as a result of intensive predator control and ungulate exclusion at breeding sites.[3] Although breeding sites within Upper Limahuli are not free of terrestrial predators and constant removal of predators is required to maintain high reproductive performance, the high breeding probability and reproductive success rates combined with best estimates of survivorship (Section 2.4.4 Annual Survivorship) produced a growth rate of at least 1.016.

2.3 Data Quality

We compiled the best available data to develop inputs to demographic parameters for our modeling scenarios including the population size, age at first breeding, survivorship of adults, sub-adults, and juveniles, reproductive success, and breeding probability.[4] Table 1 summarizes the studies and data used that provided direct measures of demographic information. Significant resources for this information on Newell's shearwater and analogous species were found in Ainley *et al.* (2001), Griesemer and Holmes (2011), and USFWS (2017a).

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[2] A growth model has an output, lambda (λ), greater than one (1).

[3] The Kauai Endangered Seabird Recovery Project provided the Service summarized empirical data in 2014 to assist the Service with information to update Newell's shearwater demography and parameters in Service population modeling (KESRP unpublished data 2014).

[4] A general description of Newell's shearwater demographic information is included in the main text of the Biological Opinion, Status of the Newell's Shearwater, section *iv*.

Model development of the current condition of the Kauai Newell's shearwater population and the action area population (Environmental Baseline) required estimating the effects of major threats on the population, including collisions with power lines, light attraction/fallout, and predation.[5] To develop models for additional fallout and tower collisions due to PMRF activities, we relied on data used for our analysis of these effects in the biological opinion. The beneficial effects on colony productivity from predator management were also investigated in the modeling. The monitoring data that we relied on to model these threats and colony management are summarized in Table 1.

[5] A general description of threats to the Newell's shearwater population is included in the main text of the Biological Opinion, Status of the Newell's Shearwater, section v.

Table 1. Data Quality for Newell's shearwater Modeling Inputs

Measure	Direct		Indirect
	Recent (≥2010)	**Historic (<2010)**	**Estimated from Analogous Species**
Basic Life History			
Adult Survival			Griesemer and Holmes 2011, USFWS 2017a
Juvenile/Sub-adult Survival			Ainley *et al.* 2001
Reproductive Success		Kalaheo colony 81-85, 93-94	
Breeding Probability		Kalaheo colony 81-85, 93-94	
Age of first breeding			Ainley *et al.* 2001
Population Size	NOAA surveys 98-11	At-sea studies 80-94	
Threat Rates			
Power line Collision	KIUC UMP studies 14-15	EPRI studies 93-94	
Fallout	SOS Database 10-15	SOS Database 79-10, EPRI studies 93-94	
Predation	Hono o Na Pali 11-13 Predation Mortalities	Kalaheo colony 81-85, 93-94	
PMRF Fallout	SOS Database 14-15, PMRF Monitoring 14-15	SOS Database 07-10	
PMRF Comm. Tower Collision	PMRF tower surveys 10, 15		
Colony Management			
Adult Survival			Griesemer and Holmes 2011, USFWS 2017a
Juvenile/Sub-adult Survival			Griesemer and Holmes 2011, USFWS 2017a
Reproductive Success	Hono o Na Pali 13-15, Upper Limahuli 11-15		
Breeding Probability	Hono o Na Pali 13-15, Upper Limahuli 11-15		

2.4 Demographic Parameters

2.4.1 Population Size and Age of First Breeding

The most recent assessment of population size, based on survey data collected by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA-NMFS) Southwest and Pacific Islands Fisheries Science Centers from 1998 to 2011, estimated the total Newell's shearwater population at 27,011 (95% CI = 18,254-37,125) including juveniles and sub-adults (Joyce 2013). Previous assessments of population size estimated the total Newell's shearwater population at 84,000 (95% CI = 57,000-115,000) including juveniles and sub-adults, based on at-sea surveys conducted in the central and eastern tropical Pacific between 1980 and 1994 (Spear *et al.* 1995). Estimates indicate a significant percent of the global population resides on Kauai (Ainley *et al.* 1997). For the purposes of our modeling, we adjusted Joyce's (2013)

estimate for the population breeding on other islands (10% in Griesemer and Holmes 2011) producing an estimated Kauai Newell's shearwater population of 24,310 individuals (USFWS 2017a, p. 113).

Our models used an age of first breeding of 6 years of age, consistent with other Newell's shearwater modeling efforts (Ainley *et al.* 2001; Griesemer and Holmes 2011; and USFWS 2017a). Ainley *et al.* (2001) reported this breeding age, based on the timing of recoveries of banded Newell's shearwater of known age and the average of empirical data from the closely related Manx shearwater (*Puffinus puffinus*) (Brooke 1990). The percentage of the population that is breeding age (6 years of age or older) is estimated at 0.637 (Ainley *et al.* 2001, p.115), equaling a Kauai Newell's shearwater adult population of 15,485 individuals.

The initial population size in the action area was projected using a methodology similar to those employed in USFWS (2017b), based on statistical analyses of Newell's shearwater calling data from auditory surveys conducted by the Kauai Endangered Seabird Recovery Project (KESRP). The populations in all occupied nesting areas of Kauai were partitioned from the current Newell's shearwater population estimate (Joyce 2013). The subset of the meta-population within the action area provided an estimate of the initial population size (8,508 individuals). Of these individuals, 5,420 (63.7%) are assumed to be adults (Ainley *et al.* 2001).

2.4.2 Breeding Probability

Ainley *et al.* (2001) estimated breeding probability between 0.60 and 0.50 based on monitoring data from the Kalaheo nesting colony on the island of Kauai (Ainley *et al.* 2001, p. 118). This breeding probability is markedly lower than the breeding probability (0.82) of other Procellariidae species (Griesemer and Holmes 2011), likely the result of high mate loss due to predation (Ainley *et al.* 2001), the presence of predators at unprotected burrows reducing breeding attempts, or other threats affecting individual fitness. Adults that lose a mate cannot obtain a new one quickly and have been observed not to breed the following season.

Between 2011 and 2015 at breeding sites in Upper Limahuli, where the largest set of burrows are known, the percentage of active burrows (i.e., confirmed breeding) ranged from 0.76 to 0.87 (Raine and McFarland 2013, Raine and McFarland 2014, Raine and Banfield 2015a, Raine *et al.* 2016a).[6] During this period, the number of burrows monitored by KESRP in Upper Limahuli increased from 15 (2011) up to 82 (2015). An average of 92 percent of burrows was active in 2012 and 2013 out of a subset of 31 burrows known to have previously hosted breeding pairs (KESRP unpublished data, 2014). Ongoing predator management at Upper Limahuli likely influenced a reproductive performance consistently higher than previously measured at Kalaheo.

Based on the information above, we used a breeding probability of 0.90 for our Growth model (Table 2). The 90% breeding probability is consistent with analogous species for which long-term measures of breeding probability are available: 86-90% (n=15 years) in Cory's shearwater (*Calonectris diomedea*) (Mougin *et al.* 1997) and 86% (n>40 years) in short-tailed shearwaters (*Puffinus tenuirostris*) (Bradley *et al.* 2000). Adjustments to breeding probability to account for

[6] KESRP confirms breeding status through presence of (1) adult during day in June or July, (2) an egg or eggshell fragments, or (3) chick.

negative effects of predation and beneficial effects of predator management are described in corresponding sections.

2.4.3 Reproductive Success

Using data collected in a five-year monitoring study (1981-1985) of the Kalaheo nesting colony, Ainley *et al.* (2001) estimated an annual reproductive success of 0.66 fledglings per breeding pair. In the years of the study, predation primarily consisted of adults and sub-adults rather than chicks. Over a recent five year period (2011-2015), the reproductive success of Newell's shearwater pairs ranged between 0.68 and 0.88 within Upper Limahuli (Raine *et al.* 2016a, p. 16), where breeding pairs received intensive predator control to reduce chick mortalities. In comparison, the Manx shearwater, a closely related species with an extensive range and a stable global population, has a reproductive success of 0.70 (Brooke 1990, Ainley *et al.* 2001). Brooke (1990) measured the 0.70 success rate at Skolkhom Island colony where non-native predators have not occurred at nest sites.

The Service used 70% in our Growth model (Table 2) to represent mean, long-term reproductive success in predator free conditions, consistent with Griesemer and Holmes (2011) and USFWS (2017a). This is based on the mean reproductive success and long-term studies of other Procellariidae species (n=44 studies); Griesemer and Holmes (2011) considered that 0.70 reproductive success represents an upper end of Newell's shearwater mean, long-term reproduction. In the USFWS (2017a) assessment of variance in Newell's shearwater reproductive success, 0.70 was approximately the upper quartile boundary of the boxplot representing mean reproductive success without predation. Adjustments to reproductive success to account for negative effects of predation and fallout and the beneficial effects of predator management are described in corresponding sections.

2.4.4 Annual Survivorship

Annual survivorship of adult Newell's shearwater has not been directly measured in field studies (Ainley *et al.* 2001, USFWS 2017a). Adult survivorship of Procellariidae species is related to body mass, where adults with a greater body mass exhibit a higher likelihood of survival, all else being equal (Croxall and Gaston 1988, p. 1184). Based on this allometric relationship and linear regression of the log of adult body size to survivorship data from closely related Procellariidae species, previous modeling studies estimated Newell's shearwater adult survivorship at 0.905 (Ainley *et al.* 2001, p. 116) to 0.920 (Griesemer and Holmes 2011, p. 20). An updated linear regression assessment incorporating additional field-derived adult survivorship data from other Procellariidae species estimated Newell's shearwater adult survivorship at 0.920 (USFWS 2017a). We used an adult survivorship of 0.920 for our Growth model (Table 2) consistent with the Service's updated assessment (USFWS 2017a) and Griesemer and Holmes (2011).

Based on long-term survivorship data from the Manx shearwater, we estimated the likelihood of a Newell's shearwater fledgling surviving to adulthood (0.333) (Brooke 1990). We followed methods of Ainley *et al.* 2001, to develop age specific survivorships, consistent with other studies (Griesemer and Holmes 2011, USFWS 2017a). For our Growth model (Table 2) we used age specific survivorships of 0.654 (age 0-1), 0.78 (age 1-2), 0.89 (age 2-3), and 0.905 (ages 3-4, 4-5, and 5-6). Adjustments to the adult and sub-adult survivorship for the effects of predation,

power line collisions, communication tower collisions, and predator management are described in corresponding sections.

Table 2. Adjustments from growth modeling for all Newell's shearwater model scenarios.

		Breeding Probability	Reproductive Success	Survivorship (age)						
				0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	Adult (6+)
Growth Model		0.9000	0.7000	0.6540	0.7800	0.8900	0.9050	0.9050	0.9050	0.9200
Predation		-0.3000	-0.2000			-0.0242	-0.0242	-0.0242	-0.0242	-0.0425
Power Line Collision	Low					-0.1570	-0.1570	-0.1570	-0.1570	-0.0168
	Medium					-0.2174	-0.2174	-0.2174	-0.2174	-0.0232
	High					-0.2778	-0.2778	-0.2778	-0.2778	-0.0297
Fallout	Low		-0.0358							
	Medium		-0.0460							
	High		-0.0562							
PMRF Fallout	Action Area Pop.		-0.0044							
PMRF Comm. Tower Collision	Action Area Pop.									-0.0092
Predation with cats, rats, pigs & barn-owls controlled	70% Effectiveness	-0.0900	-0.0600			-0.0073	-0.0073	-0.0073	-0.0073	-0.0128
	80% Effectiveness	-0.0600	-0.0400			-0.0048	-0.0048	-0.0048	-0.0048	-0.0085
	90% Effectiveness	-0.0300	-0.0200			-0.0024	-0.0024	-0.0024	-0.0024	-0.0043

2.4.5 Power Line Collision

For purposes of this assessment, we relied on modeled estimates in USFWS (2017a) which extrapolate the amount of Newell's shearwater collisions with power lines documented by the KIUC Underline Monitoring Program (UMP) to the entire power line system, encompassing power lines and infrastructure in the central, eastern, northern, southern, and western portions of the island of Kauai.

In the Kauai Population model, we used the island-wide collision estimate of 1,800 Newell's shearwater mortalities per year, the rounded averages of selected scenarios for the 2014 and 2015 projections (USFWS 2017(a), p.123). This data set was used to scale collision levels such that the minimum, average, and maximum values represented low collision mortality (1,300), medium collision mortality (1,800), and high collision mortality (2,300) in that order. We separated the strike estimates into age classes using an adult to sub-adult ratio (80:20) of Newell's shearwater carcasses collected under power lines during standardized searches (Ainley *et al.* 2001), consistent with previous assessment methods (USFWS 2017a; Griesemer and Holmes 2011). The adult mortalities at low, medium, and high collision levels (260, 360, and 460) equaled 1.68%, 2.32%, and 2.97%, respectively, of the total Kauai adult population of 15,485. The sub-adult mortalities for the collision levels (1,040; 1,440; and 1,840) equaled 15.70% (low), 21.74% (medium), and 27.78% (high) of the total Kauai sub-adult population of 6,624 [24,310 minus adults (15,485) and 2,200 one-year olds at sea (0.09% of Kauai population; Ainley *et al.* 2001)]. We reduced the adult and sub-adult survivorship according to these percentages to account for power line collision in the Kauai population (Table 2). These estimates are substantially greater than previously modeled estimates in Ainley et al. (2001), based on 1993-1994 Electric Power Research Institute studies.

The Service's modeled estimates of the annual number of collisions per line segment were used to characterize power line threats to the Newell's shearwater in the consultation action area for the Environmental Baseline model. Figure 2 illustrates the annual number of collisions, including both Newell's shearwater and Hawaiian petrel (*Pterodroma sandwichensis*) projected across transmission power line segments, based on power line exposure heights, least cost path flyways, and modeled UMP data (USFWS 2017a). The relative likelihood of two of the seabird species on the island of Kauai affected by power lines is 0.81 Newell's shearwater and 0.19 Hawaiian petrel (USFWS 2017a). Under the scenarios selected in the USFWS Newell's Shearwater Landscape Strategy Appendix 2 (2017a, p. 123) estimate of 1,800 mortalities (scenarios IV, VB, VIA), approximately 15% of Newell's shearwaters that strike power lines die as a result of the collision. According to the distribution of collisions across power lines depicted in Figure 2, less than five strikes per year per line segment are anticipated in the action area; however, low to moderate levels of strike are anticipated to occur at specific line segments in the Waimea and Kekaha. On the basis of the estimated number of strikes per segment in the action area (Figure 2), that 81% of strikes are Newell's shearwaters, and that 15% of those strikes result in mortality, the Service applied the low rates of collision to the action area population in the Environmental Baseline model. We reduced survivorship of adults in the action area by 1.68% and sub-adults by 15.7%.

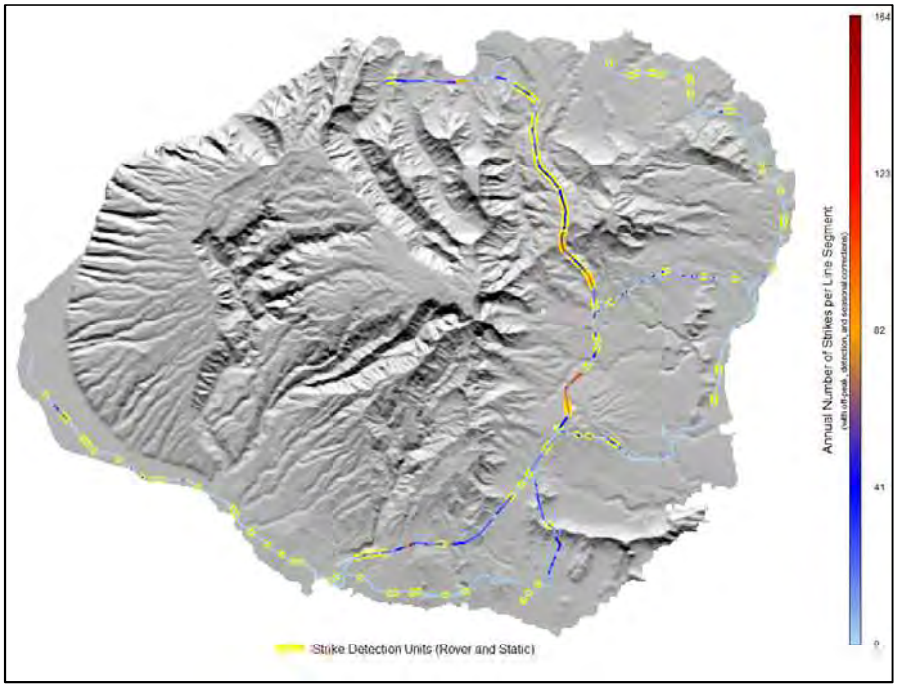

Figure 2. Map of projected annual power line collisions of Newell's shearwater and Hawaiian petrel per power line segment from USFWS (2017a). Strike detection units, shown in yellow, represent locations of song meter units in 2015.

2.4.6 Predation

We developed current estimates of predation at breeding sites using recent data collected in 2011-2015 by the KESRP at the Hono o Na Pali nesting colonies. The Service estimated adult and chick predation (differential predation) using estimates of mortalities for an unmanaged colony, based on observations during seabird colony monitoring in 2011 to 2013 (KESRP unpublished data 2014).[7] We estimated that approximately 29 chicks and 17 adults are predated by cats, rats, pigs, and barn-owls in an unmanaged colony with a meta-population of 400 breeding adults (Table 3). Assuming that this meta-population, predator-free, would produce 125 chicks (0.90 breeding probability and 0.70 reproductive success), the 29 chicks represent 20% of the total chicks produced. We reduced reproductive success for predation by 0.20 in our Kauai Population model and Environmental Baseline model (Table 2), consistent with moderate rates of chick predation estimated in Griesemer and Holmes (2011). To account for the predation of adults, we reduced adult survivorship by 4.25% (17 out of every 400 adults) in these models (Table 2). This adult mortality rate suggests that the extent of adult Newell's shearwater predated by cats, pigs, and barn-owls is substantially higher than observed at the Kalaheo colony (which was 1%) (Ainley *et al.* 2001) or considered in threat models by Griesemer and Holmes (2011).

Although differential predation estimates were derived from data collected in the 2011 to 2013 breeding seasons, the predation of adult and nestling shearwaters has continued to occur at the Hono o Na Pali colony in 2014 and 2015. At least eleven Newell's shearwaters from over 20

[7] USFWS (2017a) used the same predation data to develop demographic variables for Leslie matrices, referred to as KESRP Defined Predation, and transformed variables to proportional estimates for 100 breeding pairs.

shearwater burrows monitored by KESRP were predated by cats, consisting of eight adults and three nestling shearwaters (Raine *et al.* 2016b, 2016c, 2016d). At one burrow in 2015, a cat was documented on camera killing an adult Newell's shearwater and its nestling over two consecutive nights (Raine *et al.* 2016c). In 2014, at nesting colonies within Hono o Na Pali, rats predated 11% of burrows (n=14 of 125) where breeding of Newell's shearwater or Hawaiian petrel was confirmed (Raine and Banfield 2015b, 2015c, 2015d). These predation events provide further evidence of moderate to high levels of predation of adults and chicks in unmanaged seabird colonies.

Table 3. Estimated number of Newell's shearwaters predated by cats, pigs, rats, and barn-owls in a colony not receiving predator management, assuming a meta-population of 400 breeding pairs.

Predator		
	Adults	**Chicks**
Cat	8	8
Pig	8	8
Barn-owl	1	0.5
Rat	0	12
Total	**17**	**28.5**

On the basis of the adult mortality data from Hono o Na Pali nesting colony and the breeding probability reported in Ainley *et al.* (2001), we used a breeding probability of 0.60 for the Kauai Population model and Environmental Baseline model, reducing by 0.30 to account for mate loss due to predation, the presence of predators decreasing breeding attempts, and other factors affecting individual fitness (Table 2).

We also estimated reductions in survivorship of sub-adults which are susceptible to predation when returning to nesting colonies to prospect and form pair bonds (Warham 1996). We considered a stable-age distribution (Ainley *et al*. 2001; USFWS 2017a, p. 121) to estimate an additional 36.3% of the adults predated are sub-adults (2 to 5 years old), and reduced sub-adult survivorship by 2.42% in our Kauai Population model and Environmental Baseline model (Table 2). In an unmanaged colony with 400 breeding adults (above) this corresponded to an additional 228 sub-adults at risk of predation by cats, rats, pigs, and barn-owls. Based on this sub-adult mortality, we estimated 22 out of the 228 sub-adults are predated, totaling the 2.42% across each age (2-3, 3-4, 4-5, and 5-6 years old).

2.4.7 Fallout

Our estimates of lighting impacts to the Kauai Newell's shearwater population and action area population are based on Save Our Shearwaters (SOS) program recoveries of Newell's shearwaters that have been disoriented by lighting and grounded (referred to as "fallout"). Fallout was modeled as a reduction in breeding success at low, medium, and high levels, relying on the methodologies followed in other deterministic Newell's shearwater modeling studies (Griesemer and Holmes 2011, Ainley *et al.* 2001). We estimated the proportional decrease in the chick production of the population, assuming predation also impacted production (Griesemer and Holmes 2011). Recent results of satellite tagging studies of fledglings released by the SOS

program were considered in selecting an appropriate fallout level for the Kauai population model.

The five year average fallout (2011-2015) was 142 Newell's shearwater fledglings, based on the number of fledglings recovered by the SOS program.[8] We used a 50% discovery rate to estimate the percentage of the total birds found and recovered by the SOS program (Ainley *et al.* 2001). The 17th, 50th, and 83rd percentiles of the range of fallout recorded in 2011 to 2015 (142-284 fledglings) represented low, medium, and high fallout mortalities. The proportional decrease in the total chick production (lowered for predation) of the Kauai population equaled 3.6%, 4.6%, and 5.6% using an average fallout of 166 (low), 214 (medium), and 261 fledglings (high) (Table 2).

Research was conducted in 2014 and 2016 to compare the survival of SOS-released shearwater fledglings to the survival of shearwater fledglings that naturally leave out to sea from montane breeding colonies. Although earlier years of the program did not always include bird banding prior to release, since 1979 a total of 24 Newell's shearwaters previously banded and released through the SOS program as fledglings have been recovered or re-sighted as adults (T. Anderson, personal communication, July 27, 2016). The SOS low re-sight numbers prompted the pilot studies conducted by KESRP in coordination with the U.S. Geological Survey, Western Ecological Research Center. The primary focus of the 2014 pilot study was to evaluate attachment technique and tagging technology. Results of the 2016 study indicated that the same percentage of birds (83.3%, n=12) survived beyond 14-days after release regardless of whether they naturally fledged to sea from Upper Limahuli or were SOS-retrieved fledgling birds. Fourteen days is expected to be the maximum time period in which a hatch-year bird would need to learn how to feed itself or succumb to starvation (Mougin *et al.* 2000), and it is the time period in which we would expect the hatch-year bird to succumb to any unknown injuries from being grounded, if those injuries were present (Raine *et al.* 2017a, p. 15). All SOS-released and naturally fledged hatch-year birds (n=12), successfully traveled to foraging grounds at-sea and exhibited normal movement patterns as indicated from tagging data (Raine *et al.* 2017a, p. 9). The SOS-released fledglings chosen for the 2016 tagging study were individuals that were submitted to SOS and deemed healthy (e.g., good release weight, plumage, body condition, and lack of physical injuries) and suitable for immediate release (within 0-1 days); therefore, the 2016 tagging study did not evaluate SOS-rehabilitation efficacy.

In 2016, 100 Newell's shearwater fledglings were handled by the SOS program, including 93 fledglings released and seven that were dead on arrival, died in care, or were euthanized (2016 DOFAW). Of the 100 fledglings handled by the SOS program, 63 (63%) were released to sea the same day or next day (DOFAW 2016). Another 30 fledglings were rehabilitated with time in care equal to or exceeding two days, then released to sea. Based on the above and the results of the 2016 pilot study, we estimate that at least 63 of the 2016 SOS-released birds are likely to survive at the same rate as fledglings that naturally fledged to sea (65.4%, Section 2.4.4 Annual Survivorship). The 63% SOS-release survival would lower the maximum mortality considered in our models from 261 to 172 (89 of the 142 fledglings (5 year average) survive). Thus, in our Kauai population model, we selected low fallout mortality (166 fledglings) and decreased

[8] The 5 year average excludes Newell's shearwater downed and recovered at PMRF facilities which were considered as additional threats in this assessment.

reproductive success by 3.6%; consistent with SOS-release survival resulting from tagging studies.

In the Environmental Baseline model, we estimated reductions to breeding success based on the amount of fallout fledglings recovered by SOS in the action area, including Port Allen, Hanapepe, and Waimea aid stations. The Newell's shearwaters recovered at these aid stations in 2012 through 2015 equaled up to 27% of the total recovered by SOS.[9] Given the percentages of fallout in the action area and information on SOS-release survival above, we selected the low rate, and decreased breeding success of the population in the action area by 3.6%.

2.4.8 PMRF Fallout and Communication Tower Collisions

To adjust demographic parameters for PMRF activities, we relied on our analysis (included in the Effects of the Action section of the biological opinion) of the average annual fallout at PMRF sites and fatalities at PMRF towers located at Kokee Site C. We used data on the number of Newell's shearwater downed at PMRF sites and recovered by SOS in 2014-2015 to model impacts from fallout which is anticipated to be reflective of lighting conditions over the 50-year term of the biological opinion. As part of the Service's collision risk assessment for PMRF communication towers, we evaluated direct measures of mortalities at PMRF communication towers (Kleidosty Pacific 2011; Kleidosty Pacific 2016) and developed a collision model to estimate Newell's shearwater fatalities from PMRF towers located at Kokee Site C. The collision model (Appendix 1 of the biological opinion) is based on a template modified from Sanzenbacher and Cooper (2013), incorporating updated seabird movement rates in the action area and tower characteristics.

We calculated the anticipated proportional decrease in the chick production associated with Newell's shearwater fallout due to lighting at PMRF facilities to further adjust reproductive success for PMRF fallout in the Environmental Baseline with PMRF Activities model. The average annual fallout of seven Newell's shearwater fledglings at PMRF sites further decreased reproductive success by 0.44% in the action area population (Table 2).

We used the medium fatality estimate of 50 adult Newell's shearwater per year to further adjust adult survivorship for collisions with PMRF communication towers. We reduced adult survivorship by 0.918% to account for the additional impact on the adult population in the action area (50 out of 5,420 adults) in the Environmental Baseline with PMRF Activities model (Table 2).

The Service estimated the number of Newell's shearwater chicks or eggs that are likely to be killed per year as a result of its parent colliding with a PMRF communication tower, based on the annual number of adult collisions (0.918% of adults in action area) and the reproductive rates of the action area population in the Environmental Baseline model (breeding probability of 60% and reproductive success of 46.4%).

2.4.9 Predator Management

[9] Beginning in 2012, the specific number of Newell's shearwaters recovered from each aid station was summarized in SOS reports (KHS 2013, 2014, 2015, 2016); thus, the amount of fallout at Port Allen, Hanapepe, and Waimea aid stations in previous years was omitted from current condition section for purposes of reporting consistency.

We adjusted the reduction for predation in demographic parameters in our Predator Control model (Table 2). The predation effect on demographic parameters was decreased by 70%, 80%, or 90% in the Predator Control model. The Service considered 80% efficacy achievable in nesting habitat (providing sufficient funding), based on Newell's shearwater reproduction measured in Upper Limahuli nesting colony which suggests a very high efficacy in decreasing the number of active burrows predated by feral cats, pigs, rats, and barn-owls (Raine and Banfield 2015a, Raine *et al.* 2016a). Predator management that achieves 80% effectiveness (from the removal of feral cats, pigs, rats, and barn-owls) increased breeding probability to 84%, reproductive success to 66%, adult survival to 91.2%, and fledgling to adult survival to 32.9%.

3.0 RESULTS

3.1 Environmental Baseline and Kauai Population Models

The lambdas (growth rate) for all threat combinations considered in the development of the Environmental Baseline model and the Kauai population model are shown in Table 4. In the absence of predation, power line, and fallout threats, the demographic parameters of the growth model produced a lambda of 1.016. Predation produced a decline of 7.4% per year (λ = 1.016 – 0.942). Power line mortality produced declines of 5.2% (low), 7.0% (medium), and 8.8% (high) per year. Fallout produced declines of 0.4%, 0.5%, and 0.6% per year at low, medium, and high levels, respectively.

The Environmental Baseline model with predation, *low* power line collision, and *low* fallout resulted in an annual decline in the action area population of -10.3% (λ of 0.897). The Kauai Population model with predation, *medium* power line collision, and *low* fallout resulted in a population decline of -11.7% per year (λ of 0.883). This decline in the Newell's shearwater Kauai population is comparable to the mean annual rates of decline indicated by ornithological radar data for the island of Kauai (-12.5%) over the 20-year period 1993-2013.[10] This rate of decline is also within the range of annual declines reported in stochastic Newell's shearwater population models which incorporated variability in mortality and climate change (USFWS 2017a, p 159).

Table 4. Growth rates for Newell's shearwater without predation (none) and with predation (unmanaged colony) under none, low, medium, and high levels of fallout and power line mortality.

				Power Line Collisions			
				None	*Low*	*Medium*	*High*
Predation	*None*	**Fallout**	*None*	1.016	0.964	0.946	0.928
			Low	1.013	0.962	0.944	0.927
			Medium	1.012	0.961	0.943	0.926
			High	1.011	0.961	0.943	0.926

[10] The overall mean for shearwaters across all 13 radar sites on the island of Kauai surveyed in 1993 was 524 ± 207 targets/h and in 2013 was 34 ± 9 targets/h, representing a mean decrease of 94% between the two periods (t = 2.37, P = 0.03; Raine *et al.* 2017b). All of the 13 sites showed a large decrease in movement rates over the entire period, with movement rates at 12 (92%) out of 13 sites showing statistically significant declines (Raine *et al.* 2017b). Based on the radar data (Raine *et al.* 2017b) as a proxy for the breeding population, the Newell's shearwater population on the island of Kauai declined, annually, at a mean rate of 12.5 percent over the 20-year period.

Predation	*Unmanaged Colony*	**Fallout**	*None*	0.942	0.900	0.885	0.870
			Low	0.939	**0.897**	**0.883**	0.869
			Medium	0.938	0.897	0.882	0.869
			High	0.937	0.896	0.882	0.868

3.2 PMRF Activities added to Environmental Baseline

The accumulated effect of PMRF activities over a 50-year period of implementing the action is likely to result in the loss of 450 adults and 63 egg/chicks caused by PMRF communication towers and the loss of 63 fledglings due to PMRF lighting (Table 5). The number of Newell's shearwaters taken per year is anticipated to decrease each year, because as years pass in the implementation of the proposed action, the Newell's shearwater population in the action area is anticipated to decline by 11% (Environmental Baseline) and the proportion of individuals affected by the action in each respective age class (fledgling, sub-adults, and adults) of the action area population remains the same.

The fallout and seabird collision mortalities likely to be caused by PMRF lighting and communication towers increased the annual decline of the Newell's shearwater Environmental Baseline condition from -10.3% to -11.0% (a decrease in the growth rate from a λ of 0.897 to 0.890) (Table 6, Figure 3). By year 10 of implementation of the proposed action, the decrease in the baseline population in the action area likely to be caused by PMRF facilities was estimated to be 236 individuals [3,208 (action area population) – 2,971 (PMRF effects added to action area population)].

Table 5. Annual estimate of take and total (accumulated) take of Newell's shearwater that is likely to occur over the 50-year period of the proposed action.

		Annual	**50-year**
PMRF Lighting (Fallout)	fledglings	7	63
PMRF Communication Towers	adults & sub-adults	50	450
	eggs/chicks	7	63

Table 6. Lambdas and projected annual decline of (1) the action area population, including effects of predation, low fallout, low power line (Environmental Baseline), and (2) PMRF fallout and tower collision mortalities added to the action area population.

	Growth rate (λ)	**Projected Annual Decline**
Environmental Baseline (action area population)	0.897	-10.3%
Environmental Baseline with PMRF Fallout + Tower Collision	0.890	-11.0%

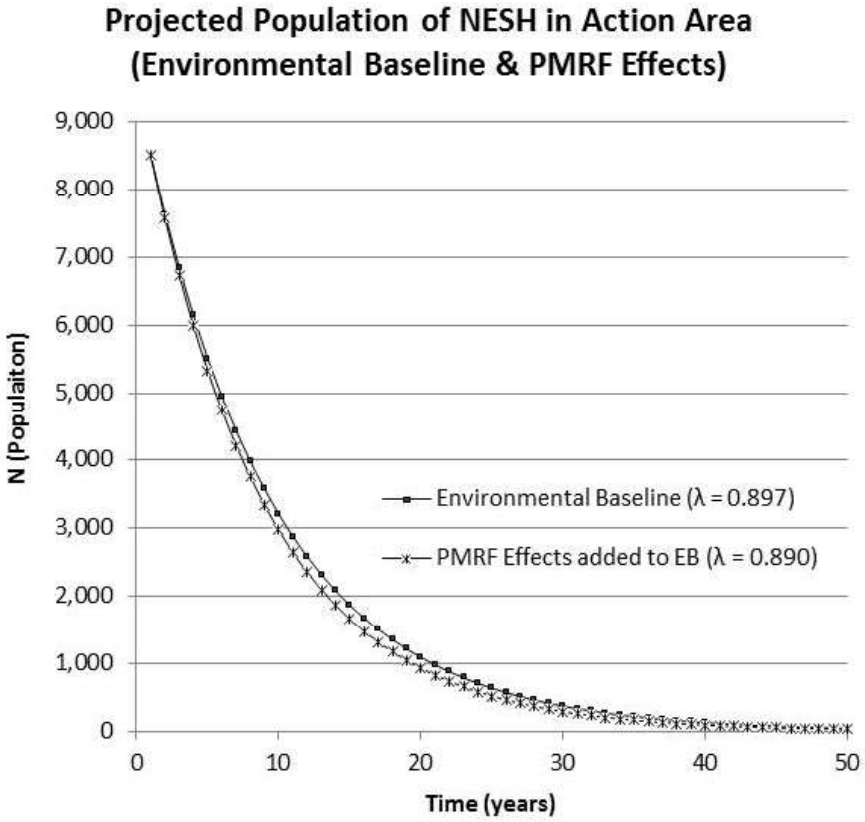

Figure 3. Newell's shearwater population in action area, including (a) growth rate associated with population in action area (Environmental Baseline, line-dots), and (b) growth rate for PMRF fallout and tower collisions added to the environmental baseline (line-crosses).

3.3 Predator Management

Decreasing predation by feral cats, pigs, rats, and barn-owls at 70%, 80%, and 90% efficacies resulted in lambdas of 0.995 (70% effectiveness), 1.002 (80% effectiveness), and 1.009 (90% effectiveness), respectively. Predator control at 80% effectiveness for 50 breeding pairs over 50 years (the term of the biological opinion) provided a reproductive benefit of 1,476 fledglings to the Kauai population (Figure 4).

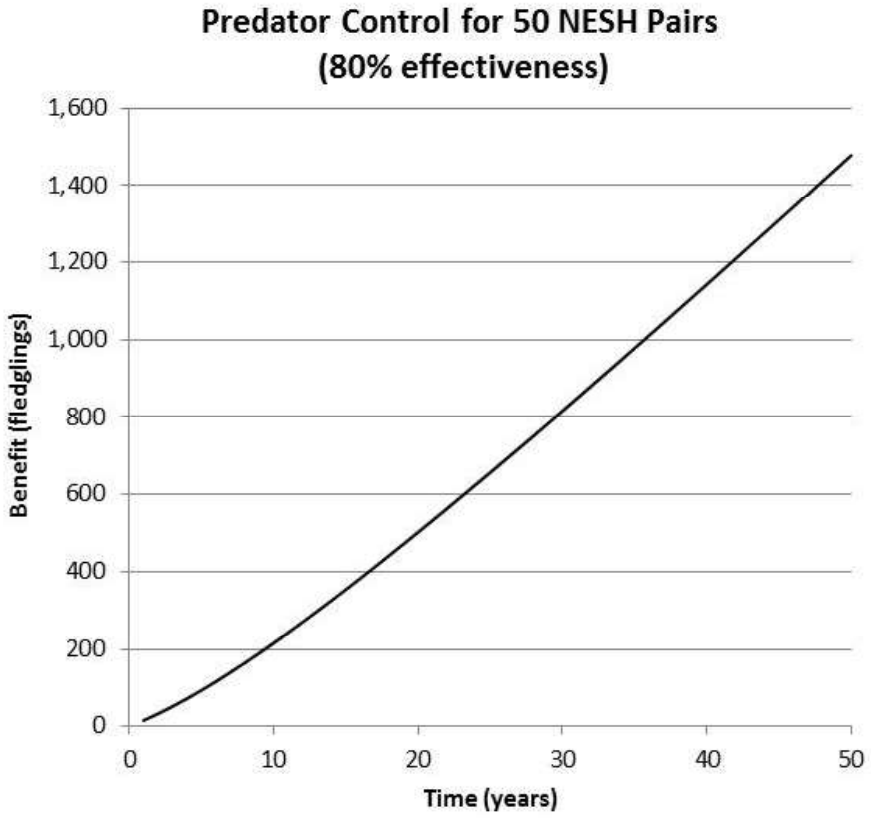

Figure 4. Projected fledgling benefit including control of cat, rat, pig, and barn-owl predation with 80% effectiveness for 50 Newell's shearwater breeding pairs.

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Biological Opinion for Base Infrastructure Operations and Maintenance at Pacific Missile Range Facility (PMRF) Sites on Kaua‘i, Hawai‘i

Photo Credit: Pacific Missile Range Facility

January 15, 2025
(2024-0133757-S7)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai‘i 96850

In Reply Refer To:
2024-0133752-S7

January 15, 2025

Brett A. Stevenson
Captain, U.S. Department of the Navy
Commanding Officer
Pacific Missile Range Facility
P.O. Box 128
Kekaha, Hawai‘i 96752-0128

Subject: Reinitiation of Formal Consultation for Base Infrastructure Operations and Maintenance at Pacific Missile Range Facility (PMRF) Sites on Kaua‘i, Hawai‘i

Dear Captain Stevenson:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed base infrastructure operations and maintenance at Pacific Missile Range Facility (PMRF) sites on Kaua‘i, Hawai‘i, and its effects on the threatened Hawaiian goose or nēnē (*Branta sandvicensis*); the endangered Hawaiian stilt or ae‘o (*Himantopus mexicanus knudseni*), Hawaiian gallinule or ‘alae ‘ula (*Gallinula galeata sandvicensis*), Hawaiian coot or ‘alae ke‘oke‘o (*Fulica alai*), and Hawaiian duck or koloa maoli (*Anas wyvilliana*) (hereafter collectively referred to as Hawaiian waterbirds); and the endangered Hawaiian hoary bat or ‘ōpe‘ape‘a (*Lasiurus cinerus semotus*), in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Effects from these activities on the threatened Newell’s shearwater or ‘a‘o (*Puffinus newelli*), endangered Hawaiian petrel or ‘ua‘u (*Pterodroma sandwichensis*), and endangered Hawai‘i distinct population segment of the band-rumped storm-petrel or ‘akē‘akē (*Hydrobates castro*) (collectively referred to as Hawaiian seabirds) are currently addressed in the following biological opinions: 01EPIF00-2014-F-0066 and 01EPIF00-2015-F-0227.

The U.S. Department of Navy (Navy) formally requested reinitiation of formal consultation on this action due to changes in the project description and higher than anticipated take levels associated with vehicular driving that were addressed in the original biological opinion, dated September 9, 2014, for this action (01EPIF00-2014-F-0066). This biological opinion also considers the new listing status of nēnē, which was downlisted to threatened, including a section 4(d) rule of the Act associated with this species, effective on January 21, 2020 (hereafter referred to as the nēnē 4(d) rule).

Your initial request for reinitiation of formal consultation was received on December 15, 2021. The Service received an updated biological assessment for this action on April 25, 2024, with all information required to reinitiate consultation considered received on August 7, 2024.

This biological opinion is based on: (1) information provided in the April 25, 2024, biological assessment and associated appendices; (2) email and phone correspondence between the Service and Navy between April 25, 2024, and January 6, 2025; and (3) other sources of information available to us. A complete administrative record of this consultation is on file at the Pacific Islands Fish and Wildlife Office (PIFWO) in Honolulu, Hawai‘i.

CONSULTATION HISTORY

August 7, 2024: All information related to the proposed activities and reinitiation was considered received, therefore, formal consultation was considered initiated on this date.

August 16, 2024: The Navy emailed the Service to clarify the description of activities related to launches and live fire activities at PMRF Barking Sands.

August 20, 2024: The Navy requested to see a draft biological opinion before finalization.

August 22, 2024: The Service sent the letter of initiation of formal consultation to the Navy.

October 21-28, 2024: The Service and Navy exchanged emails to clarify descriptions of activities associated with hazing of nēnē near launch pads and vegetation maintenance occurring at the KIUC PV site at PMRF Barking Sands.

November 20, 2024: The Service sent the Navy a draft biological opinion and requested comments.

December 16, 2024: The Service and Navy met to discuss the Navy’s comments on the draft biological opinion. Both parties agreed to a 30-day extension of the final biological opinion from the date the Navy sends written comments to the Service.

December 31, 2024: The Service received the Navy’s written comments on the draft biological opinion.

BIOLOGICAL OPINION

Description of Proposed Action

The Navy’s PMRF is the largest instrumented multi-environment test range in the U.S. and

includes land, sea, and air zones. PMRF supports research, development, testing and evaluations (RDT&E) of air, surface, and subsurface weapons systems for Department of Defense (DoD) and other U.S. departments and agencies, foreign military forces, and private industry. PMRF maintains facilities and provides services to support Commander, U.S. Pacific Fleet (COMPACFLT) military readiness activities. PMRF's main base, located at Barking Sands, has areas for tracking and surveillance radars, launch pads, data processing, communication networks, and an airfield. In addition to the Barking Sands installation (hereafter referred to as PMRF Barking Sands or Barking Sands), PMRF is comprised of support facilities on Kauaʻi at Makaha Ridge (secondary range), Kōkeʻe (tracking radars, telemetry, communications, command, and control), Kamokala Ridge (munitions storage), Port Allen (pier for weapons recovery and Navy Seaborne Powered Targets boats), and Miloliʻi Ridge (reflectors) (Commander Navy Region Hawaii 2010).

The scope of the proposed action considered in this biological opinion includes activities by PMRF personnel, tenants, facility users and contractors within all 6 aforementioned PMRF sites on Kauaʻi. The specific activities considered include the following, which will be described in the sections below: 1) air operations; 2) bird aircraft strike hazard (BASH) management activities; 3) hazing and nest removal near launch pads; 4) use of driving range and athletic fields; 5) oxidation pond management and upgrades; 6) vehicular driving; 7) vegetation maintenance; 8) construction activities; 9) hazing for bird protection and safety; 10) development of a hunting program; 11) predator control program; and 12) barbed wire fencing.

The term of the proposed action is 10 years. At the end of the 10-year term, the Navy will coordinate with the Service to reevaluate the biological opinion. If the proposed action has not substantially changed and reinitiation is not required, the Navy and Service will coordinate the possibility of extending the term for additional years.

Air Operations – PMRF Barking Sands

PMRF airfield supports Navy and U.S. Marine Corp activities at the forefront, but also provides opportunities for the Air Force, Air National Guard, and U.S. Coast Guard. This includes use of a variety of aircraft, including but not limited to C-17s, C-130s, C-40s, C-26s, and S-61 helicopters. Air operations are generally conducted Monday thru Friday during daytime hours with infrequent training exercises that involve evening and/or weekend operations. On average, the PMRF airfield accommodated 6,441 takeoff/landings annually between 2014 and 2020.

Currently, PMRF is limited to the number of landings/takeoffs allowed per the airfield pavement design and life cycle. In 2025, it is anticipated that the runway will be replaced to allow for additional flights and accommodate increased aircraft exercises from DoD agencies. Projections on future air operations at PMRF are detailed in Figure 1. This includes a projected increase in usage by C-17 cargo airplanes (from 176 passes per year to a projected 4,320 passes per year) and the ability to land MV-22 Osprey at PMRF.

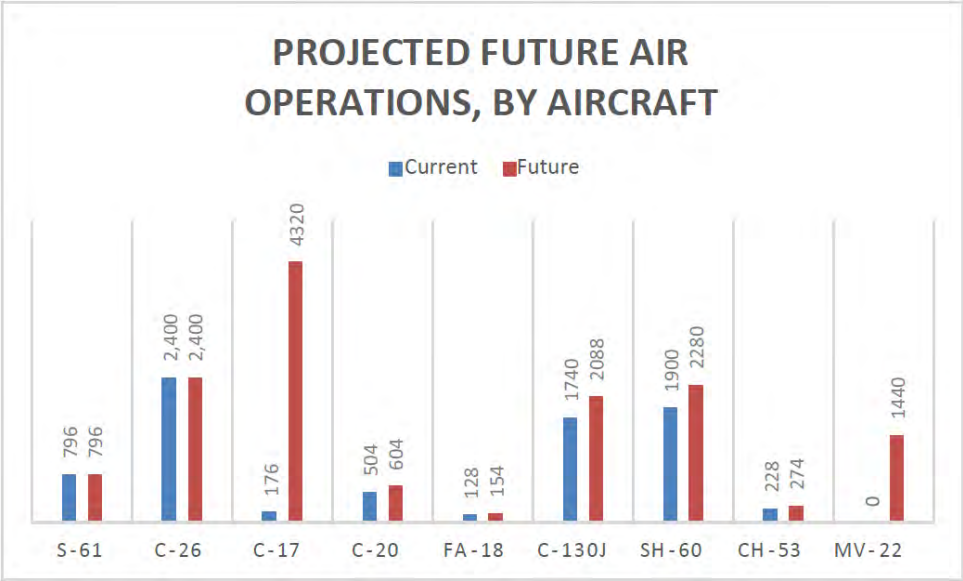

Figure 1. Projected annual air operations by aircraft at PMRF (passes per year).

BASH Management Activities – PMRF Barking Sands

Increasing populations of listed birds (e.g., nēnē) on Kauaʻi and an increase in air operations as previously described will escalate the risk and potential for bird-aircraft strikes. Bird aircraft strike hazard (BASH) management is a comprehensive approach to controlling and minimizing the impacts of hazardous wildlife to aircraft operations. BASH management requires the PMRF airfield (located at Barking Sands) to identify hazardous wildlife, hazardous wildlife attractants and associated management techniques to reduce or exclude hazardous wildlife from the airfield. Habitat modification, exclusion, use of repellents, harassment techniques and wildlife removal are the foundation of BASH management. PMRFs primary BASH management activities include: 1) habitat modification and exclusion; 2) BASH hazing for Hawaiian waterbirds; 3) BASH hazing for nēnē; and 4) the nēnē nest removal zone. These activities are described in the following subsections.

Habitat Modification and Exclusion

Habitat modification and exclusion focus on management of food/prey, cover or vegetation, and water resources to reduce the attractiveness of an area to hazardous wildlife. There are many wildlife attractants adjacent to PMRF Barking Sands, which are not managed by the Navy (i.e., Kawaiele Waterbird Sanctuary, agricultural lands and drainage ditches, Kekaha landfill, etc.). Wildlife attractants on PMRF property that can be managed for BASH include (by priority): Kinikini Ditch and ditch systems on base, maintained/irrigated grasses on base (specifically near the airfield), and unmaintained vegetation throughout PMRF Barking Sands where nēnē may nest on the fringe of the vegetation.

Proposed high priority habitat modification and exclusion projects include (Figure 2):

- Clear and maintain invasive vegetation along the coastal berm that is parallel to the runway (approximately 1-2 acres) to remove attractive nesting habitat. Vegetation adjacent to the runway consists of uneven terrain, which is managed via a ride-on tractor

with a blade attachment. Chainsaws are used, when necessary, to remove larger diameter vegetation.

- Maintain vegetation heights of 7-14 inches (in) around Kinikini Ditch to reduce foraging and nesting opportunities by nēnē. Maintain vegetation within the ditch's sloping embankment at 2-8 in.
- Cease irrigation or replace grass with synthetic turf near central base support facilities to reduce foraging opportunities and nesting opportunities for nēnē.
- Require that future earthmoving projects remove all excess soil from the vicinity of the PMRF airfield to reduce mounds/berms that are utilized by nēnē for nesting.
- Maintain vegetation on a monthly basis at the Oxidation Pond to deter nēnē from nesting.
- Pending Air Ops funding, conduct a feasibility study to identify a barrier or deterrent under Nohili Road to exclude nēnē and Hawaiian waterbirds from utilizing Kinikni ditch to access the airfield. Pending feasibility study results, install a wire grate/ exclusionary device or deterrent at the opening of Kinikini Ditch that runs under Nohili Road to block access of nēnē to the south end of the runway.

All vegetation removal projects will require a nest survey by a qualified biologist prior to commencement of work, and no work shall commence within 100 feet (ft) of an active listed species nest. A biological monitor will be present during vegetation removal work to ensure work is conducted outside of the 100 ft buffer. All BASH-related habitat modification projects will follow protocols outlined in the Nene & Hawaiian Waterbirds Hazing Protocols (Appendix A). Additionally, all other general BASH vegetation maintenance activities are described in the "Vegetation Maintenance" section below.

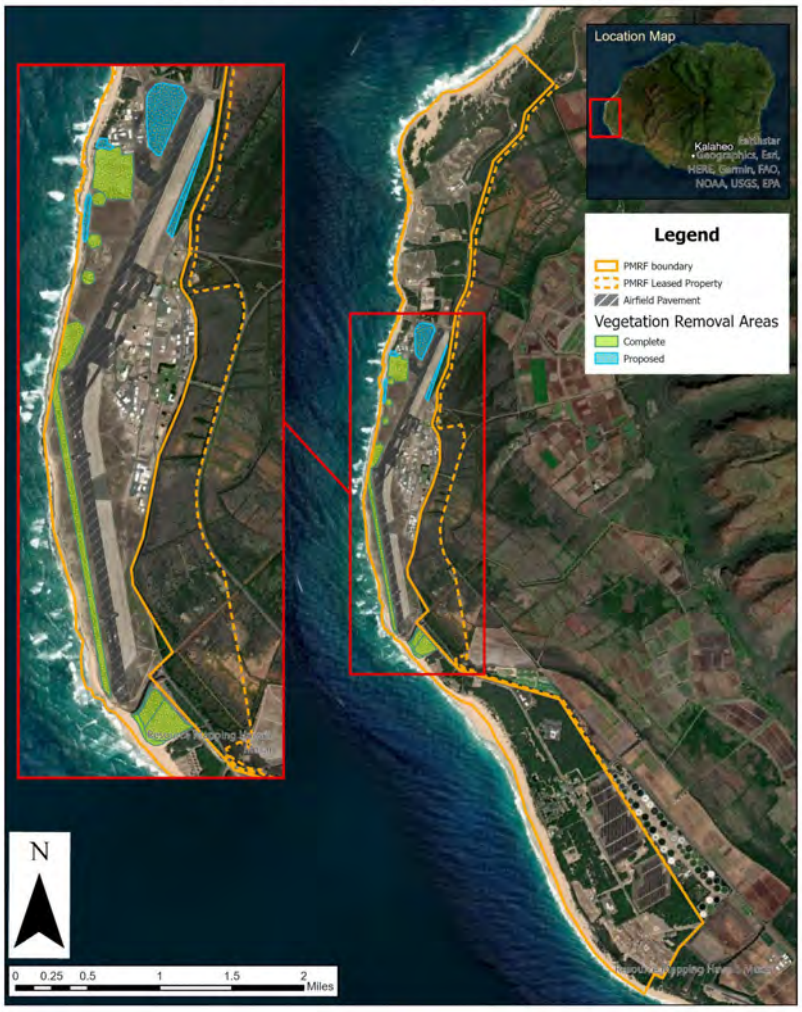

Figure 2. Locations of habitat modification and exclusion projects at PMRF Barking Sands.

BASH Hazing for Hawaiian Waterbirds

Hawaiian waterbirds are commonly observed in Kinikini Ditch at the south end of the runway, and occasionally walk onto the runway creating a BASH risk. Hazing events from 2015-2023 (Figure 3), show that koloa maoli and aeʻo are the primary waterbirds hazed in relation to BASH management. PMRF is proposing hazing of Hawaiian waterbirds when they are observed on the airfield or within 750 ft from the runway and determined to be a direct risk to flight operations. The methods to haze Hawaiian waterbirds are listed in Table 1 and include vehicle harassment, on foot harassment, hand clapping, noise makers, effigies, pyrotechnics, flags, and mylar tape. Hazing of Hawaiian waterbirds will be conducted by U.S. Department of Agriculture Wildlife Services (USDA-WS) and the Wildlife Detection Dispersal Team (WDDT). The WDDT is a group who identify wildlife hazards and safely mitigate them for aviation safety within the airport operating area. They are trained by USDA-WS and may comprise of personnel from Airfield Services, Airfield Management, Aircraft Rescue and Fire Fighting personnel, Air Traffic Control, the Natural Resource Manager and USDA employees. Specific protocols for hazing Hawaiian waterbirds can be found in Appendix A.

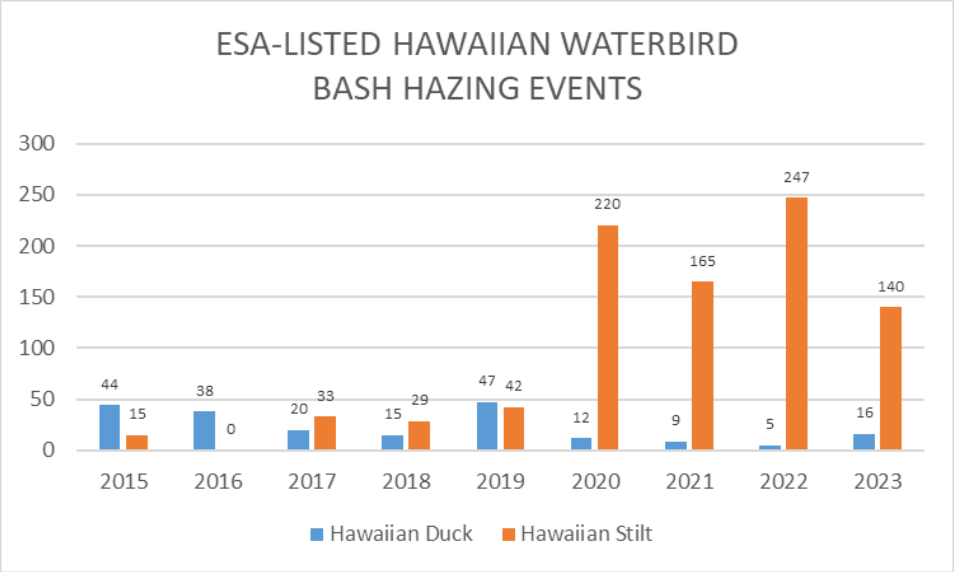

Figure 3. Hawaiian waterbird BASH hazing events from 2015-2023.

BASH Hazing for Nēnē

The nēnē is the primary species that requires hazing at PMRF Barking Sands and poses the largest BASH threat of the listed species there. The BASH program has initiated base-wide hazing of nēnē, as authorized under the nēnē 4(d) rule, and proposes to expand hazing techniques to implement more effective management of nēnē near the airfield and across PMRF Barking Sands. The objective of these harassment techniques is to reduce the presence of nesting nēnē base-wide and address the increasing nēnē populations on PMRF Barking Sands.

BASH-related hazing for the nēnē occurs year-round, with increased efforts prior to and during the nēnē breeding season (September-April). Hazing is conducted by USDA-WS, PMRF Natural Resource (NR) staff, as well as trained Command Duty Officers (CDOs) to provide weekend coverage. PMRF conducts base-wide hazing of nēnē, the majority of which is compliant with the nēnē 4(d) rule, utilizing hazing techniques listed in Table 1. Hazing of brooding adults (e.g., adults with an active nest or gosling) and/or adults in molt is prohibited under the nēnē 4(d) rule. PMRF is proposing to implement hazing of gravid females not actively nesting, families with mobile young, breeding pairs and/or molting adults within 8,000 ft of the airfield (referred to as the nēnē family hazing zone) (Figure 4, Table 1). These hazing techniques will be implemented with the understanding that these individuals are vulnerable and will be hazed with extra care. In the event a nēnē establishes a nest outside the nēnē nest removal zone (NNRZ) (see next subsection for more details), hazing will not be conducted, and the nest will be protected by a 100 ft buffer. Some of the hazing techniques listed in Table 1 may not be realized due to funding constraints or other logistics, however all potential hazing techniques are included. Detailed descriptions and protocols for nēnē hazing techniques can be found in Appendix A.

Table 1. Hazing techniques for nēnē and Hawaiian waterbirds at PMRF Barking Sands.

Hazing Techniques for BASH	Type	Personnel Authorized	ESA-Listed Species Used on	Location
Modified Pistols	Pyrotechnics	USDA-WS	Waterbirds	Airfield/750 ft.
12-gauge shotgun	Pyrotechnics	USDA-WS	Waterbirds	Airfield/750 ft.
Bangers/Whistles/Screamers	Pyrotechnics	USDA-WS	Waterbirds	Airfield/750 ft.
Vehicle Harassment	Active Hazing	USDA-WS	Waterbirds	Airfield/750 ft.
On-foot Harassment	Active Hazing	USDA-WS, WDDT	Waterbirds	Airfield/750 ft.
Sirens/Horns/Clapping	Noise Making	USDA-WS, WDDT	Nēnē & Waterbirds	Airfield/750 ft.
Ultrasonic Repellers	Noise Making	USDA-WS	Nēnē *	Airfield AOA
Propane Cannons	Static Deterrent	USDA-WS	Nēnē *	Airfield AOA
Vehicle harassment	Active Hazing	USDA-WS	Nēnē ***	Airfield/8,000 ft.
On-foot Harassment	Active Hazing	USDA-WS, WDDT	Nēnē *	Airfield/8,000 ft.
Sirens/Horns/Clapping	Noise Making	USDA-WS, WDDT	Nēnē *	Airfield/8,000 ft.
Flags	Static Deterrent	USDA-WS	Nēnē & Waterbirds	Airfield/8,000 ft.
Mylar tape	Static Deterrent	USDA-WS	Nēnē & Waterbirds	Airfield/8,000 ft.
Scarecrow/Effigies/Decoy	Static Deterrent	USDA-WS	Nēnē & Waterbirds	Airfield/8,000 ft.
Inflatable Air Dancers	Static Deterrent	USDA-WS	Nēnē & Waterbirds	Airfield/8,000 ft.
Balloons	Static Deterrent	USDA-WS	Nēnē & Waterbirds	Airfield/8,000 ft.
Hazing with trained dogs	Active Hazing	Trained handler	Nēnē *	Main Base-wide
12-gauge shotgun	Pyrotechnics	USDA-WS	Nēnē **	Main Base-wide
Bangers/Whistles/Screamers	Pyrotechnics	USDA-WS	Nēnē **	Main Base-wide
Recorded Barks	Bioacoustics	USDA-WS	Nēnē **	Main Base-wide
Distressed Calls of Geese	Bioacoustics	USDA-WS	Nēnē **	Main Base-wide
Non-Toxic Repellent	Chemical	USDA-WS	Nēnē **	Main Base-wide
Herding or Harassing w/ Tethered Dogs	Active Hazing	USDA-WS	Nēnē **	Main Base-wide
Herding by Vehicle	Active Hazing	USDA-WS, WDDT	Nēnē **	Main Base-wide
Vehicle Harassment	Active Hazing	USDA-WS, WDDT	Nēnē ***	Main Base-wide
On-Foot Harassment	Active Hazing	USDA-WS, WDDT	Nēnē **	Main Base-wide
Horns/Clapping	Noise Making	USDA-WS, WDDT	Nēnē **	Main Base-wide
Access Control (net/fence)	Exclusion	USDA-WS, WDDT	Nēnē & Waterbirds	Main Base-wide
Geotech Cloth	Static Deterrent	USDA-WS	Nēnē & Waterbirds	Surface waters

*Technique has the potential to incidentally harass Hawaiian Waterbirds

**Base-wide BASH hazing will only be conducted to non-brooding/molting adults with no goslings present

***Vehicle harassment will not be used on nēnē families with mobile young

To note: Hazing to nēnē on the airfield or within the 8,000 ft. buffer zone includes brooding/molting adults

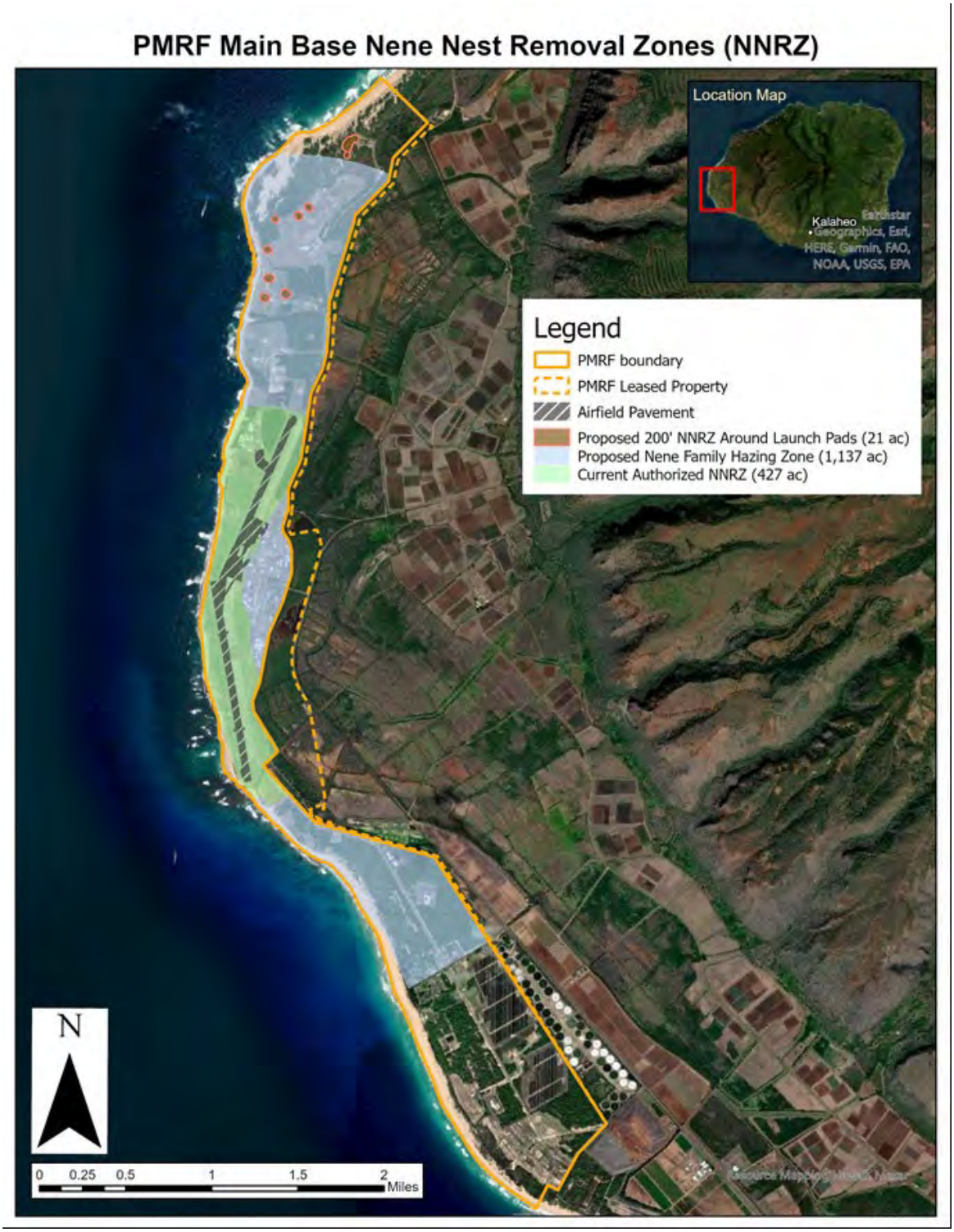

Figure 4. Proposed nēnē nest removal zone (NNRZ) and nēnē family hazing zone (within 8,000 ft of runway).

Nēnē Nest Removal Zone

Despite the implementation of hazing and other BASH management activities, there is still the possibility that nēnē may nest near the runway. Therefore, PMRF has previously coordinated with the Service to establish a nēnē nest removal zone (NNRZ) that extends 750 ft on either side of the runway centerline, 150 ft on either side of the taxiway's centerlines, and 100 ft from the edge of aircraft parking aprons (Figure 4). Within the NNRZ, PMRF is proposing that USDA-WS personnel and the WDDT are authorized to remove nēnē nests. In the event a nēnē establishes a nest inside the proposed NNRZ, PMRF NR will contact the Service within 24 hours. USDA-WS, the WDDT and PMRF NR will meet to discuss the stage of nest development and timing for nest removal, if determined necessary. Nest removal will follow procedures described in Appendix A. As mentioned previously, proactive hazing before nēnē breeding season will be conducted, along with habitat management, to reduce the necessity of these actions. In addition, PMRF Air Ops is proposing to increase the current NNRZ to include a buffer around launch pads, which is discussed in the next section.

Hazing and Nest Removal Near Launch Pads – PMRF Barking Sands

There are four launch areas in the northern third of PMRF Barking Sands that contain multiple launch pads and associated launch facilities (Figure 5). The four launch areas are managed by PMRF, Department of Energy (DOE)/National Nuclear Security Administration (NNSA) and Missile Defense Agency (MDA) and are as follows: North Launch Complex (also referred to as North Launch Area 1), Kauaʻi Test Facility, 50K Launch Area (located at North Launch Area 2), and Vertical Launch System (located at North Launch Area 2). A fifth launch site (THAAD launch pad) is in the southern third of base and was used once by the University of Hawaiʻi, with no plans to use that launch site for launches or live fire activities.

The North Launch Complex encompasses approximately 3 acres, is managed by PMRF, and contains nine launchers, some of which are mobile/temporary. The Kauaʻi Test Facility is managed and operated by the DOE/NNSA's Sandia National Laboratory (SNL). This site is approximately 95 acres and contains four launch pads. The 50K Launch Area is managed by PMRF and contains one launch pad, as well as open space for live fire exercises. The 50K launch area encompasses approximately 28 acres and is located along the coastline of PMRF Barking Sands. The Vertical Launch System (VLS) is managed by MDA and encompasses approximately 2.3 acres. The extant THAAD launch pad is managed by MDA and has been decommissioned, with no plans to utilize this launch site. Live fire training events may occur at both PMRF-managed sites; the north launch pad and 50K launch site. Launch and live fire training activities have been previously consulted on with the Service.

Figure 5. Launch Facilities in the Northern portion of PMRF Barking Sands.

The proposed plan is to actively haze nēnē observed within 500 ft from a launch site or live fire activity with a launch or live fire exercise scheduled within 30 days. The hazing would be conducted by USDA-WS, trained PMRF personnel and/or trained PMRF tenants. Proposed hazing techniques are outlined in Table 2 and further described in Appendix A; a designated PMRF Range POC would coordinate with USDA-WS to identify areas and timelines requiring monitoring, and to coordinate scheduling and training of identified support staff. PMRF plans to fund a full-time dog handler and trained dog(s) to assist with hazing around the airfield air operation area (AOA) and launch pads. Alternatively, if a dog handler is not feasible, PMRF plans to fund a trained biologist to cover hazing activities around the airfield AOA and launch sites. Any person that is involved in hazing of nēnē for the military mission is required to be trained by the USDA-WS biologist prior to hazing.

Table 2. Proposed nēnē hazing techniques near launch pads.

Hazing Techniques at Launch Pads	Type	Personnel Authorized	ESA-Listed Species used on	Location
Hazing with trained dogs	Active Hazing	Trained handler	Nēnē	500’ from pads
Herding or Harassing w/ Tethered Dogs	Active Hazing	USDA-WS	Nēnē	500’ from pads
On-foot Harassment	Active Hazing	USDA, trained staff	Nēnē	500’ from pads
Vehicle Harassment	Active Hazing	USDA, trained staff	Nēnē	500’ from pads
Horns/Clapping	Noise Making	USDA, trained staff	Nēnē	500’ from pads

Additionally, PMRF is proposing to include a 200 ft buffer around launch pads/live fire areas (Figure 4). If a nest is found within 200 ft of a launch pad or live fire area with a launch or live fire event scheduled within 30 days, a PMRF biologist, USDA-WS biologist or Navy-approved biologist will coordinate with Range Operations and/or launch tenants to see if the launch can be delayed avoiding nest removal. Nēnē nest removal will only occur if a nest is discovered within 200 ft of a launch site or live fire training area and the exercise is not able to be delayed or relocated and it is determined a safety risk for the mission activity. If it is determined that nest removal is required, the PMRF NRM will be contacted immediately to record the location of the nest, number of eggs, data on the parents, and to contact the Service to coordinate nest removal. If not avoidable, the nest will be removed in accordance with Appendix A. In some scenarios, it may be determined that nest removal is not required and a PMRF NR biologist, USDA-WS biologist or Navy-approved biologist will monitor the nest and nesting adult(s) to document any adverse effects, should they occur, from the launch activity.

Use of Driving Range and Athletic Fields – PMRF Barking Sands

PMRF Barking Sands contains a driving range, baseball field, tennis courts, racquetball courts, basketball courts and a soccer field (with synthetic turf), all within the southern portion of PMRF. There are approximately 150 personnel, including family members, who reside at PMRF and can utilize these facilities. PMRF also allows guests to stay on Barking Sands property and use these facilities as well.

The athletic fields and courts are used regularly by adults and children. The driving range, located further south on base, is seldom used by PMRF residents and guests. The driving range is a self-service venue, where users obtain balls from the Morale, Welfare and Recreation (MWR) office and bring their own clubs to practice. MWR explains to all users that in the event a nēnē is observed on the driving range, all ball striking activities will cease until the nēnē leaves the area due to hazing or on its own accord.

Oxidation Pond Management and Upgrades – PMRF Barking Sands

Within the southern third of PMRF Barking Sands is a sewage oxidation complex. The complex consists of 1 untreated sewage pond, 1 solids/sludge dry bed, and 2 effluent ponds. The untreated sewage pond is a shallow pool designed to treat wastewater through the interaction of sunlight, bacteria and algae. Outbreaks of avian botulism occasionally occur at the Oxidation Pond due to low oxygen and anaerobic conditions. When a bird is found deceased in the Oxidation Pond, it is retrieved whenever possible and tested for botulism if body size and condition are sufficient to allow for testing. This typically precludes testing on all chicks and on Hawaiian stilts unless

multiple carcasses are collected. The Oxidation Pond complex is then thoroughly checked for deceased waterbirds each day for one week to ensure that a botulism outbreak is immediately identified and minimized. All listed birds found deceased on PMRF sites are reported to the Service within 24 hours.

Maintenance and upgrades to the Oxidation Pond are necessary to decrease the likelihood of botulism outbreaks and to ensure proper functioning of the Oxidation Pond. Projects may include flushing of the ponds and dredging of accumulated sludge to reduce the occurrence of anaerobic conditions. One proposed project involving construction activities at the Oxidation Pond is the Oxidation Pond re-lining project. This project will require an authorized biologist to haze Hawaiian waterbirds and nēnē prior to construction commencing to avoid potential nests within the project footprint. Vegetation maintenance will also be conducted on a more frequent basis beginning a year prior to the project to remove attractive nesting habitat. The project may also require ongoing hazing by an authorized biologist to reduce potential collisions with construction equipment. If a nest is discovered within the project footprint, a determination will be made if a buffer will be implemented, and the nest can remain until the chick(s)/gosling(s) have hatched and can safely leave the nest site. If a buffer will not be implemented, work will continue in the area up to the nest site. Re-lining of the Oxidation Pond is anticipated to take 6-8 months to complete. The project will require using an adjacent effluent pond as the main retention pond, while the Oxidation Pond is drained for re-lining. The project will also require removal of vegetation around the pond prior to construction.

Vehicular Driving – all PMRF sites

Due to the long and narrow layout of PMRF Barking Sands, personnel use a 5 mile stretch of roadway, Nohili Road/Sidewinder Road, to traverse from the southern portion of the base to the northern portion. Nohili Road has a speed limit of 35 mph during the day and 25 mph from 6:00pm to 6:00am (excluding from the airfield to the Operations Gate and North of the Japanese Cemetery). In total there are 23.4 miles of roadways on PMRF Barking Sands. Speed limits along all roads, excluding Nohili Road, are 25 mph or less. Tartar Drive is the main road to access PMRF property, which has a speed limit of 15 mph.

There are approximately 150 personnel, including dependents, who live full-time on PMRF Barking Sands. Additionally, there are military personnel, civilian employees and contractors who work at PMRF and drive on PMRF property Monday thru Friday (approximately 700 people). There are also people who come to PMRF Barking Sands to stay at the beach cabins (up to 130 cottage guests) and recreate on property, which may increase vehicles on the road during weekends. In addition to daily commuters, when military events or launch activities occur, there is an influx of personnel, and therefore an increase in vehicles.

Most vehicles on the roads of PMRF are civilian-owned, personal vehicles. There are also contractor-owned vehicles and trucks on property related to the long-term base-wide contract that services the entire base, as well as USDA-WS personnel, and contractors working on specific construction projects. Military vehicles use PMRF Barking Sands during training events, which occur sporadically throughout the year and may involve up to 100 personnel using the

northern portion of PMRF Barking Sands. While most of the vehicular driving occurs at PMRF Barking Sands due to the high use of that area by personnel/civilians, this activity occurs at all PMRF sites.

Vegetation Maintenance – all PMRF Sites

Vegetation maintenance occurs throughout PMRF Barking Sands, Makaha Ridge and Kōkeʻe. Most landscape maintenance activities are performed under a base-wide contract. The grounds at PMRF Barking Sands, Makaha and Kōkeʻe are categorized by five maintenance levels: Prestige, improved, semi-improved, unimproved and BASH. Work performed under the base-wide contract includes grounds maintenance, lawn care, edging, applying herbicide, irrigation operation/maintenance, shrub and hedge maintenance, debris removal, and tree maintenance. These services are provided routinely, on a cyclical basis, or as an on-call service, depending on the maintenance level and need.

Prestige grounds at Barking Sands encompasses approximately 3.8 acres and includes areas such as the manicured grass surrounding the pass and ID house. Many of the commonly used buildings and facilities on Barking Sands (e.g., base administration buildings, driving range, and Shenanigans restaurant) are surrounded by "improved grounds", which total approximately 12.4 acres. Maintenance equipment generally used for prestige and improved grounds includes hand-pushed mowers, ride-on mowers, loppers, gas-powered hedge trimmers, and weed whackers. Prestige maintenance includes weekly or bi-weekly mowing, removal of grass shavings, irrigation, weeding and applying herbicide if necessary, and manicuring hedges. Improved grounds are maintained on a bi-weekly to monthly basis, which depends on wet season versus dry season.

Semi-improved grounds include most grassy areas adjacent to buildings, parking lots and facilities on Barking Sands and account for approximately 60.8 acres. Semi- improved grounds maintenance generally uses ride on mowers and weed whackers. In areas where the terrain is uneven, a ride-on tractor with blade attachment is used. The maintenance schedule for semi-improved grounds is monthly. The contractor is required to only use herbicides on a DoD approved herbicide list and must record all herbicide applications monthly. Herbicides are generally used only around pavements and fencing.

Unimproved grounds make up most of the acreage on Barking Sands, totaling approximately 403 acres. These areas are generally composed of kiawe and koa haole, with an invasive grass understory. Other areas of unimproved grounds include roads along Makaha and Kokeʻe. Tree trimming may occur on unimproved grounds to maintain fire breaks or to avoid branches from falling or touching utility lines. Maintenance of unimproved grounds includes ride-on mowers, ride-on tractors with a blade attachment, and use of chainsaws to cut branches or trees that pose a safety risk. Occasionally, herbicides are used to keep invasive grasses from encroaching onto semi- improved grounds. Grounds maintenance generally occurs monthly.

BASH maintenance areas include the open land surrounding the runway in all directions. The total acreage for BASH managed vegetation maintenance is approximately 239 acres. Personnel

most commonly use weed eaters and tractors with a pull behind cutter blade to maintain vegetation and grasses. Maintenance equipment may also include ride-on mowers for level areas, and use of a chainsaw or loppers to cut larger vegetation bushes that have established along the shoreline. Grass heights are maintained between 7-14" in BASH managed areas.

The base-wide contractor is also responsible for tree trimming activities when they are determined necessary. There are circumstances where tree trimming, or removal is determined necessary due to human health and safety and must be conducted during the bat pupping season of June 1st to September 15th. Past examples of tree trimming/removal due to emergency situations include: an unhealthy branch hanging over the entrance of the childcare center, a water main leak that required tree removal to access the break, and a tree branch touching an electrical line. Any emergency tree trimming activities occurring during the bat pupping season will follow protocols in the PMRF Roost Detection Protocol for Hawaiian hoary bats (Appendix B). Tree maintenance generally involves chainsaws and a cherry picker or ladder to access the branches for pruning. Tree trimming activities could occur at all PMRF sites.

There is also the 181-acre Kauaʻi Island Utility Cooperative (KIUC) PV solar array and associated buildings in the southern portion of base. This area is leased to KIUC and maintained by a sub-lessee/subcontractor, AES. Vegetation in this area is generally maintained three times per year and PMRF NR is working to standardize this schedule to September, January and May, which would reduce potential nesting habitat prior to the nēnē breeding season. AES is also exploring the potential to replace large-scale mechanical mowing and herbicide application with using sheep to graze, which has been successful at other PV sites. Sheep would be managed by a Kauaʻi rancher and would be kept inside solar powered electric fence paddocks, which would be rotated throughout the 181-acre parcel. Sheep are not able to graze around electrical equipment at the PV site, therefore mechanical removal and herbicides would still be used on a smaller scale at this site.

<u>Construction Activities – PMRF Barking Sands, Makaha and Kamokala Ridge</u>
The types of proposed construction activities include repair, maintenance and upgrade projects to existing structures, buildings, grounds, utilities, and airfields; installation of perimeter fencing without barbed wire; replacement or reconstruction of existing structures or facilities where the new structure will be located in the same site with the same purpose; interior upgrades/repairs; as well as replacement and consolidation of buildings/facilities.

Table 3 includes a list of potential future construction projects scheduled for FY24-34 that may occur at Barking Sands or other PMRF sites on Kauaʻi. However, the Navy noted that the project execution year for projects could be pushed back, and projects may not be realized due to funding restraints and changing command priorities.

Table 3. Proposed Future Construction Activities at PMRF sites from FY24-34.

FY24-26 PMRF Proposed Future Project List	Timing	Approx. Footprint	Location
Replace communication hand holes lids to service existing telcom lines	1-2 months	3,000 sq. ft. or less	Barking Sands

Add a roof/shelter to the existing airfield navigational aid generator	1-2 months	3,000 sq. ft. or less	Barking Sands
Repair roof, siding, and gutters on B413	1-2 months	3,000 sq. ft. or less	Barking Sands
Install an electric meter to service select existing facilities	2-4 months	3,000 sq. ft. or less	Barking Sands
Add smart data systems to the current water and wastewater utilities to make them more energy efficient	2-4 months	3,000 sq. ft. or less	Barking Sands
Upgrade existing electrical and HVAC systems to smart grid controls	2-4 months	3,000 sq. ft. or less	Barking Sands
Install speed calming measures with signage on Nohili Road at Aegis Ashore, HIANG corner, Kinikini Ditch, and/or Nohili Ditch	2-4 months	3,000 sq. ft. or less	Barking Sands
Repair/replace wells, pumps, and outlet pipe at Mana Well, near Kamokala Ridge	4-6 months	3,000 sq. ft. or less	Kamokala Ridge
Repair and renovate Shenanigans Restaurant	4-6 months	3,000 sq. ft. or less	Barking Sands
Installation of fire protection flooring at hangar including exterior tank	6-8 months	3,000 sq. ft. or less	Barking Sands
FY27-34 PMRF Proposed Future Project List	**Timing**	**Approx. Footprint**	**Location**
Repair walls and roof on Hangar	2-4 months	3,000 sq. ft. or less	Barking Sands
Install wire grate under Nohili bridge to exclude nene from Kinikini Ditch	4-6 months	3,000 sq. ft. or less	Barking Sands
Upgrade/increase the capacity of the existing water system	4-6 months	10,000 sq. ft. or less	Barking Sands
Replace the current guard shack at the entrance and install a covered area for vehicle inspections	6-8 months	3,000 sq. ft. or less	Makaha Ridge
Rockfall Mitigation at Kamokala Caves site	8-10 months	10,000 sq. ft. or less	Kamokala Ridge
Consolidate a KIUC existing electrical feeder under on electrical grid	8-12 months	10,000 sq. ft. or less	Barking Sands

All construction contractors and sub-contractors for the projects above will be required to follow protocols developed by the PMRF NR office. All construction personnel must keep a 100 ft distance from any listed species observed on or near the construction site and will allow the species to leave on its own accord. For construction sites using heavy equipment with known listed species on or near the construction site, a qualified biologist is required to perform monitoring during the activities to ensure species are not affected by activities. If a nest is discovered, the project manager shall notify the PMRF NR office, and all work shall cease around the nest. A PMRF biologist will identify the nest, collect information on the nest and erect a 100 ft buffer fence around the nest to avoid further disturbance. For construction projects that do not fall into the proposed types of construction activities as described above (e.g., repair, maintenance, upgrade, replacement of existing structures or facilities, etc.), the Navy will consult with the Service separately as necessary. For construction projects not requiring separate

consultations, the general construction protocols above and outlined in Appendix A will be applied.

Hazing for Bird Protection and Safety – all PMRF sites

PMRF proposes to initiate hazing of nēnē and Hawaiian waterbirds for their protection at all six PMRF sites with emphasis on PMRF Barking Sands (2,060 acres) and Makaha Ridge (209 acres) in areas determined to be high risk for nēnē and Hawaiian waterbirds (along roadways, and in situations of imminent danger). Proposed hazing for nēnē and Hawaiian waterbird protection at the Kōkeʻe sites (19 acres), Kamokala Ridge Magazines (29 acres), Port Allen (120 acres), and Miloliʻi Ridge (.0138 acres) will be less frequent but may increase in the event populations increase. Hazing activities for bird protection are listed in Table 4 and include on-foot harassment, horns/clapping, inflatable air dancers, access control, and static deterrents. These hazing activities will be primarily executed by PMRF NR staff, including PCSU staff. Additional PMRF personnel and contractors may be trained and authorized to conduct hazing if deemed necessary.

It may be necessary to haze brooding adults, molting adults and/or goslings during the nēnē and/or Hawaiian waterbirds breeding seasons if they are found along roadways or near activities that may cause injury or mortality (e.g. vehicle collision, botulism event, missile launch, construction equipment operation, vegetation maintenance activities). The hazing techniques include intentional harassment of gravid females not actively nesting, families with mobile young, breeding pairs and/or molting adults with the understanding that these individuals are vulnerable and will be hazed with extra care. Hazing will be done with the upmost care to ensure no injury or mortality. USDA-WS personnel, WDDT personnel, trained PMRF NR personnel and trained PMRF staff would be authorized to haze brooding adults, molting adults, and/or goslings in situations that ensure the safety of nēnē or Hawaiian waterbirds.

Table 4. Proposed hazing techniques for nēnē and Hawaiian waterbird for protection and safety from high-risk activities.

Hazing Technique	Type	Personnel Authorized	Listed Species Used On	Location
On-foot Harassment	Active Hazing	NR, trained staff	Nēnē & Hawaiian waterbirds	All PMRF Sites
Horns/Clapping	Noise Making	NR, trained staff	Nēnē & Hawaiian waterbirds	All PMRF Sites
Inflatable Air Dancers	Static Deterrent	NR, trained staff	Nēnē & Hawaiian waterbirds	All PMRF Sites
Access Control (net/fence)	Exclusion	NR, trained staff	Nēnē & Hawaiian waterbirds	All PMRF Sites

Development of a Hunting Program – PMRF Barking Sands, Makaha and Kamokala Ridge

The Navy developed PMRF Hunting Instruction 1710.2A in June 2019 to establish a hunting program at PMRF sites. The hunting program includes three PMRF sites: Barking Sands,

Makaha Ridge, and Kamokala caves. Hunting is limited to feral hogs, feral goats, and black tailed deer. Hunters are only authorized to use bow and arrow (e.g., compound, recurve, and crossbows); dogs and firearms are prohibited.

Hunting on PMRF sites will only be authorized on days designated by the Commanding Officer, typically Saturday or Sunday, from one half hour before sunrise to one half hour after sunset. Hunting areas that include known listed species attractants (e.g. the Oxidation Pond) will be closed during Hawaiian waterbird and nēnē breeding seasons or when increased activity of Hawaiian waterbirds and/or nēnē are observed. The PMRF hunting program requires all personnel involved in hunting to obtain a State of Hawai‘i hunting license, become a member of the Barking Sands Archery Club (BSAC) and have an authorization to transport archery equipment on base. Hunters are required to attend an annual PMRF Hunting Rules, Regulations, and Safety brief, which includes protocols to identify, avoid and protect listed species. Hunters must check-in and check-out, carry a hunting pass on their vehicle and wear blaze orange to ensure safety. The PMRF hunting program allows the following number of personnel for each site: 10 hunters and one assistant per hunter for a maximum of 20 personnel on Barking Sands; six hunters and one assistant per hunter for a total of 12 personnel at Kamokala caves; and eight hunters and one assistant per hunter for a total of 16 personnel at Makaha Ridge.

The Game Warden is responsible for ensuring that hunting is conducted in accordance with base environmental policy to achieve wildlife and habitat management objectives. The Game Warden is also responsible for communicating and coordinating with PMRF NR staff to avoid and minimize impacts to listed species, such as using closed seasons and off-limits areas where increased activity of listed species are observed.

<u>Predator Control Program – PMRF Barking Sands, Makaha Ridge, and Kōke‘e</u>
The Navy has a Cooperative Agreement with the University of Hawai‘i (UH) through the Research Corporation for UH (RCUH) and the Pacific Cooperative Studies Unit (PCSU) to provide predator control activities at the installation for the protection of native species. There are currently two full-time field biologists that specialize in the trapping, removal, and euthanasia of invasive vertebrate species. These staff are authorized to remove feral cats, rodents, dogs, pigs, and barn owls from the landscape through a variety of lethal and non-lethal techniques. Most of the trapping effort occurs at Barking Sands due to the higher likelihood of predator-prey interactions compared to other sites. Less frequently, trapping occurs at Makaha Ridge and Kōke‘e due to lower densities of predators and limited breeding of listed birds at these sites. Predator control focuses on removing feral cats and rodents from the landscape because the high abundance and densities of these species poses the highest risk to protected avian species.

Cage traps (live traps) are used to remove feral cats. Captured cats are either euthanized or transported to Kaua‘i Humane Society. Live traps are required to be checked daily and in practice are checked as early as possible each day to minimize an animal’s time in the trap. During a typical trap night, up to 30 cage traps are open across Barking Sands, Makaha Ridge and the Kōke‘e Sites. Trap locations and distribution are chosen to protect native species most effectively, considering season and potential food sources for cats. In the program’s current

form, four nights for trapping every standard work week contributes to the removal of over 100 cats from PMRF annually. GoodNature A24 traps are lethal, self-resetting traps that provide landscape level rodent control. A24 trap grids are deployed in known breeding areas of listed species to reduce rodent populations and minimize egg depredations. A24s are deployed at Kōkeʻe and Barking Sands.

Several measures are taken to minimize interactions between predator control methods and listed species. These measures include maintaining a trap-free buffer area around high-use areas for protected species, using lures instead of bait in traps near high-use areas, deploying gosling guards on the fronts of traps, and using strategically placed vegetation to deter curious birds. Furthermore, all traps are out of view of the public and have either full or partial shade provided by vegetation and/or a trap cover (roof shingle) to protect trapped animals from exposure to sun and rain. A24 traps are additionally deployed with the downward-facing opening close (4-5") to the ground and with wire guards in place if there is any possibility that a protected species may interact with the trap.

Dog control occurs infrequently and only in response to dog sightings. PSCU staff only use live traps to capture loose dogs, and all dogs are transported to the Kauaʻi Humane Society. Feral pig and barn owl control is not currently being operated by PCSU staff at PMRF.

Barbed Wire Fencing – all PMRF sites

All six PMRF sites currently have a total of 8.2 miles (mi) of 3-strand barbed wire fencing. Additionally, Barking Sands has 0.7 miles of 6-strand barbed wire. Barbed wire fencing at PMRF sites is for security purposes and are installed in a wide range of areas throughout installation sites.

Conservation Measures

The following conservation measures will be implemented to avoid or minimize impacts to listed species and are considered part of the project description. These include conservation measures that were implemented at PMRF prior to reinitiation of this consultation. Conservation measures are tied to specific actions as described above. If an action does not occur, the associated conservation measure will not be implemented.

Hawaiian Goose or Nēnē

BASH Management Activities:

- Hazing efforts will be increased prior to the nēnē breeding season to avoid nesting within the proposed NNRZ. Hazing efforts will be conducted by USDA-WS personnel, the WDDT and if requested, the PMRF NR staff. The objective is to reduce successful nesting attempts within the NNRZ to reduce nest removal, with a goal of 100% coverage within the NNRZ during daylight hours.
- PMRF Air Ops, in coordination with the base-wide landscape contractor, will monitor and maintain grasses to 7-14" in areas managed for BASH, specifically within the proposed NNRZ, to reduce suitable nesting habitat, thereby minimizing nest removal.

- PMRF will flatten and remove berms near the runway, which attract nēnē (applies only to berms that attract nēnē).
- PMRF Commanding Officer will authorize weekend support for BASH hazing to reduce nēnē nesting attempts within the proposed NNRZ.
- PMRF has obtained a trained hazing dog in compliance with nēnē 4(d) rule requirements and will utilize the hazing dog to haze nēnē more effectively within the proposed NNRZs and base wide, which will reduce the need for nest removal.
- Future buildings/facilities will utilize xeriscaping, artificial turf, native plant species, gravel, or other unattractive landscaping to reduce foraging and nesting opportunities within the NNRZ for nēnē. This will reduce physical disturbance to nēnē and potential nest removal if found within the NNRZ.

Hazing and Nest Removal Near Launch Pads:

- PMRF Commanding Officer will authorize weekend support of hazing near launch pads to reduce nēnē nesting attempts; nēnē will be hazed if observed within 500 ft of a launch site or live fire activity site with a launch or live fire scheduled within 30 days.
- If a nest is found within 200 ft of a launch pad or live fire area with a launch or live fire event scheduled within 30 days, a PMRF biologist, USDA-WS biologist or Navy-approved biologist will coordinate with Range Operations and/or launch tenants to see if the launch can be delayed avoiding nest removal.
- PMRF will use a trained or tethered hazing dog to haze nēnē more effectively within 500 ft of a launch pad, which will reduce the need for nest removal. Alternatively, if a dog handler is not feasible, PMRF will fund a trained biologist to cover hazing activities around the airfield AOA and launch sites.
- Low-lying and grassy vegetation around launch pads will be maintained at a height of 7-14” to reduce suitable nesting habitat for nēnē, reducing the need for nest removal.

Use of Driving Range and Athletic Fields

- Install signage at the athletic field complex and driving range explaining protocols and providing the PMRF NR Hotline number so that authorized and trained biologists can assist with hazing, and/or install nest protection in the event of a nest.
- MWR explains to all users that in the event a nēnē is observed on the driving range, all ball striking and activities that may harm the nēnē will cease until the nēnē leaves the area due to hazing or on its own accord. The driving range user is responsible for abiding by the protocols to stop using the driving range until nēnē have left on their own accord or until trained personnel can safely haze them from the driving range.

Oxidation Pond Management and Upgrades

- Hazing will be conducted by trained and authorized individuals that follow hazing techniques outlined in Table 4, to minimize physical disturbance and stress to nēnē.
- Deterrents to exclude wildlife from the pond will be designed to avoid physical disturbance due to entanglement with exclusionary netting.
- Vegetation will be maintained with grasses below 6” and shrubs below 12” to discourage nesting and foraging which will reduce exposure to sporadic avian botulism events.

Vehicular Driving

- Installation of traffic calming measures (e.g. expanded rumble strips, flexible delineator columns, speed cameras, traffic safety painting/markings, etc.) at high-risk locations for nēnē such as HIANG, Aegis Ashore, Kinikini Ditch, and/or Nohili ditch.
- Installation of four listed-bird awareness signs to warn drivers that they must slow down and that "speeding kills nēnē".
- Procurement and use of a moveable LED marquis sign to alert drivers of the potential of nēnē and/or Hawaiian waterbirds in a specific area.
- Utilize public relation outlets (PMRF Facebook page, PMRF MWR page, bulletin boards around Barking Sands, etc.) to provide facts and information on nēnē, and to reinforce the importance of driving slowly and paying attention.
- Test the efficacy of predator effigies and recordings of dog barking near high strike areas on Nohili Road to deter nēnē along roadsides.
- Reduce speed to 25 mph in south end of PMRF Main Base, from Nohili Road at Club Drive (Shenanigans) to end of Nohili Road, to proactively reduce risk in area of base where nēnē are shifting use.
- During events requiring a large increase in visiting personnel, PMRF will implement nēnē awareness and speed reduction measures to include:
    - Reemphasize & highlight nēnē safety in "Orientation Brief" at Shore Support
    - Increase temporary signage in areas with high nēnē use, and risk areas as applicable for the event.
    - Use digital vehicle speed display south of Aegis Ashore
    - Increase speed enforcement capacity during high use events.
    - Increase operating hours at the centrally located Operations Gate to reduce vehicles in the central part of the base, dependent on size and duration of event.

<u>Completed</u> conservation measures for "Vehicular Driving" that have occurred prior to reinitiation of consultation include:

- Place moveable nēnē caution signs (sandwich board) along Nohili Road and at the main entrance to reduce direct strike and physical disturbance to nēnē; at least one sign is left in place at each location throughout the breeding season. (Continuing)
- Install signage near beach cottages and near dining locations that feeding of nēnē is prohibited on base. (Continuing)
- Install crushed coral, then subsequently pave with asphaltic concrete, along Nohili Road (from the Navy exchange to Kinikini Ditch) to reduce foraging opportunities for nēnē along roadside. This increased the buffer distance from foraging areas to the roadway; only three nēnē have been struck in this area in the two years since completion, compared to nine in the two years prior to the project. (Maintained)
- Install rumble strips along Nohili road to slow drivers. (Completed)
- Reduce the speed limit on Nohili Road from 45 mph to 35 mph. (Continuing)
- Reduce speed on Nohili road during nighttime hours (6pm to 6am) from 35 mph to 25mph. Nohili road speed limit remains 35 mph at night from the airfield to the Operations Gate and North of the Japanese Cemetery. (Continuing)

- Increase enforcement of speed limits by base security personnel. (Continuing)
- Open operations gate entrance at Imiloa Road (central portion of base) during high traffic times to reduce cars using high risk sections of Nohili Road. Operations gate will remain closed on weekends and holidays. (Continuing)
- Increase resident and visitor awareness of nēnē, their protected status and the importance of not feeding nēnē. (Continuing)

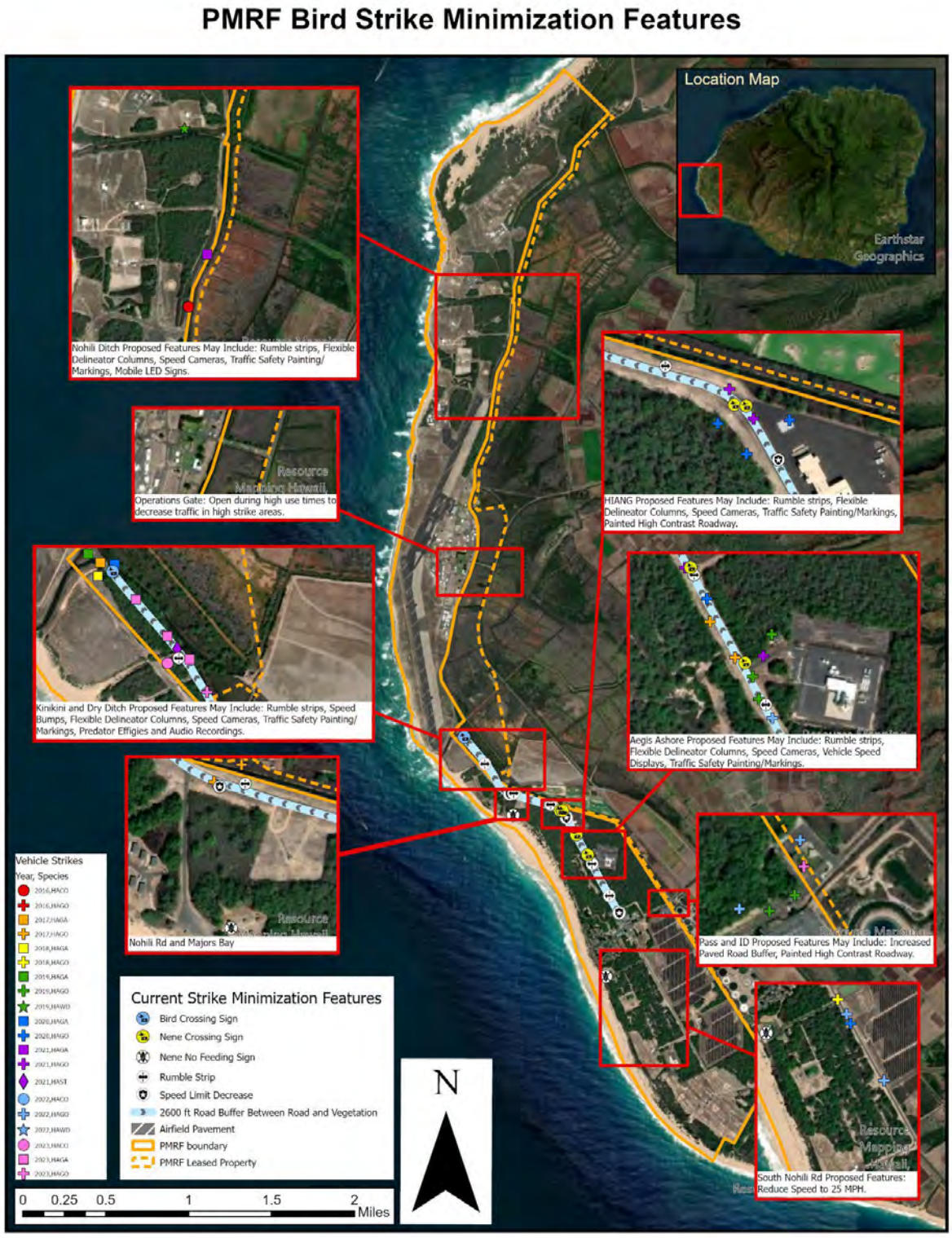

Figure 6. PMRF Barking Sands vehicle strike minimization features.

Vegetation Maintenance/Construction Activities/Oxidation Pond Re-lining Project

- Conduct nest surveys prior to vegetation maintenance and/or construction activities for any areas with vegetation higher than 17" and for areas with known nesting activity (e.g. Oxidation Pond, KIUC PV array).
- The Navy, tenants and contractors will implement the Nēnē and Hawaiian Waterbird Hazing Protocols (Appendix A) and include it in contracted work to ensure the protection of nēnē and their nests to minimize physical disturbance and potential nest abandonment.
- Public Works Office will include all required measures, as outlined in the Nēnē and Hawaiian Waterbird Hazing Protocols in SOWs and contracting documents.
- Prohibit vegetation maintenance and/or construction activities within 100 ft of an active nēnē nest to avoid physical disturbance that may lead to nest abandonment. Note: this measure may not apply to the Oxidation Pond re-lining project. Refer to "Oxidation Pond Management and Upgrades" section above for details.
- Haze nēnē at the Oxidation Pond, and other construction sites, prior to construction activities to avoid nesting in a construction site.
- Conduct vegetation removal at the Oxidation Pond beginning a year prior to the Oxidation Pond construction projects to discourage nēnē from nesting within the project footprint.
- Use the shortest route(s) possible from entrance points to construction sites to reduce vehicles on roadways at Barking Sands. When deemed necessary, require contractors to provide traffic control personnel to manage increased vehicular traffic.
- Future buildings/facilities will maintain vegetation to reduce attractive nesting habitat.

Hazing for Bird Protection and Safety

- Implement non-lethal hazing prior to the breeding season to minimize the presence of nēnē in areas that may cause them injury (e.g. vehicle collision, botulism event, missile launch), to minimize the need to haze breeding adults, molting adults or goslings in these areas. All hazing will be conducted by trained and authorized individuals that follow hazing techniques outlined in Table 4, to minimize physical disturbance and stress to nēnē.

PMRF Hunting Program

- Hunting areas that include known listed species attractants (e.g. Oxidation Pond) will be closed during Hawaiian waterbird and nēnē breeding seasons or when increased activity of Hawaiian waterbirds and/or nēnē are observed.
- Hunters are required to attend an annual PMRF Hunting Rules, Regulations, and Safety brief, which includes protocols to identify, avoid and protect listed species.

<u>Hawaiian Waterbirds</u>

Oxidation Pond Management and Upgrades

- Hazing will be conducted by trained and authorized individuals that follow hazing techniques outlined in Table 4, to minimize physical disturbance and stress to Hawaiian waterbirds.
- Potential deterrents to exclude wildlife from the pond will be designed to avoid physical disturbance due to entanglement.
- Conduct studies at the Oxidation Pond to look at ways of reducing anaerobic conditions, which contribute to botulism outbreaks.

Vehicular Driving

- Installation of traffic calming measures (e.g. expanded rumble strips, flexible delineator columns, speed cameras, traffic safety painting/markings, etc.) at two high risk locations for Hawaiian waterbirds – near Kinikini Ditch and/or Nohili ditch.
- Install two speed bumps between Kinikini Ditch and Dry Ditch to reduce speeding.
- Installation of signage to warn drivers that they must slow down.
- Procurement and use of a moveable LED marquis sign to alert drivers of the potential of Hawaiian waterbirds in a specific area.
- Utilize public relation outlets (PMRF Facebook page, PMRF MWR page, bulletin boards around Barking Sands, etc.) to provide facts and information on Hawaiian waterbirds, and to reinforce the importance of driving slowly and paying attention.

Completed conservation measures for "Vehicular Driving" that have occurred prior to reinitiation of consultation include:

- Install rumble strips along Nohili road to slow drivers. (Completed)
- Reduce the speed limit on Nohili Road from 45 mph to 35 mph. (Continuing)
- Reduce speed on Nohili road during nighttime hours (6pm to 6am) from 35 mph to 25mph. (Continuing)
- Increase enforcement of speed limits by base security personnel. (Continuing)
- Open operations gate entrance at Imiloa Road (central portion of base) during high traffic times to reduce cars utilizing high risk sections of Nohili Road. Operations gate will remain closed on weekends and holidays. (Continuing)
- Increase resident and visitor awareness of Hawaiian waterbirds and their protected status. (Continuing)

Vegetation Maintenance/Construction Activities/Oxidation Pond Re-lining Project

- Conduct nest surveys prior to vegetation maintenance and/or construction activities for any areas with vegetation higher than 17" and for areas with known nesting activity (e.g. Oxidation Pond).
- Develop and enforce the Nēnē and Hawaiian Waterbird Hazing Protocols (Appendix A) to ensure the protection of Hawaiian waterbirds and their nests to minimize physical disturbance and potential nest abandonment.
- Prohibit vegetation maintenance and/or construction activities within 100 ft. of an active Hawaiian waterbird nest to avoid physical disturbance that may lead to nest

abandonment. Note: this measure may not apply to the Oxidation Pond re-lining project. Refer to "Oxidation Pond Management and Upgrades" section above for details.
- Haze Hawaiian waterbirds at the Oxidation Pond prior to construction activities to avoid nesting in a construction site.
- Conduct vegetation removal at the Oxidation Pond beginning a year prior to the Oxidation Pond construction projects to reduce suitable nesting habitat within the project footprint.
- Use the shortest route possible from entrance points to construction sites to reduce vehicles on roadways at Barking Sands. When deemed necessary, require contractors to provide traffic control personnel to manage increased vehicular traffic.

Hazing for Bird Protection and Safety
- Hazing will be conducted by trained and authorized individuals that follow hazing techniques outlined in Table 4, to minimize physical disturbance and stress to Hawaiian waterbirds.

PMRF Hunting Program
- Hunting areas that include known listed species attractants (e.g. Oxidation Pond) will be closed during Hawaiian waterbird and nēnē breeding seasons or when increased activity of Hawaiian waterbirds and/or nēnē are observed.
- Hunters are required to attend an annual PMRF Hunting Rules, Regulations, and Safety brief, which includes protocols to identify, avoid and protect listed species.

Predator Control Program
- Trap-free buffer area is maintained around high-use areas for listed species.
- Using lures instead of bait in traps near high-use areas.
- Deploying gosling guards on the front of traps when necessary and using strategically placed vegetation to deter curious birds.
- Live traps are checked daily and as early as possible each day to minimize an animal's trap time in the trap.
- Live traps have either full or partial shade provided by vegetation and/or a trap cover (roof shingle) to protect trapped animals from exposure to sun and rain.

<u>Hawaiian Hoary Bat or ʻŌpeʻapeʻa</u>

Vegetation Maintenance
- Tree trimming and/or removal will primarily be conducted outside of the bat pupping season (June 1st - September 15th) to avoid physical disturbance to bats. An annual notice of this requirement is signed by the Commanding Officer and released to base personnel and residents.
- Emergency tree trimming that takes place during the bat pupping season will follow thermal imaging surveys outlined in the PMRF Roost Detection Protocol for Hawaiian hoary bats (Appendix B).

- Emergency tree trimming during the bat pupping season will keep 100 ft buffer from any known roost, as described in Appendix B.
- Conduct follow up acoustic surveys for Hawaiian bats every 5 years.

Barbed Wire Fencing

- Continue twice weekly visual surveys of road-accessible sections of barbed wire fence lines (74% of barbed wire fencing) in conjunction with nēnē and Hawaiian waterbird surveys. Surveys require visually (naked eye or binocular) scanning barbed wire for animals or snagged material and investigating any observations.
- Conduct visual surveys along 100% of fence line twice monthly during September, October, and November to coincide with bat fledging season.

Action Area

The action area is defined at (50 CFR 402.02) as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project includes the main base of PMRF at Barking Sands; and the following PMRF support facilities/sites on Kauaʻi: Makaha Ridge, Kōkeʻe, Kamokala Ridge, Port Allen, and Miloliʻi Ridge.

Details of the sites which encompass the action area are provided below based on descriptions found in the Navy's biological assessment and current condition sections of the draft 2024 PMRF Integrated Natural Resource Management Plan (INRMP). Additional details including maps and pictures of each PMRF site are provided in the draft 2024 PMRF INRMP.

PMRF Barking Sands is located along the Mana Plain on the west side of Kauaʻi near the town of Kekaha. Barking Sands is long and narrow (approximately 7 miles long and 0.5 mile wide), encompassing approximately 2,060 acres. Figure 7 displays a map of Barking Sands with significant facilities/features labeled along with adjacent land use.

Makaha Ridge is located 7 miles north of Barking Sands at approximately 1,400 to 1,850 ft elevation on a high ridge top of the central mountain range of Kauaʻi. This site encompasses approximately 209 acres of land and utilized as a secondary range. The PMRF Kōkeʻe sites are located within Kōkeʻe State Park east of Makaha Ridge at 3,500 ft in elevation. Kōkeʻe sites encompass approximately 19 acres and are composed of tracking radars, telemetry, communications, and command and control. Kamokala Ridge (29 acres) is located approximately 1.5 miles east of Barking Sands and is used primarily for munitions storage. Port Allen is located on the southwestern shore of Kauaʻi adjacent to Hanapepe Bay in the small town of ʻEleʻele. The Navy uses this pier primarily for weapons recovery and supporting operation of Navy Seaborne Powered Targets boats. The last site, Miloliʻi Ridge, is the smallest site (0.0138 acres) and encompasses posts supporting three passive 200 ft^2 reflectors.

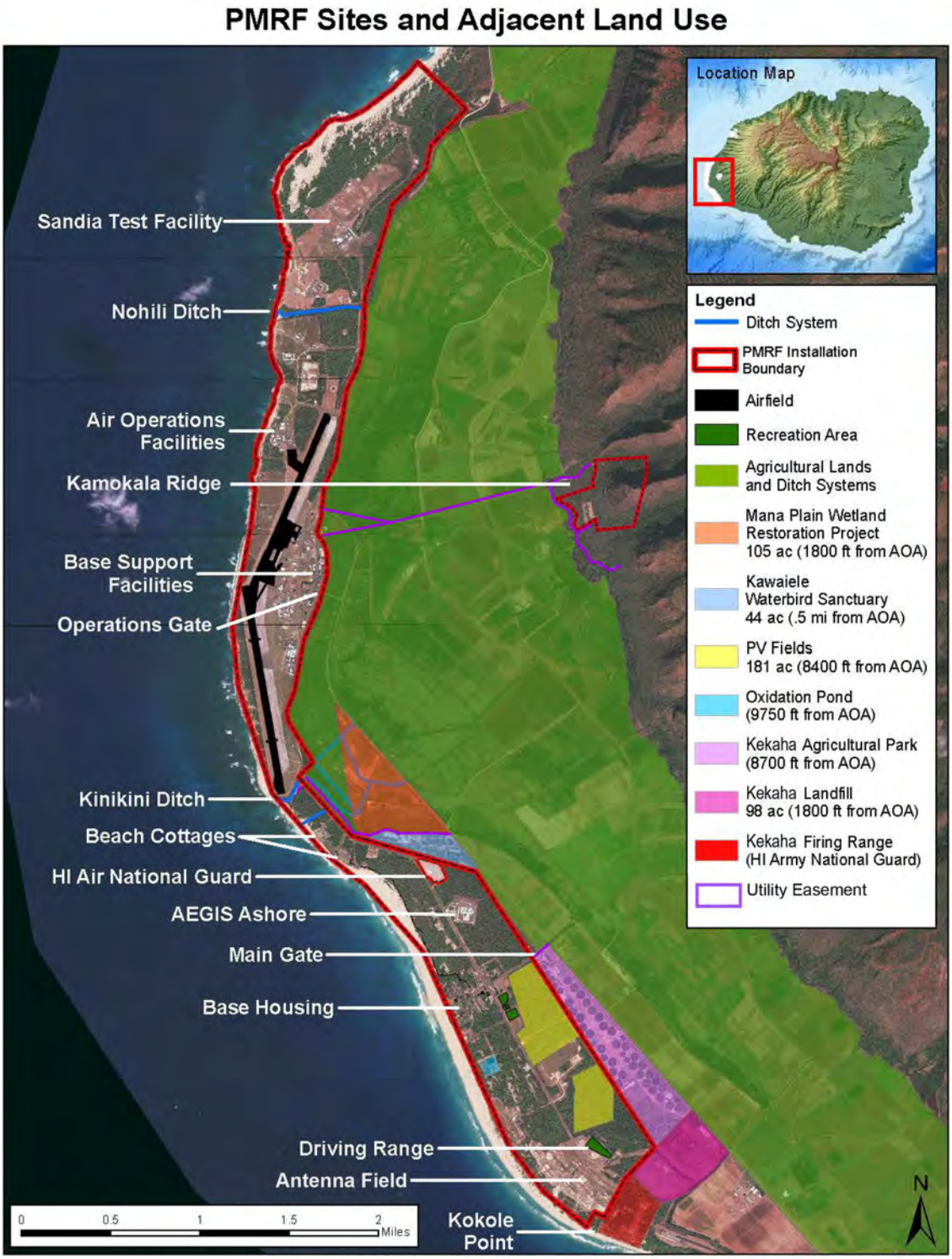

Figure 7. Location and map of PMRF Barking Sands and adjacent land use.

Analytical Framework for the Jeopardy/Adverse Modification Analysis

Jeopardy Analysis Framework

In accordance with regulation (see 84 FR 44976), the jeopardy determination in this Biological Opinion relies on the following four components:

1. The *Status of the Species*, which evaluates the species' current range-wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; its survival and recovery needs; and explains if the species' current range-wide population is likely to persist while retaining the potential for recovery or is not viable;

2. The *Environmental Baseline*, which evaluates the current condition of the species in the action area relative to its reproduction, numbers, and distribution absent the consequences of the proposed action; the factors responsible for that condition; and the relationship of the action area to the survival and recovery of the species;

3. The *Effects of the Action*, which evaluates all future consequences to the species that are reasonably certain to be caused by the proposed action, including the consequences of other activities that are caused by the proposed action, and how those impacts are likely to influence the survival and recovery role of the action area for the species; and

4. *Cumulative Effects*, which evaluates the consequences of future, non-Federal activities reasonably certain to occur in the action area on the species, and how those impacts are likely to influence the survival and recovery role of the action area for the species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the consequences of the proposed Federal action in the context of the species' current range-wide status, considering any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The key to making this finding is clearly establishing the role of the action area in the conservation of the species, and how the effects of the proposed action, taken together with cumulative effects, are likely to alter that role and the continued existence (i.e., survival) of the species.

Status of the Species

Hawaiian Goose or Nēnē (*Branta sandvicensis*)

Species Description
The nēnē is a medium-sized goose with an overall length of approximately 25 to 27 inches (in) (Banko et al. 1999, p. 2). The plumage of both sexes is similar (Banko et al. 1999, p. 2). This species is adapted to a terrestrial and largely non-migratory lifestyle in the Hawaiian Islands with limited freshwater habitat (Banko et al. 1999, p. 1). Adaptations to a terrestrial lifestyle include increased hind limb size, decreased forelimb size, more upright posture, and reduced webbing between the toes compared to other species of *Branta* (Banko et al. 1999, p. 1; Olson and James 1991, p. 42). Compared to the related Canada goose (*Branta canadensis*), nēnē wings are reduced by about 16 percent in size and their flight is not as strong (Banko et al. 1999, p. 9). Nēnē are capable of inter-island and high-altitude flight, but they do not migrate from the archipelago (Banko et al. 1999, p. 9).

Historic and Current Distribution
Nēnē were once widely distributed among the main Hawaiian Islands (island of Hawai‘i, Maui, Lāna‘i, Moloka‘i, Kaua‘i, and Kaho‘olawe) (Service 2004, p. 6). However, by 1951, only about 30 nēnē remained on the island of Hawai‘i (Smith 1952, p. 8). It is thought that nēnē populations on the higher islands, Maui and the island of Hawai‘i persisted into the historical periods due to the availability of larger tracts of habitat in remote rugged upland areas, where hunting and predation by introduced mammals were less intense (Banko et al. 1999, p. 3). The release of captive-bred nēnē, which began in 1960, helped save the species from imminent extinction (Service 2004, pp. 2–3).

The release of captive-bred nēnē occurred at four different sites at different times on the island of Kaua‘i, resulting in four population centers. With the exception of the Nā Pali Coast population, all of the Kaua‘i populations are found at low elevations, ranging from sea level to 600 ft. Approximately 25 captive nēnē were released by Kipu Kai Ranch in 1985 on the southeast coastline of Kaua‘i. These birds were originally obtained from the Shipman Estates on the island of Hawai‘i in the late 1960s. Another 38 captive-bred nēnē have been released at the Kīlauea Point National Wildlife Refuge (NWR) since 1991. These birds have bred successfully, and together these populations in 2004 were estimated to number 358 individuals. A third population was initiated on the Nā Pali Coast of northwestern Kaua‘i with the release of 62 captive nēnē from 1995 to 1996. The fourth population was a release of 24 nēnē to the Kīlauea Point NWR in April 2000, which has since increased to over 150 individuals. The 2022 statewide population of wild nēnē was estimated to be 3,545 individuals comprised of 1,034 on the island of Hawai‘i; 2,199 on Kaua‘i; 306 on Maui; and 6 on Moloka‘i (NRAG 2022, in litt., entire). The number of nēnē on Kaua‘i increased from 1,891 in 2019 to 2,199 in 2022 (NRAG 2019, 2022, in litt., entire).

Life History
Nēnē currently occupy various habitats and vegetation community types ranging from coastal dune vegetation and non-native grasslands (e.g., golf courses, pastures, and rural areas) to

sparsely vegetated low and high-elevation lava flows, mid-elevation native and non-native shrubland, cinder deserts, native alpine grasslands and shrublands, and open and non-native alpine shrubland-woodland community interfaces (Banko et al. 1999, pp. 4–6). The current distribution of wild nēnē has been highly influenced by the location of release sites for captive-bred birds. On Kauaʻi, nēnē are primarily found utilizing lowland habitat, such as coastal wetlands at Hanalei and Hulēʻia NWRs, with the exception of the Nā Pali Coast (Service 2004, pp. 15–19).

Nēnē have an extended breeding season with eggs reported from all months except May, June, and July (Banko et al. 1999, p. 12), however, most birds in the wild nest between October and March (Service 2004, p. 19). Nesting peaks in December and most goslings hatch from December to January (Banko et al. 1999, p. 12). Nēnē nest on the ground in a shallow scrape in the dense shade of a shrub or other vegetation. A clutch typically contains three to five eggs and incubation lasts for 29 to 31 days. Once hatched, young remain in the nest for one to two days (Banko et al. 1999, pp. 16–17). Fledging of captive birds occurs at 10 to 12 weeks but may take longer in the wild. During molt (March to June), adults are flightless for a period of four to six weeks and generally attain their flight feathers around the same time as their offspring. When flightless, goslings and adults are extremely vulnerable to predators, such as cats and dogs. From June to September, family groups join others in post-breeding flocks often far from nesting areas.

Nēnē reach sexual maturity at one year of age, but usually do not form pair bonds until their second year. Historical reports from the island of Hawaiʻi indicate that nēnē bred and molted primarily in the lowlands during winter months and moved upslope in the hotter and drier summer months (Henshaw 1902, p.105; Perkins 1903; Munro 1944, pp.41–42; Banko 1988, p. 35). Reproductive success is relatively low in upland habitats on Maui and the island of Hawaiʻi and higher in lowland habitat on Kauaʻi (Telfer 1995, 1996; Banko et al. 1999, p. 19).
Nēnē are browser-grazers; and the composition of their diet depends largely on the vegetative composition of their surrounding habitats. They appear to be opportunistic in their choice of food plant as long as they meet nutritional demands (Banko et al. 1999, pp. 6–8; Woog and Black 2001, p. 324). It is thought that this adaptability in their use of food items allowed nēnē to survive in marginal habitats to which they were relegated, as habitats that are more traditional were lost to humans (Black et al. 1994, p. 103; Banko et al. 1999, p. 6). However, it is believed that nēnē require a diverse suite of food availability that may include non-native and native vegetation (Banko et al. 1999, p. 6), due to the loss of traditional foraging habitats (Black et al. 1994, p. 103).

Threats to Nēnē
Current threats to nēnē include depredation of eggs and goslings by introduced mammals (i.e., cats, rats, dogs, pigs, and mongooses); limited availability of suitable habitat due to habitat loss, fragmentation, and degradation, especially lowland breeding habitat; insufficient nutritional resources due to habitat degradation; and human-caused disturbance (including habituation to humans) and mortality (especially deaths due to collisions with vehicles). Most nesting failures of wild nēnē on Hawaiʻi and Maui are due to mongoose depredation (Hoshide et al. 1990, p. 154; Banko 1992, pp. 101–102; Black and Banko 1994, p. 400; Baker and Baker 1999, p. 8).

Mongooses kill incubating females (Banko 1992, p. 102) and rats are also a predator of nēnē eggs (Baker and Baker 1999, p. 12).

Hawaiian Stilt or Aeʻo (*Himantopus mexicanus knudseni*)

Species Description
The aeʻo is part of a superspecies complex of stilts (Family: Himantopus) and is considered a distinct subspecies of the black-necked stilt (*Himantopus mexicanus*) (Service 2011, p. 45). Aeʻo are slender wading birds, black above (except for the forehead), white below, and with distinctive long, pink legs. Sexes are distinguished by the color of the back feathers (brownish female, black male) as well as by voice, which is lower in females. Downy chicks are well camouflaged, tan with black speckling. Immature birds have a brownish back and white patches on their cheeks (Hawaii Audubon Society 2005, p. 49). The total length of adult aeʻo is about 16 inches with the mass of males and females averaging 7.0 ± 0.49 ounces (n=42) and 7.27 ± 0.77 ounces (n=43), respectively (Robinson et al. 1999, p. 16).

Historic and Current Distribution
Aeʻo were historically known from all the main Hawaiian Islands, except Lānaʻi and Kahoʻolawe (Service 2011, p. 46). No historical estimate of aeʻo population size is available, but by the early 1940, the statewide population was estimated to be between 200 and 1,000 birds (Service 2011, p. 46). However, these population estimates did not account for aeʻo present on Niʻihau and are therefore considered underestimates. Aeʻo are currently found on all the main Hawaiian Islands, except Kahoʻolawe. Though aeʻo census data show high year-to-year variability in the number of birds observed (Service 201l, p. 47), long-term census data indicate that the statewide population has been relatively stable or slightly increasing. Currently, this trend has continued and the statewide aeʻo population is stable to increasing with an average of approximately 1,500 birds over the 10-year period of 1998 to 2007 (DOFAW 1976-2008; Service 2011, p. 47-49). The data for aeʻo collected between 2006 and 2016 for winter and summer surveys show flucuations ranging from 1,400 to 2,200 individuals. Surveys where counts have surpassed 2,000 individuals have been followed in the subsequent year by a decrease of 300 to 700 birds (Service 2020a, p. 3). This variability in count numbers can be partially explained by variation in reproductive success and depredation. While the number of aeʻo counted on surveys has not consistently exceeded 2,000 individuals during winter or summer counts for at least 5 consecutive years, the population has remained relatively stable over the years (Service 2020a, p. 5).

Life History
Aeʻo use a variety of aquatic habitats but are limited by water depth and vegetation cover. They are known to use ephemeral lakes, anchialine pools, prawn farm ponds, marshlands, and tidal flats. Foraging habitat for the aeʻo is early successional marshland or other aquatic habitat with a water depth less than 9 inches and perennial vegetation that is limited and low growing. Native low-growing wetland plants associated with stilt nesting areas include *Bacopa monnieri* (water hyssop), *Sesuvium portulacastrum* (sea purslane), and the sedges *Cyperus laevigatus* (makaloa)

and *Bolboschoenus maritimus* (kaluha). Aeʻo use kalo ponds in the early stages of planting, but do not frequent closed canopy loʻi kalo (Service 2011, p. 59).

Aeʻo prefer to nest on freshly exposed mudflats interspersed with low growing vegetation (Service 2011, p. 57). Nesting also occurs on islands (natural and manmade) in freshwater or brackish ponds (Shallenberger 1977, p. 23, Coleman 1981, p. 42). The nest itself is usually a simple scrape on the ground but may also be a shallow bowl with vegetation and other debris (Shallenberger 1977, p. 24). Aeʻo have also been observed using sticks, small pebbles, shells, small dirt clods, and debris for nesting material (Coleman 1981, p. 53).

The aeʻo nesting season normally extends from mid-February through August, with peak nesting varying among years (Robinson et al. 1999. pg. 14). Aeʻo usually lay three to four eggs that are incubated for 23 to 26 days (Coleman 1981, p. 61, Reed et al. 1998, p. 37). Both parents take turns incubating the eggs day and night (Coleman 1981, p. 61; Shallenberger 1977, p. 24). Chicks are precocial and are able to walk and swim within a few hours of hatching (Coleman 1981, p. 77). Aeʻo chicks fledge about 28 days after hatching (Reed el al. 1999, p. 478). Young may remain with both parents as late as February of the year after hatch (Robinson et al. 1999, p. 19). First-year survival has been estimated at 0.55, with higher estimated mortality in the first two months compared with subsequent months (Reed et al. 2015, p. 179). Adult survival was similar for both sexes, with estimates of 0.79 for females and 0.80 for males (Reed et al. 2015, p. 179). The oldest females observed were seen 16 and 19 years after hatch. Six males lived to at least 16 years, with one observed 29 years after banding (Reed et al. 2015, p. 179). It is important to note that the aeʻo in this survival study were located at protected sites with predator control and public access management; in the absence of this active management survival rates are expected to be much lower (Reed et al. 2015, p. 183).

Aeʻo are opportunistic feeders. They eat a wide variety of invertebrates and other aquatic organisms available in shallow water and mudflats. Specific organisms taken include water boatmen (Corixidae), beetles (Coleoptera), possibly brine fly (*Ephydra riparia*) larvae, polychaete worms, small crabs, Mozambique tilapia (*Tilapia mossambica*), western mosquito fish (*Gambusia affinis*), and tadpoles (*Rhinella* spp.) (Service 2011, p. 59). Ephemeral ponds provide an immediate and short-term food supply with the emergence of invertebrates (Service 2011, p. 60).

Hawaiian Gallinule or ʻAlae ʻula (*Gallinula galeata sandvicensis*)

Species Description
The ʻalae ʻula is an endemic subspecies of the common gallinule (*Gallinula chloropus*). It is a dark gray bird with a black head and neck, and white feathers on their flanks and on their undertail coverts. They have a distinctive red frontal shield, and their bill tip is yellow with a red base. Their legs and feet are greenish and without lobes. The ʻalae ʻula usually measures about 13 inches in length and 11 to 16 ounces in mass, with males typically larger and heavier than the female (Bannor and Kiviat 2002, online p. 2). Both sexes are similar and have chicken-like cackles and croaks.

Historic and Current Distribution

No historical population estimates are available for the ʻalae ʻula prior to the first biannual waterbird count by the State of Hawaiʻi Division of Forestry and Wildlife (DOFAW) in 1977. Because they are such secretive birds, particularly when nesting, it is difficult to conduct population surveys for this species. It is believed that they were common on the main Hawaiian Islands, except Lānaʻi and Kahoʻolawe, in the 1800s but radically declined by the mid-1900s. Surveys from the 1950s through the 1960s estimated only 57 individuals (Engilis and Pratt 1993). Currently, ʻalae ʻula inhabit Kauaʻi and Oʻahu (Service 2011, p. 37, DOFAW). The State attempted a reintroduction of six ʻalae ʻula (three females and three males) on May 18, 1983, to the island of Molokaʻi at Kakahaiʻa NWR. At least two birds were present in January 1984, but there have been no confirmed sightings since 1985 (Service 2011, p. 40).

ʻAlae ʻula generally occur in wetland habitats below 410 feet in elevation on Kauaʻi and Oʻahu. Biannual waterbird counts indicate the statewide population of ʻalae ʻula is stable with an average of 287 birds over 10 years (1998 to 2007), but count numbers are extremely variable between summer and winter surveys (Service 2011). The 2016 summer surveys counted 596 birds on Kauaʻi and a total of 755 individuals throughout the State of Hawaiʻi. The most recent minimum population estimate of ʻalae ʻula is a 5-year average of 927 (678-1,235) individuals statewide from surveys between 2012 to 2016 (Service 2021a, p. 2). On Kauaʻi, the largest populations occur in the Hanalei and Wailua river valleys, Waiakalua Reservoir, and Wilcox Ponds (Service 2011, p. 40). ʻAlae ʻula also occur in the irrigation canals on the Mana Plain of western Kauaʻi and in loʻi kalo fields. While the State biannual survey numbers provide an idea of population trends, the counts are thought to be underestimates because of the species' cryptic behavior. Standard survey methods in these counts include visual and aural detection. Recent research conducted by DesRochers et al. (2008) in 2005 through 2007 has shown that passive surveys of cryptic waterbirds underestimate numbers of individuals present in the wetlands. Alternatively, broadcasting vocalizations of cryptic waterbirds to elicit responses increases detection. On average this research has shown that broadcasting calls increased ʻalae ʻula detection by 30 percent on the island of Oʻahu and 56 percent on the island of Kauaʻi.

Life History

ʻAlae ʻula are the most secretive of the native waterbirds, preferring to forage, nest and rest in dense late succession wetland vegetation. Most birds feeding along the water's edge or in open water will quickly seek cover when disturbed. The preferred habitat for ʻalae ʻula are lowland freshwater habitats, and declines have been observed in ponds where freshwater was converted to saltwater (Engilis and Pratt 1993). Key habitat features include interspersed dense stands of robust late succession vegetation near open water, floating or barely emergent mats of vegetation, and water depth less than three feet (Service 2011, pp. 45). ʻAlae ʻula are opportunistic feeders and their diet likely varies with habitat, but includes algae, grass seeds, insects, snails, introduced fishes, crustaceans, mollusks, emergent grasses, and wetland plants (Service 2011, p. 44).

ʻAlae ʻula nest year-round but most activity occurs from March through August (Service 2011, p. 34). It is believed that the nesting phenology is related to water levels and late succession wetland vegetation. ʻAlae ʻula usually lay an average of five to six eggs with the incubation period ranging from 19 to 22 days (Service 2011, p. 43). Re-nesting and multiple broods during one season have been observed (Byrd and Zeillemaker 1981). Platform nests are constructed in dense vegetation over water or near the edge. The species of emergent plant used for nest construction is not as important as stem density and vegetation height (Service 2011, p. 43). Kauaʻi kalo farmers reported that ʻalae ʻula are not successful reproducing during winter months as they are during summer months, likely due to highly fluctuating water levels from rain and flooding (Greer 2006, p. 287). ʻAlae ʻula make a great deal of noise when their nests are approached by predators, but if their nests are left unharmed and reproduction is a success, they will continue to use the nest for future broods (Greer 2006, p. 288). ʻAlae ʻula are a precocial species; chicks are covered with down and are able to walk but are dependent on parents for several weeks. The lifespan of this species is unknown; however, an ʻalae ʻula was recaptured after 10.5 years (Service 2011).

Hawaiian Coot or ʻAlae keʻokeʻo (*Fulica alai*)

Species Description
The ʻalae keʻokeʻo was considered a subspecies of the American coot (*Fulica americana*) but is now considered a distinct species (Service 2011, p. 19). Adults have a black head, a slate gray body with white undertail feathers, and a prominent white frontal shield and bill; feet are lobed rather than webbed and are greenish gray. No reliable measurements of total length or size are available; however, the ʻalae keʻokeʻo is slightly smaller in body size than the American coot which averages 13 to 17 inches in total length and 15 to 30 ounces in mass (Pratt and Brisbin 2002, p. 34).

Historic and Current Distribution
The ʻalae keʻokeʻo historically occurred on all of the main Hawaiian Islands except Lānaʻi and Kahoʻolawe, and were considered most numerous on Oʻahu, Maui, and Kauaʻi (Shallenberger 1977, p. 28). The ʻalae keʻokeʻo population in 1977 was estimated at 2,500 birds (Shallenberger 1977, p. 28), and is currently estimated between 1,500 to 2,800 birds (DOFAW 1976-2008, Service 2011, p. 21). Looking at the survey data from the biannual waterbird counts from 1976 through 2007, the ʻalae keʻokeʻo population has an overall slightly increasing trend (Service 2011, p. 22). While not all wetlands are surveyed, the counts are considered an accurate representation of the minimum population size. About 80 percent of the population detected in the surveys occur on the islands of Kauaʻi (Hanalei, Hulēʻia, ʻŌpaekaʻa), Oʻahu (coastal wetlands and reservoirs such as Lake Wilson and Nuʻuanu Reservoir, Kahuku Point and along the windward shore), and Maui (Kanaha and Keālia Ponds, Nuʻu Pond) (Service 2011, pp. 21-27). The remaining 20 percent of the population occurs in coastal ponds and playa wetlands, including breeding populations on Lānaʻi, Molokaʻi, and the island of Hawaiʻi. Several authors have speculated that annual migration occurs between Kauaʻi and Niʻihau, but statewide surveys indicate that these movements are less frequent, usually occurring when annual precipitation is above normal and ephemeral lakes on Niʻihau become flooded (Engilis and Pratt 1993).

Numbers of ʻalae keʻokeʻo counted on Niʻihau during wet winters include 949 birds in 1986 and 803 birds in 1996, but Niʻihau has not been surveyed since 1999 (Service 2005). The most recent minimum population estimate of ʻalae keʻokeʻo is 1,815 (1,248-2,577) individuals (Service 2021b, p. 2).

Life History

ʻAlae keʻokeʻo generally occur within wetland habitats with suitable emergent plant growth interspersed with open water, especially freshwater wetlands, but also freshwater reservoirs, cane field reservoirs, sewage treatment ponds, taro loi, brackish wetlands, and limited use of saltwater habitats. Elevation ranges from the coastal plains at sea level to 850 feet, rarely to 3,500 feet (Service 2011, p. 33). However, on the island of Kauaʻi, some birds occur in plunge pools above 4,900 feet in elevation and on the island of Hawaiʻi, stock ponds up to 6,600 feet in elevation.

The species typically forages in water less than 12 inches deep but will dive in water up to 48 inches deep (Service 2011, p. 33). ʻAlae keʻokeʻo prefer to forage in water that is more open. They use logs, rafts of vegetation, narrow dikes, mud bars, and artificial islands for resting. Ephemeral wetlands support large numbers of ʻalae keʻokeʻo during the non-breeding season.

Nesting habitat includes freshwater and brackish ponds, irrigation ditches, reservoirs, small openings in marsh vegetation, commercial prawn farm ponds and taro fields (Shallenberger 1977, p. 27). Floating nests are constructed of aquatic vegetation and found in open water or anchored to emergent vegetation (Byrd et al. 1985, p. 58). Open water nests are usually composed of mats of *Bacopa monniere* (water hyssop) and *Paspalum conjugatum* (Hilo grass) (Byrd et al. 1985, p. 58; Pratt and Brisbin 2002, p. 35). Nests in emergent vegetation are typically platforms constructed from buoyant stems of species such as *Scirpus* spp. (bulrush) (Byrd et al. 1985, p. 58). Average depth of water at ʻalae keʻokeʻo nest sites was 13 inches in natural habitats (Byrd et al. 1985, p. 59).

Nesting occurs primarily from March through September, although some nesting occurs in all months of the year (Shallenberger 1977, p. 27; Morin 1998, p. 10). The timing of nesting appears to correspond with seasonal weather conditions (Byrd et al. 1985, p. 59; Engilis and Pratt 1993, pp. 154-155). Nest initiation corresponds to rainfall, as appropriate water levels are critical to nest success. Clutch size ranges from one to ten eggs, and young hatch after a 25-day incubation period (Byrd et al. 1985, p. 59; Shallenberger 1977, p. 27). Chicks swim from the nest soon after hatching but remain close to parents; immature birds have been seen with parents several weeks after hatching (Shallenberger 1977, p. 27). There is no information on the lifespan and survivorship of this species; however, banding records indicate the oldest American coot was at least 22 years old (Klimkiewicz and Futcher 1989, p.478).

ʻAlae keʻokeʻo are generalists and feed on land, grazing on grass adjacent to wetlands, or in the water. They have been observed grazing from the surface of the water or foraging by diving to obtain food resources (Shallenberger 1977, p. 27). Food items include seeds and leaves, snails, crustaceans, insects, tadpoles, and small fish. ʻAlae keʻokeʻo will travel long distances, including between islands, when local food sources are depleted (Engilis and Pratt 1993, pp. 154-155).

Hawaiian Duck or Koloa Maoli (*Anas wyvilliana*)

Species Description
The koloa maoli is one of two extant endemic duck species (Family: Anatidae) found in Hawai‘i from at least 13 species of endemic Hawaiian waterfowl known from the fossil record (Olson and James 1991, Burney et al. 2001). The koloa maoli is closely related to but genetically and morphologically distinct from the mallard (*A. platyrhynchos*) (Fowler et al. 2009). Both sexes of the koloa maoli are mottled brown and may resemble a small female mallard. Adult males have darker heads, with distinctive brown chevrons on the breast, flank and back feathers, and olive-colored bills (Engilis et al. 2002). Adult females are similar but are smaller than males on average and slightly lighter in color, with plainer, buff colored chin and back feathers.

Historic and Current Distribution
In the early 1900s, koloa maoli were common in the coastal marshes of all the main Hawaiian Islands except for Lāna‘i and Kaho‘olawe (Munro 1944). By the mid-1900s, the species had been reduced to 500 birds on Kaua‘i and a few isolated pairs on other islands (Schwartz and Schwartz 1953). In the mid-l950s, the State of Hawai‘i began a captive propagation and release program for koloa maoli. From 1958 to 1990, 757 captive-bred koloa maoli were released on O‘ahu (326), Maui (12), and the island of Hawai‘i (419) to repatriate the species within its former range (Giffin 1983). The koloa maoli release program was complicated by the problem of interbreeding with feral mallards (ornamental or farm ducks that have escaped or were released into the wild).

Recent genomic research indicates that duck populations on the islands of O‘ahu, Maui, Moloka‘i, and the island of Hawai‘i are koloa maoli-mallard hybrids due to genetic intermixing with feral mallards (Service 2021c). However, ducks sampled on Kaua‘i appear to be pure or nearly pure koloa maoli, although recent genomic research suggest that there are some koloa maoli-mallard hybrids on Kaua‘i as well (Service 2021c). These results provide an example of how localized extinction is occurring in koloa maoli populations by introgressive hybridization. There are believed to be fewer than 2,000 pure koloa maoli remaining statewide, with most of these occurring on Kaua‘i (Service 2021c). On the island of Kaua‘i, the minimum population size for koloa maoli is approximately 947 (751-1,185) individuals (Service 2021c).

Life History
Koloa maoli are found from sea level to 9,900 feet elevation. The koloa maoli occurs in a wide variety of natural and artificial wetland habitats including freshwater marshes, flooded grasslands, montane stock ponds, streams, forest swamplands, taro patches, *Nelumbo nucifera* (lotus) farms, irrigation ditches, reservoirs, and mouths of larger streams (Service 2011). Since 2006-2007, significant wetland habitat improvements have been made for koloa maoli at Hanalei and Hulē‘ia NWRs on Kaua‘i with the intent of providing optimal foraging, loafing, and breeding habitat. This has resulted in an overall increase in State biannual counts of koloa maoli for the Refuge from 2006 to 2015. Watershed protection and management is beneficial to koloa

because of the species' elevational range and use of wetland habitats from the coastal plain to mountain top.

Koloa maoli nest in lowland habitats on Kauaʻi as well as along stream banks and in the upper Alakaʻi swamp (Service 2011). Nests have also occurred in forests, kalo farming areas, managed wetlands, grasslands, and scrub/shrub; with associated topographic features like dikes, upland flats, dry wetland basins, and mountain ridges (Malachowski et al. 2018). Nesting generally occurs year-round, but peak nesting (up to 94 percent) occurs between September and May on Kauaʻi (Malachowski et al. 2019, p. 78) and March to July on the island of Hawaiʻi (Giffin 1983). Koloa maoli usually nest on the ground in herbaceous and/or woody vegetation in wetland-associated uplands. Generally, 4 to 10 eggs are laid, with clutch size typically higher during the wet season (November to April) than the dry season (May to October) (Malachowski et al. 2018). Precocial ducklings hatch after 26 to 30 days of incubation, and ducklings attain flight after 65 to 70 days of protection and rearing usually by the lone female (Swedberg 1967, Giffin 1983).

Koloa maoli move between feeding and breeding habitats, and are known to fly between the islands of Kauaʻi and Niʻihau. The species typically forages in water less than six inches deep. Koloa maoli are opportunistic and their diet includes snails, aquatic insects, earthworms, grass seeds, green algae, and seeds and leaves of wetland plants. The koloa maoli duckling diet has never been studied. However, mallard ducklings eat mainly animal foods for the first 25 days of life (aquatic insects especially chironomids, small crustaceans, and mollusks) spending 65 to 80 percent of daylight feeding. After 20 to 30 days, seeds become more prominent in the mallard duckling diet (Drilling et al. 2002). Koloa maoli are found alone or in pairs and are wary, especially when nesting or molting. During the winter, koloa maoli may gather in larger numbers to exploit abundant food resources (Service 2011).

Threats to Hawaiian Waterbirds

The primary causes of decline for Hawaiian waterbirds are loss of wetland habitat, altered hydrology, alteration of habitat by invasive non-native plants, predation by introduced animals, over-hunting in the late 1800s and early 1900s, disease, and possibly environmental contaminants (Service 2011, p. iv-v). Currently, hybridization with feral mallards is the most serious threat to koloa maoli, while predation by introduced animals may be the greatest threat to the other Hawaiian waterbird species (Service 2004, p. 27; Service 2011, p. 77).

Loss and Degradation of Wetland Habitat

The greatest threat to waterbirds worldwide is the reduction in habitat quantity and quality (Parnell et al. 1988. p. 133). In Hawaiʻi, a significant number of wetlands have been lost due to human activities, including filling and draining for agriculture, houses, hotels, and golf courses (Service 2011 p. 77). Statewide wetland loss in Hawaiʻi is estimated at 15 percent, ranging from 6 to 8 percent on Maui, Molokaʻi, Kauaʻi, and the island of Hawaiʻi to 65 percent loss on Oʻahu (Van Rees and Reed 2014, p. 335). Most of the wetland loss (44 percent) occurred in coastal areas (Van Rees and Reed 2014, p. 335), where most Hawaiian waterbird habitat exists. Most of the remaining wetlands are degraded by altered hydrology, invasive species, human

encroachment, and contaminants (Service 2011, p. 77-81).

Depredation
Depredation by introduced animals may currently be the greatest threat to all these Hawaiian waterbird species, except koloa maoli (Service 2004, p. 27; Service 2011, p. 77). Small Indian mongoose (*Herpestes auropunctatus*), cats, dogs (*Canis lupus familiaris*), rats, cattle egrets, non-native fishes, and bullfrogs are all presently found within wetlands and pose a serious threat to Hawaiian waterbird reproductive success by taking eggs, young birds, and even adults (Service 2011, p. 82-83). Small Indian mongooses (*Herpestes auropunctatus*) are not believed to be established on Kauaʻi, however three were captured in recent years (Phillips and Lucey 2016). Wetland areas that receive predator control have shown higher waterbird reproductive success and greater waterbird population densities (Underwood et al. 2014, p. 32). For example, after predator control was implemented at ʻAimakapā Pond from 1993 to 1994, aeʻo fledgling success increased (Morin 1998, p. 20). Without active predator control, it is expected that survivability of waterbirds will be lower, particularly in the hatch-year class (Reed et al. 2015, p. 183).

Hybridization of Koloa Maoli with Feral Mallards
The greatest current threat to koloa maoli is genetic introgression (the introduction of genes from one species into the gene pool of another) through interbreeding with feral mallards; also referred to as hybridization (Service 2011, p. 85). The number of hybrids has shown to rapidly increase in recent years but may have been occurring for some time with the apparent increase due to greater recognition of the issue and more careful identification of duck-like birds (Service 2011, p. 85-97). Recent statewide genetic analyses indicate Oʻahu, Maui, Molokai, and Hawaiʻi birds can be characterized as hybrid swarms, with all sampled populations on these islands being mallard-koloa hybrids (Wells et al. 2019). With Kauaʻi having the largest true koloa maoli population, it is extremely important to manage suitable habitat and protect the genetic integrity of Kauaʻi birds. This population is valuable as a potential source for translocation or captive breeding and reintroduction to other islands.

Hawaiian Hoary Bat or ʻŌpeʻapeʻa (*Lasiurus cinerus semotus*)

Species Description
The ʻōpeʻapeʻa is a medium-sized (0.5 to 0.8 ounces), nocturnal, insectivorous bat, with a wingspan of 10.5 to 13.5 inches. “Hoary” refers to the white-tinged, frosty appearance of the bat’s grayish brown or reddish-brown fur. Sexual dimorphism (females larger than males) has also been observed in ʻōpeʻapeʻa collected across all Hawaiian Islands (Pinzari 2019). Additional morphological analyses are underway (Pinzari and Bonaccorso 2018, pers. comm.). ʻŌpeʻapeʻa are not colonial, and roost solitarily in tree foliage (Service 1998).

The ʻōpeʻapeʻa is classified under the Family Vespertilionidae of the Suborder Microchiroptera and is one of three recognized hoary bat subspecies. The other two subspecies are *Lasiurus cinereus cinereus*, one of the most common and widespread bats in North America, and *Lasiurus cinereus vilosissimus*, which occurs in South America and the Galapagos (Shump and Shump 1982). Jacobs (1996) reported morphological divergence in the ʻōpeʻapeʻa from the North American subspecies involving characteristics related to flight and feeding. According to Jacobs (1996), the ʻōpeʻapeʻa has a 45 percent reduction in body size with allometric responses in the size of its wings when compared to the continental North American subspecies, *L. c. cinereus*. The wing changes result in a lower ratio of weight to wing area, and are expressed as long, narrow wings relative to the continental North American subspecies. This physical trait permits slower and more maneuverable flight near vegetation and enduring flight in open areas. This increased flexibility in flight behavior has allowed the ʻōpeʻapeʻa to expand its foraging habitat to include both open habitats like those of *L. c. cinereus*, and closed habitats not used by *L. c. cinereus*. Skeletal features related to feeding also diverge with ʻōpeʻapeʻa having relative increases in the size of the mouth opening (gape), the size of the muscle that closes the jaw (masseter muscle) and the height of the coronoid process relating to the structure of the jawbone. These changes give the jaw more crushing power for more efficient processing of large and hard-bodied prey. This has enabled the ʻōpeʻapeʻa, despite a marked reduction in body size, to include large, hard-bodied insects such as beetles, not taken by *L. c. cinereus* in its diet. Similarly, Barclay et al. (1999) found that ʻōpeʻapeʻa use on average higher frequency calls (26.2-29.8 kHz) compared to *L. c. cinereus* (20.1 kHz).

The ʻōpeʻapeʻa has been in Hawaiʻi for at least 10,000 years and possibly as long as 1.8 million years (Russell et al. 2015; Baird et al. 2015). Genetic analyses indicate the species migrated from North America at least twice, and possibly more times (Russell et al. 2015; Bonaccorso and McGuire 2013). The population structure and genetic basis of these multiple migration events of the ʻōpeʻapeʻa are currently being researched.

Three different publications have been released in the past few years that analyzed the genetic relationships of the ʻōpeʻapeʻa, both within the larger Lasiurus complex and within the Hawaiian Islands (Russell et al. 2015, Baird et al. 2015, Baird et al. 2017). These studies indicate that two genetically distinct groups or clades of hoary bats - derived from different arrivals to the islands - exist within Hawaiʻi. While both clades have been found on Oʻahu and Maui, no "pure" forms of the *L. c. cinereus* clade have been found on the other islands as of yet, although putative hybrids between the two clades have been found from the island of Hawaiʻi (Baird et al. 2017). Very few samples have been tested from Kauaʻi, and no analyses of bats from Molokaʻi, Lānaʻi, or Kahoʻolawe have been published. Until the genetic differences and hybridization status are further resolved, the ʻōpeʻapeʻa taxonomic classification follows the current listing status which is recognized as one subspecies across the State of Hawaiʻi.

Historic and Current Distribution

The ʻōpeʻapeʻa is endemic to the State of Hawaiʻi and is the only existing terrestrial mammal. The ʻōpeʻapeʻa was listed under the ESA based on perceived habitat loss and limited knowledge

of its distribution and life history requirements (Service 1970, 1998). At the time of listing there was no population estimate and no documentation of a population decline.

The ʻōpeʻapeʻa is distributed across Kauaʻi, Oʻahu, Maui, Molokaʻi and the island of Hawaiʻi, with breeding confirmed or highly likely to occur based on current monitoring data (Bonaccorso and Pinzari 2011; Wolfe 2018; Hosten and Poland 2018). ʻŌpeʻapeʻa have been observed year-round in a wide variety of habitats and elevations below 7,500 feet, and a few sightings from limited surveys have been reported as high as 13,199 feet. Hawaiian hoary bats have been detected in both wet and dry areas of the island of Hawaii but seem to be more abundant on the drier leeward side (Jacobs 1994, p. 199) and generally less abundant in wet areas (Kepler and Scott 1990, p. 62). Three researchers examined spatial and temporal variation in occurrence patterns of bats in Hawaii, with conflicting conclusions about possible altitudinal or regional migration (Jacobs 1994, pp. 193-200; Menard 2001, pp. 1-149; Tomich 1986, pp. 1-30). However, recent vocalization data recorded over a period of five years (2007-2011) in 25 sample areas across the island of Hawaii indicate that bats concentrate in coastal lowland areas during the breeding season and migrate to highlands in the winter nonbreeding season (Gorresen et al. 2013).

Movement of bats between the major islands is thought to be infrequent (Pinzari and Bonaccorso, pers. com 2018). However, the high level of mobility of the ʻōpeʻapeʻa within an island contributes to the resiliency of the species by lessening the impacts of localized threats and contributes to its continued survival and recovery. Island subpopulations likely provide a source of biological redundancy statewide, as it can provide for genetic exchange and representation. A study conducted by Gorrensen et al. (2013) from 2007 to 2011 suggests that the ʻōpeʻapeʻa population on the island of Hawaiʻi is stable to increasing. However, no population trends have been established for the other Hawaiian Islands.

Life History

Day-roost habitat requirements for the ʻōpeʻapeʻa are tall (greater than 15 ft crown height), shady trees frequently including mature native *Metrosideros polymorpha* (ʻōhiʻa), but also including a wide variety of introduced species such as *Litchi chinensis* (lychee), various species of *Eucalyptus* spp. (eucalyptus), *Mangifera indica* (mango), and numerous other tree species (Bonaccorso et al. 2015). Roost trees noted from radio-tracked bats on Maui include *Eucalyptus globulus* (blue gum eucalyptus), *Spathodea campanulata* (African tulip tree), and *Cupressus macrocarpa* (Monterey cypress) (Johnston et al 2018).

The ʻōpeʻapeʻa primarily feeds on nocturnal moths and beetles, which it hunts in flight across a wide array of habitat types and plant communities from sea level to at least 11,800 ft above sea level (Whitaker and Tomich 1983; Jacobs 1999; Todd 2012; Bonaccorso et al. 2015; Bonaccorso et al. 2016). Bonaccorso et al. (2015) found ʻōpeʻapeʻa using foraging areas up to 571 ac in size with smaller, core use ranges of around 62 ac targeted within that larger landscape, with little to no overlap among individuals. Bats can use widely dispersed resources and move away from poor foraging conditions, such as heavy rain. Overall, bat activity and movements on the landscape are not determined by one variable, but an interaction of a complex array of

environmental factors. Seasonal changes in temperature, rainfall, wind, insect abundance, and energetic costs associated with reproduction of the ʻōpeʻapeʻa all play important roles in its movement and habitat use (e.g. Todd 2012; Gorresen et al. 2013; Bonaccorso et al. 2015; Gorresen et al. 2015; Bonaccorso et al. 2016; Todd et al 2016).

The physical structure of the spaces in which the ʻōpeʻapeʻa forages are also extremely varied, including forest gaps and clearings, forest edges along planted windrows of trees, above forest canopies, and along roads. These areas can occur in a range of habitats including undisturbed native forest, mature eucalyptus plantations having mixed understory trees and shrubs, lowland forest dominated by introduced trees, suburban and urban areas planted with ornamental trees, grassland/pasture, river gorges, arboretums, macadamia nut orchards, and coastal bays (Bonaccorso et al. 2015; Gorresen et al. 2013).

The lifespan of the solitary ʻōpeʻapeʻa is estimated to be between 4-10 years (Bonaccorso 2016). The average number of pups produced each year is estimated to be 1.8 and survival rate is estimated to be 30 percent. Thus, ʻōpeʻapeʻa reproductive success is estimated at 0.5 pups per female. The ʻōpeʻapeʻa breeding activity takes place between April and August, with pregnancy and the birth of two (or occasionally one) pups, occurring from April to June (Bogan 1972). The pups are completely dependent on the female until weaning at three months of age. Lactating females have been documented from June to August, and a female tending pups has been observed in early September (Pinzari 2015, pers. comm). The ʻōpeʻapeʻa pupping season is June 1 through September 15, when mature females are likely caring for dependent young.
Several studies have examined ʻōpeʻapeʻa movement and habitat use across the islands (Todd 2012, Gorresen et al. 2013, Bonaccorso et al. 2015, Gorresen et al. 2015, Bonaccorso at el. 2016, Todd et al. 2016). The median core use area for a male bat was estimated as 20.3 ac based on raw data from Bonaccorso et al. (2015) and excluding data from juvenile individuals without established core use areas (DOFAW 2015; Bonaccorso et al. 2015). Female ʻōpeʻapeʻa may have overlapping core use areas (Bonaccorso et al. 2015).

Threats to ʻŌpeʻapeʻa
Expansion of land-based wind energy facilities is the greatest known source of mortality of the ʻōpeʻapeʻa. As of June 2018, there have been 76 observed ʻōpeʻapeʻa fatalities at the six facilities monitoring and reporting take of bats; these data reflect a likely take amount of 90 to 164 bats across three islands where wind energy projects are located. There are wind turbine facilities on Oʻahu, Maui, and the island of Hawaiʻi. The majority of impacts occur on Oʻahu and Maui. No wind turbine facilities are planned for Kauaʻi, Molokaʻi, of Lānaʻi (Service 2020b). Other threats include habitat loss, tree trimming and cutting during the period when pups are non-volant, entanglement on barbed wire fences, pesticides and rodenticides, competition from invasive species, such as coqui frogs, and potentially predation from native and non-native owls and hawks, as well as non-native rats and cats (Service 1998).

Environmental Baseline
Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action

area. Also included in the environmental baseline are the anticipated and/or ongoing impacts of all proposed federal projects in the action area that have undergone Section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

Status of Nēnē within the Action Area

Bi-weekly surveys of nēnē are conducted at 44 locations across PMRF Barking Sands. There are 24 survey sites located in the south end, 14 sites in the central portion and 6 sites in the north end. Nēnē distribution on Barking Sands is concentrated in the southern portion of the installation due to attractive habitat. Survey averages reflect a stable nēnē population at Barking Sands, with a low of 20.5 nēnē in 2017 and a high of 40 nēnē in Fiscal Year (FY) 2022 (Figure 8) (FY is October 1 through September 30). Based on these surveys, there are seasonal fluctuations of nēnē presence on Barking Sands, with a typical dip in numbers from February through April. Nēnē presence increased during the pre-breeding season (August to November) with a peak from November to January (Figure 9).

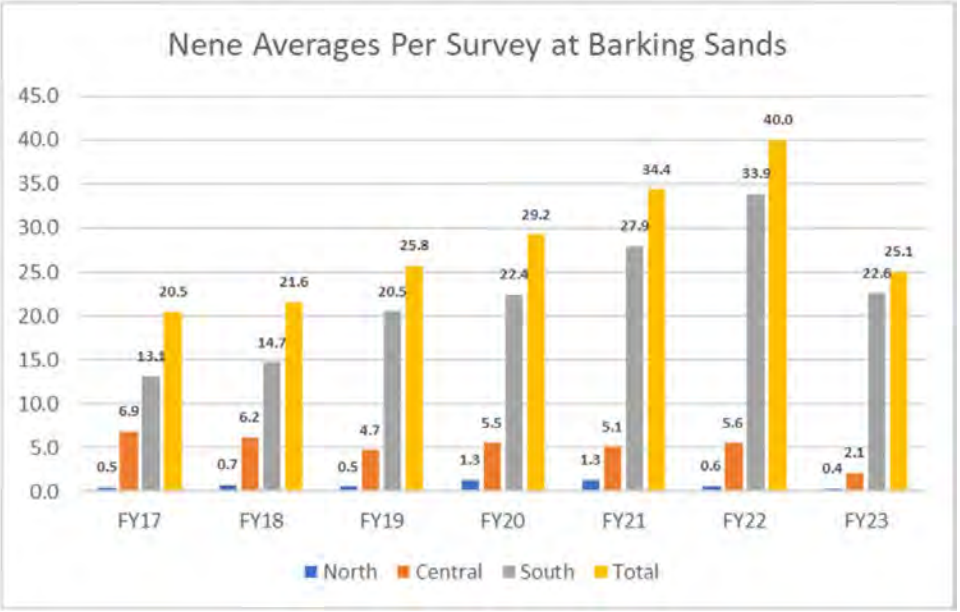

Figure 8. Nēnē bi-weekly survey averages by geographic area at Barking Sands from FY 2017 to 2023.

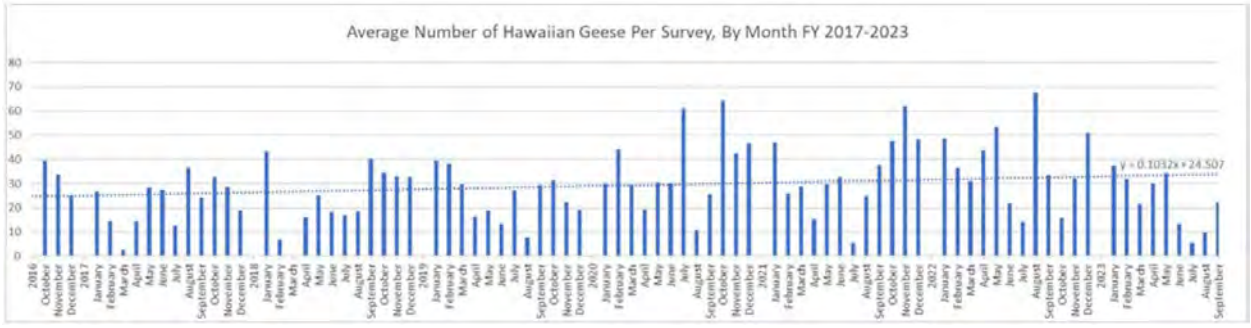

Figure 9. Trend of nēnē presence at Barking Sands by month from 2016 to 2023.

Nēnē nesting events at Barking Sands have been increasing each breeding season, with a total of 39 nests during the breeding season of FY 2022 and 43 nests during the FY 2021 breeding season (40 nests and 1 nest cup at PMRF Barking Sands, and 2 nests at Makaha). Data from FY 2017 to FY 2023 shows 76.9% of nests successfully hatched, with an average hatch rate of 2.17 goslings. Nēnē at PMRF have an average fledge rate of 1.97 goslings per family. Because young nēnē exhibit strong natal site fidelity in choosing breeding locations, it is anticipated that nesting events will correlate to larger nēnē populations on Barking Sands and Makaha in future years.

Nēnē are most observed at the sewage Oxidation Pond and Kinikini Ditch at PMRF Barking Sands, however they are also seen foraging along roadways and in open grassy areas in the central and southern portions of PMRF Barking Sands. Nēnē have established nests throughout PMRF Barking Sands, with most nests occurring adjacent to the sewage Oxidation Pond, in the dry, grassy basins (Figure 10). Nests have been recorded near the Hawai‘i Air National Guard (HIANG) Complex and Aegis Ashore complex, which is adjacent to the section of Nohili Road with the highest nēnē strikes. Nēnē are also recorded on Makaha Ridge Tracking Station, with an average of 5 nēnē documented during surveys. Nēnē have been observed infrequently at the Kōke‘e sites. No nēnē have been recorded at Port Allen, Kamokala Ridge Magazines, and Miloli‘i Ridge sites.

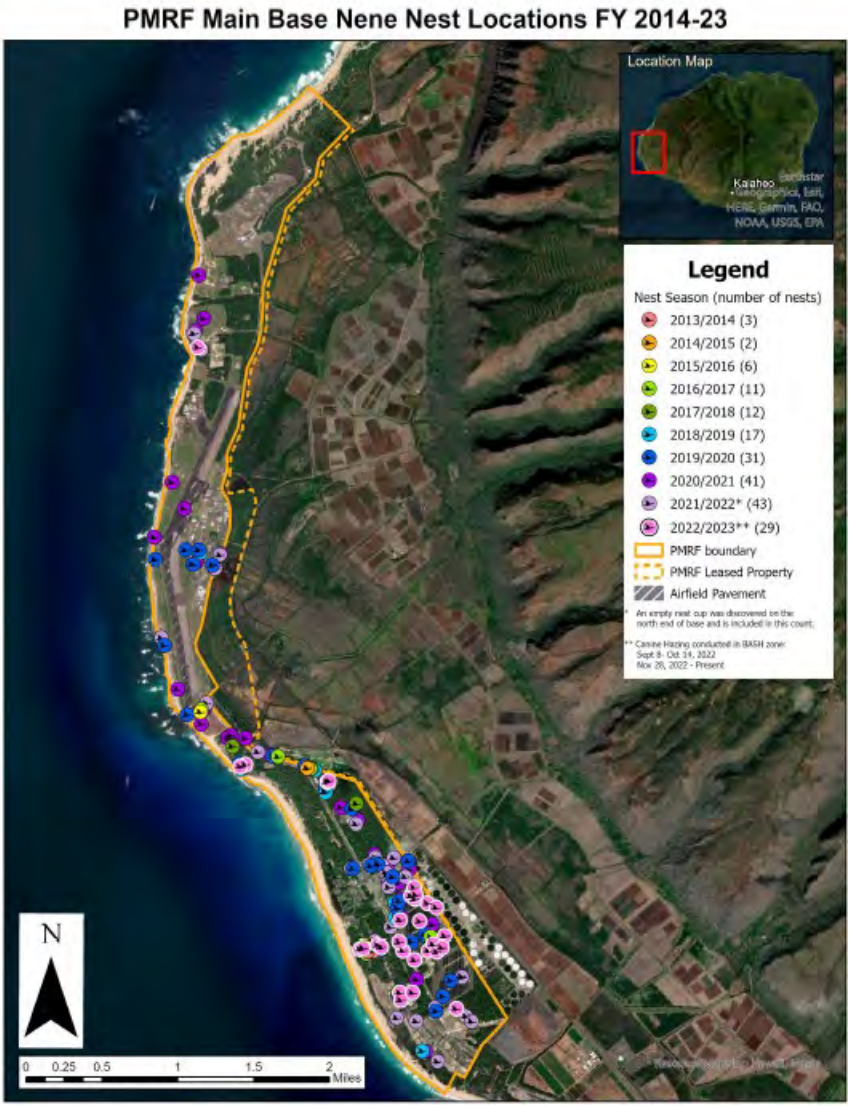

Figure 10. Nēnē nest locations at Barking Sands from FY 2014 to 2023.

Status of Hawaiian Waterbirds within the Action Area

All species of Hawaiian waterbirds (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, koloa maoli) at PMRF use similar areas of the action area, therefore the status of these species within the action area is summarized in one section. Hawaiian waterbirds regularly forage and loaf in the aquatic areas of PMRF Barking Sands, consisting of the agricultural drainage ditches (Nohili and Kinikini Ditches) and the sewage Oxidation Pond in the southern section of the base. Aeʻo have been observed on the eastern side of Nohili Road from Major's Bay to the HIANG Complex during heavy rainy periods.

The Oxidation Pond has been regularly surveyed since March 2012, with an average of five surveys conducted per month over an 11-year period. Results of these surveys have indicated a

mean of 7 aeʻo and 14 ʻalae keʻokeʻo at the Oxidation Pond per survey, with a high count of 34 aeʻo (April 2019) and 33 ʻalae keʻokeʻo (May and June 2019). The pond is used to a lesser extent by Koloa maoli. While no koloa maoli nests have been detected within the Oxidation Pond complex, family groups have been detected on and around the pond frequently. ʻAlae ʻula have not been observed using the Oxidation Pond but occur exclusively in the agricultural drainage ditches on the base.

Nesting events or young waterbird families (presumed nesting) have been documented at PMRF Barking Sands at the Oxidation Pond and Kinikini Ditch. ʻAlae keʻokeʻo nests were detected in both areas (6 at Oxidation Pond/2 at Kinikini Ditch in FY 2018, 2/1 in FY 2019, 3/0 in FY 2020, 6/0 in FY 2021, 1/0 in FY 2022, and 4/0 in FY 2023). Koloa maoli family groups were also documented in both areas respectively (4 at Oxidation Pond/0 at Kinikini Ditch in FY 2018, 5/0 in FY 2019, 9/0 in FY 2020, 4/1 in FY 2022 and 5/2 in FY 2023). ʻAlae ʻula nests that were detected were all found at the Kinikini Ditch (3 in FY 2018, 3 in FY 2019, 1 in FY 2020, 3 in FY 2021, 1 in FY 2022, and 1 in FY 2023.

Status of ʻŌpeʻapeʻa within the Action Area

A comprehensive acoustical survey of PMRF, including sites at Barking Sands, Mākaha Ridge, and Kokeʻe, demonstrated year-round use of all these areas by ʻōpeʻapeʻa, although different seasonal values indicate varying use throughout the year (Bonaccorso and Pinzari 2011). ʻŌpeʻapeʻa appeared to be using low elevation habitats (Barking Sands) primarily during the summer and fall, but then showed increased activity at higher elevations (Mākaha Ridge and Kokeʻe) during the winter months (Bonaccorso and Pinzari 2011).

ʻŌpeʻapeʻa were also detected in acoustical surveys at Kekaha Firing Range (KFR), which is adjacent to PMRF Barking Sands' southern border (Montoya Aiona et al. 2020). Peak frequency of ʻōpeʻapeʻa detection at KFR was generally observed from May through October coinciding with pregnancy (May to June), lactation (July to August), and fledgling/post lactation period (September to October). Foraging activity was also observed via feeding "buzzes", with highest numbers occurring from August through October.

Effects of the Action

The likely effects to nēnē, Hawaiian waterbirds, and ʻōpeʻapeʻa include effects associated with the following proposed activities: 1) air operations; 2) BASH management activities; 3) hazing and nest removal near launch pads; 4) use of driving range and athletic fields; 5) oxidation pond management and upgrades; 6) vehicular driving; 7) vegetation maintenance; 8) construction activities; 9) hazing for bird protection and safety; 10) PMRF hunting program; 11) predator control program; and 12) barbed wire fencing. Each stressor and benefit caused by the proposed actions may have consequences to nēnē, Hawaiian waterbirds, and ʻōpeʻapeʻa. The consequences of the proposed actions on each species (when applicable) are discussed below.

Consequences of the Proposed Action

Effects Associated with Air Operations

Air operations are expected to have adverse impacts to nēnē and all four Hawaiian waterbird species (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, and koloa maoli) as this activity is likely to result in direct aircraft strikes to these species. Nēnē are commonly observed in Kinikini Ditch near the runway and have nested within the vicinity of the airfield in the past. Nēnē are large-bodied birds with a low flight pattern and flocking behavior, which deems them high risk for air operations. Nēnē are relatives to Canada geese, which rank within the top 5 most hazardous species to aviation nationwide for both civilian and military aircraft (FAA 2018). Additionally, nēnē have proven highly adaptable and comfortable using human-altered habitats, which increases their risk to aircraft operations due to habituation. Most aircraft strikes (78%) occur below 1,000 ft above ground level (AGL), with 50% of those strikes occurring below 100 ft AGL (FAA 2013). The typical flight altitude of nēnē (328 ft. AGL) increases their hazard potential to aircraft at PMRF, specifically during take-off and landing (Banko et al. 2020).

All four Hawaiian waterbird species are commonly observed in Kinikini Ditch at the south end of the runway, and occasionally walk onto the runway creating a BASH risk. Hazing events at PMRF from 2015-2020 show that aeʻo and koloa maoli are the primary waterbirds hazed in relation to BASH management. In 2021, a Wildlife Hazard Assessment (WHA) for PMRF was completed for BASH risk. The WHA identified the nēnē and Laysan albatross as the two highest risk species to aircraft operations at PMRF Barking Sands. ʻAlae ʻula and ʻalae keʻokeʻo were determined as very high risk, koloa maoli as high risk, and aeʻo as moderate risk.

Between 2014 and 2021 there were 56 documented bird-aircraft strikes or near misses on the PMRF airfield (Figure 11). These incidents involved 12 different bird species, with nēnē involved in 3 near misses and 1 aircraft strike in 2020-2021. In September 2020, there was one aborted take-off due to 7 nēnē within the airfield AOA, and one air traffic control wave-off of an aircraft landing due to nēnē presence. In October 2020, there was another air traffic control wave-off of an aircraft landing due to nēnē presence. On 24 August 2021, the airfield reported its first nēnē strike involving a flock of 3-4 nēnē that hit the nose of a C-26D aircraft while approaching the PMRF runway resulting in a nēnē mortality. Nēnē presence on the airfield has been increasing, with over 100 nēnē hazed in one day in May 2021 within the airfield AOA. In all situations of nēnē involved in a near miss or aircraft strike, hazing was conducted the day of the incident.

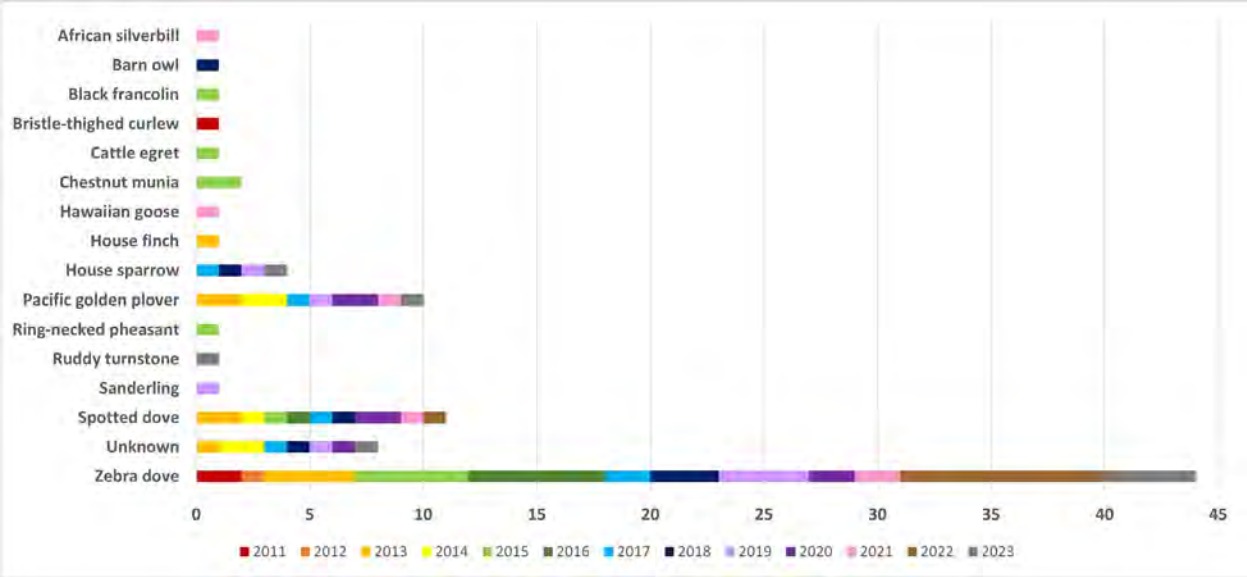

Figure 11. PMRF Airfield Strike and Near Miss Data from 2014 to 2023.

With the re-paving of the airfield, air operations are expected to increase at Barking Sands, which will increase the risk of aircraft strikes to wildlife. Air operations will rely on BASH management activities to reduce the likelihood of aircraft strikes to wildlife. However, despite these activities, aircraft strikes to wildlife are still expected to occur.

To estimate the number of aircraft strikes on nēnē and Hawaiian waterbirds at PMRF, we used data of the past documented bird-aircraft strikes or near misses at PMRF airfield. Based on this data, there have been incidents of 3 near misses and 1 aircraft strike over the course of a one-year period for nēnē (2020-2021). The 1 aircraft strike involved a flock of 3-4 nēnē. Considering the proposed BASH management activities and the increase in flight operations, we anticipate that up to 1 aircraft strike per year could occur for nēnē. Due to the past incident involving 4 nēnē individuals, it is anticipated that an average of up to 4 nēnē individuals per year may be taken in the form of injury or mortality due to aircraft strikes. Similarly, we anticipate that up to 1 aircraft strike per year could occur for each of the four Hawaiian waterbird species. However, due to their smaller population sizes near the airfield compared to nēnē, it is anticipated that up to 1 individual per year for each Hawaiian waterbird species (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, and koloa maoli) may be taken in the form of injury or mortality due to aircraft strikes.

Effects Associated with BASH Management Activities

BASH management activities are anticipated to have effects on nēnē and all four Hawaiian waterbird species (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, and koloa maoli). Specifically, adverse effects are expected from the nēnē nest removal. Effects associated with BASH hazing for Hawaiian waterbirds, BASH hazing for nēnē, and habitat modification and exclusion are not anticipated to rise to the level of adverse effects. The effects of each activity on the relevant species are discussed in the following subsections.

Habitat Modification and Exclusion

Habitat modification and exclusion projects will be implemented as a BASH management activity to reduce the attractiveness of hazardous areas to listed species. Nēnē and all four Hawaiian waterbird species are known to use the proposed project areas. All habitat modification and exclusion projects will require a nest survey by a qualified biologist prior to commencement of work, and no work will commence within 100 ft of an active listed species nest. Additionally, a biological monitor will be present during vegetation removal work to ensure work is conducted outside of the 100 ft buffer. By implementing these conservation measures, adverse impacts to nēnē and the four waterbird species are highly unlikely to occur and are considered discountable. Therefore, it is expected that effects associated with habitat modification and exclusion as a BASH management activity may affect but are not likely to adversely effect nēnē and all four Hawaiian waterbird species.

BASH Hazing for Hawaiian Waterbirds

All four species of Hawaiian waterbirds are commonly observed in Kinikini Ditch at the south end of the runway, creating a BASH risk. Proposed BASH hazing methods for Hawaiian waterbirds include pyrotechnics, noise makers (sirens, horns, clapping), mylar tape, flags, effigies, air dancers, balloons, access control (net, fence), static deterrents (geotech cloth), vehicle harassment and on foot harassment. To date, koloa maoli and aeʻo are the only Hawaiian waterbirds that have been hazed at PMRF as a part of the BASH program. However, ʻalae ʻula and ʻalae keʻokeʻo are likely to be hazed in the future due to their presence in the proposed hazing areas. BASH hazing of Hawaiian waterbirds is proposed when they are observed on the airfield or within 750 ft from the runway and determined to be a direct risk to flight operations.

When hazed, Hawaiian waterbirds are expected to be startled, disturbed, and to temporarily abandon their normal behavior and the areas they currently occupy. They may be stressed, miss feedings, miss provisioning their young, or may leave the area. However, these disruptions to their normal behavior would not result in reduced fitness, physical injury, or mortality because the disruptions are temporary. Hazing of Hawaiian waterbirds will be conducted by trained personnel that will avoid injuring or harming birds by following the protocols outlined in Appendix A. While hazing may disrupt birds from their normal behavior, it is not expected that the proposed hazing will reduce the fitness or survivorship of Hawaiian waterbirds. Additionally, BASH hazing will remove Hawaiian waterbirds from hazardous areas and reduce the risk of injury or death from aircraft strikes. Considering the hazing activities as proposed and their associated conservation measures, we do not expect the project to result in any meaningful disruption to their normal behaviors, nor any measurable reduction in reproductive success or reduced fitness. Therefore, effects to all four Hawaiian waterbird species associated with BASH hazing are expected to be insignificant.

BASH Hazing for Nēnē

BASH hazing for nēnē will occur year-round, with increased efforts prior to and during the nēnē breeding season (September-April). Hazing is conducted by trained staff utilizing techniques in Table 1. Majority of the techniques as described are authorized by the nēnē 4(d) rule. However, hazing of brooding adults (e.g., adults with an active nest or gosling) and/or adults in molt is prohibited under the nēnē 4(d) rule. PMRF is proposing to implement hazing of gravid females

not actively nesting, families with mobile young, breeding pairs and/or molting adults within 8,000 ft. of the airfield (nēnē family hazing zone). The techniques proposed within the nēnē family hazing zone include vehicle harassment (excluding families with mobile young), on-foot harassment, noise making (i.e., sirens, horns, clapping), and static deterrents (i.e., flags, mylar tape, scarecrow, inflatable dancers, balloons). These hazing techniques will be implemented with the understanding that these individuals are vulnerable and will be hazed with extra care.

When hazed, gravid females not actively nesting, families with mobile young, breeding pairs and molting adults are expected to be startled, disturbed, and temporarily abandon their normal behavior and the areas they currently occupy. Similar to effects on Hawaiian waterbirds noted above, nēnē may be stressed, miss provisioning their young, or leave the area. However, these disruptions to their normal behavior will be temporary and are not expected to result in physical injury or mortality as proposed. Additionally, BASH hazing will remove nēnē from hazardous areas, deter nesting near the airfield, and ultimately reduce the risk of injury or death from aircraft strikes. Considering the hazing activities as proposed and their associated conservation measures, we do not expect the project to result in any meaningful disruption to their normal behaviors, nor any measurable reduction in reproductive success or reduced fitness. Therefore, effects to nēnē associated with BASH hazing are expected to be insignificant.

Nēnē Nest Removal Zone

The nēnē nest removal zone (NNRZ) is expected to have adverse effects on nēnē. PMRF has coordinated to establish the NNRZ that extends 750 ft on either side of the runway centerline, 150 ft on either side of the taxiway's centerlines, and 100 ft from the edge of aircraft parking aprons (Figure 4). PMRF is proposing to remove nēnē nests within the NNRZ, which would result in direct mortality from the destruction of the eggs in the nest. In the event a nēnē establishes a nest inside the proposed NNRZ, PMRF NR will notify the Service within 24 hours. PMRF will determine the stage of nest development and timing for nest removal, if determined necessary, and follow procedures described in Appendix A.

To estimate the number of nests destroyed by nest removal, we considered past nesting data within the NNRZ, nēnē population trends at PMRF Barking Sands, and conservation measures being implemented to deter nesting. From 2014 to 2022, there were a total of 14 nests documented within the proposed NNRZ boundary with a range of between 0 to 6 nests per year. Given the relatively large range of nests in this area per year, we estimated both an average and maximum number of nests that may be destroyed. Over that 8 year period, there was an average of 1.75 and maximum of 6 nests documented per year within the proposed NNRZ boundary. Conservation measures to deter nesting in this area will include various hazing techniques, vegetation maintenance, and habitat modification and exclusion projects. Considering the increase in nēnē population at PMRF Barking Sands, despite the conservation measures being implemented, it is likely that the number of nēnē nests established in these areas may slightly increase. Therefore, it is anticipated that up to an average of 3 nēnē nests per year and maximum of 7 nēnē nests in one year may be taken in the form of mortality due to nest destruction within the NNRZ.

Effects Associated with Hazing and Nest Removal Near Launch Pads

Effects associated with this activity are expected for nēnē, as they are the only species that utilize the areas near launch pads at PMRF Barking Sands. The proposed hazing near launch pads at PMRF Barking Sands involves hazing nēnē within 500 ft from a launch site or live fire activity when these activities are scheduled within 30 days. Hazing would be conducted by trained personnel and will use the techniques outlined in Table 2. Use of these hazing techniques near launch pads are expected to be compliant with the nēnē 4(d) rule and will not involve brooding/molting adults. However, numerous launch pads are within 8,000 ft of the airfield (designated as the nēnē family hazing zone). Therefore, in instances when hazing of brooding/molting adults is necessary near launch pads, the techniques described for the nēnē family hazing zone (Table 1) will be used. Effects of hazing techniques used in the nēnē family hazing zone were described and analyzed in the previous section (BASH Hazing for Nēnē).

Nest removal near launch pads is expected to have adverse effects on nēnē. PMRF is proposing to include a 200 ft buffer around launch sites or live fire areas. If a nest is found within this buffer with a launch or live fire activity scheduled within 30 days, it may be considered for removal. The nēnē nest will only be removed if the launch or live fire activity is not able to be delayed or relocated and it is determined to be a safety risk for the mission activity. This would result in direct mortality from the destruction of the eggs in the nest. In some scenarios, it may be determined that nest removal is not required and the nest will be monitored to document any potential effects from the activity. In that scenario, without an appropriate buffer (100 ft) around the nest to exclude disturbing activities there is likely to be injury or mortality of eggs in the nest due to nest failure or abandonment as a result of disturbance from the launch or live fire activities.

To estimate the number of nests destroyed by nest removal and number of nests that could be abandoned due to disturbance from launch or live fire activities, we considered past nesting data and conservation measures being implemented to deter nesting near launch pads. Based on past nesting data, the majority of nēnē nesting at PMRF Barking Sands has occurred in the southern portion of the base away from the launch pads. Since FY14, there have been less than 10 nēnē nests documented north of the airfield, where the launch pads are located. Additionally, conservation measures such as hazing and ongoing vegetation maintenance will reduce or maintain this low level of nēnē nesting near launch pads. Considering nēnē nesting is expected to remain low near launch pads, we anticipate that very few nēnē nests will be destroyed or could be abandoned due to this activity. Therefore, it is anticipated that up to 1 nēnē nest per year may be taken in the form of mortality due to nest destruction near launch pads; and up to 1 nēnē nest per year may be taken in the form of injury or mortality due to nest failure or abandonment as a result of disturbance associated with launch or live fire activities.

Effects Associated with Use of Driving Range and Athletic Fields

The use of the driving range and athletic fields are anticipated to have effects on nēnē that do not rise to the level of adverse effects. Hawaiian waterbirds are not expected to be impacted by this activity as they have not been observed in these areas, with their nearest observations occurring

at the Oxidation Pond over 0.6 miles away. Nēnē have been observed foraging within the vicinity of these areas. However, no documented nests have ever been recorded on the driving range or athletic fields. This activity involves the risk of nēnē being accidentally struck by a golf ball. However, due to the infrequent use of the driving range and by implementing the conservation measures above (i.e., installing signage, and ceasing ball striking if nēnē are observed), adverse impacts are highly unlikley to occur and are considered discountable. Therefore, it is expected that effects associated with the use of driving range and athletic fields may affect, but are not likely to adversely affect nēnē.

Effects Associated with Oxidation Pond Management and Upgrades

Oxidation Pond management and upgrades may include activities such as flushing of the ponds and dredging of accumulated sludge to reduce the occurrence of anaerobic conditions that lead to avian botulism. One project in particular, the Oxidation Pond re-lining project, is expected to have adverse effects on the nēnē, ʻalae keʻokeʻo, and koloa maoli. The project description above mentions hazing occurring associated with this project. Hazing associated with the Oxidation Pond re-lining project is analyzed in the "Hazing for Bird Protection and Safety" section below, as this type of hazing is described in that section (i.e., hazing near activities [construction equipment operation] that may cause injury or mortality).

Nēnē, ʻalae keʻokeʻo, and koloa maoli are known to occur at the Oxidation Pond complex. Nēnē have been documented nesting in the adjacent dry, grassy, basins; and ʻalae keʻokeʻo have nested along the edge of the main Oxidation Pond and in the outfall basin. While no koloa maoli nests have been recorded here, families with young ducklings use the main pond and outflow basin and are believed to be nesting near the complex.

The Oxidation Pond re-lining project is likely to cause disturbance to the nēnē, ʻalae keʻokeʻo, and koloa maoli in the vicinity. Conservation measures include vegetation removal to reduce suitable nesting habitat and conducting nest surveys prior to construction activities. If a nest is discovered within the project footprint, a determination will be made if a 100 ft buffer can reasonably be implemented and prevent disturbance within that buffer until the chick(s)/gosling(s) have hatched and safely leave the nest site. However, if a buffer cannot be implemented, work will continue in the area up to the nest site. In cases where a buffer cannot be implemented, the disturbance caused by construction activities may lead to nest abandonment.

To estimate the number of nests that could be abandoned from disturbance caused by construction activities, we used data of nests documented at the Oxidation Pond for each species. We also considered the estimated length of the project (6-8 months) and the proposed conservation measures being implemented. Data has shown that within the past five years, the maximum number of nests observed annually for each species at the Oxidation Pond are as follows: 6 for nēnē in FY22, 6 for ʻalae keʻoʻkeʻo in FY21, and 9 observations of family groups (0 nests) for koloa maoli in FY20. By implementing the conservation measures above, such as vegetation removal to reduce suitable nesting habitat, we expect a significantly a smaller number of nests than those maximum numbers to occur during this project. Additionally, by conducting nests surveys, and implementing a 100 ft buffer around nests when feasible, the number of nest

abandonments caused by disturbance for each species is expected to be minimal. Therefore, it is anticipated that up to one nest of each species (nēnē, ʻalae keʻokeʻo, and koloa maoli) may be taken in the form of injury or mortality due to nest failure or abandonment because of disturbance associated with the Oxidation Pond re-lining project.

Effects Associated with Vehicular Driving

Vehicular driving occurs at all PMRF sites at varying levels and is expected to have adverse effects on nēnē and all four Hawaiian waterbird species (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, and koloa maoli). Vehicular driving has proven to be a larger concern to wildlife than previously thought, particularly at PMRF Barking Sands. This site has the highest use of vehicular driving compared to other PMRF sites.

Vehicle strikes for nēnē, and all four Hawaiian waterbird species have been documented at PMRF (Figure 12). Additionally, nēnē populations have increased across Kauaʻi and at PMRF in recent years, increasing the risk for vehicle strikes. There have been numerous conservation measures completed at PMRF Barking Sands to address this issue, such as rumble strips, reduced speed limits, increased speed limit enforcement, and increased awareness. Additional conservation measures proposed include installation of traffic calming measures at high-risk locations, speed bumps, signage, and a moveable LED sign. Hazing will also be implemented for bird protection and safety to reduce the risk of vehicle strikes in hazardous areas. Despite all these measures, vehicle strikes to these species are likely to occur.

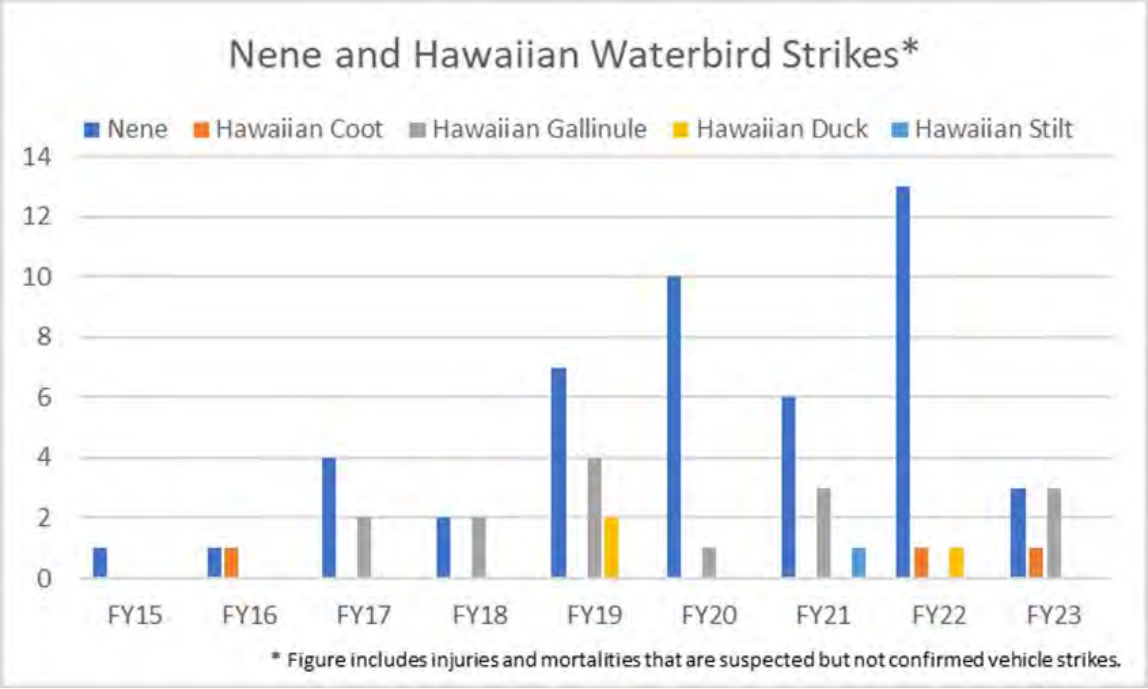

Figure 12. Nēnē and Hawaiian waterbird vehicle strikes at PMRF from FY 2014 to 2023.

To estimate the number of nēnē that could be injured or killed due to vehicle strikes, we used the previously documented data of vehicle strikes at PMRF (Figure 12). Within the last 5 years

(FY19-23), there has been between 3 to 13 vehicle strikes of nēnē per year. Due to the large range of strikes between years, we estimated both an average and maximum number of nēnē that could be impacted. In the last 5 years, there has been an average of 7.8 and a maximum of 13 nēnē struck by vehicles per year. Considering the increase in nēnē population at PMRF, despite the conservation measures being implemented, it is likely that the number of nēnē struck by vehicles per year may increase slightly. Therefore, it is anticipated that up to an average of 10 nēnē per year and a maximum of 15 nēnē in one year may be taken in the form of injury or mortality due to vehicle strikes.

To estimate the number of each Hawaiian waterbird species that could be injured or killed due to vehicle strikes, we again used previously documented data of vehicle strikes at PMRF (Figure 12). Compared to nēnē, vehicles strikes for Hawaiian waterbirds at PMRF has been much lower likely due to population sizes and the areas that these species use on base. Within the last 5 years (FY19-23), there has been 1 vehicle strike in FY21 for aeʻo; between 1 and 4 vehicle strikes per year for ʻalae ʻula; 1 vehicle strike in FY16, FY22, and FY23 for ʻalae keʻokeʻo; and 2 vehicle strikes in FY19 and 1 in FY22 for koloa maoli. Due to the small range of strikes between years and much lower number of strikes per year for Hawaiian waterbirds, we did not estimate an average number impacted per year as we did with nēnē. However, like nēnē, considering the projected population increases for these species at PMRF, despite the conservation measures being implemented, it is likely that the number of each Hawaiian waterbird species struck by vehicles per year may increase slightly. Therefore, it is anticipated that up to: 1 aeʻo per year, 5 ʻalae ʻula per year, 2 ʻalae keʻokeʻo per year, and 3 koloa maoli per year may be taken in the form of injury or mortality due to vehicle strikes.

Effects Associated with Vegetation Maintenance

Vegetation maintenance occurs throughout PMRF sites, but primarily at PMRF Barking Sands, Makaha Ridge, and Kōkeʻe. Vegetation maintenance includes mowing of grass areas, pruning of landscaping vegetation, grass-cutting and clearing, and tree trimming. These activities are anticipated to have impacts that do not rise to the level of adverse effects on nēnē and all four Hawaiian waterbird species (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, and koloa maoli). However, tree trimming activities as proposed are expected to have adverse impacts on the ʻōpeʻapeʻa.

Vegetation maintenance activities such as operation of mowers, other mechanical tools, and grazing sheep have the potential to cause physical disturbance to nēnē and Hawaiian waterbirds, particularly those that are actively nesting. By incorporating conservation measures such as conducting nest surveys prior to vegetation maintenance and establishing a 100 ft buffer around active nests to avoid disturbance, adverse impacts to these species are highly unlikely to occur and are considered discountable. Therefore, it is expected that effects associated with vegetation maintenance may affect, but are not likely to adversely affect nēnē and all four Hawaiian waterbird species.

Tree trimming activities associated with vegetation maintenance are likely to have adverse effects on the ʻōpeʻapeʻa. ʻŌpeʻapeʻa roost in woody vegetation and will leave their young unattended in trees and shrubs when they forage. If trees or shrubs 15 ft or taller are cleared

during the pupping season, June 1 through September 15, there is a risk that young bats could inadvertently be harmed or killed, since they are too young to fly or move away from disturbance. The majority of tree trimming activities at PMRF will occur outside of the pupping season. However, there are emergency situations where trimming of woody vegetation over 15 ft tall is determined necessary within the bat pupping season. In these situations, a PMRF biologist will conduct thermal imaging of trees to determine presence or absence of roosting sites. If a roost is not detected, tree trimming will commence. If a roost is detected, tree trimming will occur outside of a 100 ft buffer from any known roost. In emergency situations where trimming or removal of a tree with a known bat roost is determined necessary (e.g., for human life, health or safety), PMRF NR staff will coordinate with the Service prior to commencement of activities to report the situation. Considering the conservation measures above, emergency tree trimming activities, particularly in cases with detected roosts, are likely to be rare. It is expected that up to two ʻōpeʻapeʻa roosts may be taken in the form of injury or mortality for the 10-year term of this proposed action. Because the average number of pups produced each year is estimated to be 1.8, we define a roost as 1 adult ʻōpeʻapeʻa and 2 pups. Therefore, it is anticipated that up to 2 adult ʻōpeʻapeʻa and 4 pups in 10 years may be taken in the form of injury or mortality due to emergency tree trimming activities associated with vegetation maintenance.

Effects Associated with Construction Activities

Construction activities are anticipated to have impacts that do not rise to the level of adverse effects on nēnē and all four Hawaiian waterbird species (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, and koloa maoli). The types of proposed construction activities include repairs, maintenance and upgrade projects, and replacement or reconstruction projects. The proposed future construction activities at PMRF are included in Table 3. These projects may involve use of heavy equipment that have the potential to cause physical disturbance to nēnē and Hawaiian waterbirds, particularly those that are actively nesting. By implementing conservation measures such as conducting nest surveys prior to construction activities and implementing a 100 ft buffer around active nests, adverse impacts to these species are highly unlikely to occur and are considered discountable. Therefore, it is expected that effects associated with construction activities may affect, but are not likely to adversely affect nēnē and all four Hawaiian waterbird species.

Effects Associated with Hazing for Bird Protection and Safety

Hazing for bird protection and safety is anticipated to have impacts that do not rise to the level of adverse effects on nēnē and all four Hawaiian waterbird species (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, and koloa maoli). Hazing for bird protection and safety will be implemented in areas determined to be high risk for these species (e.g., along roadways and in situations of imminent danger). Hazing techniques utilized for this purpose will include on-foot harassment, horns/clapping, and inflatable air dancers (Table 4). For nēnē, most hazing will be conducted on non-brooding/molting adults in compliance with the nēnē 4(d) rule. However gravid females not actively nesting, families with mobile young, breeding pairs and molting adults may be hazed with the understanding that these individuals are vulnerable and will be hazed with extra care.

When hazed, nēnē and Hawaiian waterbirds are expected to be startled, distrubed, and temporarily abandon their normal behavior and the areas they currently occupy. Birds may be

stressed, miss provisioning their young, or leave the area. However, these disruptions to their normal behavior are not expected to result in physical injury or mortatilty and disruptions will be temporary. This type of hazing as proposed is not expected to reduce the fitness or survivorship of nēnē or Hawaiian waterbirds. Additionally, hazing for bird protection and safety will remove these species from areas of imminent danger or threats and reduce the overall risk of death or injury associated with the perceived threat (e.g., vehicle collision). Considering the hazing activities as proposed and their associated conservation measures, we do not expect the project to result in any meaningful disruption to their normal behaviors, nor any measurable reduction in reproductive success or reduced fitness. Therefore, effects to nēnē and all four Hawaiian waterbird species associated with hazing for bird protection and safety are expected to be insignificant.

Effects Associated with the PMRF Hunting Program

The PMRF hunting program is anticipated to have impacts that do not rise to the level of adverse effects on nēnē and all four Hawaiian waterbird species (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, and koloa maoli). The hunting program includes three PMRF sites: Barking Sands, Makaha Ridge, and Kamokala caves. Hunting is limited to feral hogs, feral goats, and black tailed deer with the use of bow and arrow only; dogs and firearms are prohibited. Hunting activities have the potential to cause physical disturbance to nēnē and Hawaiian waterbirds if hunters approach a species too quickly or are unaware of their presence. By implementing conservation measures such as closing hunting areas with known listed species attractants during breeding seasons and briefing hunters on protocols/listed species, adverse impacts to these species are highly unlikely to occur and are considered discountable. Therefore, it is expected that effects associated with the PMRF hunting program may affect, but are not likely to adversely affect nēnē and all four Hawaiian waterbird species.

Effects Associated with the Predator Control Program

The predator control program at PMRF is beneficial for nēnē and all four Hawaiian waterbird species. The primary purpose of this program is to control feral cats and rodents that are threats to these listed species. Predator control will use both live traps (to target cats) and self-resetting A24 traps (to target rodents). While this activity is largely beneficial and critical to management of these species, there are potential adverse effects associated with the use of live traps on ʻalae ʻula and koloa maoli. Both species have been documented as incidentally trapped by live/cage traps throughout Hawaiʻi predator control programs in the past. Because of their nature (e.g., ʻalae ʻula tend to be secretive) and tendency to seek cover when disturbed, in rare cases these species have proven to enter traps by mistake. While nēnē have also been documented as incidentally captured in live traps, this predator control activity as proposed is considered authorized under the nēnē 4(d) rule.

Conservation measures for live trapping will include trap-free buffer areas around high-use areas for listed species, checking traps daily, and full or partial shade on traps to protect trapped animals from exposure. Despite the conservation measures being implemented, incidental captures resulting in injury or death to ʻalae ʻula and koloa maoli may occur.

To estimate the number of ʻalae ʻula and koloa maoli incidentally captured by live traps, we referenced the best available trapping data for non-target captures by a predator control program at Hanalei National Wildlife Refuge (NWR). From 2014 to 2018, Hanalei NWR recorded an average incidental trap rate (i.e., rate of incidental captures of ʻalae ʻula) of 0.004280 and average number of trap nights of 2,009.2. Based on these data, we estimated that up to 9 (8.6) birds would be incidentally captured per year at their site. The average number of ʻalae ʻula and koloa maoli surveyed at Hanalei NWR during that period was 384 and 401, respectively. The average number of ʻalae ʻula and koloa maoli surveyed at PMRF sites is closer to 10 individuals, respectively, or about 39 times less than Hanalei NWR. Therefore, we took 9 birds per year divided by 39 to account for population differences between sites to equal 0.23 birds per year incidentally captured at PMRF sites. Over the 10-year term of this BO, this would be 2.3 birds of each species (ʻalae ʻula and koloa maoli) incidentally captured by live traps. Therefore, it is anticipated that up to three ʻalae ʻula and three koloa maoli in 10 years may be taken in the form of injury or mortality due to incidental capture associated with predator control activities.

Effects Associated with Barbed Wire Fencing

Barbed wire fencing at all PMRF sites is expected to have adverse effects on the ʻōpeʻapeʻa. ʻŌpeʻapeʻa forage for insects from as low as 3 ft to higher than 500 ft above the ground and can become entangled in barbed wire used for fencing. When bats forage and consume invertebrates, their sonar is disrupted while they are masticating, making them more prone to colliding with obstacles when flying. So thin strands of barbed wire may be difficult for bats to detect.

The areas surrounding barbed wire fencing at PMRF sites vary from tall vegetation, various sized structures/buildings, and large swaths of open areas. Barbed wire fencing surrounded by large open areas are particularly high risk for entanglement due to the lack of other structures/objects that bats could detect and avoid in the immediate vicinity of barbed wire. The total length of barbed wire fencing throughout all six PMRF sites includes 8.2 mi of 3-strand barbed wire fence, and 0.7 mi of 6-strand barbed wire fence. While there is no data available for density of ʻōpeʻapeʻa at PMRF sites, acoustical surveys have detected use of these sites by ʻōpeʻapeʻa throughout the year.

Considering the areas surrounding barbed wire fencing, the significant length of barbed wire fencing, and the presence of ʻōpeʻapeʻa at PMRF sites, adverse effects to ʻōpeʻapeʻa as a result of entanglement with barbed wire are likely to occur. To estimate the number of ʻōpeʻapeʻa that may become entangled with barbed wire, we used a formula derived by USGS studies. The formula estimates that 0.013 bats may be harmed per mile of each barbed wire strand per year. This estimate is derived from data gathered from known bat fatalities on barbed wire fencing. While this formula is based on a limited data set, it is the best data available to estimate the risk caused by barbed wire fencing. By using this formula, we multiplied 0.013 bats by 28.8 miles (total length of barbed wire strands) by 10 years (term of the proposed action) to equal 3.744 bats. Therefore, it is anticipated that up to 4 ʻōpeʻapeʻa in 10 years may be taken in the form of injury or mortality due to entanglement associated with barbed wire fencing.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

Conclusion

After reviewing the status of nēnē, aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, koloa maoli, and ʻōpeʻapeʻa, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the base infrastructure operations and maintenance at PMRF, as proposed, is not likely to jeopardize the continued existence of these species. No critical habitat has been designated for these species; therefore, none will be affected.

Adverse effects from the proposed action are anticipated to have low impacts on the nēnē reproduction and population. In total, up to an average of 6 nēnē nests per year may be injured or result in mortality due to nest failure/abandonment or nest destruction. While this impact may occur annually for the 10 year term of this action, this impact represents a slight reduction in reproductive effort and reproductive success at PMRF annually and is not expected to have population or species level impacts. The total take of nēnē individuals that may be injured or killed is up to an average of 14 nēnē individuals per year. This take represents approximately 0.4 percent of the total population (3,545) of nēnē and about 0.6 percent of the population of nēnē on Kauaʻi (2,199). While this take may occur annually, it is not expected to appreciably reduce the overall long-term total population of nēnē. Beneficial effects from implementing predator control should also mitigate some of these effects. Additionally, conservation measures are anticipated to avoid and minimize adverse effects, such as various traffic calming measures to reduce vehicle collisions, vegetation maintenance to decrease attractiveness of sites to nēnē, and hazing in areas to reduce the risk of injury or death to nēnē from hazards (e.g., BASH, roads/vehicles, etc.). Therefore, the overall effects from the proposed action on nēnē is not expected to appreciably reduce their long-term population and have population or species level impacts.

Adverse effects from the proposed action are anticipated to have low impacts on the aeʻo population. Up to 2 aeʻo individuals per year may be injured or killed, which is minimal compared to the overall estimated population of aeʻo statewide (1,400 to 2,200). Beneficial effects from implementing predator control should also mitigate some of these adverse effects. Therefore, the overall effects from the proposed action on aeʻo is not expected to appreciably reduce their long-term population and have population or species level impacts.

Adverse effects from the proposed action are anticipated to have low impacts on the ʻalae ʻula population. Up to 6 ʻalae ʻula individuals per year and an additional 3 individuals within the 10

year term of this action may be injured or killed, which is minimal compared to the overall population of ʻalae ʻula statewide (927) and on the island of Kauaʻi (596). Beneficial effects from implementing predator control should also mitigate some of these adverse effects. Therefore, the overall effects from the proposed action on ʻalae ʻula is not expected to appreciably reduce their long-term population and have population or species level impacts.

Adverse effects from the proposed action are anticipated to have low impacts on the ʻalae keʻokeʻo reproduction and population. Up to 1 ʻalae keʻokeʻo nest may be injured or result in mortality due to nest failure or abandonment, which represents a slight reduction in reproductive effort and reproductive success at PMRF. Up to 3 ʻalae keʻokeʻo individuals per year may be injured or killed, which is minimal compared to the overall population estimate of ʻalae keʻokeʻo statewide (1,815). Beneficial effects from implementing predator control should also mitigate some of these adverse effects. Therefore, the overall effects from the proposed action on ʻalae keʻokeʻo is not expected to appreciably reduce their long-term population and have population or species level impacts.

Adverse effects from the proposed action are anticipated to have low impacts on the koloa maoli reproduction and population. Up to 1 koloa maoli nest may be injured or result in mortality due to nest failure or abandonment, which represents a slight reduction in reproductive effort and reproductive success at PMRF. Up to 4 koloa maoli individuals per year and an additional 3 individuals within the 10-year term of this action may be injured or killed, which is minimal compared to the overall population estimate of koloa maoli on the island of Kauaʻi (947). Beneficial effects from implementing predator control should also mitigate some of these adverse effects. Therefore, the overall effects from the proposed action on koloa maoli is not expected to appreciably reduce their long-term population and have population or species level impacts.

Adverse effects from the proposed action are anticipated to have low impacts on the ʻōpeʻapeʻa population. Up to 10 individuals over the 10-year term of this action may be injured or killed. While ʻōpeʻapeʻa have been detected to use areas around PMRF sites, there is currently no data to show the total population of ʻōpeʻapeʻa in the action area. Conservation measures include tree trimming primarily occurring outside the pupping season, using thermal imaging to detect bats for emergency tree trimming, and visual surveys of barbed wire fences. While population trends have not been established for the island of Kauaʻi, the ʻōpeʻapeʻa population on the island of Hawaiʻi is considered to be stable to increasing. Therefore, the anticipated take of 10 individuals that may occur over the 10-year term of this action is not expected to cause downward trends in overall population and have species level impacts.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to

engage in any such conduct. Harm is further defined by FWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by FWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is following the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be undertaken by the Navy so that they become binding conditions of any grant or permit issued by the Navy, as appropriate, for the exemption in section 7(o)(2) to apply. The Navy has a continuing duty to regulate the activity covered by this incidental take statement. If the Navy (1) fails to assume and implement the terms and conditions or (2) fails to require any applicant (e.g., contractor) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Navy must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

Amount or Extent of Take Anticipated

The Service anticipates the following incidental take may occur over the 10-year term of this proposed action:

Hawaiian Goose or Nēnē

- Up to four (4) nēnē individuals per year may be taken in the form of injury or mortality due to aircraft strikes associated with air operations.
- Up to an average of three (3) nēnē nests per year and a maximum of seven (7) nēnē nests in one year may be taken in the form of mortality due to nest destruction within the nēnē nest removal zone.
- Up to one (1) nēnē nest per year may be taken in the form of mortality due to nest destruction near launch pads.
- Up to one (1) nēnē nest per year may be taken in the form of injury or mortality due to nest failure or abandonment because of disturbance associated with launch or live fire activities near launch pads.
- Up to one (1) nēnē nest may be taken in the form of injury or mortality due to nest failure or abandonment because of disturbance associated with the Oxidation Pond re-lining project.
- Up to an average of ten (10) nēnē individuals per year and a maximum of fifteen (15) nēnē individuals in one year may be taken in the form of injury or mortality due to

vehicle strikes.

Hawaiian Stilt or Aeʻo

- Up to one (1) aeʻo individual per year may be taken in the form of injury or mortality due to aircraft strikes associated with air operations.
- Up to one (1) aeʻo individual per year may be taken in the form of injury or mortality due to vehicle strikes.

Hawaiian Gallinule or ʻAlae ʻula

- Up to one (1) ʻalae ʻula individual per year may be taken in the form of injury or mortality due to aircraft strikes associated with air operations.
- Up to five (5) ʻalae ʻula individuals per year may be taken in the form of injury or mortality due to vehicle strikes.
- Up to three (3) ʻalae ʻula individuals may be taken in the form of injury or mortality due to incidental capture associated with predator control activities.

Hawaiian Coot or ʻAlae Keʻokeʻo

- Up to one (1) ʻalae keʻokeʻo individual per year may be taken in the form of injury or mortality due to aircraft strikes associated with air operations.
- Up to one (1) ʻalae keʻokeʻo nest may be taken in the form of injury or mortality due to nest failure or abandonment because of disturbance associated with the Oxidation Pond re-lining project.
- Up to two (2) ʻalae keʻokeʻo individuals per year may be taken in the form of injury or mortality due to vehicle strikes.

Hawaiian Duck or Koloa Maoli

- Up to one (1) koloa maoli individual per year may be taken in the form of injury or mortality due to aircraft strikes associated with air operations.
- Up to one (1) koloa maoli nest may be taken in the form of injury or mortality due to nest failure or abandonment because of disturbance associated with the Oxidation Pond re-lining project.
- Up to three (3) koloa maoli individuals per year may be taken in the form of injury or mortality due to vehicle strikes.
- Up to three (3) koloa maoli individuals may be taken in the form of injury or mortality due to incidental capture associated with predator control activities.

Hawaiian Hoary Bat or ʻŌpeʻapeʻa

- Up to two (2) adult ʻōpeʻapeʻa and four (4) pups may be taken in the form of injury or mortality due to emergency tree trimming activities associated with vegetation maintenance.
- Up to four (4) ʻōpeʻapeʻa individuals may be taken in the form of injury or mortality due to entanglement associated with barbed wire fencing.

Effect of Take

In this biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy of the nēnē, aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, koloa maoli, and ʻōpeʻapeʻa.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of nēnē, aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, koloa maoli, and ʻōpeʻapeʻa:

1. The Navy will minimize the potential for death and injury of nēnē and all four Hawaiian waterbird species (aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, and koloa maoli) due to aircraft strikes and vehicle strikes.

2. The Navy will minimize the potential for death and injury of ʻalae ʻula and koloa maoli due to incidental capture associated with predator control. Implementation of predator control will provide an overall benefit to nēnē and all four Hawaiian waterbird species.

3. The Navy will minimize the potential for death and injury of nēnē, ʻalae keʻokeʻo, and koloa maoli due to nest destruction (for nēnē only) or nest failure/abandonment associated with nest removal (for nēnē only) or disturbance from project activities (e.g., activities near launch pads and Oxidation Pond re-lining project).

4. The Navy will minimize the potential for death and injury of ʻōpeʻapeʻa due to emergency tree trimming activities and entanglement with barbed wire fencing.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Navy must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. The following terms and conditions apply to all reasonable and prudent measures (#1-4) above:

- The Navy will notify the Service by email or telephone within 24 hours upon the discovery of an injured or dead nēnē, aeʻo, ʻalae ʻula, ʻalae keʻokeʻo, koloa maoli, or ʻōpeʻapeʻa. The Navy will provide the Service a written notification, summarizing the event, within 30 days. Written notification will include details such as date/time of discovery, relevant species information (e.g., age, if banded bird), location, probable cause of injury or death with supporting evidence, condition of specimen, and any action(s) taken.

- The Navy will notify the Service by email or telephone within 24 hours upon the discovery of an abandoned or failed nēnē, ʻalae keʻokeʻo, or koloa maoli nest. The Navy will provide the Service a written notification, summarizing the event, within 30 days.

Written notification will include details such as the date/time of discovery, nest details (e.g., number of eggs, age/lay date, etc.), location, probable cause of abandonment or failure with supporting evidence, condition of the nest/eggs, and any action(s) taken.

- The Navy will notify the Service by email or telephone within 24 hours upon the discovery of a nēnē nest that is considered for removal (i.e., nest destruction) within the NNRZ or near launch pads. If nest removal is carried out, the Navy will provide the Service a written after-action report, summarizing the event, within 30 days. The after-action report will include details such as date/time of nest discovery, nest details (e.g., number of eggs, age/lay date, etc.), location, efforts to prevent nesting in the area (i.e., hazing, monitoring, vegetation maintenance), and details of the action/nest removal.

- The Navy will notify the Service by email or telephone within 24 hours upon determining emergency trimming or removal of a tree with a known ʻōpeʻapeʻa roost may be necessary. This notification will occur prior to commencement of tree trimming or removal activities. If trimming or removal of a tree with a known ʻōpeʻapeʻa roost is carried out, the Navy will provide the Service a written after-action report, summarizing the event, within 30 days. The after-action report will include details such as date/time of action, location, reason for emergency, details of roost, protocols followed, details of the action(s), and impacts to roost observed.

- The Navy will submit annual reports detailing the implementation of the above conservation measures used to minimize impacts for the effects of the action. Annual reports will also summarize survey and monitoring results, hazing efforts, and levels of take or potential take of all listed species (summary of written notifications and after-action reports above). Annual reports will be submitted to the Service by February 1 following the end of each fiscal year. If an extension is needed, the Navy will notify the Service to coordinate.

- Should take of listed species occur and the carcass recovered, the Service may request that the carcass be subjected to necropsy. Otherwise, the depository designated to receive specimens that are found is the B.P. Bishop Museum, 1525 Bernice Street, Honolulu, Hawaiʻi, 96817 (telephone: 808/847-3511). If the B.P. Bishop Museum does not wish to accession the specimens, contact the Service's Division of Law Enforcement in Honolulu, Hawaiʻi (telephone: 808/861-8525; fax: 808/861-8515) for instructions on disposition.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service recommends the Navy undertake the following conservation recommendations:

- The Navy should consider coordinating with the Service and other partners to explore potential opportunities for relocating nēnē from PMRF to other locations. This would reduce the population of nēnē at PMRF that may be impacted by the proposed action.

- The Navy should continue efforts to assess and implement traffic calming measures to further reduce the risk of vehicle strikes to nēnē and Hawaiian waterbirds.

- The Navy should support efforts and contribute funds to projects that support the recovery and conservation of nēnē and Hawaiian waterbirds and their habitats off installation.

- The Navy should support efforts and contribute funds to ʻōpeʻapeʻa research aimed at increasing our understanding of migration and resource use on the island of Kauaʻi. With limited information currently available, this type of research will increase our understanding of this species and allow us to make informed management decisions to benefit ʻōpeʻapeʻa on the island of Kauaʻi.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

Reinitiation-Closing Statement

This concludes formal consultation on the actions outlined in this biological opinion. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) if the amount or extent of taking specified in the incidental take statement is exceeded; (2) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action.

We appreciate your cooperation and assistance in helping us prepare this biological opinion. If you have any questions about this consultation, please contact Ryan Peʻa, Fish and Wildlife Biologist, at (808) 792-9400 or by email at ryan_pea@fws.gov. When referring to this project, please include this reference number: 2024-0133752-S7.

Sincerely,

AARON NADIG
Digitally signed by AARON NADIG
Date: 2025.01.15 15:22:16 -10'00'

Deputy Field Supervisor
Programmatic Operations

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APPENDIX A. Nene and Hawaiian Waterbird Hazing Protocols at PMRF Sites, 2024

Nene & Hawaiian Waterbird Hazing Protocols

Pacific Missile Range Facility (PMRF), Kauai, Hawaii

April 2024

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1. INTRODUCTION

1.1 Purpose

This protocol formalizes procedures for hazing nene and Hawaiian waterbirds – the Hawaiian duck, Hawaiian stilt, Hawaiian coot and Hawaiian gallinule at PMRF Main Base (hereafter referred to as Barking Sands) and associated sites. At Barking Sands there is Bird/Animal Aircraft Strike Hazard (BASH) hazing to protect human safety and reduce flight collisions with animals. At Barking Sands and associated PMRF sites there is also hazing to protect the military mission (i.e. launch sites, live fire training, etc.). At all PMRF sites with nene and/or Hawaiian waterbird presence there is hazing to protect birds from hazards related to operations and activities at PMRF sites. Hazards include strikes by vehicles, strikes by golf balls, injury or mortality due to vegetation maintenance or construction activities, injury or mortality due to launch activities and sickness or mortality due to botulism.

BASH hazing is conducted basewide year-round for nene, with an emphasis before and during the breeding season to non-nesting adults. Basewide hazing is conducted to discourage nene from habituating and nesting at Barking Sands, which can result in an increase of nene families utilizing PMRF and becoming a risk to mission or a BASH hazard to aviation. Hazing to breeding pairs is also conducted within the *proposed* 8,000 ft. buffer zone around the airfield, which extends south to Tartar Drive. Within this 8,000 ft. buffer zone breeding nene pairs are targeted for hazing to reduce successful nesting attempts within the current authorized NNRZ and the *proposed* ~~5,000~~ 200 ft. around launch pads Nene Nest Removal Zone (NNRZ).

Hazing may be conducted to breeding pairs and nene families for their protection anywhere on Barking Sands, Makaha Ridge or Kokee sites if they are in imminent danger (i.e. near roadsides, in close proximity to vegetation maintenance equipment, in close proximity to construction equipment). Nene may also be hazed within 500' from a launch pad or training site to deter nene from habituating near areas that may result in injury or mortality.

This protocol outlines personnel involved in hazing ESA-listed nene and Hawaiian waterbirds as well as the training requirements that must be met to haze. It integrates PMRF Air Operations BASH Program objectives with the PMRF Natural Resources Program objectives. Both programs are required to follow federal regulations that meet standards for safe air operations and for the protection of threatened and endangered species. These protocols *will* comply with the incidental take statement, terms and conditions as well as reasonable and prudent measures outlined in the Biological Opinion issued by the U.S. Fish and Wildlife Service (USFWS) to PMRF.

1.2 Location and Setting

The protocol applies to all PMRF sites where nene and/or Hawaiian waterbirds may occur. PMRF sites with known nene presence include, Barking Sands (2,060 acres), Makaha Ridge (209 acres) and Kokee Sites (19 acres). PMRF sites with known Hawaiian waterbird presence include Barking Sands. The majority of hazing activities will occur on Barking Sands due to the population numbers of nene and Hawaiian waterbirds coupled with the activities that take place on Barking Sands – airfield operations, range operations, launch activities, vehicular driving, vegetation maintenance, construction activities, etc. Hazing operations shall only occur within the borders of PMRF sites, including leased land, as deemed necessary for human and bird safety and protection.

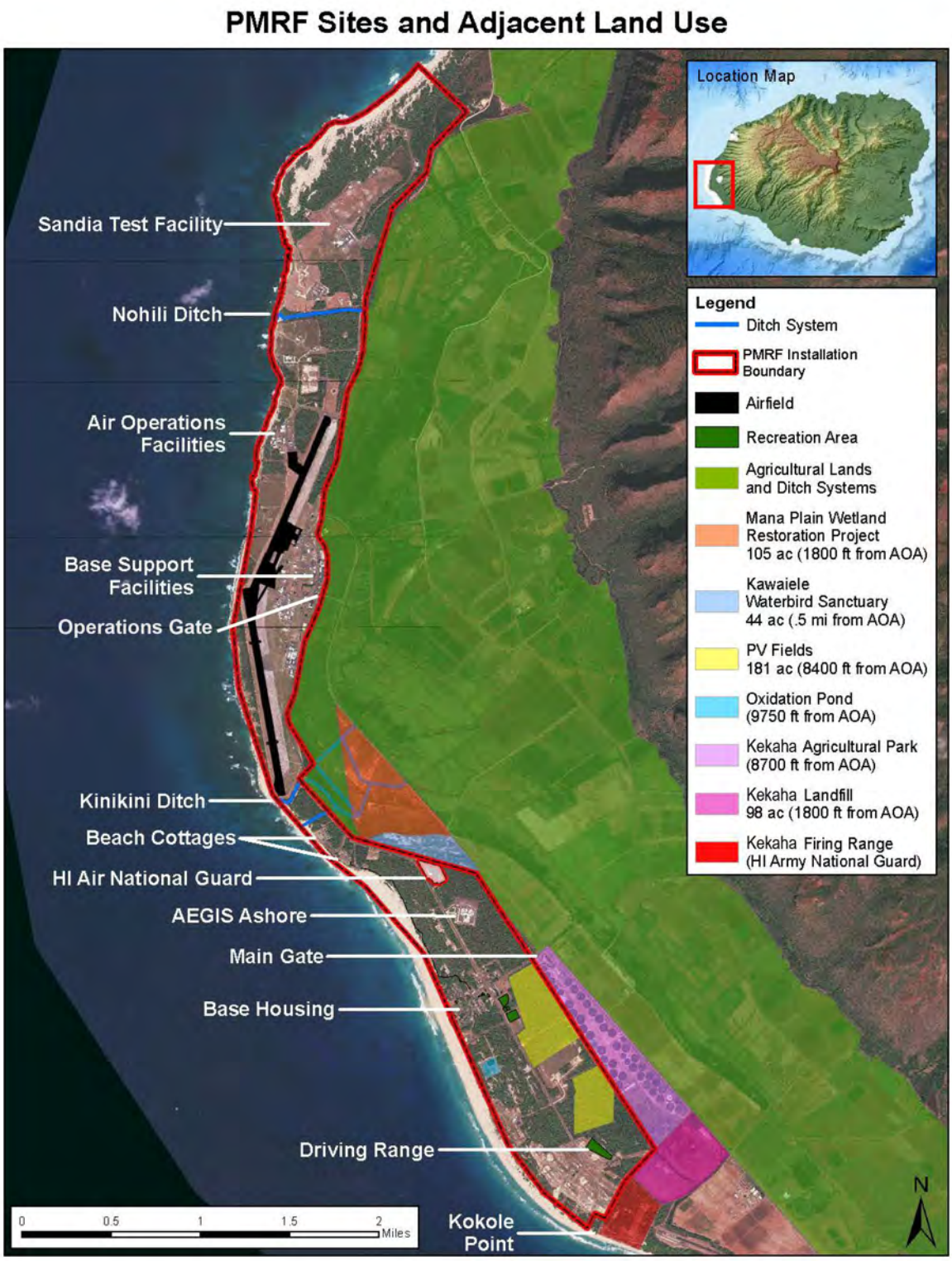

Figure 1. Map of PMRF Barking Sands and Adjacent Land Use.

2. NENE & HAWAIIAN WATERBIRD LISTING STATUS & BIOLOGY

ESA-Listed nene and Hawaiian waterbirds have different breeding seasons, including year round nesting by the Hawaiian duck, Hawaiian coot and Hawaiian gallinule. The primary method used to monitor abundance of these species and other wetland birds is the biannual state-wide waterbird count administered by the Hawaii Division of Forestry and Wildlife (DOFAW). The survey is conducted twice a year, in winter and summer, and covers most of the wetlands known to support waterbirds on each island, except Niihau. Additional surveys are conducted monthly by USFWS staff at each national wildlife refuge across the state of Hawaii.

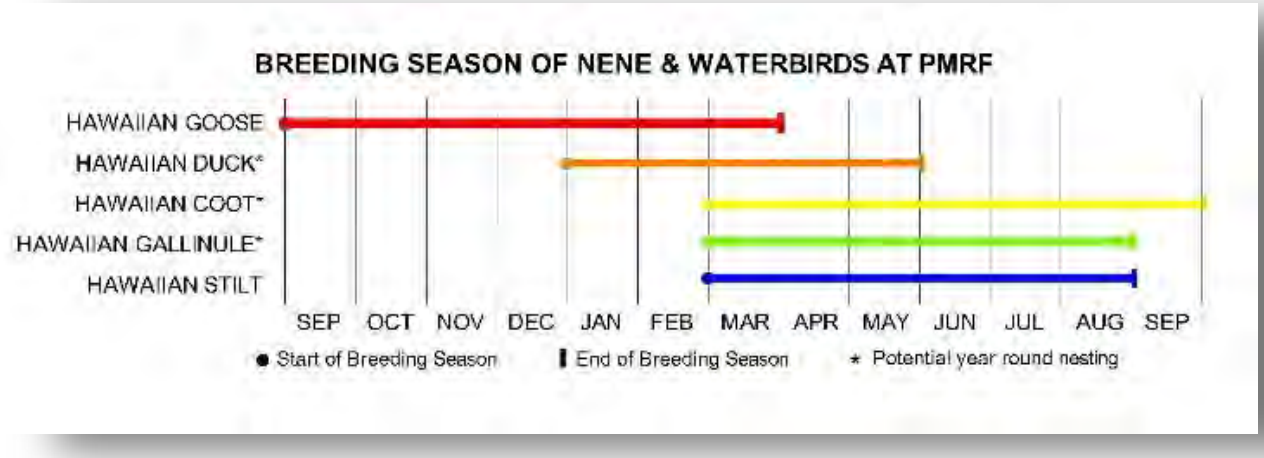

Figure 2. Breeding Seasons of Nene and Hawaiian Waterbirds

2.1 Hawaiian Goose (*Nene*)

Listing Status: Federally listed as threatened. On January 21, 2020 the Hawaiian Goose (nene) was reclassified under the US Fish and Wildlife Service's Endangered Species Act (ESA) from endangered to threatened, along with issuance of a Section 4(d) Rule. This rule allows for more flexibility in management and removes prohibitions on take for actions not anticipated to cause direct injury or mortality.

Population Size and Trends: In 1951, the wild nene population was estimated at 30 individuals. By 2014 the population was estimated at 2,450 birds (DLNR 2015). The 2017 statewide nene survey by DLNR DOFAW recorded 1,482 individuals on Kauai, which accounted for nearly half of the statewide counts, totaling 3,252 individuals; by 2019 Kauai was estimated to have 1,891 individuals. Populations on Kauai have been observed to be stable and increasing, although populations on the West-side of the island can be variable.

Breeding Season: The nene breeding season at PMRF generally spans from September – March, with increased nest building and clutches laid during October - December. However, goslings have been spotted as early as August at PMRF Barking Sands. Nests are shallow with moderately lined plant materials and down, usually hidden in dense vegetation. Non-native vegetation utilized for nesting include: Christmas berry (*Schinus terebinthifolius*), shrub verbena (*Lantana camara*), and ironwood (*Casuarina* spp.) (DLNR 2015). Females lay between one to five eggs, with an average clutch size of 3.5 on Kauai. Incubation takes around 30 days. Goslings fledge about 70-84 days after hatching. Goslings

typically stay with their family until the next breeding season or until they are able to breed at 2 years of age (Kauai Nene HCP, 2017).

Signs of breeding include courtship displays by males, in which they attack or threaten potential competitors, run back to their mate, and call loudly (DLNR 2015). If nene are hazed from a particular area and return back almost immediately, they may be scouting a potential nest site. Pairs typically mate for life, return to their previous years' nest site and live approximately 20 years.

Diet: Nene graze and browse on the leaves, seeds, flowers, and fruits of at least 50 native and nonnative grasses, sedges, composites, and shrubs. Diet varies by location and habitat, and they may require a diverse suite of food plants (DLNR 2015). At PMRF nene are observed grazing on seeding grass and newly emergent grasses, which is problematic when near roadsides, on or near the airfield, launch facilities and sources of Electromagnetic fields (EMF). They have also been observed foraging and loafing near pig divots.

2.2 Hawaiian Duck (*Koloa maoli*)

Listing Status: Federally listed as endangered.

Population Size and Trends: The Hawaiian duck population is estimated at 2,200 individuals, with 90 percent of individuals occurring on Kauai (DLNR 2015). The total population appears to be increasing due primarily to population increases on Kauai, but numbers are declining on other islands due to hybridization (Vanderwerf 2012). DLNR DOFAW conducts biannual state-wide counts of Hawaiian waterbirds, but due to hybridization and varied habitats, it is difficult to accurately measure population numbers. Hawaiian ducks occur in a variety of wetland habitats from sea level to 6,900 feet elevation.

Breeding Season: The Koloa is a small brownish duck, in which both sexes are similar in appearance to a female Mallard. Adult males and females are mottled brown overall. Males have darker heads and necks, olive bills and bright orange feet. The bills of females are more orange, their feet are dull orange, and they are smaller than males (DLNR 2015). Nesting occurs year-round, but most breeding activity occurs between January through May. Nests are usually on the ground in dense vegetation, near water. Clutch size ranges from two to ten eggs, with an approximately 30 day incubation period, and chicks hatching in April-June (VanderWerf 2012).

Diet: Koloa are opportunistic feeders and their diet includes snails, dragonfly larvae, earthworms, small fish, grass seeds, green algae, and seeds/leaf parts of wetland plants. They are usually found alone or in pairs and are guarded, especially when nesting or molting, although during the winter they may gather in larger numbers to exploit abundant food resources. Koloa typically forage in shallow water, less than 5 inches deep (DLNR, 2015).

2.3 Hawaiian Stilt (*Ae'o*)

Listing Status: Federally listed as endangered. USFWS is proposing to reclassify the Hawaiian stilt from endangered to threatened in 2021.

Population Size and Trends: Based on the biannual Hawaiian waterbird counts from 1998-2007, the Hawaiian stilt population averaged 1,484 birds, but fluctuated between approximately 1,100 and 2,100 birds. The population trend has been increasing over the past 30 years. (USFWS 2011). On Kauai, stilts are found in large rivers, on the Mana Plains, as well as reservoirs and former sugarcane settling ponds. Hawaiian Stilts move seasonally between Kauai and Niihau in response to water level changes in Niihau's

ephemeral lakes. (DLNR 2015). On PMRF Main Base, Hawaiian stilts are seen throughout the ditch systems.

Breeding Season: Adults are mostly black above and white below with a long, thin black bill and long, delicate pink legs. Females are more brownish on the back than males, and immatures have more white on the face and sides of the neck. Nesting occurs between March and August and peaks in May and June. Generally, three to four eggs are laid, and the precocial chicks hatch approximately 24 days later. Both parents incubate eggs and brood young, and fledglings remain with their parents for several months. (DLNR 2015). Nesting occurs on freshly exposed mudflats with some low-growing vegetation; individuals will also nest on islands in freshwater and brackish water ponds or artificial floating nest structures. They aggressively defend their nests, calling and diving at intruders and performing broken-wing displays to attract potential predators away from their nests. (DLNR 2015).

Diet: Foraging habitat consists of ephemeral freshwater, brackish water, or saltwater habitats. Hawaiian Stilts favor shallower water for foraging (<9 in.) and are more tolerant of higher salinity. They are opportunistic and prey on a variety of animals that inhabit shallow water or mudflats, including bristle worms, small crabs, insects, and small fish. Water depth, salinity levels and vegetation density are important determinants of foraging habitat suitability. (DLNR 2015).

2.4 Hawaiian Coot (*'Alae ke'oke'o*)

Listing Status: Federally listed as endangered.

Population Size and Trends: The Hawaiian coot occurs in coastal plain wetlands on all the Main Hawaiian Islands except for Kahoolawe; with about 80 percent of the population on Kauai (DLNR 2015). The average number of Hawaiian Coots observed during DLNR DOFAW's biannual statewide waterbird count has averaged about 2,000 from 1997-2006, but numbers have fluctuated between 1,500 and 2,800. The population trend has been increasing from 1981 to 2011. (USFWS 2011). On Kauai, coots are found at many locations, but the largest concentrations are at Hanalei National Wildlife Refuge (NWR), the Kauai Lagoons golf course, and fragmented wetlands on the Mānā Plain. Coots may move seasonally between Kauai and Niihau in response to water level changes in Niihau's ephemeral lakes, with over 900 birds counted on Niihau in particularly wet years. Hawaiian coots often use more open wetlands with deeper water. (USFWS 2011).

Breeding Season: Adult males and females have a black head, a slate gray body with white undertail feathers, and a prominent white frontal shield and bill; feet are lobed rather than webbed and are greenish gray. (DLNR 2015). The nesting season is primarily March – September, but varies depending on water levels, however nests can be found year-round. Nest initiation is tied to rainfall because appropriate water levels are critical to nest success. Clutch size range from three to ten eggs, and precocial young hatch after a 25-day incubation period (DLNR 2015). The nest is a platform built of aquatic vegetation and may be floating in open water, anchored to emergent vegetation, or in clumps of vegetation on the shoreline. Small islands may be preferred if available (USFWS 2011).

Diet: Hawaiian coots are generalist feeders that forage on the water surface, forage by diving down to pick at mud or sand and forage by grazing on upland grassy sites near wetlands. Foods eaten include algae, leaves and seeds, various invertebrates including snails, crustaceans, insects, larvae, tadpoles, and small fish. They prefer freshwater but are often found in brackish wetlands. They usually forage in water less than 12 in. deep, but can dive below the surface up to about 48 in. (USFWS 2011).

2.5 Hawaiian Gallinule (*'Alae 'ula*)

Listing Status: Federally listed as endangered.

Population Size and Trends: Hawaiian gallinules are currently found only on the islands of Kauai and Oahu, with each island supporting roughly half the total population, but historically Hawaiian gallinules occurred on all the main Hawaii Islands except Lanai and Kahoolawe (USFWS 2011). An average of 287 Hawaiian Gallinules were observed during the biannual state-wide waterbird count from 1998-2007 but numbers have fluctuated between about 100 and 450 (USFWS 2011). However, these numbers are not accurate and are best viewed as an index; the actual population size probably is higher, but it is difficult to estimate because of the species secretive habits and preference for densely vegetated wetlands. The population trend is thought to be increasing or stable (USFWS 2011). On Kauai, the largest populations occur in the Hanalei and Wailua river valleys, and in irrigation canals on the Mana Plains (VanderWerf, 2012). Key habitat features include dense stands of emergent vegetation along shorelines or in open water, floating or barely emergent mats of vegetation, and water depths less than 3 feet (DLNR 2015).

Breeding Season: The species' life history and breeding biology are poorly known. Adults are black above and dark slate blue below, with a white stripe on their flanks and a prominent red shield over their red and yellow bill. Feet are lobed rather than webbed, and males are larger than females (DLNR 2015). The nesting season is primarily March – September, but varies depending on water levels and presence of dense vegetation, with nests found in all months. Platform nests are constructed in dense vegetation over water less than 24 in. deep. Five to six eggs are laid and hatch after 22 days. Although chicks are precocial and can swim shortly after hatching, they are dependent on their parents for several weeks. (DLNR 2015). Hawaiian gallinules cannot fly for about 25 days each year when they are molting, usually from June-September, increasing their vulnerability to predation (DesRochers et al. 2009).

Diet: Gallinules use a variety of freshwater habitats and can be somewhat secretive, foraging in dense emergent or floating vegetation. They are opportunistic feeders, and their diet likely varies with habitat, but includes algae, grass seeds, plant material, insects, larvae and snails. (DLNR 2015).

3. BASH HAZING & NEST REMOVAL OPERATIONS & PROCEDURES

3.1 Training & Personnel Involved

Personnel involved in hazing ESA-listed species for BASH purposes will be required to take a training course conducted by the PMRF USDA-WS personnel. All installation personnel involved in direct control measures within the airfield environment will complete a training syllabus in accordance with CNICINST 3750.1 (series) and be designated, in writing, by the Air Operations Officer, who is also the BASH Program Manager. In addition to the WDDT, PMRF personnel that have been deemed necessary by the BASH Program Manager to assist with BASH hazing and have completed the above training, will assist with hazing activities on PMRF Barking Sands. The USDA-WS wildlife biologist is responsible for maintaining a record of trained individuals.

U.S. Dept. of Agriculture, Animal Plant Health Inspection Services – Wildlife Services (USDA-WS):

The current interagency agreement between CNIC and USDA-WS funds a full-time wildlife biologist and a full-time wildlife technician for BASH support at PMRF. The USDA-WS Work/Financial Plan requires USDA-WS to train PMRF personnel who are involved with BASH hazing. USDA-WS is authorized to haze brooding/molting adults, and goslings within the *proposed* 8,000 ft. AOA buffer. USDA is authorized to remove nene nests/eggs within the current authorized NNRZ and *proposed* 200 ft. around launch pads NNRZ buffer, in coordination with the PMRF NRM.

Wildlife Detection and Dispersal Team (WDDT):

The WDDT identifies wildlife and wildlife attractants, assesses wildlife hazards, determines BASH conditions, reports wildlife observations, wildlife hazards, BASH conditions, and disperses wildlife to mitigate hazards. The WDDT is also responsible for rapid response to deal with emergent BASH issues impacting flight operations at the PMRF airfield. The WDDT is authorized to haze non-brooding/molting nene basewide. PMRF's WDDT personnel include but are not limited to: USDA personnel and airfield operations personnel. The Natural Resources Manager is part of the BASH Working Group, but not part of the WDDT.

Other PMRF Personnel, Tenants and Contractors:

Additional PMRF personnel, tenants and contractors may be required to assist with BASH hazing efforts when the airfield is closed for sporadic weekend, evening, and holiday support. Pending training by the USDA-WS personnel, and designation by the BASH program manager, trained PMRF personnel will be able to assist with BASH hazing basewide to help prevent nene nesting within the NNRZ.

3.2 Hazing & Nest Removal Techniques for Nene and Hawaiian Waterbirds

Thirty BASH hazing techniques and 9 protocols are utilized at PMRF. The most effective BASH hazing techniques used at Barking Sands to deter nene are vehicle harassment, and vehicle herding. PMRF plans to utilize a hazing dog primarily for launch and live fire activities, however, the dog will be utilized to assist the BASH program when priorities allow. Higher hazing numbers are generally recorded in the months leading up to the nene breeding season, with the nene breeding season spanning September – April. Table 1 below lists the specific BASH hazing actions, as well as the areas they will occur.

In the immediate vicinity of the airfield, USDA-WS and the WDDT may utilize pyrotechnics (e.g. modified pistols, 12 gauge shotguns, bangers), noise making devices (e.g. ultrasonic repellers, horns, sirens, propane cannons), static deterrents (e.g. effigies, mylar tape), active hazing (vehicle harassment and on-

foot harassment), a bird deterrent laser to reduce bird presence near the airfield, and other bird deterrent measures as authorized under the 4(d) Rule.

Within 8,000 ft. from the airfield, USDA-WS, the WDDT and other authorized PMRF personnel, tenants and contractors may utilize vehicle harassment, and on-foot harassment to harass nene that are attempting to breed. Additional deterrents that may be used within the 8,000 ft. boundary by USDA-WS include: flags, mylar tape, predator effigies, decoys, air dancers, and balloons. Noise making devices may also be used within the 8,000 ft. boundary to deter nene from foraging and nesting near the airfield.

Basewide BASH hazing of nene, under parameters of the 4(d) rule, may be conducted by USDA-WS, the WDDT and other authorized PMRF personnel, tenants and contractors. Basewide 4(d) compliant hazing may utilize noise making devices (e.g. 12 gauge cracker shells, bangers, whistles, screamers, recording barks), herding by vehicles, vehicle harassment, on-foot harassment, and harassment by tethered or trained dogs. Access control, predator effigies and non-toxic chemical bird repellents may be utilized to discourage foraging and nesting. Hazing that occurs outside the 8,000 buffer zone will not be conducted to brooding/molting adults, families or goslings. Basewide hazing will focus on hazing outside of the nene breeding season, with the breeding season spanning from September – April. Hazing may occur during the nene breeding season after a qualified biologist1 has surveyed the area and confirmed that there are no nests, or goslings present within 100 ft. Brooding2 adults or adults in molt3 are not allowed to be hazed at any time under the 4(d) rule.

Table 1. BASH Hazing Techniques for Nene and Hawaiian Waterbirds

Hazing Techniques for BASH	Type	Personnel Authorized	ESA-Listed Species Used on	Location
Modified Pistols	Pyrotechnics	USDA-WS	Waterbirds	Airfield/750 ft.
12 gauge shotgun	Pyrotechnics	USDA-WS	Waterbirds	Airfield/750 ft.
Bangers/Whistles/Screamers	Pyrotechnics	USDA-WS	Waterbirds	Airfield/750 ft.
Vehicle Harassment	Active Hazing	USDA-WS	Waterbirds	Airfield/750 ft.
On-foot Harassment	Active Hazing	USDA-WS, WDDT	Waterbirds	Airfield/750 ft.
Sirens/Horns/Clapping	Noise Making	USDA-WS, WDDT	Nene & Waterbirds	Airfield/750 ft.
Ultrasonic Repellers	Noise Making	USDA-WS	Nene*	Airfield AOA
Propane Cannons	Static Deterrent	USDA-WS	Nene*	Airfield AOA
Vehicle harassment	Active Hazing	USDA-WS	Nene***	Airfield/8,000 ft.
On-foot Harassment	Active Hazing	USDA-WS, WDDT	Nene*	Airfield/8,000 ft.
Sirens/Horns/Clapping	Noise Making	USDA-WS, WDDT	Nene*	Airfield/8,000 ft.
Flags	Static Deterrent	USDA-WS	Nene & Waterbirds	Airfield/8,000 ft.
Mylar tape	Static Deterrent	USDA-WS	Nene & Waterbirds	Airfield/8,000 ft.
Scarecrow/Effigies/Decoy	Static Deterrent	USDA-WS	Nene & Waterbirds	Airfield/8,000 ft.
Inflatable Air Dancers	Static Deterrent	USDA-WS	Nene & Waterbirds	Airfield/8,000 ft.
Balloons	Static Deterrent	USDA-WS	Nene & Waterbirds	Airfield/8,000 ft.
Hazing with trained dogs	Active Hazing	Trained handler	Nene*	Main Base-wide
12 gauge shotgun	Pyrotechnics	USDA-WS	Nene**	Main Base-wide
Bangers/Whistles/Screamers	Pyrotechnics	USDA-WS	Nene**	Main Base-wide
Recorded Barks	Bioacoustics	USDA-WS	Nene**	Main Base-wide
Distressed Calls of Geese	Bioacoustics	USDA-WS	Nene**	Main Base-wide
Non-Toxic Repellent	Chemical	USDA-WS	Nene**	Main Base-wide

Herding or Harassing w/ Tethered Dogs	Active Hazing	USDA-WS	Nene**	Main Base-wide
Herding by Vehicle	Active Hazing	USDA-WS, WDDT	Nene**	Main Base-wide
Vehicle Harassment	Active Hazing	USDA-WS, WDDT	Nene**	Main Base-wide
On-Foot Harassment	Active Hazing	USDA-WS, WDDT	Nene**	Main Base-wide
Horns/Clapping	Noise Making	USDA-WS, WDDT	Nene**	Main Base-wide
Access Control (net/fence)	Exclusion	USDA-WS, WDDT	Nene & Waterbirds	Main Base-wide
Geotech Cloth	Static Deterrent	USDA-WS	Nene & Waterbirds	Surface waters
Bangers/Whistles/Screamers	Pyrotechnics	USDA-WS	Nene**	Basewide
Recorded Barks	Bioacoustics	USDA-WS	Nene**	Basewide
Distressed Calls of Geese	Bioacoustics	USDA-WS	Nene**	Basewide
Non-Toxic Repellent	Chemical	USDA-WS	Nene**	Basewide
Herding w/ Trained Dogs	Active Hazing	USDA-WS	Nene**	Basewide
Herding by Vehicle	Active Hazing	USDA-WS, WDDT	Nene**	Basewide
Vehicle Harassment	Active Hazing	USDA-WS, WDDT	Nene**	Basewide
On-Foot Harassment	Active Hazing	USDA-WS, WDDT	Nene**	Basewide
Horns/Clapping	Noise Making	USDA-WS, WDDT	Nene**	Basewide
Access Control (net/fence)	Exclusion	USDA-WS, WDDT	Nene & Waterbirds	Basewide
Geotech Cloth	Static Deterrent	USDA-WS WDDT	Nene & Waterbirds	Surface waters

*Technique has the potential to incidentally harass Hawaiian Waterbirds

**Base-wide BASH hazing will only be conducted to non-brooding/molting adults with no goslings present

***Vehicle harassment will not be used on nene families with mobile young

To note: Hazing to nene on the airfield or within the 8,000 ft. buffer zone includes brooding/molting adults

[1] Qualified biologist - is an individual with a combination of academic training in the area of wildlife biology or related discipline and demonstrated field experience in the identification and life history of the nene. (Federal Register, Vol. 84, No. 244, Dec 19, 2019)

[2] Brooding – a pattern of behavior of certain egg-laying animals, especially birds, marked by cessation of egg laying and readiness to sit on and incubate eggs. (Britannica)

[3] Molt - to lose a covering of hair, feathers, etc. and replace it with new growth in the same place. (Britannica)

[4] Trained Handler – Handlers will be experienced with nene and trained to identify breeding. They will evaluate all birds for breeding behavior prior to hazing

PROTOCOL 1: BASH HAZING WITHIN THE 8,000 FT. AIRFIELD BUFFER:

Only USDA-WS and the WDDT are authorized to haze nene and Hawaiian waterbirds within the airfield AOA. Hazing techniques used in the vicinity of the airfield include pyrotechnics (e.g. modified pistols, 12 gauge cracker shells, bangers), noise making devices (e.g. ultrasonic repellers, horns, sirens, propane cannons), static deterrents (e.g. effigies, mylar tape), bird deterrent lasers and active hazing (vehicle harassment and on-foot harassment) to reduce bird presence near the airfield. USDA-WS personnel conduct all pyrotechnics hazing activities and provide the majority of hazing support for the airfield. BASH hazing within 750 ft. of the airfield shall coordinate activities with the air traffic tower on the radio to alert them of the location and number of birds to ensure no hazards to flight operations.

Within 750 ft of the airfield, on-foot harassment, vehicle harassment and hazing with a trained dog is conducted for airfield to nene, Hawaiian stilts and Hawaiian ducks. The use of a trained hazing dog may be used within the 8,000 ft. buffer zone around the airfield, which includes launch pads to the north of the airfield. On foot harassment involves approaching the bird with vocalizations, hand clapping and/or whistles to encourage the bird to leave the area. If hazing involves a family the WDDT will haze the nene or Hawaiian waterbird using the on-foot technique. Qualified biologists and trained individuals actively survey for nesting behavior and if a pair is spotted, exhibiting nesting behavior, the WDDT will haze the pair and search the area for active nests or attempted nesting sites. Vehicle harassment and vehicle herding involves approaching nene or Hawaiian waterbird(s) using horns and lights to encourage the bird to leave the area. Hazing with a trained dog involves a professionally trained K9 team with voice commands and herding techniques, obedience training, etc. In addition to active hazing, static deterrents and exclusionary measures may be used. Intentional harassment of brooding adults (e.g., adults with an active nest or gosling) and/or adults in molt is prohibited under the 4(d) rule. The hazing techniques described here include intentional harassment of gravid females not actively nesting, families with mobile young, breeding pairs and/or molting adults with the understanding that these individuals are vulnerable and will be hazed with extra care. A qualified biologist or trained individual is an individual with a combination of academic training in the area of wildlife biology or related discipline and demonstrated field experience in the identification and life history of the nene (Federal Register, Vol. 84, No. 244, Dec 19, 2019).

If any pair of nene prior to nesting is found outside of the NNRZ but within 8000' of the airfield, the WDDT and trained PMRF personnel should haze nene to reduce successful nesting attempts. In addition to active hazing, static deterrents and exclusionary measures may be used throughout the 8,000 ft. buffer zone. Basewide hazing techniques (i.e. vehicle herding) may be used within the 8,000 ft. hazing zone to non-brooding adults.

USDA-WS and the WDDT will record the date and time of hazing, GPS coordinates, hazing technique used, how many birds, banding information, direction of flight and landing site if known, time of day, what the bird was doing and any other pertinent information. Hazing information will be compiled by USDA and submitted to the quarterly BASH working group. The BWG is comprised of representatives from airfield operations, USDA- WS, public works, natural resources, public affairs, security, and mission-related operations.

PROTOCOL 2: BASH HAZING BASEWIDE 4(D) COMPLIANT:

USDA-WS, the WDDT and authorized PMRF personnel, tenants and contractors may haze nene basewide using techniques listed in Table 1 that are not likely to cause injury to nene. Basewide hazing must be in compliance with the 4(d) rule and does **not** include hazing to brooding/molting adults or goslings. Pyrotechnics, bioacoustics, non-toxic chemical repellent, herding with tethered or trained dogs, herding by vehicle, vehicle harassment, on foot harassment and access control are able to be used basewide to discourage nene from habituating and nesting at Barking Sands. USDA-WS may utilize a trained dog to conduct hazing and/or herding of nene basewide.

The WDDT and authorized PMRF personnel, tenants and contractors will record the date and time of hazing, GPS coordinates, hazing technique used, how many birds, banding information, direction of flight, and any other pertinent information. Hazing information will be compiled by USDA-WS and submitted to the BASH working group.

PROTOCOL 3: BASH-RELATED NEST REMOVAL:

USDA-WS and PMRF NR may removenene nests if found in the current authorized NNRZ, or within the proposed 200 ft. from launch pads. These actions are not authorized under the 4(d) rule and have annual limits based on the incidental take statement in the Biological Opinion. In the event a nene has established a nest outside the NNRZ, hazing will not be conducted and the nest will be protected by a 100ft buffer, see Protocol 9. Proactive hazing before the nene breeding season will conducted at Barking Sands basewide, along with habitat management, to reduce the necessity of these actions.

If a nest/egg has been identified and determined to be within the current authorized NNRZ or the proposed 200 ft. from a launch pad buffer zone, the USDA-WS personnel and PMRF NR personnel will collect a GPS point of the nest, record the time and date of the nest discovery and will survey the area for any additional active nests or nesting attempts. USDA-WS and PMRF NR personnel will alert the BASH Working Group (including the NRM) immediately so information can be relayed to the USFWS and DLNR DOFAW within 1 day of nest discovery and PMRF can determine the next course of action. USDA-WS or NR will hang mylar deterrent tape to discourage nene from accessing nest upon initial observation. Photographs, time and personnel will be recorded. If, upon review of existing incidental take and assessed airfield safety risk, the BASH Working Group (BWG) determines nest removal is the recommended course of action, the PMRF NRM will notify the USFWS and DLNR DOFAW of intent to proceed with nest removal. If the number of eggs has been constant for more than 24 hours, it is assumed that the female is done laying. If a USFWS approved translocation plan is in place, USFWS and DOFAW will be contacted to discuss translocation of the eggs. If the nest cannot be removed immediately and the pair is repeatedly seen returning to the nest site, BASH Program Manager (Air Operations Officer) or PMRF Natural Resources staff will contact the PMRF command to request assistance from a CDO to enact hazing after dusk and over the weekend, as feasible. When determined feasible based on schedule and completion of laying, USDA-WS and/or PMRF NR personnel will remove the nest and bury the eggs. The PMRF NRM will notify USFWS and DOFAW within 1 day of nest destruction. BASH Program Manager and/or PMRF Natural Resources staff willcoordinate with the Public Works Officer, Range Operations Officer and the Airfield Manager to remove vegetation around the nest (up to 1m) after 48 hours following nest destruction, or to install temporary fencing to discourage returning to the nest or future nesting attempts. Once nene have been absent for seven consecutive days, USDA-WS or PMRF NR personnel will remove the mylar tape and any temporary fencing, in coordination with the Airfield Manager. Nene nest removal will be recorded to

ensure removal activities do not exceed the USFWS's incidental take statement. USDA-WS and/or PMRF NR personnel will develop a report to include all details of the nest discovery (location, date and time, vegetation found in, number of eggs, picture of the nest, last hazing, monitoring prior to nest being discovered and further corrective actions such as additional hazing, habitat management, etc.) and details of all mitigation actions (timing of vegetation removal, timing of mylar tape installation, details on ongoing hazing, observance of nesting pair, timing and details of nest removal, etc.) the report will be submitted to the PMRF BASH Working Group and the USDA-WS District Supervisor. The PMRF NRM will submit the nest removal report and details to USFWS and DLNR DOFAW within 30 days in accordance with the reporting requirements in the Terms and Conditions of the Biological Opinion.

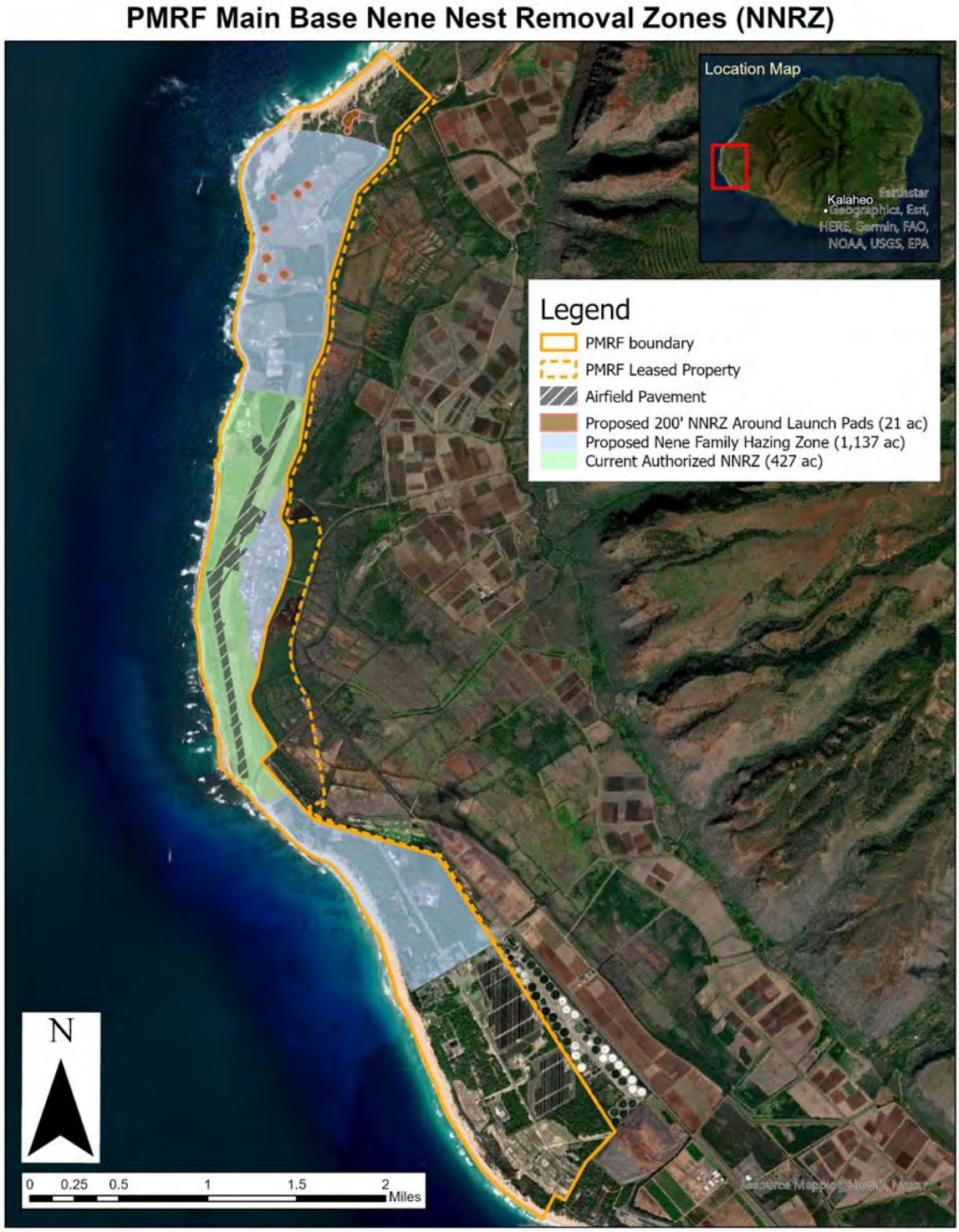

Figure 2. Proposed Nene Nest Removal Zone: On the airfield or within the lateral clear zone which extends to 750 ft on either side of the runway centerline, 150 ft on either side of the taxiway's centerlines, and 100 ft from the edge of aircraft parking aprons and 200 ft. from Launch Pads.

4. LAUNCH/LIVE FIRE HAZING & NEST REMOVAL PROCEDURES

4.1 Training & Personnel Involved

PMRF Range Operations has an interagency agreement with USDA-WS to conduct hazing in support of the military mission. USDA-WS will be the primary agency hazing around launch pads and live fire areas, primarily using trained hazing dogs. Any personnel involved in hazing ESA-listed species for launch pad operation and/or live fire exercises will be required to take a training course conducted by USDA-WS personnel. USDA-WS is responsible for maintaining a record of trained individuals.

U.S. Dept. of Agriculture, Animal Plant Health Inspection Services – Wildlife Services (USDA-WS):

USDA-WS will provide ESA-listed species hazing training for PMRF ordnance personnel, PMRF tenants that manage launch pads and related personnel that are authorized to be on site for live fire and launch pad events.

PMRF Ordnance Personnel, and Launch Operations Personnel/Tenants:

PMRF ordnance personnel, PMRF tenants involved in launch operations and personnel directly involved in launch pad activities and/or live fire exercises are able to assist with hazing efforts when USDA-WS is prevented from entering an area due to safety concerns. Most launch and live fire events have an associated Ground Hazard Area (GHA) based on the activity being performed. USDA is not authorized to enter the GHA, and will rely on mission critical staff to assist with hazing, if needed prior to an event.

4.2 Hazing & Nest Removal Techniques for Nene

Nene hazing related to launch and/or live fire exercises will occur within 500' of an area with an event scheduled within 30 days. Hazing will predominately be conducted using a trained hazing dog under the direction of USDA-WS. USDA-WS may also utilize active hazing (i.e. vehicle harassment and on-foot harassment), noise making (clapping, horns, etc.) as well as static deterrents (i.e. predator effigies).

USDA-WS may not able to haze nene within the 500' buffer zone when there is an aerial target or missile on the launch pad that have associated explosive safety quantity distance (ESQD) arcs. Only authorized personnel are allowed within ESQD arcs/GHA for safety purposes. In situations where USDA-WS is not able to haze within 500' of a launch or live fire exercise, trained personnel are able to haze within the 500' buffer to deter nene from loafing, foraging or nesting prior to a launch or live fire event. Personnel will be trained to haze utilizing vehicle harassment, on-foot harassment and noise making, as described in Protocol 4.

Launch areas on PMRF are managed by both PMRF range personnel and tenants. The Department of Energy, National Nuclear Security Administration (NNSA) manages the Kauai Test Facility (95 acres; 4 launch pads). The Missile Defense Agency (MDA) manages the Vertical Launch System (VLS) on 2.3 acres. PMRF manages both the 50K launch site (28 acres; 1 launch pad) and the north launch complex (3 acres; 9 launcher), as shown in Figure 3. Live fire training events may occur at both PMRF-managed sites; the north launch pad and 50K launch site. All launch and live fire sites, excluding the PMRF-managed north launch complex, are encompassed in the airfield's NNRZ, Figure 2.

Figure 3. Launch pad and live fire training areas at Barking Sands.

PROTOCOL 4: LAUNCH PAD/LIVE FIRE HAZING:

Only USDA-WS and trained personnel are authorized to haze nene within 500' of a launch pad or live fire training area. On-foot harassment, vehicle harassment and hazing with a trained dog is conducted within the 500' buffer area to brooding adults and nene families. On foot harassment involves approaching the bird with vocalizations, hand clapping and/or whistles to encourage the bird to leave the area. If hazing involves a family USDA-WS or trained personnel will haze nene using the on-foot technique first. If a pair is spotted, exhibiting nesting behavior, USDA-WS will haze the pair and search the area for active nests or attempted nesting sites. Vehicle harassment and vehicle herding involves approaching nene using horns and lights to encourage the bird to leave the area. Hazing with a trained dog involves a professionally trained K9 team with voice commands and herding techniques, obedience training, etc. In addition to active hazing, static deterrents may be used.

If a breeding pair of nene is found within 500 ft. of a launch pad or life fire training area with an event planned in 30 days, USDA-WS or trained PMRF personnel should haze nene to reduce successful nesting attempts. In addition to active hazing, static deterrents and exclusionary measures may be used

USDA-WS will record the date and time of hazing, GPS coordinates, hazing technique used, how many birds, banding information, direction of flight and landing site if known, time of day, what the bird was doing and any other pertinent information. Hazing information will be compiled by USDA and submitted to the Range Operations Officer, the BASH working group, the PMRF NRM and to applicable tenant(s). It is critical that hazing during air operations hours are coordinated with the Airfield Manager to ensure aircraft safety.

PROTOCOL 5: LAUNCH PAD/LIVE FIRE NEST REMOVAL:

USDA-WS and PMRF NR may remove nene nests if found within 200 ft. from a launch pad or live fire area with a launch or live fire exercise scheduled in the next 30 days. These actions are not authorized under the 4(d) rule and have annual limits based on the USFWS's incidental take statement. The 200 ft. buffer around launch pads designates the boundary for the Nene Nest Removal Zone (NNRZ). In the event a nene has established a nest outside the NNRZ, hazing will not be conducted and the nest will be protected, see Protocol 9.

If a nest/egg has been identified and determined to be within 200 ft. from a launch pad or live fire exercise with a launch or event scheduled within the next 30 days, the USDA-WS personnel and PMRF NR personnel will collect a GPS point of the nest, record the time and date of the nest discovery and will survey the area for any additional active nests or nesting attempts. USDA-WS and PMRF NR personnel will alert the BASH Working Group (BWG), Range Operations personnel, and the PMRF NRM immediately so information can be relayed to the USFWS and DLNR DOFAW within 1 day of nest discovery. PMRF will work closely with the tenant (if applicable) to determine the next course of action. USDA-WS or NR will hang mylar deterrent tape to discourage nene from accessing nest upon initial observation. Photographs, time and personnel will be recorded. If, upon review of existing incidental take the Range Operations Officer, in coordination with the tenant (if applicable), determines nest removal is the recommended course of action, the PMRF NRM will notify the USFWS and DLNR DOFAW of intent to proceed with nest removal. If the number of eggs has been constant for more than 24 hours, it is assumed that the female is done laying. If a similarly-aged nest is identified at Makaha Ridge or Koke'e sites, USFWS and DOFAW will be contacted to discuss translocation of the eggs. If the nest cannot be removed immediately and the pair is repeatedly seen returning to the nest site, Range Operations Officer or PMRF Natural Resources staff will contact the PMRF command to request assistance from a CDO to enact hazing after dusk and over the weekend, as feasible. When determined feasible based on schedule and completion of laying, USDA-WS and/or PMRF NR personnel will remove the nest and bury the eggs. The PMRF NRM will notify USFWS and DOFAW within 1 day of nest destruction. The PMRF Natural Resources staff will coordinate with the Public Works Officer, Range Operations Officer and the Airfield Manager to remove vegetation around the nest (up to 1m) after 48 hours following nest destruction, or to install temporary fencing to discourage returning to the nest or future nesting attempts. Once nene have been absent for seven consecutive days, USDA-WS or PMRF NR personnel will remove the mylar tape and any temporary fencing, in coordination with the Range Operations Officer and BWG. Nene nest removal will be recorded to ensure removal activities do not exceed the USFWS's incidental take statement. USDA-WS and/or PMRF NR personnel will develop a report to include all details of the nest discovery (location, date and time, vegetation found in, number of eggs, picture of the nest) and details of all mitigation actions (timing of vegetation removal, timing of mylar tape installation, details on ongoing hazing, observance of nesting pair, timing and details of nest removal, etc.) the report will be submitted to the Range Operations

Officer, associated tenant(s) and the PMRF BASH Working Group . The PMRF NRM will submit the nest removal report and details to USFWS and DLNR DOFAW in the PMRF quarterly INRMP report.

4. BIRD PROTECTION HAZING & NEST PROTECTION OPERATIONS & PROCEDURES

4.1 Training & Personnel Involved

Personnel involved in hazing ESA-listed species for bird protection purposes will be required to take a training course conducted by a PMRF qualified biologist. The training will cover biology and phenology of the bird species, proper techniques and considerations when hazing birds, indication of molting, identification of bird life stages and plumage, areas authorized for specific hazing actions as well as reporting requirements and procedures to capture hazing activities. All personnel authorized to haze for bird protection purposes will read this protocol and sign a form acknowledging their understanding and compliance with information and procedures outlined in this protocol. A record of trained and authorized individuals will be updated regularly by the PMRF Environmental office to reflect the current list of personnel authorized to haze for bird protection.

PMRF Natural Resources Staff:

The PMRF Natural Resources (NR) program, including PCSU staff, primarily conduct base-wide hazing in areas determined high risk for nene (i.e. along roadsides, near the oxidation pond, near construction sites, near mission activities and at recreational sites). PMRF NR will conduct hazing in situations where ESA-listed birds are interfering with the mission and at risk for injury or mortality. PMRF NR staff are authorized to haze brooding, molting adults or goslings, if determined necessary.

Other PMRF Personnel, Tenants and Contractors:

Additional PMRF personnel, tenants and contractors may be trained and authorized to conduct hazing if deemed necessary, to include security personnel, Command Duty Officers (CDOs), KIUC vegetation maintenance personnel, launch facility tenants, ordnance personnel and other personnel considered appropriate to assist with hazing for nene & Hawaiian waterbird protection. Personnel will not be authorized to haze brooding/molting adults or goslings/chicks unless determined it is a life or death situation (i.e. vehicle strike).

4.2 Hazing & Nest Protection Techniques for Nene and Hawaiian Waterbirds

It may be necessary to haze brooding/molting adults and/or goslings at all PMRF sites if a situation is observed that puts the bird(s) in imminent danger (e.g. vehicle strike, oxidation pond construction, launch activity). Additionally, it may be necessary to haze non-brooding/molting adults in situations that may injure the bird(s) (e.g. vegetation maintenance equipment, construction equipment). Hazing for bird protection is primarily conducted by the PMRF NR staff. Additional PMRF personnel and tenants may be authorized to haze for bird protection upon training by a PMRF qualified biologist. Table 2 lists the hazing techniques used for bird protection.

Table 2. Bird Protection Hazing Techniques for Nene and Hawaiian Waterbirds

Hazing Techniques for Bird Protection	Type	Personnel Authorized	ESA-Listed Species Used on	Location
Vehicle Harassment*	Active Hazing	PMRF NR	Nene & Waterbirds	All PMRF sites
On-foot Harassment	Active Hazing	NR, trained staff	Nene & Waterbirds	All PMRF sites
Horns/Clapping	Noise Making	NR, trained staff	Nene & Waterbirds	All PMRF sites

Inflatable Air Dancers	Static Deterrent	NR, trained staff	Nene & Waterbirds	All PMRF sites
Access Control (net/fence)	Exclusion	NR, trained staff	Nene & Waterbirds	All PMRF sites
Geotech Cloth	Static Deterrent	NR, trained staff	Nene & Waterbirds	All PMRF Sites

*Only authorized to non-brooding/molting adults with no goslings/chicks.

PROTOCOL 6: HAZING FOR BIRD PROTECTION- IMMINENT DANGER:

At all PMRF sites, if a situation is observed that puts a brooding/molting adult or goslings/chicks in imminent danger (e.g. vehicle strike), hazing is authorized to ensure their safety by gently hazing the nene or Hawaiian waterbird using the on-foot technique. No aggressive chasing of adult(s) with goslings/chicks will be allowed. Slowly walking towards the family will be the method used. This will discourage separation of adults from goslings/chicks, as well as any confusion that might cause injury to the birds. If a nene pair is spotted, exhibiting nesting behavior, contact the PMRF NRM immediately (808-335-4107). A PMRF biologist will search the area for active nests or attempted nesting sites. If a potential nest attempt is found with no eggs, the PMRF biologist will disassemble the nest and clear vegetation around the area to deter nene from returning. If a nest or egg is found, and the nest is outside the Nene Nest Removal Zone, the nest will be protected as outlined in Protocol 9.

PROTOCOL 7: HAZING FOR BIRD PROTECTION 4(d) COMPLIANT:

At all PMRF sites, if a situation is observed that puts a non-brooding/molting nene or Hawaiian waterbird adult in imminent danger (i.e. vehicle strike, construction equipment, launch activities, etc.), hazing is authorized to ensure their safety by gently hazing them using the on-foot technique. Observe the bird carefully before taking action to determine if there is a family present or nesting behavior. If nene are observed within the 8,000 ft. buffer to the AOA, contact the air traffic control tower to alert them of nene location and number of birds to ensure it is safe to haze without impacting air operations. Only USDA-WS and the WDDT is authorized to haze nene within the 8,000 ft. buffer area when there are active air operations. If outside the 8,000 ft. AOA buffer, hazing of nene and Hawaiian waterbirds is permitted may be conducted by trained individuals using on-foot harassment, auditory and visual techniques, including vehicle horns, human vocalizations, hand clapping, foot stomping, and flashing vehicle lights. PMRF NR staff may use vehicle harassment. Vehicles may not approach closer than 20 feet from nene or Hawaiian waterbirds.

Touching or handling of nene or Hawaiian waterbirds is not permitted. All sighting and hazing actions shall be recorded and submitted to the PMRF NR Office for accurate data collection and reporting to USFWS, USDA-WS and the BASH Working Group. Information needed for nene sighting/hazing includes: Date and time of sighting, location of sighting (coordinates), number of birds, banded or un-banded, life stage of birds, behavior, hazing technique used, direction of flight, and any other pertinent information. Details to be submitted via email to the BASH Working Group and PMRF Natural Resources Manager (NRM) at brooke.mcfarland@navy.mil. The PMRF NRM will submit the nene hazing details to the USFWS and DLNR DOFAW in the PMRF quarterly INRMP report.

PROTOCOL 8: PRE-CONSTRUCTION/VEGETATION MAINTENANCE NEST SURVEYS:

One week prior to commencement of vegetation maintenance or construction activities in areas with grass taller than 10", the project manager will contact the PMRF NRM to request a qualified biologist surveys the area for nene and Hawaiian waterbird nests. Nest surveys are required throughout the year due overlapping breeding seasons and the potential for Hawaiian ducks, coots and gallinules to nest year-

round. Once the biologist has completed the nest survey and determined no nests are presence, vegetation maintenance or construction activities may commence. If a nest is found, refer to Protocol 9. If a nest is discovered by vegetation maintenance or construction worker(s), the worker shall call the PMRF NR hotline (808-208-4416) to report the nest and no activities may occur within 100 ft. of the active nest. The nest may not be destroyed until the chicks have hatched and fledged or until the nest has been determined abandoned by a qualified biologist.

PMRF NR staff will remove the buffer when no longer needed. A PMRF biologist will identify the nest, collect information on the nest and erect a 100 ft. buffer fence around the nest to avoid further disturbance.

PROTOCOL 9: NENE & HAWAIIAN WATERBIRD NEST PROTECTION:

If nesting behavior is observed or a nest/egg is discovered at any of the PMRF sites, contact the PMRF NR personnel and USDA-WS personnel immediately. For situations where nest protection is deemed the proper course of action (based on distanced from the airfield), PMRF NR biologists and/or USDA-WS personnel will collect a GPS point of the nest and take a photograph. The PMRF biologist and/or USDA-WS personnel will erect temporary fencing or caution tape 100 ft. (if appropriate) from the nest to avoid further disturbance and not block birds from foraging areas or water. Predator traps with anti-gosling/chick guards will be installed 100 ft. away from the nest to protect from predation during the 30 day incubation period. PMRF biologists will monitor the nest to record the success or failure of the nest. Data collected for nest protection include: Date and time nest was found, activity near nesting site, location of nest (coordinates), number of eggs, vegetation found in and any other pertinent details. The PMRF NRM will submit the nest protection details to the BASH Working Group, USFWS and DLNR DOFAW in the PMRF quarterly INRMP report.

1. OXIDATION POND BOTULISM PROTOCOLS

Do not risk personal health and safety in an attempt to capture affected birds.

The Oxidation Pond should be monitored daily for breeding activity and injuries/mortalities. This can be done concurrently with other monitoring efforts (basewides, vegetation clearing, etc) and takes approximately 15 minutes. Walk around the complex paying specific attention to the main and outflow basin. Scan the birds in the area and briefly assess each bird you see. Ducks, coots, stilts, and night herons generally flush or move further into the basin when you get close, so any bird that you can walk up to should be investigated closely. Check patches of vegetation for nests, especially if there are birds exhibiting breeding behavior in the area.

Botulism monitoring: Monitoring for botulism begins when a bird (live or dead) is found with suspected botulism, ie, a carcass is found at the oxidation pond with no known cause of death. Clear predations, mortalities due to injury, or old carcasses do not prompt botulism protocols. Clinical signs of botulism in a live bird include weakness, lethargy, inability to hold head up or fly, and partial paralysis (droopy eye lids, sunken eyes, drooping wings, unable to use legs, labored breathing, inability to hold head up, etc.),

If you find a live bird with symptoms of botulism, efforts should be made to capture the individual and transfer it to S.O.S. Make sure to wear proper protective gear including gloves, towels, safety goggles,

and/or face shields (if dealing with a bird covered in raw sewage). Also alert S.O.S. that this bird has been contaminated so they can protect themselves as well. Any gear used to capture the individual should be cleaned with bleach before using it for another bird.

If you find a carcass, consider if it is fresh enough to send for botulism testing (see SOP in Botulism folder for "USGS HFS Carcass Shipment" for protocol). If you suspect it is, put it in the USDA fridge in the shed. Call Peter Silva USDA to notify him that you are storing a carcass there temporarily.You can assess whether it is fresh enough to test based on the following text and figure from the USGS HFS SOP and call HFS. Note that carcasses sitting in sewage will decompose even more rapidly.

"For an accurate diagnosis of botulism, it is very important to collect only fresh carcasses (ideally within a few hours following death)"
"Carcasses that are decomposed or scavenged are unacceptable. If the carcass has an odor, is soft and mushy, has skin discoloration, feathers or skin that easily rubs off, or has maggots present, it is too decomposed for testing"

Report to the Navy NRM as you would any injury or mortality. Also report suspected or confirmed botulism cases to https://www.hiwaterbirds.com/report-a-sick-waterbird by emailing hiwaterbirds-grp@hawaii.edu (we do this reporting, not SOS). Report format to put in the email is as follows :

Reporters Name:
Reporters Phone Number: 808-208-4416
Reporters Email Address:
Location of the sick bird(s): PMRF, Oxidation ponds
Species affected:
Approximate number of animals affected:

If there is a suspected botulism outbreak, either from a bird still alive or a suspicious carcass, monitoring efforts at the oxidation pond will increase and daily checks must be performed for 10 consecutive calendar days following the first incident. This includes weekends and/or holidays. If additional carcasses are found during this period, the 10 day period is reset and continues for an additional 10 days after the last carcass was found. Carcass removal is an extremely important step in reducing the potential or longevity of a botulism outbreak.

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APPENDIX B. PMRF Hawaiian Hoary Bat Roost Detection Protocol, 2020

Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) Roost Detection Protocol

For emergency tree trimming during pupping season

Pacific Missile Range Facility (PMRF), Kauai, Hawaii

Photo credit USGS, Frank Bonaccorso

December 2021

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1. INTRODUCTION

1. Purpose

This protocol describes methods and situations when surveying for roosting Hawaiian hoary bats (*Lasiurus cinereus semotus;* HBAT) is determined necessary. Surveys shall be conducted prior to tree trimming or removal for trees 15 feet or taller during the bat pupping season, 1 June to 15 September. Trees shall not be trimmed or cut during this period, unless there is an emergency situation requiring immediate action. Emergency situations are when unforeseeable events cause tree(s) to pose a threat to human safety or property, and where mitigation of that threat is not possible or practical. This protocol ensures that in instances where tree trimming or removal is deemed absolutely necessary during the bat pupping season, there are methods in place to reduce potential take to the endangered Hawaiian hoary bat. This protocol does not authorize tree trimming or removal during the bat pupping season for poorly planned contracted services or to utilize end of year funds.

This protocol does not replace the need for coordination of tree trimming or removal activities with the PMRF Natural Resources (NR) office for activities throughout the year. Recurrent and one-time tree trimming activities must be planned to occur outside of the pupping season of June 1st thru September 15th. Removal of coconut nuts or dead coconut palm leaves will not be subject to this protocol, but should be visually inspected during harvest to ensure no pups are present.

2. Location and Setting

This protocol will apply to all of the Pacific Missile Range Facility and its satellite installations, including: Barking Sands, Kamokala Ridge, Makaha Ridge, Milolii Ridge, Koke'e sites, and Port Allen , as well as utility/road easements needed for essential maintenance (See Figure 2.0-1). These sites encompass 2,409 acres (plus easements), with elevations from sea-level at Barking Sands to 3,710 feet at the Koke'e sites.

Woody vegetation found across the installation is largely non-native, most commonly kiawe (*Prosopis pallida*), haole koa (*Leucaena leucocephala*), ironwood (*Casuarina equisetifolia*) and, at higher elevations, strawberry guava (*Psidium cattleianum*). Native trees are primarily found at higher elevation sites and include koa (*Acacia koa*) and ohia lehua (*Metrosideros polymorpha*). Large fruiting trees are not common at the installation.

3. Training and Personnel Involved

Thermal survey training will be conducted by a knowledgeable surveyor with experience in the use of the equipment and in bat roost detections. Training will be conducted annually, and will be held for PMRF NR staff, including Pacific Cooperative Studies Unit (PCSU) contractors and other relevant contractors, as determined by Public Works Officer (PWO). Training records will be maintained by the PMRF Environmental Office.

Prior to conducting surveys independently, the following training regime will be followed:

- Sign off on protocol
- Sign off on safety procedures
- 1 session with equipment in office, familiar with troubleshooting unit and functions
- At least 1 session during nighttime hours with HBAT or non-target species visible
- At least 1 session during early morning performing full protocol with trainer using bat decoy if no HBAT seen
- An additional training session is required prior to 1 June every year, even for experienced surveyors

2. LISTING STATUS & BIOLOGY

The Hawaiian Hoary Bat is listed as endangered under the federal Endangered Species Act (ESA) due to population declines from habitat destruction and lack of population information (USFWS 1998). Hoary bats pup in June, giving birth to twins, and primarily utilize woody vegetation greater than 15 feet in height for birthing and pup-rearing (Bonaccorso et al. 2015). Although adult bats may travel up to 8 miles in a night to forage (Bonaccorso et al. 2015), pups are non-volant for 2-3 months and remain in their birth tree (USFWS 1998).

Although data is sparse, HBAT are known to breed on Kauai, and are also known to utilize a wide range of habitat types. To identify areas and times of use at the installation, an acoustic survey was conducted at PMRF over six months from September 2010 to February 2011 (Bonaccorso and Pinzari 2011). Bats were detected across the entirety of the installation, however the number of bat calls varied by region, elevation and month. The northern part of the base, in particular, is likely used by fledging pups and mating adults, and the overall installation was found to offer habitat for the species. Therefore, it is possible that hoary bats are breeding on the installation and that they may be present in all trees 15' or taller.

3. BAT ROOST DETECTION PROTOCOL

The following survey protocol is based off the *Tree Solutions & Environmental Consulting Services, Inc. Monitoring and Protection Services for Hawaiian Hoary Bats* and the *Hawaiian Electric 2018 Ti400 Hoary Bat Field Guide*.

Roost detection surveys will take place *prior* to tree trimming during the bat pupping season from June 1st to September 15th. The surveys shall commence in the early morning and must be complete by 7am. The Natural Resources Manager (NRM), in coordination with the Installation Environmental Program Director (IEPD) and PWO, will make a determination if the proposed tree trimming is required and therefore a roost detection survey is required. An emergency situation may include situations where there is an imminent threat to human health or safety, or where there is a utility failure that may result in fines or community implications.

1. Equipment

A thermal imaging system, such as the Fluke Ti401 PRO Thermal Camera or the FLIR Scout III Monocular, will be used. Both have been field tested and have demonstrated that they can identify HBAT heat signatures (Nimz and Golden). Only trained individuals will be permitted to use this equipment.

Proper Personal Protection Equipment (PPE) will be used during these surveys. PPE includes the following:

- Hard Hats
- Reflective Safety Vest
- Headlamp with red light

The general equipment needed is as follows:

- Fluke Ti400 (Ti401 PRO Thermal Camera) or the FLIR Scout III Monocular, or similar
- PPE
- Binoculars

- Headlamp
- Field Notebook
- Approved Survey Form
- Measuring tape and/or Laser Ranger finder
- Brightly colored flagging or other marker
- A hard copy of the Hoary Bat Roost Detection Protocol
- GPS
- Camera

2. Survey Procedure

Pre-survey: Determination of necessity, communication plan

As outlined in the Annual Base Notice for Tree Trimming during Bat Pupping Season, the Natural Resources Manager must be contacted prior to the emergency removal of any part of any vegetation 15' or higher from 1 June to 15 September in order to provide opportunity for surveys. If the risk is determined to be immediate, biologists may not have the opportunity to survey prior to removal. The Natural Resources Manager will contact the Installation Environmental Program Director and Public Works Officer, as well as the Fish and Wildlife Service for notification of any emergency actions. Except when not possible due to the nature of the emergency, the day prior to tree trimming PMRF NR personnel will identify trees that are 15ft or higher that are designated to be cut/disturbed. Personnel will count how many trees are 15ft or higher and identify all trees within this category. Photographs of the area prior to trimming will be taken. Trees to be cut or removed will be flagged, and bat roosting surveys of the flagged trees will occur the following morning, prior to 7am.

Survey: Communicate findings, document active trees

Surveys will occur in the 24 hours prior to trimming activities during the HBAT pupping season (June 1st to September 15th). The surveys will be completed within a half hour of sunrise. Too much daylight can result in incorrect readings from the thermal imager. No tree trimming shall commence prior to roost detection surveys, at outlined in this protocol.

All trees 15ft or greater will be examined from all angles from the ground using an approved thermal imager. All branches on each tree being surveyed will be scanned from all angles. The surveyor will walk around the tree at the drip line, examining and scanning the branches and then move 10ft farther from the base of the tree and again walk around the tree. If determined necessary, extra time will be spent observing dense vegetation as well as on the north and west facing areas of the tree. If a thermal signature similar to a bat is observed, a high-powered flashlight will be used to determine whether it is a bat.

All wildlife detected in the trees will be recorded on the data sheet (Appendix 1), along with observation height and information about the tree. If a bat is found in a tree, the tree(s) will be marked with brightly colored flagging. These marked trees with potential bat roosts are not to be cut or disturbed, and their location will be recorded with a GPS device. The results of the survey and identified bat roost locations will be communicated to all personnel involved in the action.

The survey time for each tree will vary but should take approximately 15-30 minutes per tree. If the structure of the tree is such that the surveyor is not satisfied that the thermal imager and high powered flashlights cannot adequately detect a bat through the branches, the tree shall be treated as if a bat is present. The tree(s) in which a bat is present shall not be disturbed until the bats are no longer roosting/pupping in the tree, unless the removal has been classified as an emergency and removal cannot be postponed. In such an instance, the tree will be thoroughly searched after

removal, and findings reported to FWS. All trees or branches within 100' of the roost site shall also be left undisturbed. Trees with non-target detections, that are determined not to be nests of MBTA-listed species, may be trimmed as necessary. Trees that have been surveyed and cleared of bat activity will be delineated by removal of colored flagging. Status of trees will be communicated between the authorized biologist and the tree trimming/removal crew prior to commencement of work.

Prior to tree trimming, the PMRF NRM or designee must provide verbal or written authorization to commence tree trimming activities based on negative survey results to the POC managing the tree trimming/removal work. If the tree services are contracted, the PMRF NRM will coordinate with the government project manager. If bats are determined to be present, the PMRF NRM will coordinate with the PWO to determine the necessity of the activities and determine a plan forward.

After the trees in which bats are present are clearly marked, the 100' buffer is clearly marked, photos have been taken, and the tree trimmer and associated personnel have been briefed, the biologist may leave. Tree trimmers have a 24 hour window to accomplish tree trimming on approved trees. If the 24 hour window expires, a new survey will need to be conducted.

Post survey: Documentation, reporting, follow-on surveys for active roosts

Following trimming, an assessment of the number and species of trees affected will be made. Photographs will be taken of the area, as similar in location, orientation, and composition to the pre-trimming photographs as possible. All marked roost trees will be checked to verify that they were not disturbed and a carcass search will be conducted among the downed woody material to ensure no bats were overlooked during surveys. Carcasses and injured animals will be collected.

If a roost site with bat pups is identified, biologists will conduct weekly checks starting mid-August to identify whether the pups have fledged. The trees should be documented with photographs (if it is safe to do so without disturbing the bats), and measurements taken (dbh, height of tree, height of observations throughout surveys). Once a biologist has determined that bats are no longer in the tree, the markers shall be removed and the tree can be disturbed.

4. REPORTING

A final report documenting the tree trimming/disturbance will generated by the PMRF Environmental Office and will be submitted to the Fish and Wildlife Service (USFWS) within 30 days of the tree trimming (Appendix 2). This report will document, at a minimum, location, time, reason for trimming/ cutting, survey date and time, findings and number and species of trees affected. If any bat pups or carcasses are located during the survey or post-action survey, those findings will be reported to USFWS within 24 hours and the specifics of the finding will be made available within 30 days.

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APPENDIX 1. ROOST DETECTION SURVEY FORM

PMRF Hawaiian Hoary Bat Roost Tree Survey Form

Date: _____ **Location**:_____ **Observers**: _____

Start time:_____ **End Time**:_____ **GPS?** Y / N

Cloud Cover:
___Clear
___Partly cloudy
___Overcast

Rain:
___None
___Mist/ occas.
___Rain

Wind:
___0-15
___15-25
___25+

Elevation:_____ft/m

Survey Area:

Location	Tree Species	Height (ft)	# of Trees

Observation Type:

___ None (No bats observed)
___ Incidental Obs. (bat seen in passing)
___ Host Tree Search (thermal survey of tree)

Tree Species	GPS	Aspect (general)	Tree height (ft)	Roost Height (ft)	DBH	Roost to Tree Trunk Distance (ft)

Observer Directions / Comments / Next time: (Flagging Scheme):

SKETCH MAP OF SITE:

APPENDIX 2. REPORTING FORM

PMRF After-Action Reporting Form for Emergency Tree Trimming

ACTION DATE:

LOCATION (description, inc. elevation and gps):

REQUESTOR:

ACTION REQUESTED (method, area to be treated):

IMPACT IF ACTION WAS POSTPONED:

PRESURVEY DATE/ TIME:

NUMBER/ SPECIES OF TREES >15' IMPACTED:

HBAT SURVEY DATE/ TIME:

OBSERVERS:

METHODS:

BATS OBSERVED? (if yes, attach survey form):

POST-ACTION SURVEY DATE/TIME:

POST-ACTION SURVEY METHOD:

BATS OBSERVED?:

PICTURES (attach pre- and post-action pictures):

2023 Integrated Natural Resources Management Plan (INRMP)

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Integrated Natural Resources Management Plan

Pacific Missile Range Facility
Islands of Kaua‘i, Ka‘ula, and Ni‘ihau, State of Hawai‘i
August 2023

1

Integrated Natural Resources Management Plan
Pacific Missile Range Facility
Islands of Kauaʻi, Oʻahu, Kaʻula, and Niʻihau, State of Hawaiʻi

August 2023

Prepared for:
Naval Facilities Engineering Command, Hawaiʻi
Honolulu, Hawaiʻi

Contract #: # N62470-13-D-8017-KB01

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APPROVAL

This Integrated Natural Resources Management Plan fulfills the requirements of 16 USC §670a et seq. - Sikes Act, as amended; Department of Defense Instruction 4715.03 – Natural Resources Conservation Program; Department of Defense Manual (DoDM) 4715.03 – Integrated Natural Resources Management Plan Implementation Manual; Chief of Naval Operations Instruction (OPNAVINST) 5090.1E – Environmental Readiness Program; and Chief of Naval Operations Manual OPNAV M-5090.1 – Environmental Readiness Program Manual. This document was prepared and reviewed in coordination with the Department of Interior, acting through the Director of the U.S. Fish and Wildlife Service, and the Chairperson/Chair of the Hawai‘i Department of Land and Natural Resources in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resources Management Program on Military Installations.

By their signatures below, or enclosed letters of concurrence, all parties grant their concurrence with and acceptance of the following document.

Approving Official – Pacific Missile Range Facility

_____ _____

Stephen D. Barnett Date
Rear Admiral, U.S. Department of the Navy
Commander, Navy Region Hawai`i

_____ _____

Brett A. Stevenson Date
Captain, U.S. Department of the Navy
Commanding Officer, Pacific Missile Range Facility, Kaua‘i

_____ _____

Jessica H. Behnke Date
Installation Environmental Program Director
Pacific Missile Range Facility, Kaua‘i

_____ _____

Brooke A. McFarland Date
Natural Resources Manager
Pacific Missile Range Facility, Kaua‘i

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By their signatures below, or an enclosed letter of concurrence, all parties grant their concurrence with and acceptance of the following document.

Approving Official – Naval Facilities Engineering Command, Hawai‘i

_____ _____

Cameron J. Geertsema Date
Captain, U.S. Department of the Navy
Commanding Officer, Naval Facilities Engineering Command Hawai‘i

_____ _____

Sherri Eng Date
Director, Regional Environmental Department
Naval Facilities Engineering Command Hawai‘i

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CONCURRENCE

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By their signatures below, or an enclosed letter of concurrence, all parties grant their concurrence with and acceptance of the following document.

Approving Official – State of Hawai‘i

_____ _____

David Smith Date
Admistrator
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CONCURRENCE

This Integrated Natural Resources Management Plan fulfills the requirements of 16 USC §670a et seq. - Sikes Act, as amended; Department of Defense Instruction 4715.03 – Natural Resources Conservation Program; Department of Defense Manual (DoDM) 4715.03 – Integrated Natural Resources Management Plan Implementation Manual; Chief of Naval Operations Instruction (OPNAVINST) 5090.1E – Environmental Readiness Program; and Chief of Naval Operations Manual OPNAV M-5090.1 – Environmental Readiness Program Manual. This document was prepared and reviewed in coordination with the Department of Interior, acting through the Director of the U.S. Fish and Wildlife Service (USFWS), and the Chairperson/Chair of the Hawai‘i Department of Land and Natural Resources in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resources Management Program on Military Installations and the USFWS Guidelines for Coordination on Integrated Natural Resources Management Plans (USFWS 2018b).

By their signatures below, or an enclosed letter of concurrence, all parties grant their concurrence with and acceptance of the following document. Concurrence indicates that the INRMP is compliant as it relates to exemptions under ESA section 4(a)(3)(B)(i).

Approving Official – U.S. Fish and Wildlife Service

_____ _____

Dr. Earl Campbell Date
Field Supervisor
United States Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

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CONCURRENCE

This Integrated Natural Resources Management Plan fulfills the requirements of 16 USC §670a et seq. - Sikes Act, as amended; Department of Defense Instruction 4715.03 – Natural Resources Conservation Program; Department of Defense Manual (DoDM) 4715.03 – Integrated Natural Resources Management Plan Implementation Manual; Chief of Naval Operations Instruction (OPNAVINST) 5090.1E – Environmental Readiness Program; and Chief of Naval Operations Manual OPNAV M-5090.1 – Environmental Readiness Program Manual. This document was prepared and reviewed in coordination with the Department of Interior, acting through the Director of the U.S. Fish and Wildlife Service, and the Chairperson/Chair of the Hawai‘i Department of Land and Natural Resources in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resources Management Program on Military Installations.

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Approving Official – National Marine Fisheries Service

_____ _____

Michael Tosatto Date
Regional Administrator,
Pacific Islands Regional Office, National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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Executive Summary

This Integrated Natural Resource Management Plan (INRMP) is a long term planning document that is intended to guide implementation of natural resources conservation at Pacific Missile Range Facility (PMRF) to support "no net loss" in military mission capability for military installation lands, while protecting and enhancing natural resources, and meeting legal requirements in accordance with the Sikes Act, as amended. The goal of the PMRF INRMP is to provide an adaptive, ecosystem-based conservation program that efficiently supports the installation mission and provides for the sustainability of natural resources. The INRMP provides technical guidance for the integration of natural resource considerations into planning and decision-making processes. The INRMP is the primary means by which natural resources compliance and stewardship priorities are set and funding requirements are identified for DoD installations. The main purpose of the INRMP is to ensure the installation commanding officer has an effectively managed natural resource program that supports and is consistent with the military mission; conserves and rehabilitates natural resources on military installations; sustains multipurpose use of the resources; and allows for public access consistent with safety and security requirements. In addition, the INRMP goals, objectives, and management strategies provide conservation benefits for species listed under the Endangered Species Act (ESA) and encourage participation, as appropriate, in regional ecosystem initiatives.

Pacific Missile Range Facility (PMRF) is located within the Hawaiian archipelago, on lands that are owned, leased, or otherwise controlled by the Navy. Areas included in the INRMP are: 1) Main Base at Barking Sands, 2) the Mākaha Ridge Tracking Station, 3) the Kōkeʻe sites, 4) the Kamokala Ridge Magazines, and 5) limited actions at Port Allen, on Kauaʻi, 6) the Kaʻula Island target range 7) the Mauna Kapu communications and radar facility on Oʻahu, and 8) the Niʻihau Island sites.

This document is a revision of the 2010 INRMP, which was developed to address changes in natural resources management strategies and practices and changes in protected species status for several species known or with potential to occur on or near PMRF. The revision includes management of five additional species: the False Killer Whale (*Pseudorca crassidens*) and Band-rumped Storm-petrel or ʻAkēʻakē (*Oceanodroma castro*), which were listed as endangered in 2012 and 2016 respectively; and the Scarlet Honeycreeper or ʻIʻiwi (*Vestiaria coccinea* syn *Drepanis coccinea*), oceanic whitetip shark (*Carcharinus lonigmanus*), and giant manta ray or Hāhālua (*Manta birostris*), which are listed as threatened under the ESA. The Scarlet Honeycreeper was listed in 2017 and the oceanic whitetip shark and giant manta ray were listed in 2018. A complete list of federally listed species known to occur on or have critical habitat on or adjacent to PMRF are listed included in the document.

This INRMP was developed in accordance with 16 United States Code (USC) §670a et seq. – Sikes Act, as amended; DoD Instruction (DoDI) 4715.03 – Natural Resources Conservation Program; Department of Defense Manual (DoDM) 4715.03 – Integrated Natural Resources Management Plan Implementation Manual; Chief of Naval Operations Instruction (OPNAVINST) 5090.1E – Environmental Readiness Program; Chief of Naval Operations Manual OPNAV M-5090.1 – Environmental Readiness Program Manual and USFWS Guidelines for Coordination on Integrated Natural Resources Management Plans (USFWS 2018b). Numerous Navy personnel, tenants, and related organizations, as well as, federal, state, and regional representatives and other external

organizations were invited to participate in the development and review of this document. The participating federal agencies include the statutory partners, the U.S. Fish and Wildlife Service (USFWS) and the State of Hawai‘i (SOH) Department of Land and Natural Resources (DLNR), including the SOH DLNR Division of Forestry and Wildlife (DOFAW) and the SOH Division of Aquatic Resources (DAR). In addition, the National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Services (NMFS), also called the NOAA Fisheries is another key partner because of the nearshore resources adjacent to PMRF. The public was invited to review the document as required by Sikes Act and associated DoD and DoN regulations.

The 2021 Revised PMRF INRMP establishes planning and management strategies, identifies natural resources constraints and opportunities, supports the resolution of land use conflicts, provides baseline descriptions of natural resources necessary for the development of conservation strategies and environmental assessment, and serves as the principal information source for the preparation of future environmental documents for proposed base actions. The goals, objectives, and management strategies discussed in Section 4.1 through 4.9 are balanced with the requirements of PMRF to accomplish its mission with the highest efficiency. Appendix D provides a list of actions and/or projects to be implemented based on the discussions in Section 4. The effects of implementing this INRMP are addressed under the National Environmental Policy Act (NEPA) by an Environmental Assessment and Finding of No Significant Impact, appended to this document (**Appendix H**).

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Acronyms and Abbreviations

ac	Acre
AFB	Air Force Base
AICUZ	Air Installation Compatibility Use Zone
Air Ops	Airfield Operations
AOA	Airfield Operations Area
APHIS-WS	Animal and Plant Health Inspection Service-Wildlife Services
API	Agricultural Preservation Initiative
APZs	Accident Potential Zones
ARDEL	Advanced Detection Radar Laboratory
AT/FP	Antiterrorism/Force Protection
BASH	Bird/Animal Aircraft Strike Hazard
BL	Badland
BM	Badland-Mahana
BS	Beach Sand
C	Celsius
CECOS	Civil Engineer Corps Officer School
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	Centimeters
CNIC	Commander, Navy Installation Command
CNRH	Commander, Navy Region Hawai‘i
CO	Commanding Officer
COMUSFLTFORCOM	Commander, United States Fleet Forces Command
COMUSPACFLT	Commander, United States Pacific Fleet
CWCS	Comprehensive Wildlife Conservation Strategy
CZ	Clear Zones
DAR	Division of Aquatic Resources
DL	Dune Land
DLNR	Department of Land and Natural Resources
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOE	Department of Energy
DOFAW	Division of Forestry and Wildlife
DoN	Department of The Navy
DPS	Distinct Population Segment
E	Endangered
EDRR	Early Detection and Rapid Response
EFH	Essential Fish Habitat
EMI	Electromagnetic Interference
EMR	Electromagnetic Radiation

EMRG	Electromagnetic Railgun
EMS	Environmental Managment Systems
EOs	Exeutive Orders
EPA	Environmental Protection Agency
EPR	Environmental Program Requirements
ER	Environmental Restoration
ERL	Environmental Readiness Level
ESA	Endangered Species Act
ESQD	Explosives Safety Quantity Distance
F	Fahrenheit
Fd	Fill Land
FONSI	Finding of No Significant Impact
FPCON	Force Protection Conditions
FR	Federal Register
ft	Feet
ft^2	Square Foot/Feet
GHAs	Ground Hazard Areas
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectare
HAPC	Habitat Areas of Particular Concern
HERF	Hazard of Electromagnetic Radiation to Fuel
HERO	Hazards of Electromagnetic Radiation to Ordnance
HERP	Hazards of Electromagnetic Radiation to Personnel
HIANG	Hawai‘i Air National Guard
HWMO	Hawai‘i Wildfire Management Organization
ICRMP	Installation Cultural Resources Management Plan
IEPD	Installation Environmental Program Director
iNFADS	Internet Naval Facilities Assets Data Store
INRMP	Integrated Natural Resources Management Plan
KESRP	Kaua‘i Endangered Seabird Recovery Project
Kf	Kaloko Clay Loam
Kfa	Kaloko Clay
KISC	Kaua‘i Invasive Species Committee
km^2	Square Kilometer(S)
KTF	Kaua‘i Test Facility
LEONIDAS	Low Earth Orbit Nanosat Integrated Defense Autonomous Systems
LUC	Land Use Commission
m	Meter(S)
m^2	Square Meter(S)
MaD	Mahana Silt Loam
MBTA	Migratory Bird Treaty Act
MHI	Main Hawaiian Islands
mi	Mile(s)

MILCON	Military Contruction
MMPA	Marine Mammal Protection Act
MnC	Mamala Stoney Silty Clay Loam
MOAs	Memoranda of Agreements
MOUs	Memoranda of Understanding
MWR	Morale, Welfare, And Recreation
n.d.	No Date
NASA	National Aeronautics and Space Administration
NAVFAC HI	Naval Facilities Engineering Command Hawai‘i
NAVFAC PAC	Naval Facilities Engineering Command Pacific
NEPA	National Environmental Policy Act
NFWF	National Fish and Wildlife Foundation
NERTP	Navy Environmental Readiness Training Program
NHPA	National Historic Preservation Act
NIST	National Institute of Standards and Technology
nm^2	Square Nautical Mile(S)
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NRC	Natural Resources Conservation
NRHP	National Register of Historic Places
NRM	Natural Resources Manger
NTSP	Navy Training System Plan
NWCF	Navy Working Capital Fund
NWHI	Northwestern Hawaiian Islands
NWS	National Weather Service
O&M, N	Operations and Maintenance, Navy
OPNAV M	Chief of Naval Operations Manual
OPNAVINST	Chielf of Naval Operations Instruction
PAO	Public Affairs Office
PMC	Pest Management Consultant
PVC	Polyvinyl Chloride
RBP	Regional Biosecurity Plan for Micronesia And Hawai‘i
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, Testing, and Evaluation
REPI	Readiness and Environmental Protection Integration
RPM	Remedial Project Manager
rRO	Rock Outcrop
rRR	Rough Broken Land
SCAMP	Spacecraft Antenna on Medium Pedestal
SCS	Soil Conseration Service
SOH	State of Hawai‘i
SOPs	Standard Operating Procedures
SOS	Save Our Shearwaters
STARS	Strategic Target Systems

SWAP	State Wildlife Action Plan
T	Threatened
THAAD	Terminal High Altitude Area Defense
TNC	The Nature Conservancy
TOA	Temporary Operating Area
U.S.	United States
UHF/VHF	Ultra-High Frequency/Very High Frequency
USAF	U.S. Air Force
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U. S. Geological Survey
UXO	Unexploded Ordnance
WPRFMC	Western Pacific Regional Fishery Management Council
WRCC	Western Regional Climate Center

1

1.0 OVERVIEW

1.1 Purpose and Authority

In accordance with Title 16 United States Code (USC) §670a et seq. – Sikes Act, as amended; DoD Instruction (DoDI) 4715.03 – Natural Resources Conservation Program; Department of Defense Manual (DoDM) 4715.03 – Integrated Natural Resources Management Plan Implementation Manual; Chief of Naval Operations Instruction (OPNAVINST) 5090.1E – Environmental Readiness Program; and Chief of Naval Operations Manual OPNAV M-5090.1 – Environmental Readiness Program Manual, the Department of the Navy (DoN) is required to implement and maintain a balanced and integrated program for the management of natural resources. This INRMP has been developed for the Commander, Navy Region Hawai‘i (CNRH) and the PMRF Installation to ensure consistency with the installation's military mission and to support "no net loss" in mission capability, while providing for the conservation and rehabilitation and the sustainable multipurpose use of natural resources on PMRF. In accordance with DoD policy on natural resources conservation programs, an INRMP must work to guarantee DoD's continued access to its land, air, and water resources for realistic military training and testing and to sustain the long-term ecological integrity of natural resources and the ecosystem services they provide (DoDI 4715.03). The INRMP must also ensure natural resources conservation and military operations are integrated and consistent with Navy policy on stewardship and all legal requirements concerning natural resources.

This INRMP is a long-term planning document that guides implementation of natural resources conservation at PMRF to ensure support for the installation mission, while protecting and enhancing natural resources, and meeting legal requirements. It provides technical guidance for the integration of natural resources issues into planning and decision-making processes based, to the maximum extent practicable, on the tenets of ecosystem management.

1.2 Scope of Plan

INRMPs are applicable to all DoD operations, activities, real property, and property interests owned, leased, permitted, or controlled in the United States, including public lands withdrawn from all forms of appropriation pursuant to public land laws and reserved for use by DoD, as well as State lands used for military training and testing. DoD operations, activities, and installations in the United States; U.S. territories, trusts, and possessions; and Government-owned and contractor-operated facilities are included within the scope (DoDI 4715.03).

This INRMP was prepared for PMRF, which is located within the Hawaiian archipelago, primarily on Navy-owned property on the western shore of the island of Kaua‘i. Several other leased, rented, or owned properties including Ni‘ihau Island, Ka‘ula Island, and Mauna Kapu, O‘ahu comprise portions of the facility.

The INRMP is applicable to the lands, waters, airspace, and coastal resources of all properties assigned to PMRF including 1) Main Base at Barking Sands, 2) the Mākaha Ridge Tracking Station, 3) the Kōke‘e sites, 4) the Kamokala Ridge Magazines, 5) limited areas at Port Allen, and 6) the Miloli‘i

Ridge reflector on Kauaʻi 7) the Kaʻula Island target range 8) the Mauna Kapu communications and radar facility and 9) the Mount Kaʻala communications center on Oʻahu, and 10) the Niʻihau Island sites. Some of these sites have no natural resources as they are merely building facilities or are only a few square feet (ft^2) in size. Land and water areas covered under this INRMP are more fully described in Section 2.1.2.

1.3 Vision, Goals, and Objectives

The vision for the PMRF Natural Resources Conservation (NRC) Program is to ensure the sustainability of all the ecosystems within the installation and a no net loss of the capability of installation lands or facilities to support the military mission. Maintenance of healthy ecosystems supports realistic military training and testing, which in turn promotes mission readiness. To ensure the success of the NRC Program the following must be accomplished:

- Integrate NRC responsibilities with military activities, installation planning and programming, and other activities as appropriate to ensure no net loss to the Navy mission;
- Ensure sustainable multipurpose use of the resources and public access when consistent with the mission, and safety and security requirements; and
- Interact with the surrounding community to develop positive and productive community involvement, participation, and educational opportunities.

The goal of the PMRF INRMP is to provide an adaptive ecosystem-based conservation program that efficiently supports the installation mission and provides for the sustainability of natural resources. An installation overview is provided in Chapter 2. Natural resources present at the installation are identified in Chapter 3. Management objectives and strategies are identified in Chapter 4. INRMP implementation, five-year and annual reviews, including Navy metrics, and updates are described in Chapter 5.

1.4 Navy Responsibilities

The responsibility for the development, review, revision, and implementation of INRMPs is shared by several commands and other internal Navy stakeholders. The roles and responsibilities for Navy natural resources management are fully described in SECNAVINST 5090.8A, dated 2006 and Manual 5090.1E, dated 2019 and in the Navy guidance for INRMP development and implementation (U.S. Navy 2006). A brief overview of responsibilities for natural resources management at the national and regional levels and at PMRF follows.

1.4.1 Office of the Chief of Naval Operations

The Chief of Naval Operations, Energy and Environmental Readiness Division (N45) is responsible for all Navy environmental and natural resources programs and the development and dissemination of Navy policy guidance for environmental readiness. N45 also serves as the principal leader to provide policy, guidance, and resources for the development, revision, and implementation of INRMPs and represents the Navy on issues and resolves high-level conflicts regarding development and implementation of INRMPs. With N45 support, DoD produces an end-of-year Environmental

Management Review, the Defense Environmental Programs Annual Report to Congress (DEPARC), to meet Congressional and in-house requirements from data derived from the annual metrics review.

1.4.2 Commander, Navy Installation Command

The Commander, Navy Installation Command (CNIC) has overall shore installation management responsibility and authority as the Budget Submitting Office for installation support and the Navy point of contact for installation policy and program execution oversight. The CNIC must ensure the programming of resources necessary to maintain and implement INRMPs; participate in the development and revision of INRMPs; endorse INRMPs and promote and coordinate their implementation, and evaluate and validate Program Objectives Memorandum (POM) submittals and other requests for funds for natural resources projects. The CNIC must also ensure professionally trained natural resources managers have been assigned to implement installation NRC programs and ensure natural resources on government-owned, contractor-operated installations are managed in compliance with natural resources laws, regulations, and applicable policy and guidance.

1.4.3 Commander, Navy Region Hawaii

The Commander, Navy Region Hawaii (CNRH) ensures that installations comply with DoD, Navy, and CNO policy on INRMPs and their associated National Environmental Policy Act (NEPA) documentation; that CNRH INRMPs undergo annual reviews and formal five-year evaluations; and the programming of resources necessary to maintain and implement INRMPs, which involves the evaluation and validation of Environmental Program Requirements (EPR) web-based project proposals and the funding of installation natural resources management staff.

1.4.4 Installation Commanding Officer

The PMRF Installation Commanding Officer (CO) oversees the operations occurring at the facility and is ultimately responsible for all aspects of the facility. The COs role is to: act as steward of natural resources under his or her jurisdiction and integrate natural resources requirements into the day-to-day decision making process; ensure natural resource management and INRMPs comply with all natural resources related Federal regulations, directives, instructions, and policies; involve appropriate tenant, operational, training, or testing commands in the INRMP review process to ensure no net loss of military mission; designate a Natural Resources Manager/Coordinator responsible for the management efforts related to the preparation, revision, implementation, and funding for INRMPs, as well as coordination with subordinate commands and installations; involve advice and counsel with respect to legal matters related to natural resources management and INRMPs; and endorse INRMPs via CO signature. The Installation Commanding Officer is required to participate in the annual natural resources program and INRMP metrics review. The Installation Commanding Officer is required to participate in the annual natural resources program and INRMP metrics review. The Commanding Officer must further send a written report to USFWS and the appropriate state fish and wildlife agency following the annual INRMP metric review no later than 31 January of each year. The report is discussed further in Section 5.4. Annual reviews must also be documented and signed by these parties.

1.4.5 Public Affairs Office

The Public Affairs Office (PAO) provides a significant link between the INRMP and the on-off-facility communities. The PAO can facilitate communication between the facility and the community regarding environmental management initiatives. Any proposed communications outside the facility should be discussed with the PAO.

1.4.6 Naval Facilities Engineering Systems Command

Naval Facilities Engineering Systems Command Hawai‘i (NAVFAC HI) serves as the technical and contracting support command to CNRH and PMRF. NAVFAC HI Natural Resources staff work together with PMRF and Navy activities in an on-going effort to sustainably manage the natural resources at the base. NAVFAC Pacific (NAVFAC PAC) provides additional support to NAVFAC HI, as needed.

1.4.6.1 Public Works Department

Environmental Division

The Public Works Officer is the representative of NAVFAC HI and is responsible to the CO for the PMRF Environmental Program supervised by the Installation Environmental Program Director (IEPD). Within the environmental program, the IEPD oversees natural resources, cultural resources, environmental protection and compliance on the installation. The IEPD is supported by an on-site Natural Resources Manager (NRM) who coordinates implementation of NRC Program projects and natural resources management activities at PMRF. The NRM is the point of contact to provide relevant information on issues with potential to affect natural resources and assures coordination among facility planners and federal and state officials to ensure the base’s continued ability to support the Navy mission. Conservation actions and natural resources management activities are implemented by a team of Natural Resources biologists through a Cooperative Agreement with the Pacific Cooperative Studies Unit (PCSU). This team, in conjunction with the NRM, ensures that appropriate avoidance and mitigation measures are in place to assure protection of federally listed threatened and endangered, or otherwise protected species and their habitats. Natural Resources biologists conduct field surveys and work closely with state and federal agencies to develop and implement the NRC Program. Interns, volunteers or biological technicians may also be brought on to assist with natural resources tasks, when needed. The NRM in coordination with other stakeholders conducts annual reviews to assess the INRMP goals and objectives, establish a realistic schedule for undertaking proposed actions, and determine adjustments needed to keep INRMPs current. It is recommended that the review for operation and effect be conducted during the annual INRMP metrics review.

Integrated Pest Management (IPM) at PMRF is also under the jurisdiction of the Public Works Officer and is conducted through the Base Operations Support Contract for Pest Management, which employees a Pest Management Technician.

1.4.7 Air Operations

Responsibility for the bird/animal aircraft strike hazard (BASH) program primarily lies with the Air Operations Officer at PMRF. The BASH program, however, coordinates with all entities supporting

the aviation mission, including the Environmental Program. The IEPD is responsible for ensuring the BASH program is compliant with all applicable state and federal environmental laws and regulations, and all applicable DoD, DoN, and U.S. Navy policies, directives, and instructions (CNICINST 3700). In addition, CNIC has a work/financial plan with the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Wildlife Services (WS) to provide BASH support at Barking Sands.

1.4.8 Morale, Welfare, and Recreation

Morale, Welfare, and Recreation (MWR) provides recreational opportunities to active and retired military and their dependents, DoD civilians, and sponsored guests at PMRF. MWR manages the beach cottages, recreational beach facilities, and access via the base to recreational beaches at Barking Sands and sponsors many outdoor recreational activities. MWR works with the Environmental Program to avoid and mitigate any impacts recreational activities may have on protected and sensitive species and other natural resource and collaborates on beach clean-up and Earth Day events.

1.4.9 Security Forces

Security Forces at PMRF are responsible for base security and provide support to the Environmental Program in several ways. During daily security patrols, they are asked to report particular sightings of note of rare, threatened, or endangered species that may occur on base or in the nearshore environment; and they provide a single point of contact for environmental emergencies such as injured bird response (Security then conducts proper notifications to Environmental). Conservation law enforcement is also under the purview of Security Forces and as such they enforce beach restrictions and ensure that all protective measures for protected species and wildlife are enforced. PMRF has a designated game warden who oversees the PMRF Archery Club and coordinates hunts with PMRF Command and Division of Forestry and Wildlife (DOFAW).

1.5 External Partner Responsibilities

1.5.1 Integrated Natural Resource Management Plan Signatories

A number of federal and state agencies have an interest or a role in the management of natural resources at PMRF. The involvement of these agencies is based on signatory responsibilities, cooperative agreements, regulatory authority, and technical assistance as required by federal laws and regulations. The signatories include the USFWS, National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Services (NMFS), also called the NOAA Fisheries; and the SOH DOFAW. These partners participate in INRMP reviews for operation and effect, provide advice and subject matter expertise on conservation objectives and strategies, participate in project development, and, where applicable, participate in project implementation. The partners also provide feedback on annual INRMP implementation.

The primary mission of the USFWS is working with others to conserve, protect and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people (USFWS 2019a). The USFWS provides the Navy technical assistance with rare plant and wildlife issues. In addition, the DoD and Navy consult formally and informally with the USFWS on the impacts of Navy activities on

federally listed species and designated critical habitat under section 7 of the ESA, as amended (16 U.S.C. §1631).

NOAA Fisheries is responsible for the stewardship of the nation's ocean resources and their habitat. They provide vital services for the nation: productive and sustainable fisheries, safe sources of seafood, the recovery and conservation of protected resources, and healthy ecosystems (NOAA Fisheries 2019). The Navy coordinates and consults with NOAA Fisheries regarding marine resources including Hawaiian Monk Seal or ʻIlio-holo-i-ka-uaua (*Neomonachus schauinslandi*), marine mammal, and sea turtle surveys, strandings, and management.

The mission of DLNR DOFAW is to responsibly manage and protect watersheds, native ecosystems, and cultural resources and provide outdoor recreation and sustainable forest products opportunities, while facilitating partnerships, community involvement and education (SOH DOFAW 2019). The Navy coordinates with DOFAW on seabird protection and other wildlife management issues.

This INRMP reflects the mutual agreement of these parties concerning conservation, protection, and management of fish and wildlife resources. Future involvement of the state and federal wildlife agencies will ensure continued mutual agreement and cooperation in managing the natural resources at PMRF through annual INRMP reviews and reviews for operation and effect. The INRMP also supports critical habitat exemptions for listed species on PMRF land.

1.5.2 Other External Organizations and Partners

PMRF also maintains strong, collaborative working relationships with the SOH DLNR Division of Aquatic Resources (DAR), the County of Kauaʻi Department of Planning, the University of Hawaiʻi /Kauaʻi Community College, the Kauaʻi Invasive Species Committee (KISC), non-governmental organizations including the Cascadia Research Collective, The Nature Conservancy (TNC), the National Tropical Botanical Gardens, the Kauaʻi Endangered Seabird Recovery Project, Save our Shearwaters (SOS), Native Hawaiian Organizations, and two Hawaiian language charter schools for children from Niʻihau.

PMRF is an active member of the Kauaʻi Conservation Alliance, which is a consortium of governmental non-governmental organizations and individuals who gather quarterly to share experiences and lessons learned in their various specialties and areas of interest, with the focus on cultural and natural resource conservation and education related specifically to Kauaʻi. It is an informal outreach forum where natural resources managers and concerned citizenry from different backgrounds with different mandates and/or opinions can network at a personal level.

1.6 Stewardship and Compliance

The Navy is responsible for complying with all applicable environmental laws and regulations including Presidential Executive orders (EOs); and Memoranda of Agreements or Understanding (MOAs or MOUs), and DoD and Navy directives, instructions, and manuals. The DoN further recognizes that actions beyond complying with environmental regulations are often required to sustain the mission and meet environmental stewardship responsibilities. Stewardship is the responsibility to inventory, manage, conserve, protect, and enhance the natural resources entrusted to one’s care in a

way that enhances the resources and their benefits for present and future generations (OPNAV M 5090.1). This INRMP identifies both stewardship and compliance actions and projects that help meet natural resources management goals at PMRF.

Key environmental regulatory drivers and their implication for natural resources management at PMRF were considered during the development of this INRMP and are described in **Appendix A**.

1.7 Statutory Requirements Pertinent to Natural Resources Management

1.7.1 Sikes Act

The Sikes Act is the primary federal statute requiring natural resource management on military installations. The Sikes Act requires, to the extent appropriate and applicable, that the INRMP provide for:

- Fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation;
- Fish and wildlife habitat enhancement or modifications,
- Wetland protection, enhancement, and restoration, where necessary for support of fish, wildlife, or plants;
- Integration of, and consistency among the various activities conducted under the plan;
- Establishment of specific natural resources management objectives and time frames for proposed actions;
- Sustained use by the public of natural resources to the extent such that use is consistent with the needs of fish and wildlife management and subject to installation safety and security requirements;
- Enforcement of applicable natural resources laws and regulations;
- No net loss in the capability of installation lands to support the military mission of the installation; and
- Such other activities as the Secretary of the military department determines appropriate.

The development and implementation of this INRMP revision fulfills the statutory requirements as defined under the Sikes Act.

1.7.2 Other Environmental Statutes

Additional federal environmental laws that are primary legal drivers for natural resources management at PMRF include, but are not limited to:

- Endangered Species Act (ESA)
- Migratory Bird Treaty Act (MBTA)
- Marine Mammal Protection Act (MMPA)
- Clean Water Act
- Coastal Zone Management Act
- Magnuson-Stevens Fisheries Conservation and Management Act
- Federal Noxious Weed Act

- NEPA
- Clean Air Act

Environmental mandates also include several presidential EOs and MOUs such as:

- EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds
- EO 13751 – Safeguarding the Nation from the Impacts of Invasive Species
- EO 11990 – Protection of Wetlands
- EO 11988 – Floodplain Management
- EO 12962 – Recreational Fisheries
- MOU between DoD and USFWS and the Association of Fish and Wildlife Agencies for a Cooperative Integrated Natural Resources Management Program on Military Installations (Tripartite Agreement)
- MOU between DoD and the Pollinator Partnership
- MOU between DoD and USFWS to Promote the Conservation of Migratory Birds
- MOU between DoD and Bat Conservation International.

A description of these statutory drivers and copies of the above-referenced MOUs that are integral to natural resources management at PMRF are provided in Appendix A and B, respectively.

1.8 Navy Natural Resources Management

Navy policy on natural resources management, as summarized from OPNAVINST 5090.1E, is to manage natural resources in support of and consistent with the installation mission, while protecting and enhancing those resources. Land use practices and decisions must be based on scientifically sound conservation procedures and techniques, use scientific methods, and have an ecosystem management approach.

1.8.1 Ecosystem Management

DoDI 4715.03 further requires that INRMPs incorporate the principles of ecosystem management for natural resources under the stewardship and control of DoD. DoD recognizes that maintaining or improving biodiversity contributes to overall ecosystem integrity and sustainability in support of the military mission. The goals of this strategy are to maintain and improve the sustainability and biological diversity of terrestrial and aquatic ecosystems while supporting sustainable economies, human use, and the environment required for realistic military training operations. The basic principles and guidelines of ecosystem management are to:

- Preserve the function and integrity of natural ecosystems,
- Integrate human social and economic interests with environmental considerations,
- Involve all interested parties and stakeholders in identifying management goals, and
- Adapt to changing conditions and requirements.

It is DoD policy to conduct installation programs and activities to identify, maintain, and restore the composition, structure, and function of natural communities that comprise ecosystems to ensure their

long-term sustainability and biodiversity at landscape and other relevant ecological scales to the maximum extent that the mission allows.

1.8.2 Adaptive Management

In order to be responsive to new information, changing conditions, or changes in mission requirements, an adaptive management approach should be implemented for natural resources management. Adaptive management is the process of implementing policy decisions as scientifically driven management experiments that test predictions and assumptions in management plans and use the resulting information to improve policy and management decisions (OPNAV M-5090.1). Annual reviews with installation stakeholders help facilitate adaptive management.

2.0 LOCATION, LAND USE, HISTORY

2.1 General Overview

2.1.1 Location of PMRF Facilities

PMRF is part of and falls under the command of CNRH. CNRH is comprised of over 23,000 ac (9,308 ha) of land and water resources. PMRF is comprised of the Main Base at Barking Sands on the western shore of the island of Kauaʻi and the support facilities at Mākaha Ridge (secondary range), Kōkeʻe (tracking radars, telemetry, communications, command and control), Kamokala Ridge Magazines (explosive storage), Miloliʻi Ridge (reflector site), and Port Allen (pier and building facilities) on Kauaʻi; Kaʻula Island (aircraft gunnery and inert ordnance target practice); Mauna Kapu, and Mount Kaʻala (communications and radar) on Oʻahu; and the Niʻihau Sites (radar, optics, and electronic warfare) on Niʻihau Island (**Figure 2-1, Table 2-1**).

No management activities or projects are recommended for the Miloliʻi Ridge reflector site on Kauaʻi or the Mount Kaʻala communications center on Oʻahu. The Miloliʻi site only encompasses posts supporting three passive 200 ft^2 reflectors and the Mount Kaʻala facility consists only of leased office space; neither site presents natural resources management opportunities.

The Navy also holds a restrictive easement for an area of 2,100 ac (850 ha) adjacent to Barking Sands. For public safety, the easement allows the Navy to restrict access during missile testing and launches. Management of this area is conducted by the SOH and is therefore not addressed in this INRMP.

2.1.2 Nearshore Areas

Nearshore areas include all submerged lands titled to the military and all other submerged lands that are adjacent to installations that extend from the mean high-water level, offshore to the boundary of any security areas controlled by the Military Services (DODI 4715.03). Although the PMRF installation boundary ends at the high-water mark and the Navy does not own submerged lands seaward of the high-water mark, PMRF conducts monitoring and implements proactive management to ensure conservation benefits are provided to aquatic species and habitats in waters adjacent to the installation.

The Navy also controls primary land access to water assets off Barking Sands. All persons, boats, vessels, or other craft are prohibited from entering, transiting, or remaining within, the danger zone during range operations, test and training activities, or increases in force protection that pose a hazard to the general public (33 Code of Federal Regulations [CFR] Section 334.1390). There is a no anchorage zone off Barking Sands because of the presence of underwater cables.

2.1.3 Offshore Areas

PMRF provides support for the operation of 1,100 square nautical miles ([nm^2]; 3,773 km^2) of offshore underwater ranges. The underwater ranges are within open ocean areas and extend into territorial waters, which are not under the jurisdiction of PMRF. The Navy does however conduct annual marine mammal monitoring for the Hawaiʻi Range Complex including offshore areas at PMRF (DoN 2008b). The natural resources of the underwater ranges are discussed in detail in the Hawaiʻi Range Complex

Environmental Impact Statement (DoN 2008a) and the Marine Resources Assessment for the Hawaiian Islands Operating Area (DoN 2005) as well as annual marine resources monitoring reports.

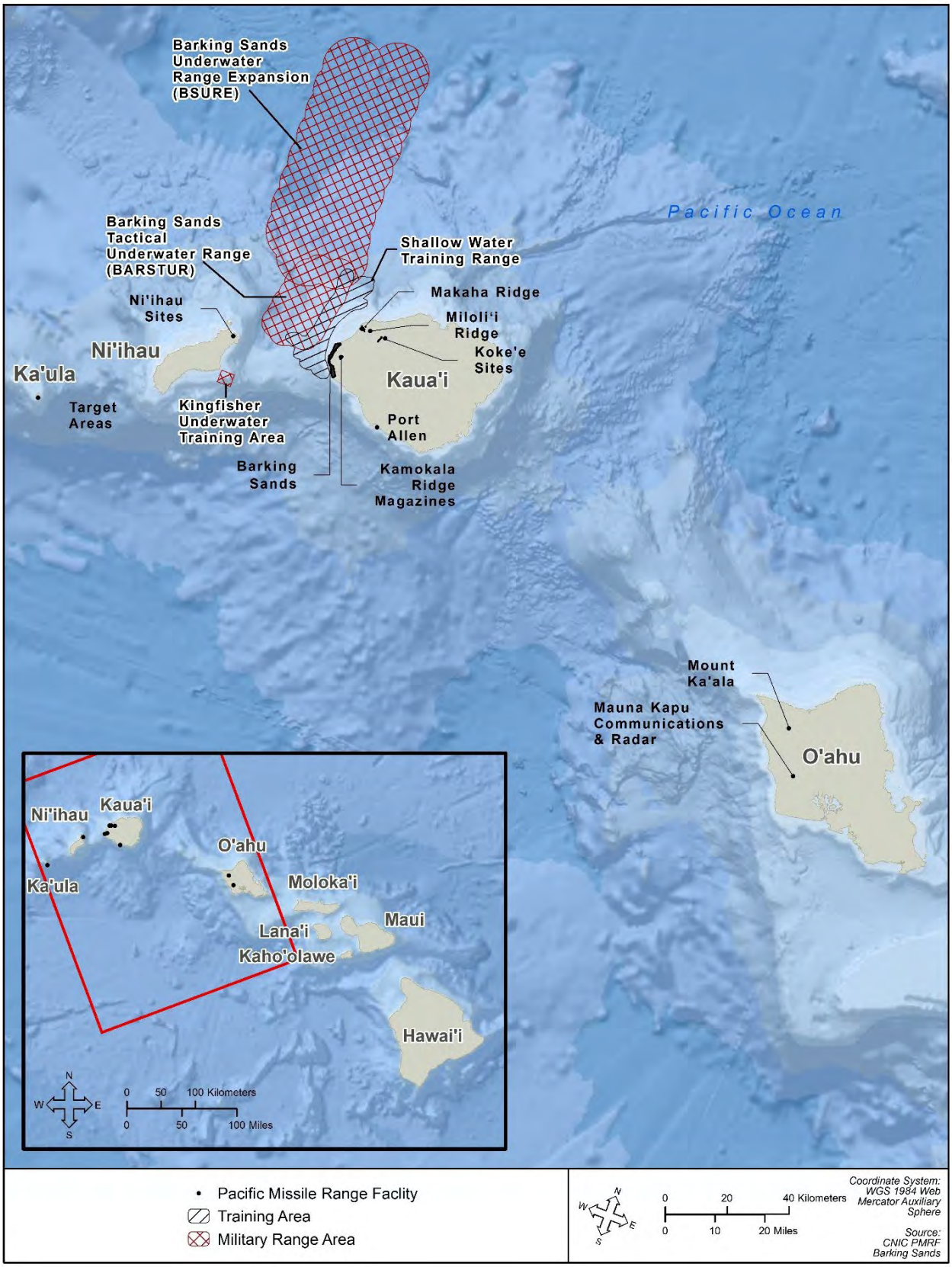


Figure 2-1. PMRF Site Locations and Supported Offshore Ranges

Table 2-1. Lands Owned, Leased or Otherwise Used by the PMRF

PMRF Facility	Land Area (ac / ha)	Ownership/Lease	Land Use and Types of Operations	Included in INRMP
KAUA‘I				
Barking Sands (Main Base)*	2,338 / 946	Navy	Range operations, missile assembly and launch, radar tracking, communications, aviation and aviation support, torpedo shop, personnel support	Yes
	200 / 81	SOH Lease		
	2,100 / 850	Restrictive Easement on SOH land	Ground hazard area during launches; Safety arcs ranging from 6,000 to 10,000 ft (1,829 to 3,048 m)	No
Mākaha Ridge Tracking Station	244 / 99	SOH Lease	Secondary operations area: (1) radar tracking; (2) telemetry receiving/recording; (3) frequency monitoring; and (4) target control	Yes
Kōke‘e Sites	22.4 / 9.1	NASA Sublease, SOH land		
Site A	4.6 / 1.9		Support buildings: (1) tracking; (2) command; (3) training; (4) administration; and (5) logistics	Yes
Site B	2.1 / 0.8		Power plant and fuel storage facility	Yes
Site C	2.1 / 0.8		Bore sight equipment, microwave antenna, and radar support buildings	Yes
Site D	6.9 / 2.8		Transmitter building and antenna support facilities	Yes
Site E	6.7 / 2.7		National Aeronautics and Space Administration’s (NASA’s) Kōke‘e Geophysical Observatory with large antenna arrays	Yes
Kamokala Ridge Magazines	104 / 42	SOH Lease	Magazines for ordnance storage	Yes
Miloli‘i Ridge	0.015/0.006	SOH Lease	Three 10 ft^2 (0.9 m^2) reflector sites (posts), each supporting one 200 ft^2 reflector	No

PMRF Facility	Land Area (ac / ha)	Ownership/Lease	Land Use and Types of Operations	Included in INRMP
Port Allen	1.0 / 0.4	SOH Lease	Warehousing, surface craft–support - building space only	Yes
NI‘IHAU				
Ni‘ihau Sites (Pāni‘au Radar Site)	1,170 / 473	Ni‘ihau Ranch Lease	Communications/electronics training activities, Perch Site and Optical Tracking Station; and Pāniau Radar Site	Yes
KA‘ULA				
Ka‘ula Island	108 / 43	Navy	10 ac (4 ha) target range for aircraft gunnery and inert ordnance	Yes
O‘AHU				
Mauna Kapu Facility	2.0 / 0.8	1.9 ac (0.8 ha) leased from the Gill-Ewa Lands LLC 0.1 ac (0.08 ha) under use agreement with U.S. government	Communications and radar tracking facility and frequency monitoring station building on a 0.4 ac (0.2 ha) site; 1.5 ac (0.6 ha) in utility easements	Yes
Mount Ka‘ala	1.8 / 0.7	FAA Lease	Communication– Center - building space only	No

*Barking Sands (Main Base) Combined Ownership/Lease Land Area 4,638 ac / 1877 ha

Commander, United States Fleet Forces Command (COMUSFLTFORCOM) and Commander, United States Pacific Fleet (COMUSPACFLT) are designated as the area environmental coordinators while at sea. COMUSFLTFORCOM and COMUSPACFLT ensure consistent application of environmental policy for Navy actions occurring on fleet training ranges and at sea operating areas from the high-water mark seaward within their assigned areas of responsibility.

2.2 Barking Sands Location, History, and Mission

2.2.1 Location

The principal operations area for PMRF is located at the Barking Sands facility on the western shore of the island of Kauaʻi. The Main Base at Barking Sands is approximately 26.5 mi (42.6 km) west of Līhuʻe, the county seat and second largest city on Kauaʻi. Barking Sands occupies approximately 2,538 ac (1,027 ha) of Navy-owned and leased land that extends from Polihale State Park in the north to Kokole Point in the south **(Figure 2-2**). Barking Sands has approximately 7.6 mi (12.2 km) of shoreline. It is just over 0.6 mi (1.0 km) at its widest points at the northern and southern boundaries and narrows to 0.3 mi (0.5 km) in the middle of the base. The northern section of Barking Sands also houses Sandia National Laboratories launch areas for the Department of Energy (DOE) and provides PMRF with rocket launch services for target systems and upper atmosphere measurements. Land seaward of the upper wash of waves or the vegetation line is unencumbered state land and the Navy has no direct management authority over this shoreline. The Navy, however, is given the authority by 33 CFR 334.1390 to limit public access to restricted beach areas for safety during operational hours.

Barking Sands is in a SOH Land Use Commission (LUC) designated State Conservation District with its eastern border adjacent to a State Agricultural District (SOH LUC 2012). A 5,000-ac (2,023-ha) Agricultural Preservation Initiative (API) area, which is administered by the SOH Department of Agriculture, Agribusiness Development Corporation, lies within the agricultural district. These lands are leased to various agricultural operations, including multi-national seed corporations.

Polihale State Park lies to the north of Barking Sands. This remote 140-ac (57 ha) beach park along the coastal dunes provides camping areas and day use facilities. The southern end of Barking Sands is bordered by the State's 158-ac (64 ha) Kekaha Agricultural Park, and Kekaha Landfill, which the County is planning to expand via vertical expansion (AECOM 2013), and the 68-ac (28 ha) Hawaiʻi Army National Guard Kekaha Range Facility. A small area of land along the southeast side of the base is also used for inland shrimp farming. The 37-ac (15 ha) Kawaiʻele Waterbird Sanctuary, which is managed by DOFAW, is situated near the middle of the base east of the boundary; the first phase of the adjacent DOFAW-managed Mānā Plain Wetland Restoration Project will be 60 ac (24 ha) and completed in 2022.

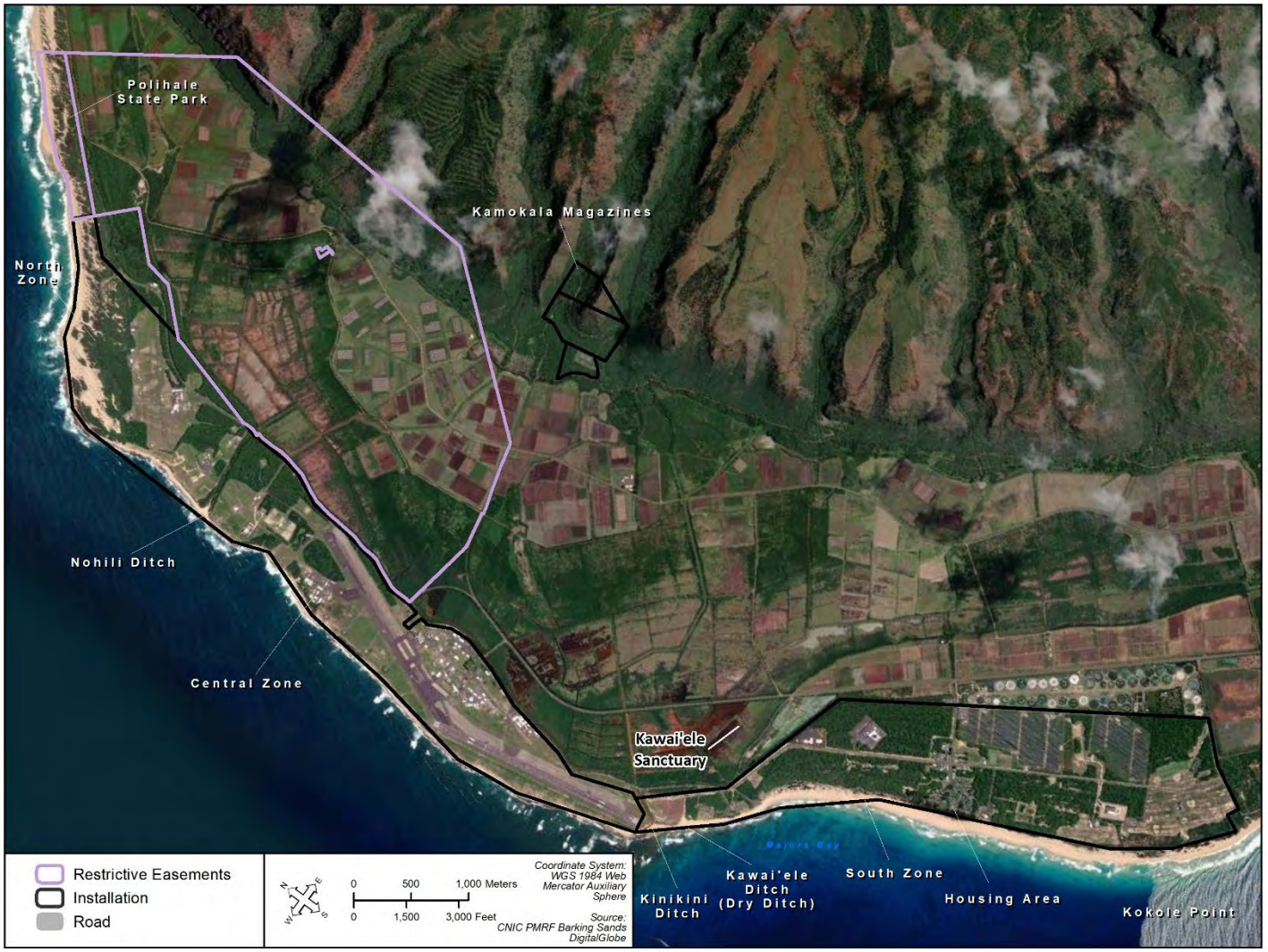


Figure 2-2. Barking Sands Overview

Kekaha, with a population of approximately 3,540 in 2010 (City Data 2015), is the nearest town and is located about 5.5 mi southeast of Barking Sands. Tourism, education, agriculture, and waste management are the leading industries in Kekaha (City Data 2015).

2.2.2 Abbreviated History and Pre-Military Land Use

Archaeological studies indicate that traditional land use in the Mānā Plain region included habitation, fishing, agriculture, and ceremonial activities. The Mānā area was especially known for its offshore fishing grounds and both temporary, seasonal fishing camps and permanent dwellings were located on the dunes or coastal back beach areas. During pre-Contact times, the coastal dunes were also used as burial grounds and human remains have been found in the sands from the north end of Barking Sands to Waiokapua Bay or Majors Bay (DoN 2012a).

Numerous historic properties including Native Hawaiian sites, plantation-era sites, and World War II-era military sites have been identified at Barking Sands. Most of these sites are located within the coastal dunes, which are considered an area of high archaeological sensitivity both because of the known buried cultural deposits and Native Hawaiian human remains, and because of the potential for encountering additional subsurface resources in the future (DoN 2012a). Plantation-era sites include a Japanese cemetery, Kawai‘ele Ditch, numerous burial sites, and a dump site. The dump site, found in 1999, was observed in the missile storage area and consisted of four to five decades worth of household items (e.g., bottles, ceramic wares, cans), vehicles, refrigerators, stoves, washing machines, 55-gallon drums, and steel cables (DoN 2012a). World War II-era sites include concrete pillboxes, concrete boxes, concrete piers and metal gun turret, wooden structures, revetments and concrete tanks (DoN 2012a). Architectural studies have also identified a number of Plantation-era elements (Kawai‘ele Ditch, Kinikini Ditch, and Nohili Ditch), and World War II-era and Cold War-era buildings at Barking Sands that are eligible for listing on the National Register of Historic Places (NRHP) (DoN 2012a).

Barking Sands Landing Field was established in 1921 as a territorial airport, one of many landing fields that were established and maintained by the U.S. Military, the government of the Territory of Hawai‘i, and commercial airlines. The 2012 Integrated Cultural Resources Management Plan (ICRMP, DoN 2012a) indicates the following key historical events leading to the present status of Barking Sands:

1922: Wetlands inland of Barking Sands were drained via a ditch through the Nohili Dune by the Kekaha plantation manager to convert the low-lying marshes into sugar cane fields. Natural water flow was replaced by a system of pumps and side canals.

1923: The Governor of the Territory of Hawai‘i designated 143 ac (57 ha) south of the Nohili Dunes as Mānā Park.

1928: An additional 550 ac (222 ha) south of Mānā Park became the site of the Mānā Airport. The airport was seldom used and was later disestablished by the Governor.

Mana Airport, looking south, 1935. Courtesy of the National Archives and Records Administration

1939-1944: The Governor set aside the former Mānā Airport land as the site for the Mānā Airport Military Reservation. Development began in 1940, and an additional 1,509 ac (610 ha) were acquired for base expansion. In 1941, the Governor withdrew control of the Mānā Park land from the County Board of Supervisors. Development of base defensive positions followed. The primary mission of the newly expanded Barking Sands Army Base during World War II was flight training. The base played a supporting role for U.S. Army Air Corps B-17s engaged in the Battle of Midway. Use of Barking Sands diminished with the end of World War II.

Barking Sands Army Base, looking south, 27 October 1943. Courtesy of the National Archives and Records Administration

1947-1949: The U.S. Air Force (USAF) was established and the base was re-designated as Barking Sands Air Force Base (AFB). Within a year, the USAF declared the base excess and deactivated the facility.

1953: Following the Korean War, Barking Sands was reactivated, renamed Bonham AFB, and was used to stockpile ordnance, missile loaders, and vehicles. Soon thereafter, Bonham AFB was downgraded to an Air Force Station. The Hawai‘i Air National Guard conducted quarterly flight deployment activities until 1992.

1956: The Navy was given permission by the USAF to use Barking Sands for the Regulus missile program, which continued until 1965. The missiles were stored and maintained at Barking Sands.

1958: Barking Sands became one of four fixed Pacific Missile Range stations in Hawai‘i as part of a network including three bases in California and eight islands in the Pacific. These stations tracked ballistic missiles launched from California and detected the impact of missile reentry.

1961-1962: Sandia National Laboratories (an Atomic Energy Commission/DOE contractor) established the Kaua‘i Test Facility (KTF). Rocket launching facilities were established at the northern end of Barking Sands in the Nohili Dunes area. These facilities supported atmospheric nuclear testing in the Pacific and later became available for other research, development, testing, and evaluation (RDT&E) activities by other federal and international agencies and laboratories.

1961-1964: The Navy was recognized as the primary user of Barking Sands and requested a transfer of lands from USAF. Three years later the transfer was completed and Bonham Air Force Station became the Navy's Auxiliary Landing Field Bonham. During the transition, the Navy transferred 229 ac (92 ha) at the southern end of the base for the Army's Pacific Scatter Station, which operated until 1967. The land was then returned to the Navy.

1966-1976: Auxiliary Landing Field Bonham was renamed Pacific Missile Range Facility or PMRF. The PMRF Hawai'i and Area Headquarters moved from Kāne'ohe Bay, O'ahu, to Barking Sands, Kaua'i. Development of an enlarged underwater range began in 1976 and became fully operational shortly thereafter.

1993-1994: PMRF supported research and development launching associated with Strategic Target Systems.

2.2.3 Military Mission, Operations, and Activities

Barking Sands is the principal operations area for PMRF and supports surface, subsurface, air, and space activities. The Mission of Barking Sands is to oversee and coordinate training events from unit level to multi-national exercises while simultaneously conducting or supporting RDT&E of U.S. Navy, other DoD, and Federal agency programs and platforms. In support of this mission, the base provides integrated range services in a modern, multi-threat, multi-dimensional environment that ensures the safe conduct and evaluation of training and RDT&E missions.

Barking Sands consists of 1,100 square nautical mi (nm^2) of instrumented underwater ranges, 42,000 nm^2 of controlled airspace, and a Temporary Operating Area (TOA) that primarily extends north and west of Kaua'i and covers some 2.1 million nm^2 of ocean area. The ranges are capable of supporting surface, subsurface, air and space events and activities simultaneously. The large area of the TOA, coupled with tracking and surveillance radars, data processing, and other communications networks Barking Sands supports RDT&E activities in the TOA for missile defense testing. Operations and activities and their associated support facilities at Barking Sands can be divided into three major areas with unique activities that dictate the constraints for that area (see **Figure 2-2**). The three areas include the:

North Zone. This area consists of all lands north of Nohili Ditch and includes the DOE KTF, a tenant aboard the base, the northern launch pad areas, and a Terminal High Altitude Area Defense (THAAD) anti-ballistic missile facility. The area is devoted to missile assembly and launch operations and RDT&E programs. Area access (including public beach access) is controlled during missile launches.

Central Zone. The central third of Barking Sands, delineated by Nohili Ditch on the north and Kawai'ele Ditch (also known as Dry Ditch) on the south includes the Main Operations Area, which supports functions that relate to flight line operations, supply and storage, public works maintenance, and range operations. The Airfield Operations Area (AOA) includes the 6002-ft (1,829-m) runway and associated airfield operations (Air Ops) facilities. In addition to the runway, these facilities include 3 helicopter landing pads, main hangar, and administrative buildings. The airfield supports C5- and C17-type cargo aircraft, tactical aircraft, and helicopters. Operations support aircraft consist primarily of C-26 airplanes used for logistics and range surveillance, and S-61 helicopters used for personnel transfer,

logistics, surveillance, and target recovery. This area is constrained by runway clear zones and accidental potential zones, as well as imaginary surfaces established (Aviation Safety Zones) to avoid dangerous encroachments into PMRF's navigational airspace.

South Zone. The Southern Zone lies south of Kawai'ele Ditch (also known as Dry Ditch) and consists of personnel support, bachelor and family housing units and community support, and recreation facilities such as a Navy Exchange and Shoppette, gymnasium, youth center, fitness center, soccer field, and movie theater. Range operations and antenna fields, a THAAD radar facility, AEGIS Ashore facility, undeveloped lands, a sewage treatment plant, and the southern launch pad are located at the southern end of this zone. A Hawai'i Air National Guard (HIANG) complex is also located in this zone.

2.2.4 Possible Mission Constraints

Current and future land uses at Barking Sands are limited by some constraining factors that need to be considered in the planning phase of construction or land use change. Natural and cultural resources constraints include wetlands habitat; nesting or overflight areas for rare, threatened, and endangered species; and sites on which significant cultural resources occur. Other restrictions on mission and land use are due to operational, environmental, and safety constraints. Base functions include radar tracking and surveillance, global positioning system (GPS) data processing, communications, and Range Operations Center command and control. In addition, Barking Sands supports an active airfield with target support, a live ordnance area, an ordnance and launching area, and a torpedo shop for torpedo operations and recovery. Land use constraints related to operations and training are designed to safeguard the public and base personnel from the potential hazards associated with operation and training activities and include Ground Hazard Areas, Electromagnetic radiation (EMR) zones, Explosive Hazard Zones, Aviation Safety Zones, and Range Safety Zones (**Figure 2-3**).

2.2.4.1 Ground Hazard Areas

Ground Hazard Areas (GHAs) have been established for the U.S. Navy Vandal missile launches and Strategic Target Systems (STARS) launches. These GHAs consist of arcs with a radius of 6,000 ft (1,829 m) for Vandal launches and 10,000 ft (3,048 m) for STARS launches to exclude non-essential personnel and the public from the hazardous areas. Some of these areas extend off base. As such, PMRF coordinates with the SOH and DLNR Division of State Parks to ensure impacted areas of Polihale Beach Park remain clear during missile launches.

2.2.4.2 Electromagnetic Radiation Zones

Line of sight requirements exist for microwave antennas and in the path of radars, as such unobstructed paths must be maintained. These required "look angles" constrain the development and placement of structures in order to avoid the introduction of electromagnetic interference (EMI). EMR zones are placed around transmitter sites and tracking radars to negate hazards of electromagnetic radiation to personnel (HERP), hazards of electromagnetic radiation to ordnance (HERO), or hazards of electromagnetic radiation to fuel (HERF). Radar and transmitter sites are situated for clear lines of sight so as to eliminate hazards to personnel in areas immediately in front of each emitter.

2.2.4.3 Explosives Safety Quantity Distance

The DoD requires that Explosives Safety Quantity Distance (ESQD) arcs be established around all activities involving explosives. These activities include storage, handling, transportation and staging of explosives. The distance an ESQD arc extends from an individual potential explosion site is based upon:

- The construction and type of potential explosion site.
- The hazard division (also known as explosive hazard classification/division) of net explosive weight for quantity distance determination of ammunition and explosives in the potential explosion site.
- The construction and type of exposed site.
- The distance separating the potential explosion site from the exposed site.
- In some instances, the orientation of the potential explosion site and the exposed site.

The land use within ESQD arcs and required separation distance is dependent on its purpose, for instance, activities and facilities not directly related to explosive storage and handling must be located at greater distances from a potential explosion site then activities and facilities directly related to explosives storage and handling operations. The ESQD arcs shown in **Figure 2-3** indicate inhabited building distances and the area within which construction of occupied facilities is not allowed. The ESQD arcs on Barking Sands extend beyond its borders into agricultural lands and the ocean on the northern portion of the base. Barking Sands has an MOA with the SOH to restrict land use within the ESQD arcs that extend off base property.

2.2.4.4 Aviation Safety Zones

Aviation Safety Zones are established around airfields to protect flight operations from encroachment by activities that are not compatible with aviation and to mitigate the impact flight operations have on activities not associated with aviation. Military installations develop Air Installation Compatibility Use Zone (AICUZ) programs to promote compatible development in the vicinity of their airfields. The AICUZ itself is a composite of many factors: day-night average noise levels, accident potential, and aircraft flight paths and altitudes. The purpose of the AICUZ program is the protection of public safety and health as well as protection of the Navy's national defense mission.

Clear zone (CZ) and accident potential zone (APZ) designation is based upon statistical analysis of past DoD aircraft accidents. The CZ, the area closest to the runway end, is the most hazardous. The overall risk is so high that DoD generally acquires the land through purchase or easement to prevent development. APZ I is an area beyond the CZ that possesses a significant potential for accidents. APZ II is an area beyond APZ I having a lower, but still significant, potential for accidents. While aircraft accident potential in APZs I and II does not warrant acquisition by the Navy, land use planning and controls are strongly encouraged in these areas for the protection of the public. The Navy's CZ is a trapezoidial shape, 3,000 ft (914.4 m) long, and divided into three sections called the Type 1, Type 2 and Type 3. The CZ Type 1 is defined by an area 1,500 ft (457.2 m) wide (centered on the runway) and extending from the end of the runway to 1,000 ft (304.8 m) past the end of the runway. The CZ Type 2 is 500 ft (152.4 m) wide (centered on the runway) extending from the end of the CZ Type 1 for

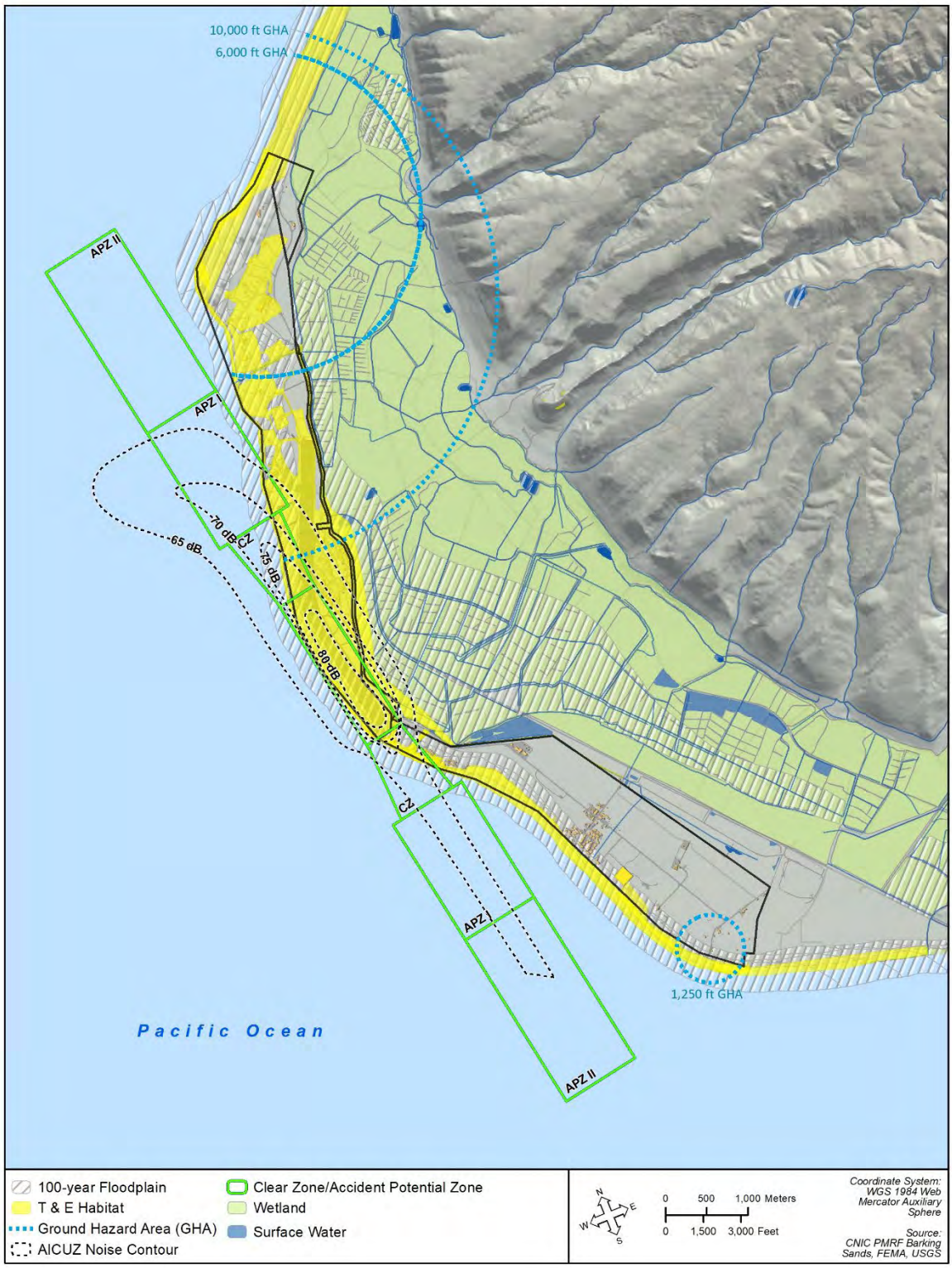


Figure 2-3. Barking Sands Constraints

2,000 ft (609.6 m). The CZ Type 3 is located on either side of the CZ Type 2. The Barking Sands recreation beach also lies within the CZ Type 1 and Type 3 for runway 16. CZ Type 1 is closed to recreation purposes when the airfield is in use. An APZ I and an APZ 2 extends from both the north and south ends of the runway; however, APZ 1 and APZ II are not required for either end since the current number of annual arrival or departure operations do not exceed 5,000.

2.2.5 Emergent and Future Training

PMRF is utilized for training by the Navy and other agency partners, generally involving both land and sea components. The tempo of training events fluctuates from year to year, but includes a bi-annual international Rim of the Pacific (RIMPAC) and other Large Scale Exercise (LSE) events that may include amphibious landings at Waiokapua (Major's) Bay. Requirements for amphibious landings and other training activities are to mitigate such that no endangered or threatened species are in the affected area when activities occur, including Hawaiian Monk Seals and sea turtles on beaches during landings. Additionally, activities at Barking Sands, Kaʻula and Niʻihau avoid adverse effects or modification of designated critical habitat. Training and testing in the marine environment is conducted under the US Pacific Fleets programmatic EIS and adheres to the protective measures of the associated consultations and will not be further discussed.

2.3 Mākaha Ridge Tracking Station Location, History, and Mission

2.3.1 Location

The Mākaha Ridge Tracking Station is located 7 mi (11 km) north of Barking Sands at approximately 1,400 ft (427 m) to 1,850 ft (564 m) in elevation on a high ridge top of the central mountain range of Kauaʻi. The facility overlooks the Kauhao Valley to the south and the Mākaha Valley to the north (**Figure 2-4**). The station encompasses approximately 244 ac (99 ha) of land leased from the SOH within the Nā Pali-Kona Forest Reserve. The station is located on the Nā Pali ridgeline, which is characterized by high volcanic uplands segmented by V-cut valleys and bounded by extremely steep coastal cliffs.

Figure 2-4. Mākaha Ridge Tracking Station Overview and Facilities

Mākaha Ridge Tracking Station is in the Waimea-Kekaha region on the western side of Kauaʻi in the SOH LUC designated State Conservation District (SOH LUC 2012). The site is bordered by steep cliffs to the north and west. Several state parks, natural area reserves, and forest reserves (Kuʻia Natural Area Reserve, Waimea Canyon State Park, and Puʻu Ka Pele Forest Reserve) lie to the east of the site.

2.3.2 Abbreviated History and Pre-Military Land Use

Cultural resources surveys have not identified any traditional Hawaiian archaeological sites, features, or buried cultural deposits at the Mākaha Ridge Tracking Station (DoN 2012a). Since 1965, the Navy has leased Mākaha Ridge from the SOH for communication, research, development, testing, tracking, evaluation, guidance, and related government purposes.

2.3.3 Military Mission, Operations, and Activities

Military use of Mākaha Ridge began during the cold war era when the Navy initiated multiple new construction projects, including radar and telemetry facilities on the ridge. Among the first buildings on Mākaha Ridge, completed in 1966, were a communications facility, power station, tracking radar, and surveillance radar (DoN 2012a).

Today, the Mākaha Ridge Tracking Station serves as PMRF's secondary missile tracking and surveillance station. The station has advanced tracking and surveillance radars as well as telemetry and recording equipment systems for the range. The site is also used by other agencies to test new radar technologies. Public access is restricted at the station.

The Mākaha Ridge Tracking Station contains a guard shack at the entrance, a Frequency Interference Control Building, Maintenance Facility, Telemetry Building, a boresight tower, telemetry antennas, water tanks, a laboratory, radar sites, communications, a power plant, antennas, a helicopter pad, and a "sea clutter site." Most of these structures are found on the top of the ridge line and are in the line of sight of Barking Sands.

The Mākaha Ridge Tracking Station provides support for various activities related to missile tracking. The station supports radar tracking and surveillance, primary telemetry receiving and recording, frequency monitoring, target control, and electronic warfare and networked operation.

2.3.4 Possible Mission Constraints

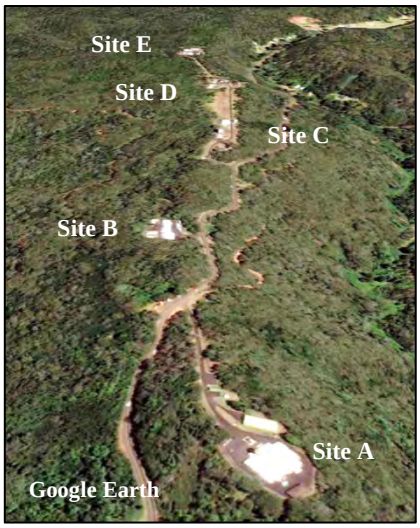
Constraints at the Mākaha Ridge Tracking Station are related to land ownership (as the sites are leased from the SOH and are located within the State Conservation District), military mission, and environmental issues. Military constraints result from restricted access and requirements that all buildings be located in unobstructed lines of sites for EMR zones. Environmental constraints result from several state and federal listed plant species that can be found at this station and the steep slopes around the southern, western, and northern borders of the site, which are severely eroded (**Figure 2-5**). The presence of nesting Nēnē (*Branta sandvicensis*), presence of federally listed Hawaiian Hoary Bat or ʻŌpeʻapeʻa (*Lasiurus cinereus semotus)*, and overflight of endangered seabirds are other potential constraints at Mākaha Ridge Tracking Station.

Figure 2-5. Mākaha Ridge Tracking Station Constraints: Surface Water, Bare Soil, and Endangered Plants

2.4 Kōkeʻe Sites Location, History, and Mission

2.4.1 Location

The PMRF Kōkeʻe sites are located within Kōkeʻe State Park east of Mākaha Ridge and at the northwestern terminus of Waimea Canyon. They are located at 3,500 ft (1,067 m) in elevation on a north-northeasterly coastal ridgeline called Kaunuohua Ridge. This volcanic terrain is characterized by numerous finger ridges, which are highly eroded, and contains many major valleys and drainage patterns.



The facility at Kōkeʻe consists of five parcels, A through E, that run along Kōkeʻe Road (**Figure 2-6**) and which are leased from the SOH by NASA. The combined area of the parcels is approximately 22 ac (9 ha) (**Table 2-2**). The Navy uses sites A through D through an agreement with NASA. Much of this land is graded and covered with asphalt, however there are open areas with mowed lawns and remnant forested areas along the property boundaries.

The Kōkeʻe sites are located within the SOH Conservation District of the Waimea-Kekaha region on the western side of Kauaʻi (SOH LUC 2012). Lands surrounding the Kōkeʻe sites are primarily used for recreation and include numerous on-site amenities such as trails, campgrounds, and scenic overlooks for recreation and tourism.

Table 2-2. Kōkeʻe Site Summary

Site	Area ac (ha)	Primary Facility and Infrastructure
Site A	4.6 (1.9)	Support buildings (tracking, command, training, administration, logistics)
Site B	2.1 (0.8)	Power plant and fuel storage facility
Site C	2.1 (0.8)	Boresight equipment, microwave antenna, radar, support buildings
Site D	6.9 (2.8)	Transmitter building, antenna support facilities
Site E	6.7 (2.7)	NASA's Kōkeʻe Geophysical Observatory with large antenna arrays
Total Area	**22.4 (9.1)**	

2.4.2 Abbreviated History and Pre-Military Land Use

The Navy has utilized land at the Kōkeʻe sites through an agreement with NASA since 1964 (DoN 2012a) for communication, research, development, testing, tracking, evaluation, guidance and related government purposes. Cultural resource surveys at the Kōkeʻe sites have found no historic sites (DoN 2012a).

Figure 2-6. Kōkeʻe Sites Overview

2.4.3 Military Mission, Operations, and Activities

The Kōkeʻe sites provide support for Navy surveillance and tracking. Each of the sites in Kōkeʻe supports various activities for the Navy and NASA. Kōkeʻe supports tracking radars, Ultra-High Frequency/Very High Frequency (UHF/VHF) communications, and seven command and control systems. Site A contains buildings that provide tracking, command, training, administration, and logistics support. Site B deals with power for the base and contains a power plant and fuel storage facility. Site C contains boresight equipment, a microwave antenna, radar, and operations and maintenance support buildings. Site D contains a transmitter building and support facilities for a Spacecraft Antenna on Medium Pedestal (SCAMP). Site E is operated by NASA which operates the Kōkeʻe Geophysical Observatory with its 22 ft (9 m) and 49 ft (20 m) antenna arrays.

2.4.4 Possible Mission Constraints

Current and future land use at the Kōkeʻe sites are limited by military protocols, mission requirements, natural resources, and land ownership, as the sites are located on leased land within the State Conservation District. Military constraints include restricted areas on the sites that are limited to approved personnel and visitors on official business. Mission requirements include maintaining vegetation height restrictions and clear lines of sight for facilities at Sites A, C, D, and E. Natural resources constraints are due to designated critical habitat for a Hawaiian picture-wing fly species that is located directly adjacent to the Kōkeʻe sites, as well as use by Hawaiian Hoary Bat, and overflights and potential strike risk to seabird species (Newell's Shearwater, Hawaiian Petrel).

2.5 Kamokala Ridge Magazines Location, History, and Mission

2.5.1 Location

Kamokala Ridge is 1.5 mi (2.4 km) east of Barking Sands at the scarp along the eastern boundary of the Mānā Coastal Plain (called Mānā Plain). The Kamokala Ridge Magazines are in the western edge of the Puʻu Ka Pele upland area. Occuping a total of 104 ac (42 ha), the Kamokala Ridge Magazines reach elevations between 240 ft (73 m) and 320 ft (97 m). Individual munitions cave storage units can be accessed via a surface road off the highway that loops through the facility. The site is leased from the SOH and is maintained by the Navy.

The Kamokala Ridge Magazines are in a State Agricultural District in the Waimea-Kekaha region on the western side of the island of Kauaʻi (SOH LUC 2012). The area to the west of the site is mostly agricultural and included in the API. The land immediately surrounding the magazine site and to the east is composed of finger ridges with steep barren, rocky slopes, and forests in the valleys between the ridges.

2.5.2 Abbreviated History and Pre-Military Land Use

No systematic archaeological surveys have been conducted at the Kamokala Ridge Magazines. However, during a 1992 field check, rock alignments that may be artifacts of traditional Hawaiian agriculture were discovered. The Navy has leased this site since 1964 with 10 of the 12 magazines built during World War II (DoN 2012a). These 10 magazines are eligible for NRHP. In 2004, the Navy built the two additional magazines (Dollar and Brock 2007). All of the structures and facilities are shown in **Figure 2-7**.

2.5.3 Military Mission, Operations, and Activities

The mission of the Kamokala Ridge Magazine area is to provide ordnance storage for the Navy, Hawai‘i Air National Guard, DOE, and other military commands with temporary requirements for training and storage, as necessary. The site consists of two earth-covered magazines, 10 ordnance storage magazines that have been excavated into the cliff face of Kamokala Ridge, and a missile assembly building. The magazine provides secure storage for Class 1.1 explosives.

2.5.4 Possible Mission Constraints

The main natural resource constraints at the Kamokala Ridge Magazines are steep terrain, erodible soils, and the potential for endangered bats. Military constraints are caused by ESQD arc requirements, which outline the hazard areas surrounding the magazines (**Figure 2-8**). In addition, access to the site is restricted to public works maintenance personnel and those involved in ordnance storage activities. The NRHP eligibility requires the Navy consider the effects of planned activities on such properties.

2.6 Port Allen Location, History, and Mission

2.6.1 Location

The Port Allen facility is located on the southwestern shore of Kaua‘i adjacent to Hanapepe Bay in the small town of ‘Ele‘ele. The greatest part of the facility is located on a pier constructed in Hanapepe Bay. PMRF leases part of a building, the north side of the pier, and a small parking lot from the State Department of Transportation, Harbors Division. The lease for this property must be renewed annually. PMRF also leases a paved outdoor storage area near the pier.

2.6.2 Mission, Operations, and Activities

The Port Allen facility provides berthing services for three Marine Department Weapons Recovery Boat operations, which support Seaborne Powered Targets boat operations, weapons and torpedo retrieval boats, and maintenance facilities. The outdoor storage area is used to store night lights, trailers, booms, target boats, other training equipment, and fueling trucks in support of the harbor facilities (DoN 2014a).

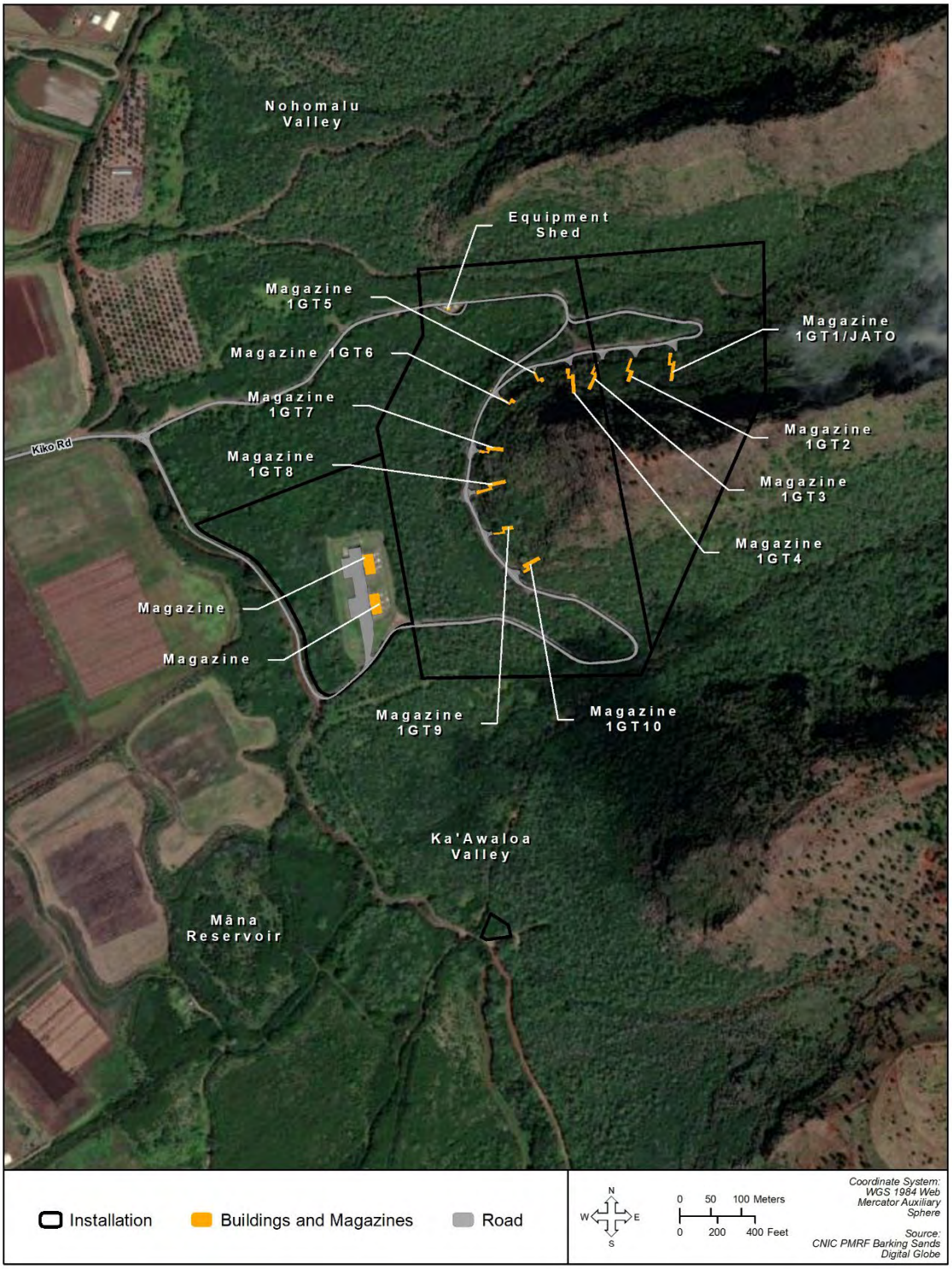


Figure 2-7. Kamokala Ridge Magazines Overview

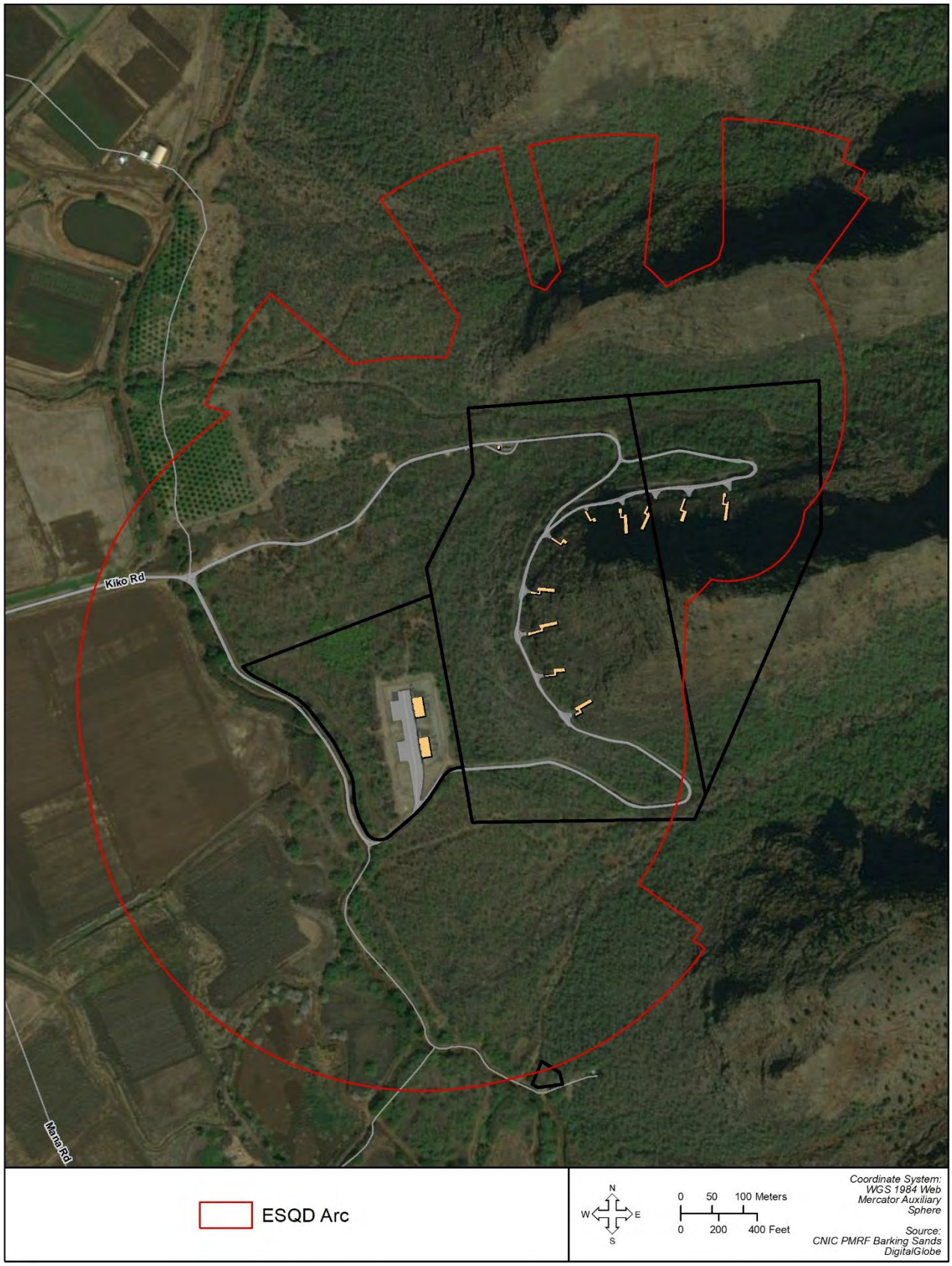


Figure 2-8. Kamokala Ridge Magazines Constraints

2.7 Ka‘ula Island Location, History, and Mission

2.7.1 Location

Ka‘ula Island, also called Ka‘ula Rock, is a small (108 ac [44 ha]), crescent-shaped volcanic islet located approximately 55 mi (88 km) southwest of Kaua‘i and 22 mi (35 km) west-southwest of Ni‘ihau. This uninhabited island is on a 27 mi^2 (70 km^2) shoal surrounded by the 100-fathom (0.2 km) depth contour. The land is owned by the U.S. government and is under the jurisdiction, control, accountability, and custody of the Navy.

Ka‘ula Island is used by the Navy for air-to-surface delivery of inert ordinance training restricted to the southern tip of the island. For safety purposes, the Navy has established a 3-mi (4.8-km) radius around Ka‘ula Island as a danger zone to prevent vessels or other crafts from entering or remaining in the danger zone except those that have been authorized by the Navy (33 CFR Section 334.1340). Fishing boats are permitted in the danger zone when bombing exercises are not being conducted. Seabirds, whales, dolphins, seals, and other marine wildlife are the primary users of the island and its surrounding waters.

2.7.2 Abbreviated History and Pre-Military Land Use

While there is no evidence of extensive human habitation on Ka‘ula Island, there are accounts of Hawaiians visiting the island to collect birds, eggs, and feathers. In addition to references to the islet in early Hawaiian lore, the discovery of six archeological sites indicate early use by native Hawaiians (DoN 2008a).

Ka‘ula Island is under the jurisdiction of the United States, and in 1924, through Territorial Executive Order, it was set aside for public purposes and put under the jurisdiction of the U.S. Lighthouse Service, which later merged with the U.S. Coast Guard (USCG). A light house was commissioned on Ka‘ula Island in 1932, which was in operation until 1947. Following World War II, the USCG used Ka‘ula Island as a radar navigation target. The Navy also used the island as an aerial bombing range under permit from the USCG. The USCG transferred the island to the Navy in 1965 (Pepi et al. 2009).

The Navy has used the southeastern portion of the island for training aviators in air-to-surface ordnance delivery since 1952. On 7 April 1965, the Kaua‘i County Board of Supervisors passed a resolution that requested the Navy cease bombing operations on Ka‘ula Island until the natural resources of the island could be evaluated for their potential as a bird sanctuary. In 1978, Ka‘ula Island was designated as part of the Hawai‘i State Seabird Sanctuary consisting of 34 islets and rocks by the SOH DLNR. Under this designation, the island is managed to conserve, manage, and protect indigenous wildlife (SOH DLNR and DoN 1998). The Navy, however, maintains jurisdiction over the island and continues to use the southern tip for ordnance training.

In 1971, the Navy agreed to allow fishermen within the 3-mi (4.8-km) restricted zone around the island when bombing exercises were not actively occurring. Since 1981, the munitions training by the Navy

at Kaʻula Island has been restricted to inert ordnance delivery and aircraft gunnery on the southern tip of the island to minimize impact to natural resources at the site.

2.7.3 Military Mission, Operations, and Activities

The Navy mission at Kaʻula Island is to train aviators in air-to-surface ordnance delivery. Approximately 9 percent, or 10 ac (4 ha), at the southern tip of Kaʻula Island is set aside to train aviators in air-to-surface (inert) weapons delivery. Gunnery exercises also include the firing of inert rounds from sea-based ships.

2.7.4 Possible Mission Constraints

Both the military mission and protected species constrain land use on Kaʻula Island. Past military use included bombing and strafing training with explosive ordnance. As a result of those activities, there are unexploded ordnance (UXO) hazards that remain in the area. As a result, access to the island is restricted by UXO hazards as well as current mission activities. Safely transporting personnel onto and off of the island by boat and helicopter is also difficult, especially when attempting helicopter insertions and extractions of personnel. Because of safety issues from UXO, BASH, and steep unstable terrain, access by any human to the island has not been granted since 1998. The presence of migratory birds and federally protected marine mammals on and in the vicinity of Kaʻula Island further constrain land use.

2.8 Mauna Kapu Location, History, and Mission

2.8.1 Location

The Mauna Kapu Communications and Radar Tracking Facility (Mauna Kapu Facility) is a 2-ac (0.8-ha) site on the island of Oʻahu. The facility is located in the southern portion of the Waiʻanae Mountain Range on Palikea Ridge, which overlooks Pearl Harbor.

The Mauna Kapu Facility is located in the SOH Conservation District (SOH LUC 2012) and land surrounding the site is largely undeveloped forest reserve. The Honouliuli Forest Reserve lies to the north of the facility and the Nānākuli Forest Reserve lies to the west directly adjacent to the facility. Recreational activities such as hiking, bird watching, camping, and sightseeing are conducted in the forest reserves. Several residential homes are also located in the area.

2.8.2 Abbreviated History and Pre-Military Land Use

The Navy initially leased the Mauna Kapu Facility from the James Campbell Company in 1963, and presently holds a lease with Gill-Ewa Lands LLC, which now owns the property. No cultural resources surveys have been conducted at the Mauna Kapu Facility and there is little recorded history of the mountain areas surrounding it (Belt Collins 2014).

2.8.3 Military Mission, Operations, and Activities

The Mauna Kapu Facility supports a remote transmitter/receiver facility for the Navy and DOE. The facility consists of one building, Building 204, and a radar equipment tower that supports electronic warfare and high frequency communication operations. The tower is anchored by cables attached to anchor blocks on the east side of the facility. The facility requires unobstructed lines of sight for electronic warfare coverage for Joint Base Pearl Harbor-Hickam and the Navy water ranges offshore of Oʻahu (DoN 2014a).

2.8.4 Possible Mission Constraints

Land use constraints at the Mauna Kapu facility results from extremely steep slopes on the east and west sides of the facility and the requirement for unobstructed lines of site for the military mission and restricted personnel access to those engaged in official business. There are no other constraints related to natural resources, although critical habitat for several species has been designated in the near vicinity. These areas contain critical habitat for the endangered Oʻahu ʻElepaio (*Chasiempis sandwichensis ibidis*) and provide habitat to other threatened or endangered plants or animals and non-listed native species (SOH DLNR 2009). Although not on site, potential affects to these resources must be considered via the NEPA process prior to implementing land use change or construction activities at the facility.

2.9 Niʻihau Sites Location, History, and Mission

2.9.1 Location

Niʻihau Island is a privately-owned island that is 44,800 ac (18,130 ha) in size and lies approximately 17 mi (27 km) southwest of Kauaʻi (SOH DLNR 2015). The dimensions of the island are approximately 18 mi (29 km) in length by 8 mi (13 km) in width stretching from the southwest to the northeast (Fletcher and Fiersten 2009). Navy-operated sites (**Figure 2-9**) are located on parcels throughout the island and total about 2.5 percent of the land, or approximately 1,170 ac (473.5 ha). However, with prior permission from the landowner and upon undergoing environmental review via the NEPA process, the Navy has the ability to conduct training activities throughout the island, its nearshore environments, and at low level altitudes above land or sea (DoN 2012b).

Niʻihau Island has been the property of the Robinson family since 1864 and is occupied by a traditional Hawaiian community, Puʻuwai, on the west-central part of the island. The people of Niʻihau have a subsistence lifestyle in which they fish and hunt pigs and wild turkey for food and collect seashells from local beaches to make shell leis that are sold throughout the state. The main sources of employment are from helicopter and safari tours, and the U.S. Navy (Niʻihau Cultural Heritage Foundation 2009a). The safari business offers hunting opportunities for feral pigs and sheep as well as limited imported African large game species. Fishing, boating, and scuba diving occur in the

Figure 2-9. Ni'ihau Island Overview and Facilities

waters around Niʻihau. Lehua Island, just north of Niʻihau, is a designated Hawaiian Island State Seabird Sanctuary and is owned by SOH.

2.9.2 Abbreviated History and Pre-Military Land Use

Niʻihau Island was one of the last Hawaiian Islands to be united under Kamehameha. The people of Niʻihau mostly depended on fishing, sweet potatoes, and breadfruit for sources of food. The islanders were also known for making the high quality makaloa mats, which were made from abundant perennial sedge.

The Island of Niʻihau was purchased by Elizabeth Sinclair in 1864 for $10,000 from King Kamehameha V. Elizabeth Sinclair and her descendants, the Robinson family, have restricted access to the island in order to preserve its cultural heritage (Niʻihau Cultural Heritage Foundation 2009b). The Robinsons opened a ranch that produced cattle, sheep, and honey and employed the people of Niʻihau.

2.9.3 Military Mission, Operations, and Activities

The Navy leases small parcels of land on Niʻihau but retains no permanent military personnel on the island and only periodically uses the leased areas to support PMRF range training missions (DoN 2012a). The Navy leases sites in the northern corner of the island, as well as a parcel with a Perch Site and a Radar Site parcel (see **Figure 2-9**). Additionally, the Robinson family has agreed to allow the Navy limited access to the island for training. With prior permission, Navy vessels currently come ashore on a periodic basis for maintenance and resupply visits (DoN 2012b).

2.9.4 Possible Mission Constraints

Constraints to military training activities on Niʻihau Island primarily consist of the presence of large numbers of federally listed species both on the island and in the surrounding waters and desginated Hawaiian Monk Seal critical habitat. NOAA Fisheries published a Final Rule designating critical habitat for Hawaiian Monk Seals in portions of the marine and terrestrial environments of Niʻihau Island in September 2015. However, because of the benefits conferred to the species, the critical habitat designation does not apply to areas covered by the PMRF INRMP (NMFS 2015).

3.0 NATURAL RESOURCES PRESENT

3.1 Physical Environment

3.1.1 Geology

The Hawaiian Archipelago was formed from a series of volcanic eruptions that created, and continue to create, the large volcanic mountain ranges of the Hawaiian Ridge. Volcanic eruptions occur as the Pacific Plate moves in a west-northwesterly direction over an area called the Hawai‘i Hot Spot, where magma forms and at times pushes through the plate (Rubin 2013). As the plate moves over the hot spot, active volcanoes move past the hot spot and become dormant and eventually extinct. These volcanoes leave the tops of the volcanic mountains exposed above the ocean surface creating the islands. Over time, the plate continues to move, shifting the islands further west-northwest. Volcanoes in the Hawaiian Islands are estimated to range in age from about 65 million years to currently active volcanoes on the Island of Hawai‘i (Rubin 2013).

3.1.2 Geography

The Hawaiian Archipelago consists of 137 islands, reefs, islets, and atolls that extend northwest from the SOH for approximately 1,700 mi (2,700 km) and end at the Kure Atoll (**Figure 3-1**) (Tilling et al. 2010). The SOH consists of 28 islands that are part of the Hawaiian Archipelago. The eight largest islands are designated as the Main Hawaiian Islands (MHI) and 20 are designated as the Northwestern Hawaiian Islands (NWHI). The general geography of Kaua‘i and O‘ahu, the two larger islands that support PMRF sites are discussed here. Ni‘ihau and Ka‘ula are discussed in Sections 3.8 and 3.10, respectively.

3.1.2.1 Kaua‘i

The Island of Kaua‘i is the northernmost of the eight MHI. It is somewhat circular in shape, with a length of 33 mi (53 km) and a width of 25 mi (40 km), covering approximately 552 mi^2 (1,430 km^2). The oldest of the principal islands, Kaua‘i was formed over five million years ago as the Pacific plate moved over the Hawai‘i Hot Spot. As such, Kaua‘i has been subjected to millions of years of natural erosion. The tallest mountain on Kaua‘i is Kawaikini Peak, at 5,243 ft (1,598 m), with two others at 5,148 ft and 4,120 ft (1,569 m and 1,256 m) (SOH 2013). The island has a variety of microclimates, due in part to its high mountains that trap moisture from the prevailing trade winds, causing intense rainfall and surface runoff events that have shaped deep canyons (University of Hawai‘i 2013a).

3.1.2.2 O‘ahu

O‘ahu is the third largest of the MHI, covering approximately 598 mi^2 (1,548 km^2). Like all the other islands in the Hawaiian Archipelago, O‘ahu is a volcanic island. The irregular shape of O‘ahu was significantly influenced by massive landslides that removed an estimated third of the northeastern portion and half of the western portion during the island’s volcanic period (University of Hawai‘i 2013b). There are two mountain ranges on O‘ahu that run nearly parallel, the Ko‘olau and Wai‘anae Ranges on the eastern and western sides, respectively. The highest mountain peaks on O‘ahu, Ka‘ala and Pu‘u Kalena are found in the Wai‘anae Range and are 4,003 ft and 3,504 ft (1,220 and 1,068 m) respectively.

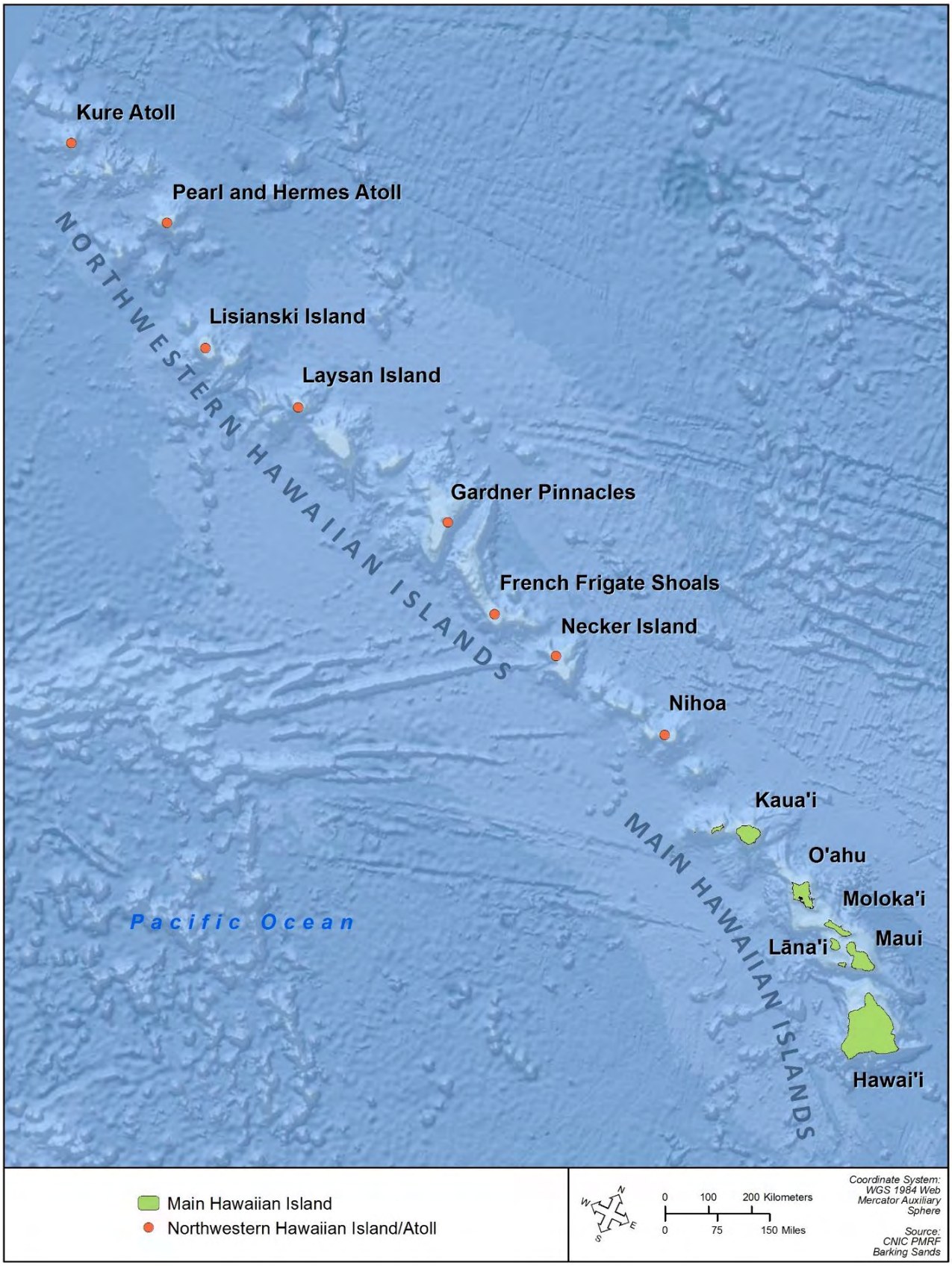


Figure 3-1. The Hawaiian Archipelago

3.1.3 Climate

In general, the climate of Hawai‘i is one of mild temperatures throughout the year, with moderate humidity, and persistent northeasterly winds (National Weather Service [NWS] 2007). There is a high degree of variability in rainfall within short distances, although severe storms are infrequent. Because Hawai‘i is located in the tropics, temperature is relatively uniform throughout the year. In addition, due to its distance from continental land masses, temperatures and humidity are considerably moderated by the surrounding ocean before reaching the islands. The seasonal variability of sea surface temperatures around Hawai‘i is only about 6 °, from a low of 73 °Fahrenheit (F) (22.8 °Celsius [C]) to a high of almost 80 °F (26.7 °C).

In the majority of the state, at elevations below 2,000 ft (610 m), rainfall is greatest in the winter. However, in extremely rainy areas above 2,000 ft (610 m) rainfall is fairly uniform throughout the year (Western Regional Climate Center [WRCC] 2015). In the lowland, rainfall is most likely to occur at night or in the morning hours throughout the year. In the summer, most rainfall is from trade-wind showers that are more likely to occur at night, while winter rainfall is the result of storms that are just as likely to occur during the day as at night (WRCC 2015).

Six of the eight main islands have mountains with elevations that rise from sea level to above 3,000 ft (1,000 m) in a relatively small area. This combination of elevation and subsequent orographic rainfall creates patterns of precipitation that range from extremely wet, in excess of 400 inches (in; 1,000 cm) of annual rainfall, to extremely dry, less than 10 in (25 cm) annually (TNC 2007). This allows for hot tropical and alpine desert regions to exist within 25 mi (40 km) of each other. There are several places in Hawai‘i in which the annual rainfall gradient exceeds 25 in per mi (40 cm per km; WRCC 2015).

3.1.3.1 Kaua‘i

The climate of Kaua‘i is sub-tropical, characterized by mild temperatures that typically range between 69 and 85 °F (21 to 29 °C). August tends to be the warmest month of the year. Kaua‘i has multiple regions with various climates; these include dry sand dune complexes in the west, cool mountain forests around Nā Pali and Waimea Canyon, interior tropical rain forests, pastoral plains in the east, and semi-arid tropical weather in the south. The variability of climates on Kaua‘i is partially a result of the island’s mountains, with peaks in excess of 5,000 ft (1,524 m), which influence rainfall patterns. One of the wettest places on earth is found on Kaua‘i; Mount Wai‘ale‘ale (5,148 ft [1,569 m]) receives an annual average of 486 in (1,234 cm) of rainfall (WRCC 2015), whereas the western part of Kaua‘i receives an annual average of 20 in (52 cm) of rainfall. The dry season in the western part of Kaua‘i occurs between June and August (<1 in [2.5 cm]) while the rainy season runs from October through March (>2 in [5 cm]) with most rain falling from November through January (≥ 3 in [8 cm]) (SOH DNLR DAR 2009).

3.1.3.2 O‘ahu

Temperatures of O‘ahu range between a high of 88 °F (31 °C) in August to a low of 66 °F (19 °C) in February. The nearly parallel Ko‘olau and Wai‘anae Ranges play a major role in O‘ahu’s climate. Tradewinds first interact with the Ko‘olau Range on the island’s eastern side. As such, this area receives the majority of rainfall, with average rainfall ranging from 65 to 275 in (200 to 700 cm)

annually (Giambelluca et al. 2013). The Central Plateau, which lies between Oʻahu's mountain range, and the Waiʻanae Range, receives an average annual rainfall between 20 and 90 in (53 and 220 cm), with the highest concentration in the upper elevations. The driest areas on Oʻahu occur on the coastal plain in the southern and southwestern portions of the island, with an average annual rainfall of approximately 20 in (51 cm).

3.1.4 Hydrology

3.1.4.1 Surface Water Resources

Streams can be classified as ephemeral, perennial, or intermittent. Streams classified as ephemeral are those that only flow as a direct response to rainfall, with stream channels above the water table. Perennial streams flow continuously year-round. However, some perennial streams flow continuously throughout their course while others only flow perennially over sections of their course. Intermittent streams are those that are dry during certain periods and flow only when they receive discharge from groundwater or surface sources.

The majority of streams on the Hawaiian Islands originate in the mountainous interiors of the islands and flow outward to the coast (Oki 2003). Runoff from precipitation, such as rain or to a lesser extent fog drip, and high-elevation aquifer discharge are the main contributors to stream flow. Other sources include water returned from bank storage[1], rainfall directly into streams, and other water such as excess irrigation (U. S. Geological Survey [USGS] 2013).

The level of stream flow is determined by factors such as rainfall amount and intensity, and the geology, morphology, size, soil and land cover of the drainage basin. While climate is dependent on an individual island's location and elevation, the wettest time of the year for windward areas is spring. Many leeward (southwest) sides of the islands can be quite arid, receiving less than 12 in (30.5 cm) of rain per year, with winter being the wettest season (NWS 2009).

Streams in Hawaiʻi are highly variable in their flow. Some streams do not flow all the way to the coast because as they flow over highly permeable rock they infiltrate into the stream bed and recharge the groundwater. Stream flow is also dependent on the height of the water table because streams either gain or lose water when the water table is respectively higher than or lower than the stream water level. In areas where volcanic dikes have formed, streams sometimes intersect with impounded groundwater. This typically causes them to gain water which increases their streamflow, and usually results in perennial streams.

Humans also impact stream flow through diversions, impoundments, channelization, land use changes, and other factors. In areas where surface water and ground water are hydraulically connected, withdrawals of groundwater may reduce ground water discharge into streams and reduce flow.

Three man-made ditches transport surface water, agricultural runoff and pumped groundwater from the Mānā Plain and agriculture fields through Barking Sands. These ditches run through or adjacent to the installation for 6.3 miles, 1.1 miles of which is within PMRF boundaries.

[1] Bank storage is a result of heavy rainfall filling the stream and water is absorbed into its banks. This stored water may return to the stream as the water level falls, thus contributing to the streamflow.

3.1.4.2 Ground Water

The availability of ground water in Hawai‘i is impacted by saltwater intrusion, reduced discharge into streams, and lowering water tables (Oki et al. 1999). Saltwater intrusion occurs when excessive freshwater withdrawals shrink a freshwater lens and allow salt and brackish water to move upward and landward into areas that once contained freshwater. Intrusion of saltwater is dependent on factors such as rock permeability, recharge rate, pumping (withdraw) rate, and location. Wells located closer to the coast are at a higher risk of intrusion than those further inland. Water withdrawals from freshwater lenses also reduce discharge into springs, streams, and the ocean. The loss of discharge into springs and streams negatively impacts freshwater availability for wildlife habitat, agriculture, recreation, and aesthetics. In areas surrounding wells, freshwater withdrawals may lower surface water levels, which can shrink ponds and wetlands. Moreover, reduced discharge into the ocean may affect marine habitat and aquacultural activities.

3.2 Biotic Environment

Hawai‘i’s unique environment and native species have evolved together in isolation over the last 70 million years and over millions of years, an estimated 20,000 species arrived or evolved here. Due to its isolation, Hawai‘i also has high numbers of endemic species with an estimated 10,000 of its native species being found nowhere else (Hawai‘i Invasive Species Council 2015b).

The varied locations and habitats occupied by the eight PMRF facilities contribute to the wide diversity of biota supported by the base. Surveys of PMRF conducted in support of previous INRMPs and other activities have documented numerous birds, mammals, reptiles, insects, marine animals, plants, and vegetation communities. The following is a general description of the flora and fauna that occur across all of the PMRF facilities. Detailed discussions on the occurrence and management of each species for each PMRF siterespectively are in Sections 3.3 – 3.10.

3.2.1 General Flora

Hawai‘i’s native plants form a variety of community types, largely based on the availability of water. Tropical moist forests in Hawai‘i are comprised of mixed mesic forests (ranging from 750 to 1,250 m in elevation), rain forests (found above mixed mesic forests up to 1,700 m), wet shrublands, and bogs in swampy areas. Moist to wet forests are commonly found on the windward lowland and montane areas of the larger islands and on mountain tops of some of the smaller islands. Koa (*Acacia koa*) and ‘Ōhi‘a (*Metrosideros polymorpha*) are common dominant canopy tree species (World Wildlife Fund 2015).

Tropical dry forests of Hawai‘i typically occurred on the leeward side of the islands, but have largely been replaced by agriculture, invasive species, and development. These areas receive less than 50 in of rain a year. The Nā Pali Coast of Kaua‘i supports a relic area of tropical dry forest (World Wildlife Fund 2015). Shrubland communities frequently occur in coastal lowlands on the leeward sides of mountains and extend to considerable altitudes where rainfall is slight. These areas have also been greatly reduced by agriculture and invasive plants and are now primarily composed of non-native grasses, shrubs, and agricultural lands.

Although the vegetation at PMRF varies between sites, there are several vegetation types that can be found at most of the larger sites The Barking Sands, Mākaha Ridge Tracking Station, Kamokala Ridge Magazines, and the Niʻihau sites all contain some area of white leadtree, or Koa Haole (*Leucaena leucocephala*) shrubland, which is a non-native moderately dense dry coastal community that can grow at higher elevations. Also common are sparsely vegetated rocky environments such as the cliff/boulder fields of the Kamokala Ridge Magazines and the coastal cliffs of Mākaha Ridge Tracking Station. Ruderal vegetation likewise is found along roadsides and in other disturbed areas of the site. Each of PMRF's sites also contain landscaped areas with introduced, non-native ornamental vegetation. In total, 327 different plant species have been identified throughout PMRF's sites. Of these approximately 111 are identified as native (including 64 endemics), 4 are attributed to Polynesian introduction, and 212 are considered non-native introduced species (**Appendix C**).

3.2.2 Special Status Plant Species

Of the native flora, four state and federally endangered species, Dwarf Iliau (*Wilkesia hobdyi*), Hawaiʻi Scaleseed (*Spermolepis hawaiiensis*), Niʻihau Lobelia (*Lobelia niihauensis*), and Kauaʻi Schiedea or Māʻoliʻoli (*Schiedea apokremnos*) and one threatened species, Makou (*Peucedanum sandwicense*), as well as unoccupied critical habitat for the endangered Niʻihau Panicgrass or Lauʻehu (*Panicum niihauense*) are known to occur on PMRF. Several other listed species have been identified adjacent to some of the installation sites and must be considered in management decisions (**Table 3-1**).

Table 3-1. Threatened and Endangered Plant Species and Critical Habitat on or adjacent to PMRF Sites

Scientific Name	Common Name	Hawaiian Name	Status	Occurrence[1]		
				Barking Sands	Mākaha Ridge	Kōkeʻe Sites
Euphorbia halemanui (syn. *Chamaesyce halemanui*)	Halemanu ʻAkoko	ʻAkoko	E			X[2]
Lobelia niihauensis	Niʻihau Lobelia	---	E		X	
Panicum niihauense	Niʻihau Panicgrass (Unoccupied Critical Habitat)	Lauʻehu	E	X[3]		
Peucedanum sandwicense	Makou	Makou	T		X	
Schiedea apokremnos	Kauaʻi Schiedea	Māʻoliʻoli	E		X	
Sesbania tomentosa	Oʻahu Riverhemp	ʻŌhai	E	X[4]		
Spermolepis hawaiiensis	Hawaiʻi Scaleseed	---	E		X	
Wilkesia hobdyi	Dwarf Iliau	---	E		X	

State and Federally listed as E = Endangered, T = Threatened
[1] Only PMRF sites with documented threatened, endangered, or candidate species on or adjacent are included in table.
[2] Not documented on PMRF, but has been documented just outside the boundary of Kōkeʻe Site D
[3] Not documented on PMRF, but unoccupied critical habitat for Niʻihau panicgrass is designated on Barking Sands
[4] Not documented on PMRF, but has been documented at Polihale State Park north of Barking Sands
Sources: Char 2000a,b,c,d, DoN 2014c, and Nyber

3.2.3 Invasive Plant Species

Hawai‘i’s native vegetation is threatened by a variety of non-native invasive species. Invasive species are defined as plants, animals or pathogens that are non-native to the ecosystem under consideration and whose introduction causes or is likely to cause harm (USDA 2018). The SOH currently has a list of plant species designated as “Noxious Weeds for Eradication or Control Purposes”, which was developed in 1992 (Hawai‘i Invasive Species Council 2015a). In addition, KISC maintains lists of species identified for early detection and rapid response (EDRR) and species that are targeted for control with the intent of eventual eradication from Kaua‘i (KISC 2017). EDRR listed species are newly discovered non-natives with limited distribution in Kaua‘i that can potentially be eradicated from the island, whereas species on the KISC target list have been identified as invasive threats and are prioritized for control or eradication (KISC 2017).

Of the 216 non-native introduced species identified at the PMRF sites, the following seven are classified as state noxious weeds and/or as KISC EDRR or target species for control and eradication: Long-thorn Kiawe (*Prosopis juliflora*), Asian Melastome (*Melastoma candidum*), Firetree (*Morella faya*), Banana Poka (*Passiflora mollissima*), Spreading Mist Flower/Spreading Snakeroot (*Ageratina ripari*a), Prickly Blackberry (*Rubus argutus*), and Comb Hyptis (*Hyptis pecinata*) (**Table 3-2**). Several other species are considered extremely invasive and detrimental to native habitats and may warrant special attention for management. These species include Koa Haole and Golden Crown-beard (*Verbesina encelioides*). Of these noxious weeds and invasive plant species, Long-thorn Kiawe is considered the greatest threat to human safety because of its thorns which grow up to 4 inches long, whereas Koa Haole, Banana Poka, Asian Melastome, Firetree, and Golden Crown-beard are considered the threats to native habitats and wildlife at PMRF.

Table 3-2. State Noxious Weeds, Kaua‘i Invasive Species Committee Target Species, and Select Invasive Plants Identified at PMRF

Scientific Name	Common Name	Status	Occurrence[1]			
			Barking Sands	Mākaha Ridge	Kōke‘e Sites	Kamokala Ridge
Ageratina riparia	Spreading Mist Flower, Hāmākua Pāmakani	Noxious Weed		X		
Calotropis procera	Small Crown Flower	KISC EDRR	X			
Cirsium vulgare	Bull Thistle	KISC EDRR		X		
Hyptis pectinata	Comb Hyptis	Noxios Weed	X			
Leucaena leucocephala	Koa Haole, White Leadtree	Invasive	X	X		X
Melastoma candidum	Asian Melastome	Noxios Weed			X	
Morella faya	Firetree	Noxios Weed			X	
Passiflora mollissima	Banana Poka	Noxios Weed			X	

Prosopis juliflora	Long-thorn Kiawe, Algaroba, Mesquite	Noxios Weed, KISC Target	X			
Rubus argutus	Prickly Blackberry	Noxios Weed			X	
Verbesina encelioides	Golden Crown-Beard	Invasive	X			X

[1] Only PMRF sites with documented state noxious, KISC target, and select invasive species are included in table.
Source: Hawai'i Invasive Species Council 2015a, KISC 2017

3.2.4 General Fauna

The Hawaiian Islands support a unique selection of fauna because of their isolation. Species native to the Hawaiian Islands include a wide array of native and endemic birds, as well as sea turtles and marine mammals that inhabit the islands' near and offshore waters. With the exception of the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) (Section 3.2.5.3. ESA-listed Mammal Species), no native terrestrial mammals are known to inhabit the SOH (SOH DLNR 2015). Hawai'i also has no native species of terrestrial-only amphibians or reptiles (Bailey 1995). However, numerous non-native birds, mammals, frogs, lizards, and freshwater turtle species have been introduced to the islands. A comprehensive list of species identified at PMRF, their regulatory status, origin, and which facilities they are known to occur on, is in **Appendix C**.

At PMRF, the avian fauna is the most diverse group of species documented. Of the 76 bird species that have been recorded base-wide, 46 species are native and 30 are non-native. Some of these birds are migratory and only stop over on their way to other areas, while others come to the island to nest, and still others are endemic and are found on the islands year-round. The most widespread bird species observed throughout the PMRF sites are the non-native Japanese White-eye (*Zosterops japonicus*) and non-native House Finch (*Carpodacus mexicanus*). Zebra Doves (*Geopelia striata*), Spotted Doves (*Spilopelia chinensis*), Common Mynas (*Acridotherestristis*), and Mannikins (*Lonchura* spp.), are other very common non-native birds.

Native bird species vary with elevation and habitat type available at each site and include a variety of seabirds, shorebirds, waterfowl, and even a native raptor. Native bird species that occur at PMRF are protected under the ESA and/or MBTA and will be discussed in Section 3.2.5 Special Status Wildlife Species and in Sections 3.3 – 3.10 below.

Sixteen mammal species have been documented at PMRF. The introduced Feral Cat (*Felis catus*) is the most common and widespread mammal, which is problematic due to its recognized impacts to native avian species. Feral cats are also a known threat to the endangered Hawaiian Monk Seal (*Neomonachus schauinslandi*) and Nēnē, and a variety of other marine mammals and birds as well as humans due to their being the definitive host for Toxoplasmosis, a parasitic disease (Barbieri et al. 2016, Harting et al. 2021). The introduced Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*), Feral Pig (*Sus scrofa*), Feral Goat (*Capra hircus*), and Black Rats or Roof Rats (*Rattus rattus*) are also fairly widespread and common at PMRF. Feral Goats, Black-tailed Deer and Feral Pigs destroy vegetation and expose soils through browsing, trampling, wallowing and rooting increasing rates of erosion and associated stream and reef siltation at Mākaha Ridge. Known vectors of a variety

of pathogens and diseases, Feral Goats, Pigs, and Deer also pose a major threat to endangered species and human health and safety.

Several reptile and amphibian species have likewise been documented at PMRF, most of which are non-native terrestrial lizards and toads, though listed native sea turtles are known or have potential to occur as well (refer to **Section 3.2.5**). Marine surveys have been conducted in the nearshore environments of Barking Sands and Kaʻula Island have identified a wide variety of native fish, including several endemic species, commercially important fish, and corals.

3.2.5 Special Status Wildlife Species

PMRF facilities and adjacent near shore waters support several federally and state-listed species, as well as numerous marine mammals protected under the MMPA and birds protected under the MBTA. The federal and state-threatened or endangered species identified during surveys conducted in support of previous INRMPs and other base activities include 10 birds, five mammals, two reptiles, two fish, and two insects on or adjacent to the PMRF sites (**Table 3-3**). Two additional birds and one marine mammal have state-listed status but are not listed under the federal ESA. For protected birds, the table lists the site on which they have been observed or have potential to fly over when commuting between nesting and at-sea foraging areas and during initial flights to sea by fledglings. Listed sea turtles and monk seals may occur on the base or in the adjacent waters that are used for training; other protected marine mammals may occur in adjacent waters.

The coastal and nearshore waters around PMRF sites are also used by marine mammals that are not federally listed under the ESA but are protected under the MMPA and numerous species of birds that are not federally listed under the ESA but are protected under the MBTA. Of the MBTA-protected species, PMRF management programs are focused on protecting those species that are native to Hawaiʻi. All native species listed under these Acts are considered special status species and are managed under this INRMP. **Table 3-4** indicates the native MMPA-protected species and MBTA-protected species documented on or in the nearshore environments off PMRF sites.

3.2.6 Invasive Fauna

As with plants, numerous animal species have been introduced to the islands and are considered invasive and/or are designated as Injurious Wildlife Species by the SOH (Hawaiʻi Administrative Rules Chapter 13-124, Exhibit 5). Species listed as injurious include numerous birds, reptiles, and invertebrates as well as the small Indian Mongoose (*Herpestes javanicus*) and even-toed ungulates (excluding those listed as game species). KISC has also identified a number of invasive EDRR animal species they target for control on Kauaʻi. EDRR species include Coqui Frog (*Eleutherodactylus coqui*), mongoose, Coconut Rhinoceros Beetle (*Oryctes rhinoceros*), Brown Tree Snake (*Boiga irregularis*), and Little Fire Ant (*Wasmannia auropunctata*), among others. All known outbreaks of these species have been controlled or are under control through extensive efforts by KISC, HDOA, and other partner agencies (KISC 2017). Awareness and reporting these species are critical to their continued control. Hawaiʻi injurious wildlife and other non-native animal species documented at PMRF are listed in **Table 3-5**. No KISC ERDD species are known to occur on PMRF.

Table 3-3. Federal and State Threatened and Endangered Wildlife Species on or adjacent to PMRF Sites

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence[2]					
				Barking Sands	Mākaha Ridge	Kōkeʻe Sites	Kamokala Ridge	Kaʻula Island	Niʻihau Island
Birds									
Anas wyvilliana	Hawaiian Duck	Koloa maoli	E	X					X
Branta sandvicensis	Hawaiian Goose	Nēnē	FT, SE	X	X	X			
Fulica americana alai	Hawaiian Coot	ʻAlae keʻokeʻo	E	X					X
Gallinula galeata sandvicensis	Hawaiian Common Gallinule	ʻAlae ʻula	E	X					
Himantopus mexicanus knudseni	Hawaiian Stilt	Aeʻo	E	X					X
Oceanodroma castro	Band-rumped Storm-petrel (Hawaiʻi DPS)	ʻAkēʻakē	E	X[3]	X[3]	X[3]			
Phoebastria albatrus	Short-tailed Albatross	---	E	X[4]					
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel	ʻUaʻu	E	X[3]	X[3]	X[3]			
Puffinus auricularis newelli	Newell's Shearwater	ʻAʻo	T	X[3]	X[3]	X[3]			X
Asio flammeus sandwichensis	Short-eared Owl	Pueo	SE Oʻahu	X	X	X			X
Gygis alba	White Tern	Manu-o-Kū	ST					X	
Vestiaria coccinea syn *Drepanis coccinea*	Scarlet Honeycreeper	ʻIʻiwi	FT, SE			X			
Mammals									
Balaenoptera physalus	Fin Whale	---	E	X				X	X
Lasiurus cinereus semotus	Hawaiian Hoary Bat	ʻŌpeʻapeʻa	E	X	X	X	X		

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence[2]					
				Barking Sands	Mākaha Ridge	Kōkeʻe Sites	Kamokala Ridge	Kaʻula Island	Niʻihau Island
Neomonachus schauinslandi	Hawaiian Monk Seal	ʻĪlio-holo-i-ka-uaua	E	X				X	X
Physeter macrocephalus	Sperm Whale	Palaoa	E	X				X	X
Pseudorca crassidens	False Killer Whale	---	E – MHI Insular DPS	X				X	X
Megaptera novaeangliae	Humpback Whale	Kōholā kuapiʻo	SE	X				X	X
Reptiles									
Chelonia mydas	Green Sea Turtle	Honu	T – Central North Pacific DPS	X				X[5]	X
Eretmochelys imbricata	Hawksbill Sea Turtle	Honuʻea	E	X[5]				X[5]	X[5]
Insects									
Drosophila musaphilia	Hawaiian Picture-wing Fly	---	E			X[6]			
Drosophila sharpi	Hawaiian Picture-wing Fly	---	E			X[6]			
Fish									
Carcharinus lonigmanus	Oceanic Whitetip Shark	---	T	X				X	X
Manta birostris	Giant Manta Ray	Hāhālua	T	X				X	X

[1] Federally and State listed as E = Endangered, T = Threatened, DPS = Distinct Population Segment, SE = State Endangered only, ST = State Threatened only
[2] Only PMRF sites with documented threatened, endangered, or candidate species on or adjacent are included in table.
[3] Potential to fly over and/or known to fall out on base
[4] Not observed at PMRF since 2000
[5] Not documented but likely to occur
[6] Not documented on site, but critical habitat is adjacent to Kōkeʻe sites

Sources: Baird et al. 2019, Baird et al 2022, Baird et al. 2021a, Baird et al. 2021b**,** Deakos et al. 2017, DoN 2008a, DoN 2014b and c, NMFS 2016c, Pepi et al 2009, Pyle and Pyle 2017, Richie et al. 2012, Uyeyama et al. 2011, VanderWerf 2012

Table 3-4. Marine Mammal Protection Act and Native Migratory Bird Treaty Act Protected Species on or adjacent to PMRF Sites

Scientific Name	Common Name	Hawaiian Name	Occurrence[1]					
			Barking Sands	Mākaha Ridge	Kōkeʻe Sites	Kamokala Ridge	Kaʻula Island	Niʻihau Island
Marine Mammals								
Globicephala macrorhynchus	Short-Finned Pilot Whale	---	X				X	X
Feresa attenuata	Pygmy Killer Whale	---	X				X	X
Grampus griseus	Risso's Dolphin	---					X	
Kogia breviceps	Pygmy Sperm Whale	---					X	X
Kogia sima	Dwarf Sperm Whale	---	X				X	X
Lagenodelphis hosei	Fraser's Dolphin	---	X				X	X
Megaptera novaeangliae	Humpback Whale	Kōholā Kuapiʻo	X				X	X
Mesoplodon desirostris	Blainville's Beaked Whale	---	X				X	X
Orcinus orca	Killer Whale	---					X	
Peponocephala electra	Melon-Headed Whale	---	X				X	X
Stenella attenuata	Pantropical Spotted Dolphin	Kiko	X				X	X
Stenella coeruleoalba	Striped Dolphin	---	X				X	X
Stenella longirostris	Spinner Dolphin	Naiʻa	X				X	X
Steno bredanensis	Rough-Toothed Dolphin	---	X				X	X
Tursiops truncatus	Bottlenose Dolphin	Naiʻa	X				X	X
Ziphius cavirostris	Cuvier's Beaked Whale	---	X				X	X
Birds								
Anas clypeata	Northern Shoveler	Koloa Mohā	X					
Anas crecca	Green-Winged Teal	---	X					

Scientific Name	Common Name	Hawaiian Name	Occurrence[1]					
			Barking Sands	Mākaha Ridge	Kōkeʻe Sites	Kamokala Ridge	Kaʻula Island	Niʻihau Island
Anous minutus	Black Noddy	Noio					X	X
Anous stolidus	Brown Noddy	Noio Kōhā					X	X
Arenaria interpres	Ruddy Turnstone	ʻAkekeke	X				X	X
Asio flammeus sandwichensis	Short-Eared Owl	Pueo	X	X	X			X
Bulweria bulwerii	Bulwer's Petrel	ʻOu					X	X
Calidris alba	Sanderling	Hunakai	X					
Fregata minor	Great Frigatebird	ʻIwa	X				X	X
Gygis alba	White Tern	Manu-o-Kū					X	
Chlorodrepanis stejnegeri	Kauaʻi ʻamakihi	ʻAmakihi			X			
Himatione sanguinea	ʻApapane	ʻApapane			X			
Larus atricilla	Laughing Gull	---	X					
Nycticorax nycticorax hoactli	Black-crowned Night-heron	ʻAukuʻu	X			X		X
Onychoprion fuscatus	Sooty Tern	ʻEwa ʻEwa					X	
Onychoprion lunatus	Gray-backed Tern	Pākalakala					X	
Phaethon lepturus	White-tailed Tropicbird	Koaʻe Kea		X				X
Phaethon rubricauda	Red-tailed Tropicbird	Koaʻe Ula					X	X
Phoebastria immutabilis	Laysan Albatross	Mōlī	X				X	X
Phoebastria nigripes	Black-footed Albatross	Kaʻupu	X				X	
Pluvialis fulva	Pacific Golden Plover	Kōlea	X	X	X	X	X	X
Pluvialis squatarola	Black-bellied Plover	---	X					
Procelsterna cerulean saxatilis	Blue-gray Noddy	---					X	

Pterodroma hypoleuca	Bonin Petrel	---					X	
Puffinus nativitatis	Christmas Shearwater	ʻAoʻū					X	X
Puffinus pacifus	Wedge-tailed Shearwater	ʻUaʻu Kani	X				X	
Sula dactylatra	Masked Booby	ʻĀ					X	X
Sula leucogaster	Brown Booby	ʻĀ	X				X	X
Sula sula	Red-footed Booby	ʻĀ					X	X
Tringa incana	Wandering Tattler	ʻŪlili	X				X	X

[1] Only PMRF sites with documented MMPA or MBTA species on or adjacent are included in table.

Sources: Baird et al. 2019, Baird et al 2022, Baird et al. 2021a, Baird et al. 2021b, Bruner 2000, DoN 2014b, Pepi et al. 2009, Pyle and Pyle 2017, Richie et al. 2012, Uyeyama et al. 2011

1 **Table 3-5. Invasive and Injurious Wildlife Identified at PMRF**

Scientific Name	Common Name	Status	Occurrence[1]					
			Barking Sands	Mākaha Ridge	Kōkeʻe Sites	Kamokala Ridge	Kaʻula	Niʻihau Island
Birds								
Bubulcus ibis	Cattle Egret	SOH Injurious	X	X		X		
Cettia diphone	Japanese Bush-Warbler	SOH Injurious	X	X	X			
Columba livia	Rock Dove, Rock Pigeon	SOH Injurious	X			X		
Lonchura malacca	Chestnut Mannikin	SOH Injurious	X			X		
Tyto alba	Barn Owl	SOH Injurious	X		X	X		
Zosterops japonicus	Japanese White-Eye	SOH Injurious	X	X	X	X		X
Herpetofauna								
Anolis carolinensis	Green Anole	SOH Injurious		X				
Cryptoblepharus poecilopleurus	Snake-Eyed Skink	SOH Injurious	X					
Hemidactylus frenatus	House Gecko	---	X	X				
Lampropholis delicata	Metalic Skink	SOH Injurious			X			
Lepidodactylus lugubrus	Mourning Gecko	---	X	X				
Rhinella marina syn. *Bufo marinus*	Cane Toad	SOH Injurious	X					
Mammals								
Canis familiaris	Feral Dog	---	X	X	X			
Capra hircus	Feral Goat	SOH Injurious		X				
Felis catus	Feral Cat	---	X	X	X	X		X
Odocoileus hemionus columbianus	Columbian Black-Tailed Deer	SOH Injurious	X	X	X	X		
Mus musculus	House Mouse	---	X					
Rattus norvegicus	Norway Rat	---	X		X			
Rattus rattus	Roof Rat	---	X	X	X			X
Rattus exulans	Polynesian Rat	---	X				X	
Sus scrofa	Feral Pig	SOH Injurious	X	X	X	X		X

2 [1] Only PMRF sites with documented state injurious, KISC target species, or other invasive animal species are included in table.

3 Source: Bruner 2000, DoN 2010, Fisher 1951, Hawaiʻi Invasive Species Council 2015a, KISC 2017

3.3 Barking Sands Natural Resources

3.3.1 Topography, Geology, and Soils

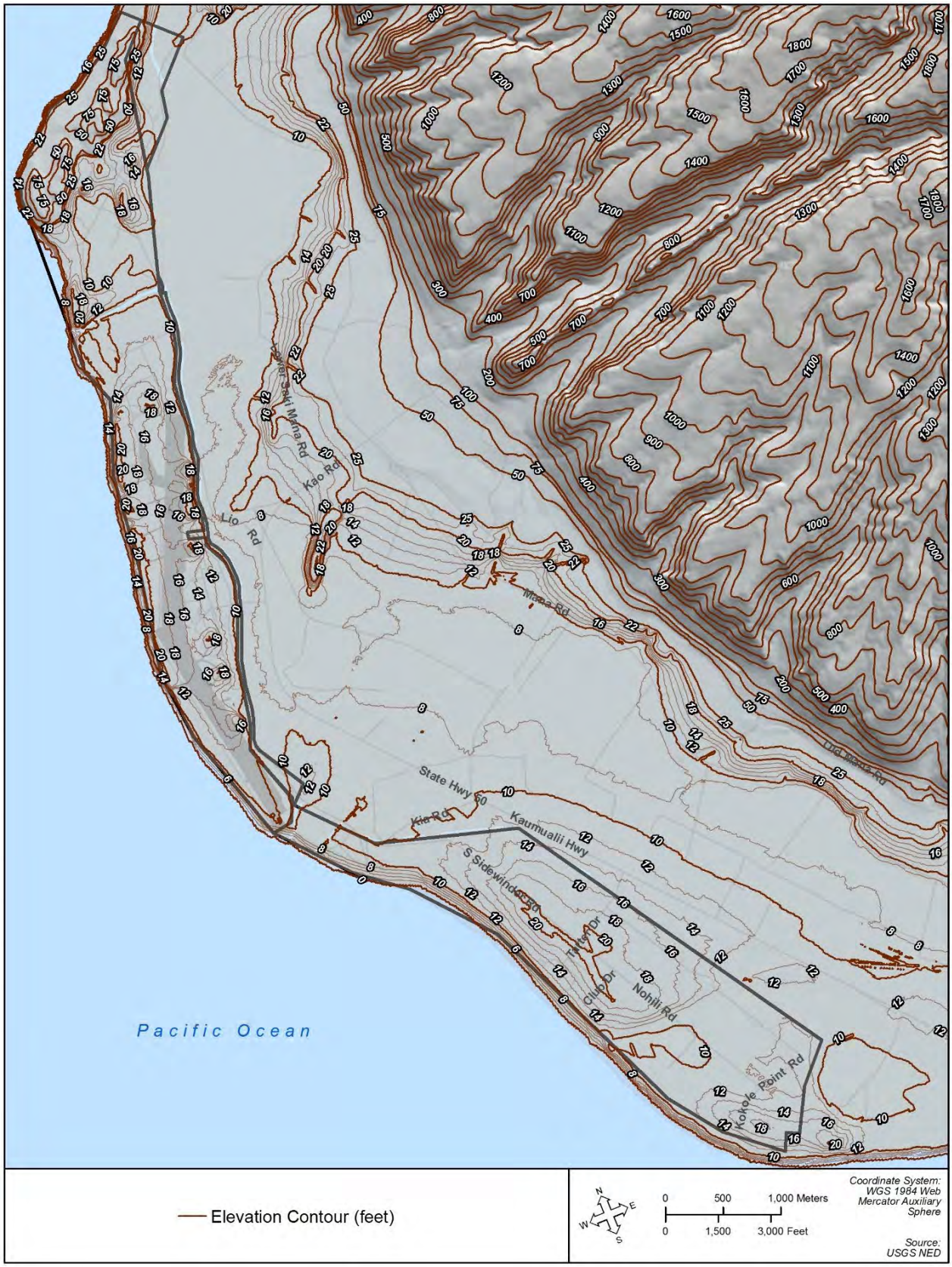
Barking Sands lies on the Mānā Coastal Plain (called Mānā Plain) with an average elevation of about 15 ft (4.6 m) above mean sea level (msl) (**Figure 3-2**). The Mānā Coastal Plain extends approximately 10 mi (16 km) along the west coast of the island, moving 3 mi (5 km) inland to the east and forming the gentle westerly slopes that border the ancient sea cliffs that stretch from Polihale to Waimea. The longest sandy beach in the state is found along the Mānā Coastal Plain. The Mānā Coastal Plain is a broad accretional strand that resulted from a convergence of longshore sediment from winter swell and trade wind transport from the northeast and summer swell and trade wind transport from the southeast, as well as the falling sea level at the end of the late Holocene (Fletcher and Fiersten 2009; University of Hawai‘i 2013a). The interior of the Mānā Coastal Plain is composed of sand and gravel deposits, and marl and clay that were deposited in an ancient shallow lagoon. The dunes along the seaward side of the plain are composed of moderately to well-cemented calcareous sand (University of Hawai‘i 2013a). Much of Barking Sands is dominated by beaches and large dunes. The dunes consist of hills and ridges of vegetation-stabilized sand. The beach berm is approximately 10 ft (3 m) high on average with dunes reaching 75 to 80 ft in the Nohili Dunes area (23 to 24 m) with two man-made channels that cut through at Nohili Ditch and Kinikini Ditch.

There are six types of soils that are found on Barking Sands (**Figure 3-3**, **Table 3-6**). The largest soil unit is Jaucas loamy fine sand (JfB), which is found on old beaches and windblown sand deposits in western and southern parts of Kaua‘i (USDA Soil Conservation Service [SCS] 1972). Soils in the Jaucas series consists of excessively drained, calcareous soils found as thin strips adjacent to the ocean on coastal plains. Permeability is rapid, runoff is very slow to slow, the water erosion hazard is slight, and the wind erosion hazard is severe where vegetation has been removed USDA SCS 1972). This soil is suitable for use for pasture, recreational areas, wildlife habitat, sugarcane, and alfalfa.

Table 3-6. Soil Series at Barking Sands

Map Unit Symbol	Map Unit Name	Surface Runoff	Hydric	Area ac (ha)	Percent of Area
BS	Beaches	Very low	Non-hydric	131 (53)	5.44%
DL	Dune land	Low	Non-hydric	137 (55)	5.70%
Fd	Fill land	Medium	Non-hydric	4 (1.6)	0.17%
JfB	Jaucas loamy fine sand, 0 to 8 percent slopes	Very low	Non-hydric	2,125 (860)	88.22%
Kf	Kaloko clay loam	Negligible	Hydric	3 (1.2)	0.14%
Kfa	Kaloko clay	Negligible	Hydric	7 (2.8)	0.29%
MnC	Mamala stoney silty clay loam, 0 to 12 percent slopes	Low	Non-hydric	1 (0.4)	0.04%
Total for Soil Survey Area				2,408 (974)	100%

Source: USDA NRCS 2015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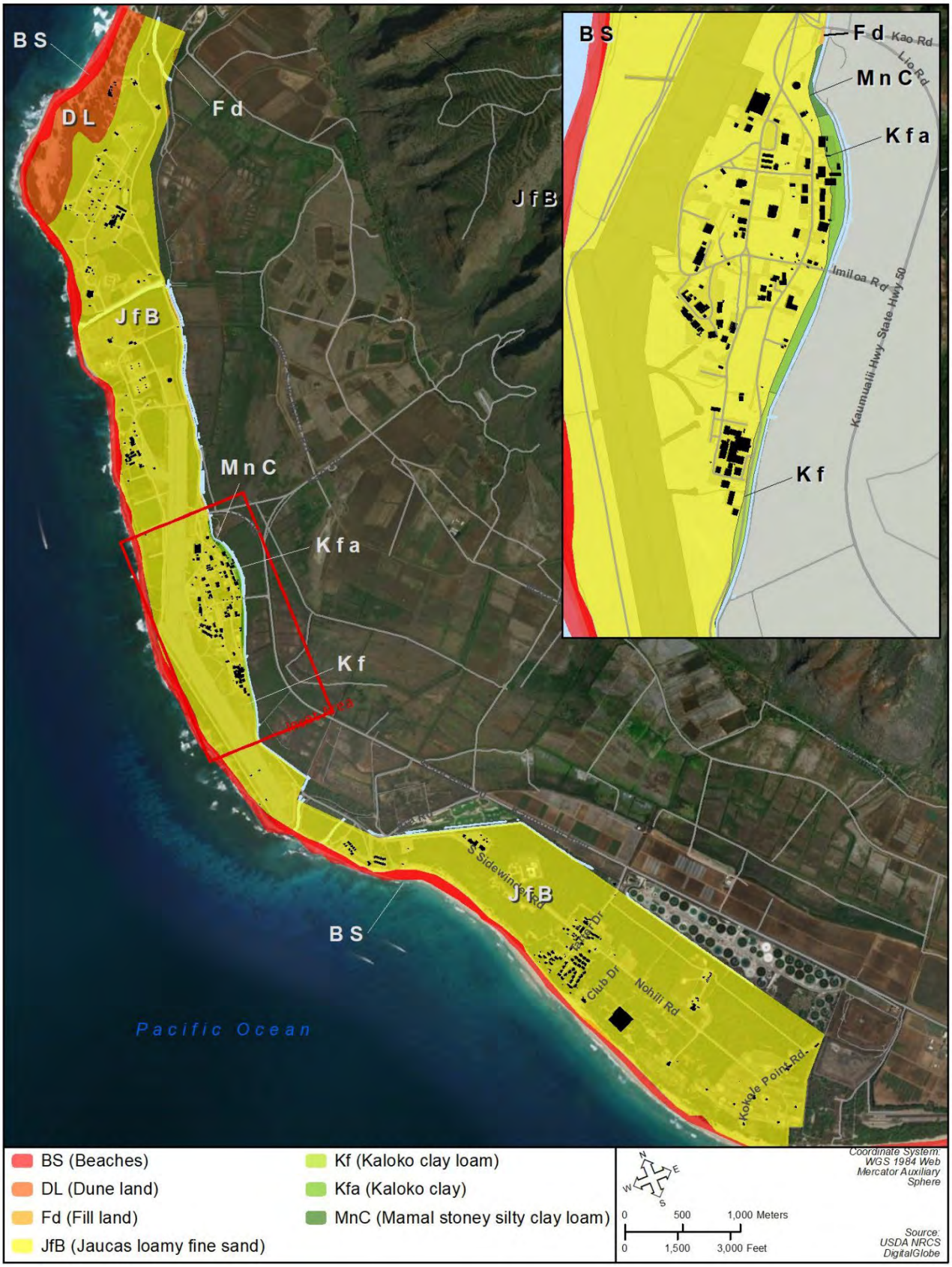


Figure 3-3. Barking Sands Soils

Dune land (DL) makes up approximately six percent of the soils at Barking Sands and includes hills and ridges formed from sand particles that have drifted and piled by wind (USDA SCS 1972). DL is actively shifting or has been so recently formed that no soil horizons exist. Dunes predominately consist of sand from coral and seashell. DL is suitable for wildlife habitat and recreational areas, though the presence of sensitive species and human remains may preclude areas from recreational use.

Beach sand (BS) comprises about five percent of the soils on Barking Sands. The BS series occurs as sandy, gravelly, or cobbly areas that are washed and rewashed by ocean waves (USDA SCS 1972). Most beaches consist of light-colored sands derived from coral and seashell, while some of the beaches consist of dark colored sands from basalt and andesite. Beaches are mainly suitable for recreational purposes and have no agricultural value.

There are small areas on Barking Sands that consist of Kaloko clay (Kfa) and Kaloko clay loam (Kf) series soils. This series consists of poorly drained soils developed in alluvium derived from basic igneous rock and deposited over marly lagoon deposits. Kfa soil consists of a dark-brown clay about 12 in (30.5 cm) thick covering a subsurface layer of dark reddish brown to weak red clay about 8 in (20.3 cm) thick (USDA SCS 1972). The permeability of Kfa is moderately slow to slow, with slow to very slow runoff, and a slight erosion hazard. This soil is difficult to work. The Kf soil found on the Mānā Plain differs slightly from Kfa in that the texture of sand in the surface layer and horizontal lenses of sand in the underlying material. Runoff is slow and there is no erosion hazard (USDA SCS 1972). Both soils are prime farmland soils if they are not frequently flooded during the growing season.

Fill land (Fd) is comprised mainly of bagasse and slurry from sugar mills but may also consist of material from dredging and excavation (USDA SCS 1972). Historically, these materials were generally dumped and spread over marshes, low-lying areas along the coastal flats, coral sand, coral limestone, or areas shallow to bedrock and do not support prime farmland.

3.3.2 Hydrology

Although Kauaʻi is known to have some of the largest rivers and the greatest amount of runoff in Hawaiʻi, the western portion of the island is relatively dry and lacks a significant amount of surface water (USGS 1986). The Mānā Plain, which once contained one of the largest wetlands in the state comprised of 1,700 ac (688 ha) of permanent, semi-permanent, and seasonal wetlands (SOH DLNR 2012), currently consist of only about 200 ac (81 ha) of aquatic habitat made up of sugar cane era reservoirs and ditches. The area also includes a waterbird sanctuary and permanent wetland area that was created when sand was mined in an area directly adjacent to PMRF (**Figure 3-4**).

Surface water and wetlands on Barking Sands are found in the Kawaiʻele (also known as Dry Ditch), Kinikini and Nohili ditches, which drain the agricultural lands east of the installation of water and associated sediment and residues. A man-made sewage oxidation pond complex is located on the southern portion of the installation. Narrow bands of wetland habitat border portions of the ditches and pond area. The estuarine and marine systems along the shoreline comprise the only natural wetland habitat on Barking Sands.

Figure 3-4. Barking Sands Wetlands and Surface Water

The 100-year floodplain encompasses all of the shoreline and a large portion of the north and central zones of Barking Sands. The primary flooding potential for western Kauaʻi, including Barking Sands, comes from overland flow after heavy rain events in Waimea Canyon that overflow streams and channels (USGS 2004). The Mānā Coastal Plain also has a high susceptibility from tsunamis and high waves resulting from tropical storms that generally pass to the west of Kauaʻi (USGS 2004).

3.3.3 Terrestrial Habitats, Vegetation Communities, and Land Cover

Complete vegetation surveys of Barking Sands were conducted in 2000 (Char et al.) and cover types were described in detail; however, cover types have been somewhat altered by further expansion of invasive species in some areas and efforts to remove Long-thorn Kiawe and restore native habitat in other areas. An updated habitat classification and vegetation mapping effort conducted at Barking Sands in 2005 indicated the base is composed of extensive areas of landscaped vegetation (39 percent) and scrub habitat dominated by invasive introduced species such as Kiawe (*Prosopis pallida*), Long-thorn Kiawe, and Koa Haole (45 percent), with other non-native cover types such as ruderal (disturbed) (3 percent), agricultural (1 percent), and ditches and manmade wetlands (1 percent) (**Table 3-7**, **Figure 3-5**). It is important to note that Long-thorn Kiawe is currently present in small areas at PMRF and is almost eradicated within PMRF boundaries due to extensive removal and survey efforts.

Table 3-7. Vegetation Cover Types at Barking Sands in 2005

Cover Type	Native/Non-native	Area ac (ha)	Percent of Area
Agave	Non-native	2.3 (0.9)	0.10%
Agriculture	Non-native	22.5 (9.1)	0.96%
Long-thorned Kiawe (Long-thorn Algaroba)	Non-native	13.2 (5.3)[1]	0.56%[1]
Grass, Herb, Shrub	Non-native	0.3 (0.1)	0.01%
Kiawe Koa Haole Scrub	Non-native	1,053.1 (426.2)	45.03%
Landscaped	Non-native	921.7 (373.0)	39.41%
Ruderal	Non-native	73.3 (29.6)	3.13%
Wetland Vegetation with Koa Haole	Non-native	25.3 (10.2)	1.08%
ʻAʻaliʻi -Nama Scrub	Native	145.5 (58.9)	6.22%
ʻAki ʻaki (beach dropseed)	Native	0.2 (0.1)	0.01%
Naupaka	Native	20.9 (85)	0.89%
Naupaka, Ipomoea	Native	0.5 (0.2)	0.02%
Pō hinahina	Native	1.8 (0.7)	0.08%
Pōhinahina-Naupaka Dune	Native	57.5 (23.3)	2.46%
Ipomoea	Native and Non-native	0.4 (0.2)	0.02%
Total		2,338.5 (946.4)	100.00%

[1]Control efforts have significantly reduced Long-thorn Kiawe occurrence since 2005 mapping effort
Source: NAVFAC PAC 2005

Native vegetation types, including ʻAʻaliʻi-Nama (*Dodonaea viscosa-Nama sandwicensis*) scrub (6 percent) and Pōhinahina -Naupaka (*Vitex rotundifolia-Scaevola sericea*) dune vegetation (3 percent), comprise only 9 percent of the base's vegetation. General descriptions of each of the cover types as described by Char (2000a) are provided below. In addition to these two surveys, a partial botanical

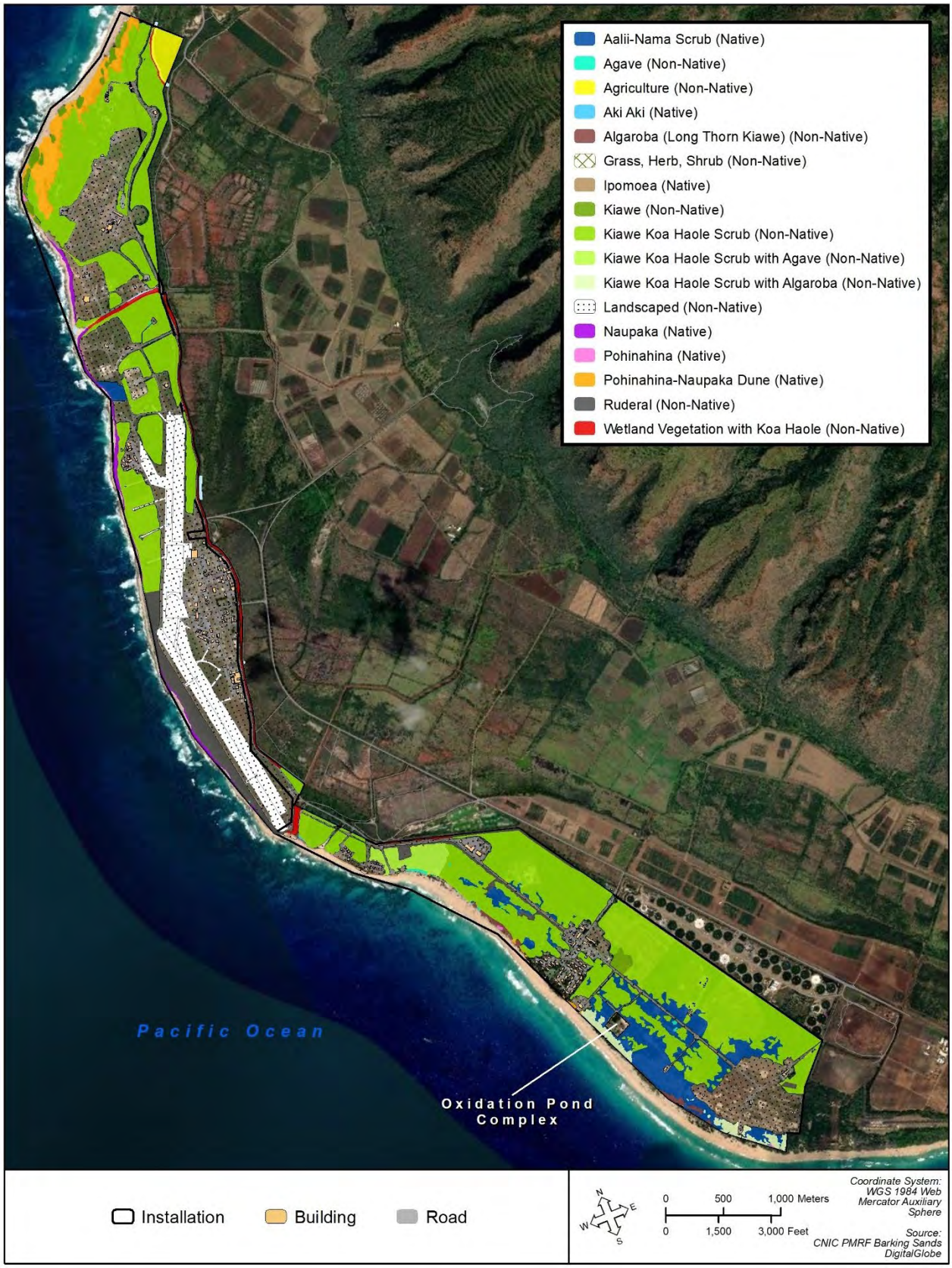


Figure 3-5. Barking Sands Vegetation Types

survey was conducted in 2006 that focused on documenting the Nohili dunes area and updating dramatic vegetation changes (NAVFAC PAC 2006b). To date, approximately 125 species have been identified at Barking Sands. Of these, approximately 97 species (78 percent) are introduced, 22 (18 percent) are indigenous, and 6 (5 percent) are endemic. For a full list of plant species from Barking Sands refer to **Appendix C**.

3.3.3.1 Kiawe and Koa Haole

Kiawe and Koa Haole are both abundant in dry, disturbed, lowland habitats. They are found in about equal numbers throughout the base. The tallest, most dense area of this vegetation type occurs behind the Nohili Point sand dunes between Nohili Road and the agricultural fields in the northern portion of the base. Non-native Guinea grass (*Urochloa maximum*) is also abundant and grows 2 to 3 ft (0.6 to 1 m) tall in this area. The Kiawe-Koa Haole scrub is more open on the southern half of the sitefrom the end of the runway near Waieli Drive to the housing area gate, with cover varying between 30 and 50 percent. Lantana shrubs (*Lantana camara*) form dense 5 to 7 ft (1.5 to 2 m) thickets between the trees. Kūpala (*Sicyos pachycarpus*) and Wild Basil shrubs (*Ocimum gratissimum*) are also abundant in some open areas. In the Kiawe-Koa Haole scrub around Majors Bay, non-native Agave (*Agave sisalana*) plants are also abundant.

3.3.3.2 ʻAʻaliʻi -Nama Scrub

The southern half of the site from the housing area to the antenna fields contains ʻAʻaliʻi -Nama scrub, with the most characteristic example of this native vegetation type found around the oxidation pond complex. ʻAʻaliʻi shrubs form a patchy 5 to 8 ft (1.5 to 2 m) cover with abundant low, rounded Nama in between these and other shrubs. The dominant vegetation is native. One of the many native plants frequently encountered is the Pololei fern (*Ophioglossum polyphyllum*). In addition, non-native Kiawe trees are scattered throughout the scrub either in small stands or as individual trees, surrounded by Buffelgrass (*Cenchrus ciliaris*), Guinea grass, and Lantana shrubs. Koa Haole shrubs grow along disturbed edges of the ʻAʻaliʻi -Nama scrub.

3.3.3.3 Pōhinahina-Naupaka Dune Vegetation

The seaward facing slopes of large dunes at Nohili Point contain native Pōhinhina-Naupaka dune vegetation. Low mats of Pōhinahina form over the dunes interspersed with low thickets of Naupaka. ʻAkoko (*Chamaesyce celastroides* syn. *Euphorbia celastroides*) is also locally abundant in the area of the launch pads. ʻAki ʻaki grass (*Sporobolus virginicus*), Beach Morning Glory (*Ipomoea pes-caprae*) and Hunakai (*Ipomoea imperati*) are abundant closer to the beach. Inland of the Pōhinahina-Naupaka dune vegetation is dense Kiawe-Koa Haole scrub, and some Kiawe and Koa Haole scrub are scattered throughout the native dune vegetation.

3.3.3.4 Strand Vegetation

A narrow band along the coastline contains strand vegetation, which is mostly bordered by Kiawe-Koa Haole scrub on the inland side. The strand vegetation varies between the area north of Waieli Drive to the area south of Waieli Drive. The northern area contains few low, scattered shrubs of Naupaka, Pōhinahina, Koa Haole, and Indian Fleabane (*Pluchea indica*), along with abundant mats of ʻAkiʻaki

grass. The area south of Waieli Drive contains scattered patches of strand vegetation behind sandy beaches. The most common native species found here are Beach Morning Glory and ʻAkiʻaki grass, but several introduced species such as Buffelgrass are also common. The southernmost portion of the site previously consisted of dense thickets Long-thorn Kiawe though control efforts have been undertaken and the infestation is greatly reduced. There are also a few scattered pockets of native strand vegetation such as Naupaka and ʻAkiʻaki grass.

3.3.3.5 Drainageway/Wetlands

Various waterbirds, including five federally listed endangered birds, utilize the small area of this vegetation type on the property. Large, often floating mats of non-native species including seashore Paspalum (*Paspalum vaginatum*) line the ditches. The lower banks of the ditches contain dense thickets of Indian Fleabane and mats of California Grass (*Brachiaria mutica*) while the top of the banks are lined with a narrow band of Koa Haole, Kiawe, and Milo (*Thespesia populnea*).

3.3.3.6 Ruderal and Landscaped Vegetation

Ruderal vegetation is found along paved and unpaved roads, as well as in disturbed, overgrown areas. Buffelgrass and Bermuda Grass (*Cynodon dactylon*) are the most abundant species on roadsides. Various other weedy non-native, mostly annual species are scattered throughout these areas. Golden Crown-beard is an invasive pioneer species in disturbed sites that is scattered throughout a large open parcel near the northern drainage ditch along with Buffelgrass, Bermuda Grass, low stubs of Koa Haole and Lantana shrubs, and numerous other non-native species.

Landscaping at Barking Sands typically includes non-native ornamental species and large areas of mowed lawn. Frequently planted species include trees such as Coconut Palms (*Cocos nucifera*), flowering shrubs (native and non-native), and lawn that is primarily comprised of Buffelgrass and Bermuda Grass.

3.3.4 Invasive and Introduced Wildlife Species

Wildlife surveys were conducted in 1999 in support of the 2001 INRMP (Bruner 2000) and in 2006 (NAVFAC PAC 2006c). The only native terrestrial mammal found at PMRF is the endangered Hawaiian Hoary Bat. All other terrestrial mammal species are non-native. Feral Cats, Roof/Black Rats, Polynesian Rats (*Rattus exulans*), and the Common House Mouse (*Mus musculus*) were documented during these surveys. Feral Cats and Roof/Black Rats were the most common mammal species encountered in both surveys. Signs of Feral Pigs and Black-tailed Deer were also found during the 2006 survey. There have been reported sightings of mongoose at Barking Sands, though none have been captured. The introduced Barn Owl (*Tyto alba*) is also a common resident at Barkings Sands and evidence of the species targeting Wedge-tailed Shearwaters has been documented on the base. Barn Owls are targeted for predator control efforts at Barking Sands as well as protection of the airfield area from bird aircraft strikes. Reptiles documented at Barking Sands include the Mourning Gecko (*Lepidodactylus lugubrus*), House Gecko (*Hemidactylus Frenatus*), And Snake-Eyed Skink (*Cryptoblepharus Poecilopleurus*). The House gecko was the most common reptile found during the survey. The only amphibian recorded on Barking Sands was the Cane Toad (*Rhinella marina* syn. *Bufo marinus*).

3.3.5 Special Status Species

A total of 19 federally protected ESA species and one area of unoccupied critical habitat are known to occur on or adjacent to, as fly-overs, or in the nearshore waters of Barking Sands. Known occurrences, both on and off base, of these species are described in **Table 3-8** and on-base areas known to support special status species and the unoccupied habitat for Niʻihau panicgrass are shown in **Figure 3-6**.

In addition to these ESA-protected species, many others are protected by the MMPA and MBTA. Marine surveys conducted in 2000 and 2006 in support of previous INRMP updates and surveys conducted annually in support of Navy training operations have identified several MMPA-protected species: Spinner Dolphin (*Stenella longirostris*), Short-finned Pilot Whale (*Globicephala macrorhynchus*), Humpback Whale (*Megaptera novaengliae*), Rough-toothed Dolphin (*Steno bredanensis*), Bottlenose Dolphin (*Tursiops truncatus*), Melon-headed Whale (*Peponocephala electra*), and rarely, Pantropical Spotted Dolphin (*Stenella attenuata*), Striped Dolphin (*Stenella coeruleoalba*), Fraser's Dolphin (Lagenodelphis hosei), Dwarf Sperm Whale (*Kogia sima*), Pygmy Killer Whale (*Feresa attenuata*), Cuvier's Beaked Whale (Ziphius cavirostris) and Blainville's Beaked Whale (Mesoplodon desirostris), in the waters off of Barking Sands (Baird et al. 2019, Baird et al 2022, Baird et al. 2021a, Baird et al. 2021b, DoN 2014b, Mobley et al. 2017, Uyeyama et al. 2011, Richie et al. 2012).

Avian surveys conducted at Barking Sands have identified 54 species of birds (Bruner 2000, Hamer Environmental L.P. 2016, NAVFAC PAC 2006a, PMRF 2018). Of these, 25 are native and 29 are non-native, though many have become naturalized on Kauaʻi (Pyle and Pyle 2017). Although non-native, most of these species are migratory and protected by the MBTA. Laysan Albatross or Mōlī (*Phoebastria immutabilis*), Black-crowned Night-heron or ʻAukuʻu (*Nycticorax nycticorax hoactli*), Black-footed Albatross or Kaʻupu (*Phoebastria nigripes*), Brown Booby or ʻĀ (*Sula leucogaster*), Ruddy Turnstone or ʻAkekeke (*Arenaria interpres*), Pacific Golden Plover or Kōlea (*Pluvialis fulva*), Sanderling or Hunakai (*Calidris alba*), Hawaiian Short-eared Owl or Pueo (*Asio flammeus sandwichensis*), and Wedge-tailed Shearwater or ʻUaʻu Kani (*Puffinus pacificus*) are relatively common native bird species known to occur at Barking Sands that are protected under the MBTA. The Pacific Golden Plover is migratory and leaves Hawaiʻi in April to breed in Alaska and returns to Hawaiʻi in August (Pyle and Pyle 2017). Wandering Tattler or ʻŪlili (*Tringa incana*) is an uncommon native MBTA-species known to occur. House Finches, Northern Mockingbird (*Mimus polyglottos*), and Northern Cardinal (*Cardinalis cardinalis*) are examples of common non-native birds that are also protected by the MBTA.

Table 3-8. Special Status Species on or near Barking Sands

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Birds					
Anas clypeata	Northern Shoveler	Koloa mohā	MBTA	Winter resident (Sept. -April). Uncommonly observed at ditch outfalls and the oxidation pond.	NA
Anas wyvilliana	Hawaiian Duck	Koloa maoli	E, MBTA	Year-round resident. Frequently observed in ditches and at oxidation pond. Young hatchlings have been observed at the oxidation pond and Kawaiʻele Ditch (also known as Dry Ditch).	Breeding Season: Year-round, peak April-Sept. Incubation: ~30 days Fledges: 50-60 days
Anas crecca	Green-Winged Teal	---	MBTA	Winter resident (Sept. – April). Uncommonly observed at the oxidation pond.	NA
Arenaria interpres	Ruddy Turnstone	ʻAkekeke	MBTA	Migrant and winter resident, few over-summer. Frequently seen at the oxidation pond complex and commonly observed at beaches.	NA
Asio flammeus sandwichensis	Short-Eared Owl	Pueo	MBTA	Year-round resident. Commonly observed at Barking Sands however no nesting or breeding has been confirmed.	Breeding Season: Year-round, with peak in winter months Incubation: 21-37 days Fledges: ~ 29 days
Branta sandvicensis	Hawaiian Goose	Nēnē	FT, SE, MBTA	Year-round resident on Kauaʻi. Commonly observed throughout site known nesting at Kinikini Ditch, the oxidation pond complex, HIANG complex, THAAD complex, and beach cottages.	Breeding Season: Aug. – April, peak Oct.–Dec. Incubation: ~30 days Fledges: ~90 days
Calidris alba	Sanderling	Hunakai	MBTA	Winter resident (July – May), few over-summer. Commonly observed at beaches.	NA
Fulica americana alai	Hawaiian Coot	ʻAlae keʻokeʻo	E, MBTA	Year-round resident. Commonly observed at Kinikini Ditch and the oxidation pond where nesting is frequently recorded.	Breeding Season: Year-round, peak April-Sept. Incubation: ~25 days Fledges: 50-75 days
Gallinula galeata sandvicensis	Hawaiian Common Gallinule	ʻAlae ʻula	E, MBTA	Year-round resident. Commonly observed in Kinikini Ditch and Kawaiʻele Ditch (also known as Dry Ditch). Nesting has been documented in Kinikini Ditch and young hatchlings are routinely observed in the Kawaiʻele Ditch (also known as Dry Ditch) during the summer months.	Breeding Season: Year-round, peak Mar.-Aug. Incubation: ~22 days Fledges: 50-75 days

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Himantopus mexicanus knudseni	Hawaiian Stilt	Aeʻo	E, MBTA	Year-round resident. Commonly observed in the ditches surrounding the base, at the oxidation pond complex, and occasionally foraging on the beach. Not known to nest on installation however adults are regularly observed with their fledged young at Barking Sands.	Breeding Season: March-Aug., peak May-June Incubation: ~24 days Fledges: ~60 days
Larus atricilla	Laughing Gull	---	MBTA	Occasional vagrant winter visitor. Uncommonly seen at Barking Sands.	NA
Numenius tahitiensis	Bristle-Thighed Curlew	Kioea	MBTA	Winter resident	NA
Nycticorax nycticorax hoactli	Black-Crowned Night-Heron	ʻAukuʻu	MBTA	Year-round resident. Commonly observed at ditches and the oxidation pond complex.	Breeding Season: March – Oct. Incubation: ~25 days Fledges: 50-75 days
Oceanodroma castro	Band-rumped Storm-petrel (Hawaiʻi DPS)	ʻAkēʻakē	E, MBTA	Breeding visitor. Known to fly over base during trips between nesting and foraging sites. Fledglings also fly through the area on their first trip to the sea and may fall out during fledgling season.	Breeding Season: May – Oct. /April - June Incubation: 39 -51 days Fledges: mid Sept. – mid Dec.
Phoebastria albatrus	Short-Tailed Albatross	---	E, MBTA	Migrant. Rare, only one sighting at Barking Sands, recorded in 2000, near runway.	NA
Phoebastria immutabilis	Laysan Albatross	Mōlī	MBTA	Breeding visitor. Commonly observed during nesting season from Kinikini Ditch to north end of base.	Breeding Season: Nov. – Dec. Fledging: June to July Incubation: 65-66 days Fledges: ~185 days
Phoebastria nigripes	Black-Footed Albatross	Kaʻupu	MBTA	Breeding visitor (Niʻihau and Kaʻula). Uncommonly observed at Barking Sands, not known to nest on base.	Breeding Season: Oct. – Jun. Incubation: ~65-66 days Fledges: ~150 days
Pluvialis fulva	Pacific Golden Plover	Kōlea	MBTA	Winter resident. Commonly observed throughout Barking Sands August – April (non-nesting season).	NA
Pluvialis squatarola	Black-Bellied Plover	---	MBTA	Winter resident. Uncommonly observed at Barking Sands beaches.	NA
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel	ʻUaʻu	E, MBTA	Breeding visitor. Known to fly over the base when traveling between nesting and foraging areas. Fledglings also fly through the area on their first trip to the sea and may fall out during fledgling season.	Breeding Season: Feb. – May Incubation: ~56 days Fledges: Oct. – Dec.

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Puffinus auricularis newelli	Newell's Shearwater	ʻAʻo	T, MBTA	Breeding visitor. Known to fly over base when traveling between nesting sites and at-sea foraging areas. Fledglings also fly through the area on their first trip to the sea and are vulnerable to fall out during fledgling season.	Breeding Season: March - April Incubation: ~51 days Fledges: mid Sept. – mid Dec.
Puffinus pacificus	Wedge-Tailed Shearwater	ʻUaʻu Kani	MBTA	Breeding visitor. Three active nesting colonies on Barking Sands; Nohili Dunes, Kinikini Ditch, and the beach cottages area with some burrows present sporadically along the coastal area near the airfield.	Breeding Season: March - June Incubation: ~50 days Fledges: mid Nov. – early Dec.
Sula leucogaster	Brown Booby	ʻĀ	MBTA	Breeding visitor (occasional) on Kauaʻi. Commonly observed foraging offshore.	Breeding Season: Jan. – Sept. and Oct. – Dec. Incubation: ~43 days Fledges: 130 – 260 days
Tringa incana	Wandering Tattler	ʻŪlili	MBTA	Winter resident. Regularly observed in the intertidal zone of Barking Sands.	NA
Mammals					
Balaenoptera physalus	Fin Whale	---	E	Considered rare, most likely to occur in fall and winter.	Breeding season: Late fall-winter.
Feresa attenuata	Pygmy Killer Whale	---	MMPA	Occurs in deeper waters year-round; may have island-associated resident populations	Calving likely peaks in summer.
Globicephala macrorhynchus	Short-finned Pilot Whales	---	MMPA	May be part of island-associated resident population that moves over area covering Kauaʻi, Niʻihau, Kaʻula, and offshore north of Barking Sands.	Breeding Season: Year-round, peaks July – Aug.
Kogia sima	Dwarf Sperm Whale	---	MMPA	May be part of an island- associated resident population; occur year-round.	Calving occurs in spring.
Lagenodelphis hosei	Fraser's Dolphin	---	MMPA	Occurs year-round in deeper waters in large pods; considered rare nearshore but has been recorded off of Barking Sands.	Calving occurs between spring and fall

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Lasiurus cinereus semotus	Hawaiian Hoary Bat	ʻŌpeʻapeʻa	E	Documented year-round, most common in winter, roosts, forages, and may breed at Barking Sands.	Breeding Season: Sept – Dec. Pupping: June – Aug. Mother likely stays with pups for 6-7 weeks.
Megaptera novaeangliae	Humpback Whale	Kōholā kuapiʻo	SE, MMPA	Occur winter / spring (Nov. – April). Commonly observed off the coast of Barking Sands.	Calving occurs in winter.
Mesoplodon desirostris	Blainville's Beaked Whale	---	MMPA	Occur in low numbers rear-round, possibly as part of a resident population.	No seasonality is known
Neomonachus schauinslandi	Hawaiian Monk Seal	ʻĪlio-holo-i-ka-uaua	E	Commonly observed on beaches at Barking Sands. One documented birth at Barking Sands, in 1999.	Breeding Season: Year-round Pupping: Feb. – Aug., peaks March – April. Mother nurses her pup for 5-6 weeks.
Peponocephala electra	Melon-headed Whale	---	MMPA	Occur year-round. Occasionally observed off the coast of Barking Sands.	No seasonality is known
Physeter macrocephalus	Sperm Whale	Palaoa	E	Higher occurrence in summer/ fall. Rarely recorded in adjacent waters.	Breeding season: Summer
Pseudorca crassidens	False Killer Whale	---	E – MHI Insular DPS	Occur year-round. Occasionally observed off the coast of Barking Sands.	No seasonality is known.
Stenella attenuata	Pantropical Spotted Dolphin	Kiko	MMPA	Rarely seen off the coast of Barking Sands.	Calving peaks in spring and fall.
Stenella coeruleoalba	Striped Dolphin	---	MMPA	Occur year-round, primarily in deeper waters, however rarely observed off the coast of Barking Sands.	Calving occurs summer to fall.
Stenella longirostris	Spinner Dolphin	Naiʻa	MMPA	Occur year-round. Commonly observed off the coast of Barking Sands.	Calving peaks range from spring to fall.
Steno bredanensis	Rough-Toothed Dolphin	---	MMPA	Occur year-round. Commonly observed. Tagged individuals tracked in PMRF area off Kauaʻi.	No seasonality is known.
Tursiops truncatus	Bottlenose Dolphin	---	MMPA	Occur year-round. Commonly observed off the coast of Barking Sands.	Calving peaks range from spring to fall.
Ziphius cavirostris	Cuvier's Beaked Whale	---	MMPA	Occur year-round, likely as part of an island-associated resident population. Occasionally observed off the coast of Barking Sands.	Breeding occurs year-round; calving peaks in spring.

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Reptiles					
Chelonia mydas	Green Sea Turtle	Honu	T – Central North Pacific DPS	Occur year-round. Common at Nohili Ditch outflow, nesting and basking documented on several sites on coast of Barking Sands.	Nesting Season: May – July Incubation: ~ 60 days Hatch: July – Sept.
Eretmochelys imbricata	Hawksbill Sea Turtle	Honu‘ea	E	Rarely reported in the open waters offshore of Kaua‘i but has not been observed on land at Barking Sands.	NA
Plants					
Sesbania tomentosa[2]	O‘ahu Riverhemp	‘Ōhai	E	Occurs in sand dunes of Polihale State Park north of the Barking Sands property line. No plants have been documented at Barking Sands.	NA
Panicum niihauense[3]	Ni‘ihau Panicgrass	Lau‘ehu	E	Observed in Polihale State Park, ~ 183 ac (74 ha) of unoccupied critical habitat is designated within the beach strands and sand dunes of Barking Sands.	NA
Fish					
Carcharinus lonigmanus	Oceanic Whitetip Shark	---	T	Occurs in tropical and subtropical oceans throughout the world. They live from the surface of the water to at least 500 ft (152 m) deep. Breeding is thought to be concentrated in the central Pacific between 1°N and 15°N.	Mating occurs in late spring and summer. Gestation is 12-13months
Manta birostris	Giant Manta Ray	Hāhālua	T	Occurs worldwide in tropical, subtropical, and temperate waters and is commonly found offshore, in oceanic waters, and near productive coastlines. Breeding sites have been identified off the coast of Ecuador and in the Galapagos Islands.	The primary breeding season is July - August. Gestation is 12-13 months.

[1] State and Federally listed as E = Endangered, T = Threatened, DPS = Distinct Population Segment, SE = State Endangered only, Native MBTA = Species protected under the Migratory Bird Treaty Act; MMPA = Protected under Marine Mammal Protection Act

[2] Not known to occur on Barking Sands [3] Unoccupied critical habitat only is on Barking Sands

Sources: Ampela et al. 2015, Baird et al. 2019, Baird et al 2022, Baird et al. 2021a, Baird et al. 2021b, Bonfil et al. 2009, Deakos et al. 2017, DoN 2005, DoN 2010, DoN 2014b, Mobley et al. 2017, NAVFAC PAC 2006a,b,c; NMFS 2014a,b,c; NMFS 2016b,c,d, NOAA Fisheries 2018, Pyle and Pyle 2017, USFWS 2008b.

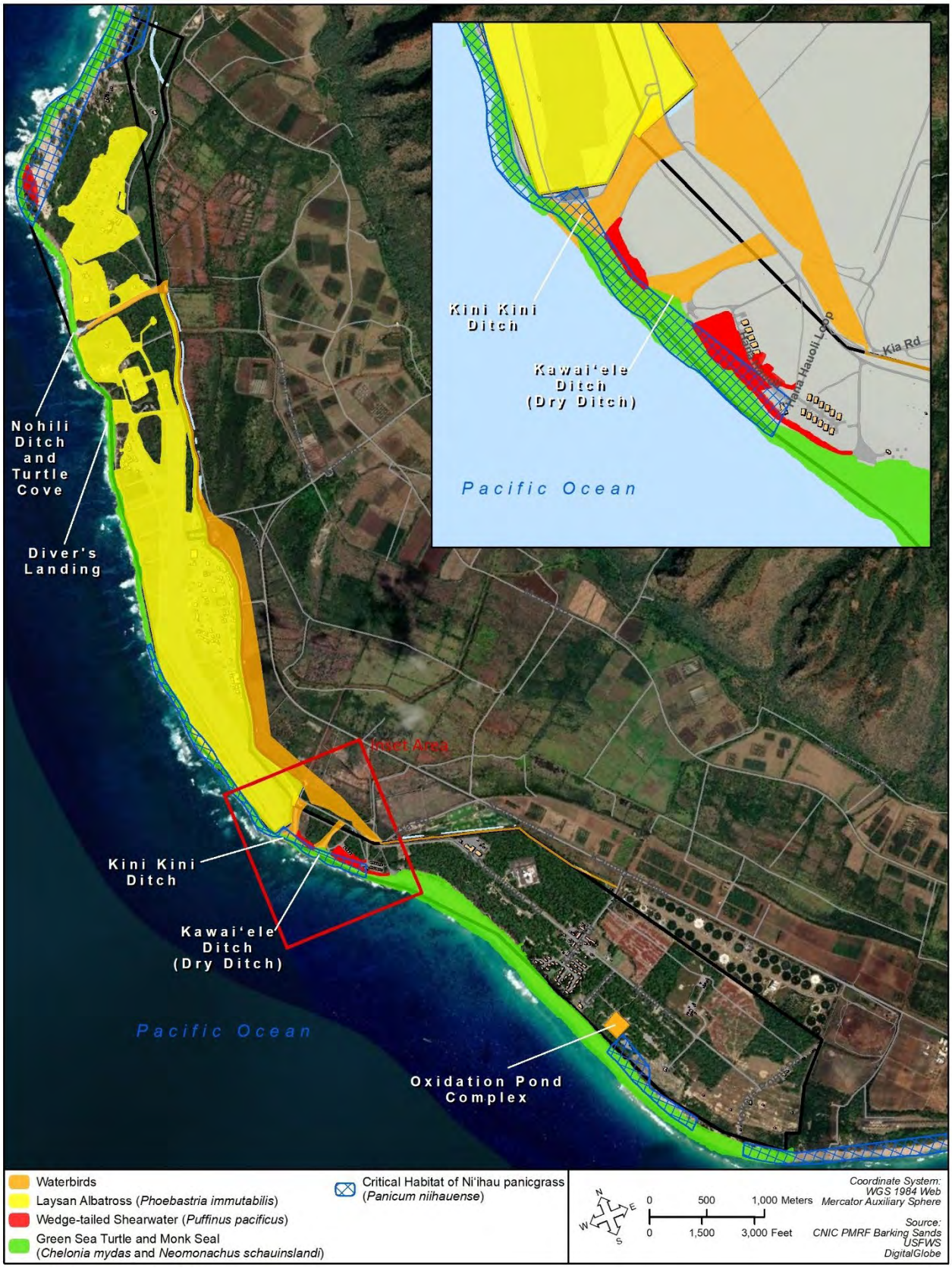


Figure 3-6. Special Status Species Habitat at Barking Sands

3.3.6 Coastal and Nearshore Environment

The nearshore environment adjacent to Barking Sands provides habitat for numerous species, including corals, macroinvertebrates, and fishes. Surveys of the marine environment were conducted in April 2000 (Dollar and Brock 2000) and August 2006 (Dollar and Brock 2007). These investigations involved point-to-point underwater swims at each dive site to evaluate abundance and other characteristics of marine communities. The investigations were limited to a maximum depth range of 65 ft (20 m) in the nearshore sector. The survey area was divided into four sectors separated by distinct physiographic and biotic structures as shown in **Figure 3-7**. The following is a summary of the 2000 and 2006 surveys (Dollar and Brock 2007) for coral reefs, fish, and macroinvertebrates. In 2022, biological and benthic habitat surveys are being conducted in the nearshore environment off of PMRF to identify any substrate or species composition changes, and to record all observations of protected species, including marine mammals and Green Sea Turtles (Miller et al. 2022).

3.3.6.1 Coral Reefs

Coral reefs are critical to the health of marine ecosystems that face severe threats world-wide. Currently 22 species of coral are protected under the ESA, however at this time, none have been listed in Hawai‘i (NMFS 2016a). The Cauliflower Coral or Ko‘a (*Pocillopora meandrina*) is present in PMRF's nearshore marine environment and was determined to be at low risk of extinction (Smith 2019). Wave action is a major inhibiting factor on coral reef structure along much of the coastline of Kaua‘i and coral density is low.

At Barking Sands, a narrow fringing reef follows the coastline north from Mānā Point to Nohili Point. Total coral cover in the Nohili Sector ranges from 32 percent to 39 percent of the total bottom cover. The most abundant coral species are Lobe Coral or Pōhaku Puna (*Porites lobata*), Cauliflower Coral, and Ringed Rice Coral (*Montipora patula*). Along the central portion of Barking Sands in the Mānā Sector, living coral is sparsely distributed, and is approximately half of that found in the Nohili area. The dominant species are Lobe and Cauliflower Corals. The nearshore region of Majors Bay differs substantially from the two northern sectors in that there is little solid reef structure within the nearshore area within the 65 ft (20 m) depth contours. Rather, nearly the entire bottom consists of shifting sands. Coral cover in the Majors Bay Sector is less than two percent (Dollar and Brock 2007). The predominant coral found in the Offshore Sector is Antler Coral (*Pocillopora eydouxi*), which occurs as single large branching colonies. Other corals found on the platform, which have a collective coverage of about five percent, include Cauliflower Coral, Lobe Coral, Rice Coral, and others. Also present along the shelf break are Black Coral (*Antipathes griggi*) and Wire Coral (*Cirrhipathes anguina*).

3.3.6.2 Fish

The topographical complexity created by the eroded reef channels provides considerable shelter for many fish and motile invertebrate species. The Nohili sector contained the most abundant fish populations ranging from 72 to 78 species recorded over a 30-minute period of observation. Fish were less abundant on the flat limestone platforms of the Mānā sector compared to the Nohili sector. Where small depressions and undercutting were encountered in the hard bottom, a number of fishes were seen.

In 2000, 30 species of fishes were encountered in the Mānā Point survey and in the 2006 survey of this area, 55 species of fishes were recorded. Results of surveys of fish communities in Majors Bay reveal that in 2000, 22 species of fishes were documented and in 2006, 30 species of fishes were recorded. The average biomass remained essentially constant during the two surveys. **Appendix C** has a complete list of species observed during these survey efforts.

Figure 3-7. Barking Sands Marine Sectors

3.3.6.3 Essential Fish Habitat

Essential Fish Habitat (EFH) has been designated and described for the Hawaiian Islands including along the Kauaʻi shoreline and the surrounding waters. EFH consists of the waters and substrate needed for federally managed fisheries species to spawn, breed, feed, or grow to maturity. It has been designated for various life stages including eggs, larvae, juveniles, and adults for five management unit species complexes including bottomfish species, pelagic fishes, crustaceans, precious corals, and coral reef ecosystem taxa based on observed habitat utilization patterns in localized areas (Western Pacific Regional Fishery Management Council [WPRFMC] 2009a; WPRFMC 2009b; DoN 2005). Uku (*Aprion virescens*) was recorded at Waiokapua (Major's) Bay and Nohili during nearshore surveys in April 2000 (Dollar and Brock 2000) and August 2006 (Dollar and Brock 2007).

3.3.6.4 Macroinvertebrates

Macroinvertebrate species observed in the Barking Sands nearshore environment include limpets or ʻOpihi (*Cellana* spp.), littorine snails (*Littorina* sp. and *Nerita* sp.), Rock Oyster (*Spondylus tenebrosus*), cone shells (*Conus* spp.), Sea Urchins (*Echinometra mathaei*), and Sea Cucumber (*Holothuria atra*) (Dollar and Brock 2007). Of these organisms, ʻOpihi are culturally significant marine mollusks that have been historically over harvested in Hawaiʻi (Bird and Toonen 2014). In 2013, surveys were conducted along the entire coastline of the PMRF to assess the density and structure of ʻOpihi populations on the site and to compare them to other ʻOpihi populations on Kauaʻi and across the Hawaiian Archipelago (Bird and Toonen 2014). An estimated 110,000 Black Foot ʻopihi, or ʻOpihi Makaiauli (*Cellana. exarata*), and 4,000 Yellow Foot ʻopihi, or ʻOpihi ʻĀlinalina, (*C. sandwicensis*) were found at Barking Sands during the course of the study. Giant ʻOpihi, ʻOpihi Kōʻele (*C. talcosa*), though also observed, were extremely rare, likely due to lack of suitable habitat on the site (Bird and Toonen 2014).

3.4 Mākaha Ridge Tracking Station Natural Resources

3.4.1 Topography, Geology, and Soils

The cliffs of the Nā Pali ridgeline, on which the Mākaha Ridge Tracking Station is located, range in elevation from a low of 1,400 ft (426 m) at the cliff face to a high of 1,800 ft (548.6 m) at the eastern perimeter (**Figure 3-8**). While elevation varies across the site, the topography generally slopes west to southwest. The ridge on which the Mākaha Ridge Tracking Station is located is composed of lava formations from the Nā Pali formation of the Waimea Canyon series, associated with pyroclastic rocks from the flanks of the major Kauaʻi shield volcano, outside the caldera.

The soils at Mākaha Ridge Tracking Station include Rock outcrop (rRO), Rough broken land (rRR), Badland (BL), Badland-Mahana complex (BM), Mahana series, Niu series, Pakala series, and Puʻu ʻŌpae series soils (**Figure 3-9, Table 3-9**).

BL is mostly barren and steep to very steep with very rapid runoff and active erosion. Badland-Mahana complex (BM, 20 to 35 percent slope) encompasses 40 percent of the acreage and contains 60 percent

Figure 3-8. Mākaha Ridge Elevation Contours

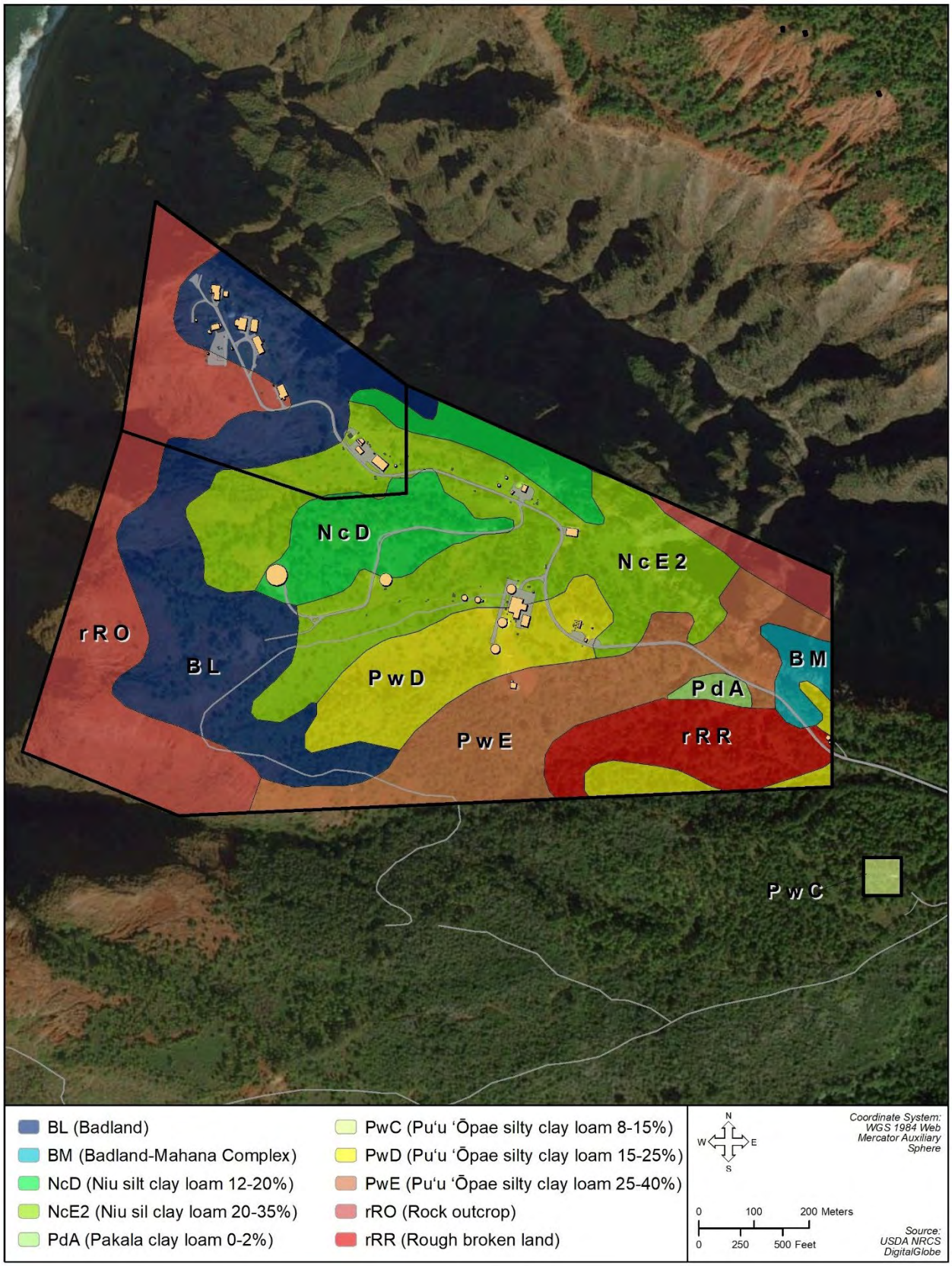


Figure 3-9. Mākaha Ridge Tracking Station Soils

Table 3-9. Soil Series at Mākaha Ridge Tracking Station

Map Unit Symbol	Map Unit Name	Surface Runoff	Hydric	Area ac (ha)	Percent of Area
BL	Badland	Very rapid	Non-hydric	49.6 (20.1)	20.4%
BM	Badland-Mahana complex, 20 to 35 percent slope	NA	Non-hydric	3.7 (1.5)	1.5%
MaD	Mahana silt loam, 12 to 20 percent slopes	Medium	Non-hydric	0.005 (0.002)	2.0 $x10^{-3}$%
NcD	Niu silty clay loam, 12 to 20 percent slope	Rapid	Non-hydric	20.3 (8.2)	8.4%
NcE2	Niu silty clay loam, 20 to 35 percent slope	Rapid	Non-hydric	52.8 (21.4)	21.7%
PdA	Pakala clay loam, 0 to 2 percent slope	Very slow	Non-hydric	1.5 (0.6)	0.6%
PwC	Puʻu ʻŌpae silty clay loam , 8 to 15 percent slope	Slow to Medium	Non-hydric	1.2 (0.5)	0.5%
PwD	Puʻu ʻŌpae silty clay loam, 15 to 25 percent slope	Medium	Non-hydric	23.1 (9.3)	9.5%
PwE	Puʻu ʻŌpae silty clay loam, 25 to 40 percent slope	Rapid	Non-hydric	31.3 (12.7)	12.9%
rRO	Rock outcrop	NA	Non-hydric	44.8 (18.1)	18.4%
rRR	Rough broken land, 40 to 70 percent slope	rapid	Non-hydric	14.9 (6.0)	6.1%
Total for Soil Survey Area				243.1 (98.4)	100%

Source: USDA NRCS 2015

BL and 40 percent Mahana silt loam. This is a barren soil with annual rainfall between 30 and 45 in (76 and 114 cm; USDA SCS 1972).

Rock outcrop (rRO) is comprised of locations in which over 90 percent of the surface is exposed bedrock, mainly basalt and andesite. The terrain is gently sloping to precipitous and it is found in locations where rainfall ranges between 22 and 55 in (56 and 140 cm). Rough broken land (rRR) is very steep land with intermittent drainage channels in gulches and on the mountainsides. The land has rapid runoff and active erosion. Soils are variable, but most places have weathered rock fragments below with the soil material. Nearly 50 percent of the Mākaha Ridge Tracking Station is comprised of these three barren, rocky soil types.

The Mahana series contains well-drained upland soils that are gently sloping to very steep. MaD is a soil in the Mahana series with medium runoff and moderate erosion. MaD has 12 to 20 percent slopes. The Pakala Series contains well-drained soils with nearly level to moderate sloping on bottom lands and alluvial fans. Pakala clay loam (PdA, 0 to 2 percent slope) has moderate permeability, very slow runoff, and less than slight erosion hazard.

The Puʻu ʻŌpae Series (PwC and PwD) includes well-drained soils from uplands on Kauaʻi that developed from weathered basic igneous rock. Puʻu ʻŌpae silty clay loam is a dusky-red silty clay loam with a subangular blocky structure. PwC has moderately rapid permeability, slow to medium runoff, and slight to moderate erosion hazard. PwD has medium runoff and moderate erosion hazard, while PwE has rapid runoff and severe erosion hazard. Because of the steep slopes and soil types,

erosion is a severe problem in parts of the station and many areas of the Mākaha Ridge and the Nā Pali Coast. Additionally, Feral Goats eat vegetation that would have held soil in place, which further exacerbates the problem of erosion. Much of the eroded soil is carried in runoff down the cliff-face into coastal waters below.

3.4.2 Hydrology

The Mākaha Ridge Tracking Station has several intermittent streams both on and adjacent to the station (**Figure 3-10**). However, no perennial water features occur at the site (NAVFAC PAC 2014). Two aquifers located beneath the site are valuable sources of drinking water although no wells are located at the station. One basal, unconfined, dike aquifer (aquifer code 20301112) is currently used for drinking water although no wells are located at the site This fresh water is classified as irreplaceable and highly vulnerable to contamination by the SOH Department of Health. The other aquifer (aquifer code 20301212) is also classified as an irreplaceable fresh drinking water source that is highly vulnerable to contamination but is not currently being used. This is a high-level, unconfined dike-confined aquifer. Both aquifers are part of the Waimea Aquifer Sector of the Kekaha Aquifer System (Mink and Lau 1992).

3.4.3 Terrestrial Habitats, Vegetation Communities, and Land Cover

Plant surveys of Mākaha Ridge Tracking Station were completed in 2000 and 2006 (Char 2000b, Wood 2006) and an unmaned aerial drone survey was conducted in 2019 (Nyberg 2019). These surveys identified 134 species of vascular plants in total, 98 of which (73 percent) are introduced. Additionally, 34 are indigenous (25 percent), including 19 species are endemic (14 percent) and 2 single-island endemics (1.5 percent), and 2 (1.5 percent) are thought to be Polynesian introductions. The plant survey from 2000 describes three general vegetation types including cliff vegetation, pine plantings/mixed scrub, and ruderal vegetation at the Mākaha Ridge Tracking Station (Char 2000b; **Figure 3-11**).

Table 3-10 provides the acreage for specific vegetation cover types from NAVFAC PAC mapping that was completed in 2005. General descriptions of each of the community types are provided below. For a full list of plant species documented at Mākaha Ridge refer to **Appendix C**.

Table 3-10. Vegetation Communities at Mākaha Ridge Tracking Station

Cover Type	Native/Non-native	Area ac (ha)	Percent of Area
Eroded, Bare Soil	Non-native	44.2 (17.9)	18%
Hawaiian Mixed Shrub Coastal Cliff	Native	79.6 (32.2)	32%
Landscaped	Non-native	22.7 (9.2)	9%
Mixed Shrub Dry Coastal Cliff	Non-native	10.24 (4.1)	4%
Mixed Shrub Dry Coastal Cliff with Koa	Native	47.1 (19.1)	19%
Pine, Mixed Shrub	Non-native	43.6 (17.7)	18%
Total		247.4 (100.1)	100%

Source: NAVFAC PAC 2005

Figure 3-10. Mākaha Ridge Tracking Station Wetlands and Surface Water

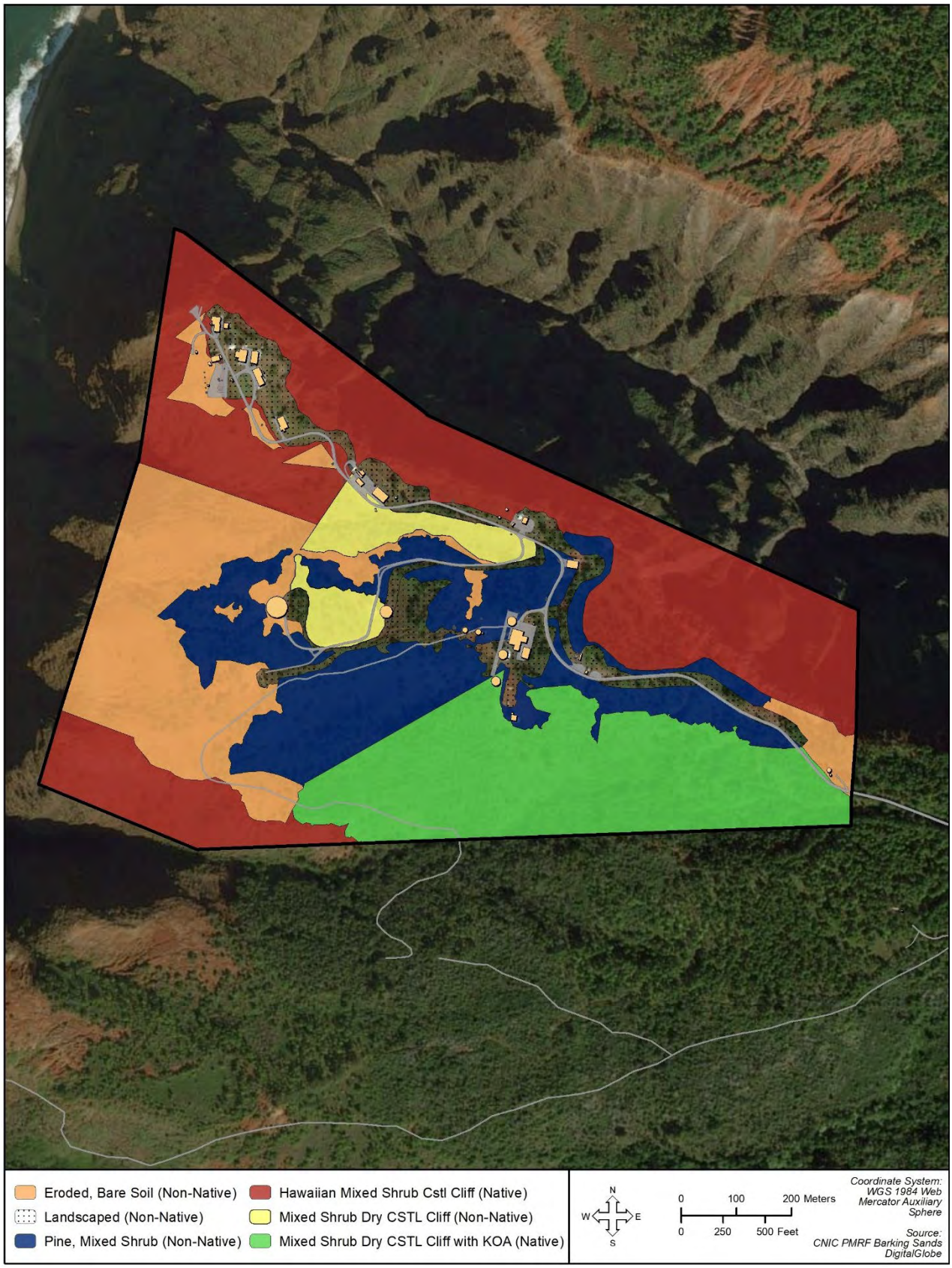
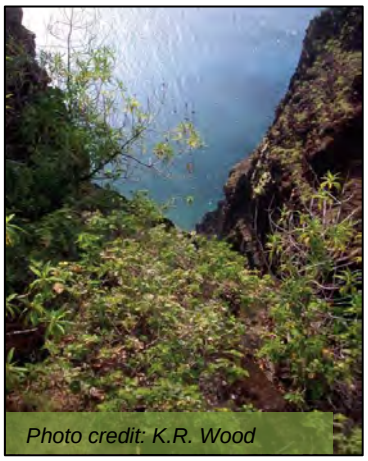


Figure 3-11. Mākaha Ridge Tracking Station Vegetation

3.4.3.1 Cliff Vegetation

Cliff vegetation is primarily composed of native Hawaiian mixed shrub coastal cliff and mixed shrub dry coastal cliff/Koa communities. A small percentage of the cliff vegetation is infested with non-native vegetation as well. Cliff vegetation is sparse with only 5 percent shrub cover and 10 to 20 percent grass cover. Most of the vegetation is either on severely eroded ridgetop or scattered in small patches along the cliff face, ledges, or long, narrow terraces. Kāwelu (*Eragrostis variabilis*), a bunch grass, was the most frequent native plant species on the cliffs in 2000, but the 2006 survey found this species severely decreased. Low (2 to 4 ft [0.6 to 1 m]) shrubs of False Sandalwood (*Myoporum sadwicense*) (Char 2000b).



***Myoporum sandwicense* (naio) dry cliff community**

The dry cliff community faces several threats. One threat is habitat degradation by Feral Goats. Several state and federally listed plants (see Section 3.4.5) are found on dry cliff communities as these extreme slopes serve as protection from browsed by Feral Goats. The other threats are competition with non-native plants and reduced reproductive vigor of rare species due to the limited number of remaining individuals (Wood 2006).

3.4.3.2 Pine Plantings/Mixed Scrub

Non-native pine plantings and mixed scrub vegetation typically includes Slash Pine (*Pinus radiata*), Lantana shrubs, and Silk Oak (*Grevillea robusta*) trees. Portions of these areas have grasses such as Little Bluestem Grass (*Schizachyrium condensatum*) or Bushy Bluestem (*Andropogon glomeratus*) or is exposed soil with unanchored small and large boulders that has been highly disturbed by goats (Char 2000b).

3.4.3.3 Landscaped Vegetation

Other than in the immediate vicinity of buildings and recent landscape improvements, very little of the station is landscaped. However, a severely eroded gulch on the southern side of the sitecontains many planted Eucalyptus trees (*Eucalyptus* sp.) with dense thickets of Strawberry Guava (*Psidium cattleianum*) on the lower slopes. Alahe‘e shrubs (*Psydrax odorata*) are abundant in areas and native Koa trees are also occasionally found here (Char 2000b).

3.4.3.4 Eroded, Bare Soil, and Ruderal Vegetation

Ruderal vegetation occurs in the disturbed and unmaintained areas. Various grasses and weedy, often annual herbaceous species compose the majority of this vegetation type (Char 2000b). Large, barren, eroded ridges surround the helicopter landing site and most of the buildings and other facilities. The majority of the vegetation in these areas is low, rounded clumps of Lantana that are 2 to 3 ft (0.6 to 1 m) high and mats of Molasses Grass (*Melinis minutaflora*).

3.4.4 Invasive and Introduced Species

Invasive and introduced species at Mākaha Ridge Tracking Station include a variety of birds, mammals, and reptiles. The most common and frequently observed bird species are the non-native Japanese White-eye followed by the Common Myna or Pihaʻekelo (*Acridotheres tristis*). Several birds that have been observed at the Mākaha Ridge Tracking Station are non-native MBTA species. Included were Northern Cardinal, House Finch, Northern Mockingbird, and Cattle Egret (Bruner 2000, NAVFAC PAC 2006a). Red Junglefowl or Moa (*Gallus gallus*) are abundant at the station as are non-native game birds including Erckel's Francolins, Black Francolin, and Chucker (*Alectoris chukar*). Feral Goats are also abundant and herds of up to 68 have been sighted (NAVFAC PAC 2006c). The presence of Feral Pigs, Columbian Black-tailed Deer, Feral Cats, and rats has also been documented at the site. Three introduced reptile species, including the Green Anole, Mourning Gecko, and House Gecko have been documented at Mākaha Ridge Tracking Station (NAVFAC PAC 2006c).

3.4.5 Special Status Species

A total of nine state and federally protected endangered species are known to occur on or fly-over the Mākaha Ridge Tracking Station. Three additional protected species are likely to fly over the site. One federally listed endangered bird species, the Nēnē, has been documented at the site (NAVFAC PAC 2006d) and is known to nest there. The endangered Hawaiian Petrel and Band-rumped Storm-petrel and the threatened Newell's Shearwater may fly over the site as active colonies are located in the region (Pyle and Pyle 2017), though these species have not been documented at this site. Two other native birds protected by the MBTA, White-tailed Tropicbird (*Phaethon lepturus*) and Pacific Golden Plover, have also been observed at the site. The Hawaiian Hoary Bat is a state and federally listed endangered mammal species that is frequently in the area of Mākaha Ridge and is known to roost or forage on the property and surrounding forest (Bruner 2000, Bonaccorso and Pinzari 2011). As previously noted, four endangered plants, Dwarf Iliau, Hawaiʻi Scaleseed, Niʻihau Lobelia, and Kauaʻi Schiedea, and one threatened species, Makou, are known to occur on the steep slopes dropping away from the Mākaha Ridge site (Wood 2006, Nyberg 2019, **Figure 3-12**). A summary of special status species known to occur or likely to fly over the Mākaha Ridge Tracking Station is provided in **Table 3-11.**

3.5 Kōkeʻe Sites Natural Resources

3.5.1 Topography, Geology, and Soils

The elevation of the Kōkeʻe sites ranges from 3,800 ft (1,158 m) at site E to 3,710 ft (1,130 m) at sites A, D, and E, with an average elevation of 3,710 ft (1,130 m) above msl (**Figure 3-13**). The slight elevation differential creates a gently sloping ridgeline in the southwest direction, which generally leads surface water runoff to flow in a northwesterly to southeasterly course.

The coastal ridge on which the Kōkeʻe sites are located is composed of lava formations from the Nāpali formation of the Waimea Canyon series, associated with pyroclastic rocks from the flanks of the major Kauaʻi shield volcano, outside the caldera.

The largest soil unit on the Kōkeʻe sites (**Figure 3-14, Table 3-12**) is Kōkeʻe silty clayey loam (KSKE, 0 to 35 percent slope). This series is highly acidic, well-drained, and was created from basic igneous

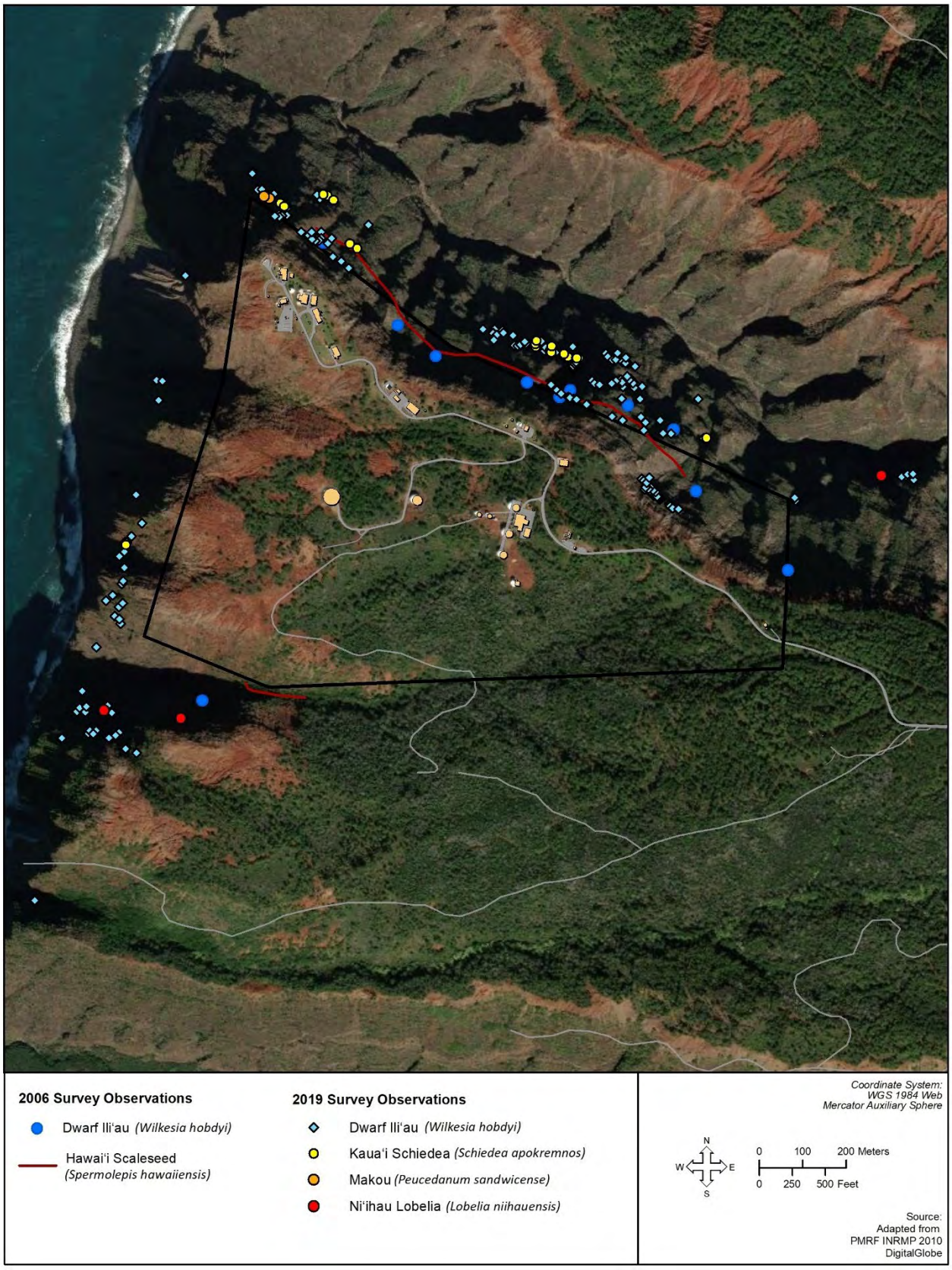


Figure 3-12. Special Status Species Habitat at Mākaha Ridge Tracking Station

Table 3-11. Special Status Species on or near at Mākaha Ridge Tracking Station

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Birds					
Branta sandviciensis	Hawaiian Goose	Nēnē	E, MBTA	Year-round resident. Live and breed in areas of managed grass, group of six regularly seen at Mākaha Ridge	Breeding Season: Aug. – April, peak Oct.–Dec. Incubation: ~30 days Fledges: ~90 days
Oceanodroma castro	Band-rumped Storm-petrel (Hawai‘i DPS)	‘Akē‘akē	E, MBTA	Breeding visitor. Not observed at Mākaha Ridge but may fly during trips between nesting and foraging sites. Fledglings also fly through the area on their first trip to the sea and have been documented as fall out during fledgling season.	Breeding Season: May - October/April - June Incubation: 39 -51 days Fledges: mid Sept. – mid Dec.
Phaethon lepturus	White-Tailed Tropicbird	Koa‘e Kea	MBTA	Breeding visitor. Commonly observed at Mākaha Ridge, though not known to breed there.	Breeding season: Year-round in Hawai‘i Incubation: 40 - 42 days Fledges: 10 -12 weeks
Pluvialis fulva	Pacific Golden Plover	Kōlea	MBTA	Winter resident. Uncommonly observed at Mākaha Ridge.	NA
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel	‘Ua‘u	E, MBTA	Breeding visitor. Not observed at Mākaha Ridge but may fly over when traveling between nesting and foraging areas. Fledglings also fly through the area on their first trip to the sea and may fall out during fledgling season.	Breeding Season: Feb. – May Incubation: ~56 days Fledges: Oct. – Dec.
Puffinus auricularis newelli	Newell’s Shearwater	‘A‘o	T, MBTA	Breeding visitor. Not observed at Mākaha Ridge but may fly over when traveling between nesting sites and at-sea foraging areas. Fledglings also fly through the area on their first trip to the sea and are vulnerable to fall out during fledgling season.	Breeding Season: March - April Incubation: ~51 days Fledges: mid-Sept. - mid-Dec.

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Mammals					
Lasiurus cinereus semotus	Hawaiian Hoary Bat	ʻŌpeʻapeʻa	E	Roost and forage at Mākaha Ridge and the surrounding area.	Breeding Season: Sept – Dec. Pupping: June – Aug. Mother likely stays with their pups for 6 - 7 weeks.
Plants					
Lobelia niihauensis	Niʻihau Lobelia	---	E	3 locations with 6 individuals on north and west facing cliff faces at Mākaha Ridge	Flowers Winter / Spring
Peucedanum sandwicense	Makou	Makou	T	2 locations with 3 individuals on the northwest cliff face at Mākaha Ridge	Flowers Winter / Spring
Schiedea apokremnos	Kauaʻi Schiedea	Māʻoliʻoli	E	5 colonies with 152 individuals on north facing cliff faces at Mākaha Ridge	Flowers Winter / Spring
Spermolepis hawaiiensis	Hawaiʻi Scaleseed	---	E	2 colonies on slopes at Mākaha Ridge at elevations between 2,000 - 2,200 ft (610 - 671 m)	Flowers: Winter / Spring
Wilkesia hobdyi	Dwarf Iliau	---	E	21 colonies with 3,635 individuals on dense, hard rock outcrops with nearly vertical faces at elevations between 1,320 - 1,680 ft (402 - 512 m)	Flowers: June, September, October, and December Fruits: November to January

[1]State and Federally listed as E = Endangered, T = Threatened,

MBTA = Indigenous species protected under the Migratory Bird Treaty Act

Sources: Bonaccorso and Pinzari 2011, DoN 2010, Nyberg 2019, Pyle and Pyle 2017, University of Hawaiʻi 2009, USFWS 2010, 2019c

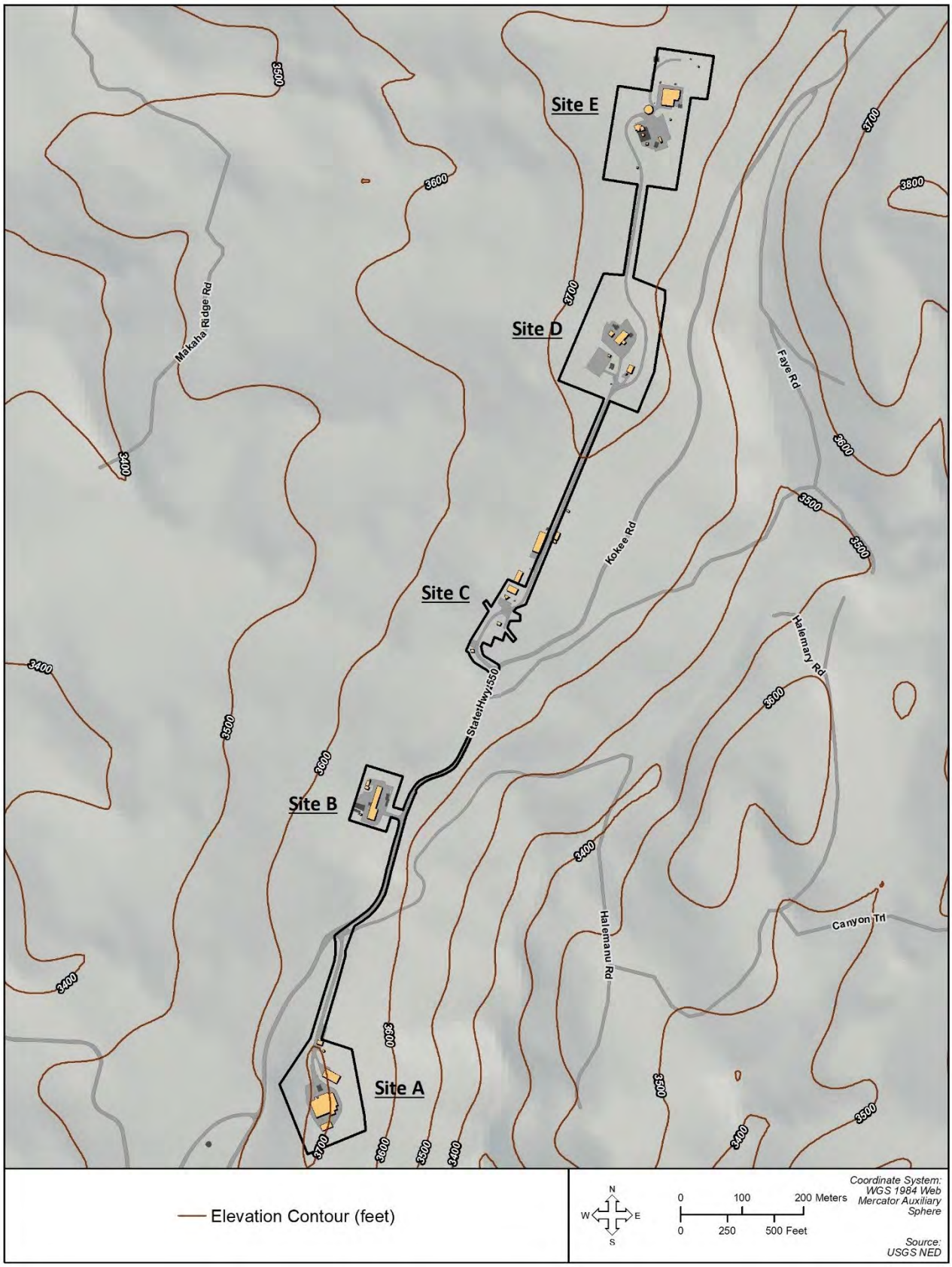


Figure 3-13. Kōkeʻe Sites Elevation Contours

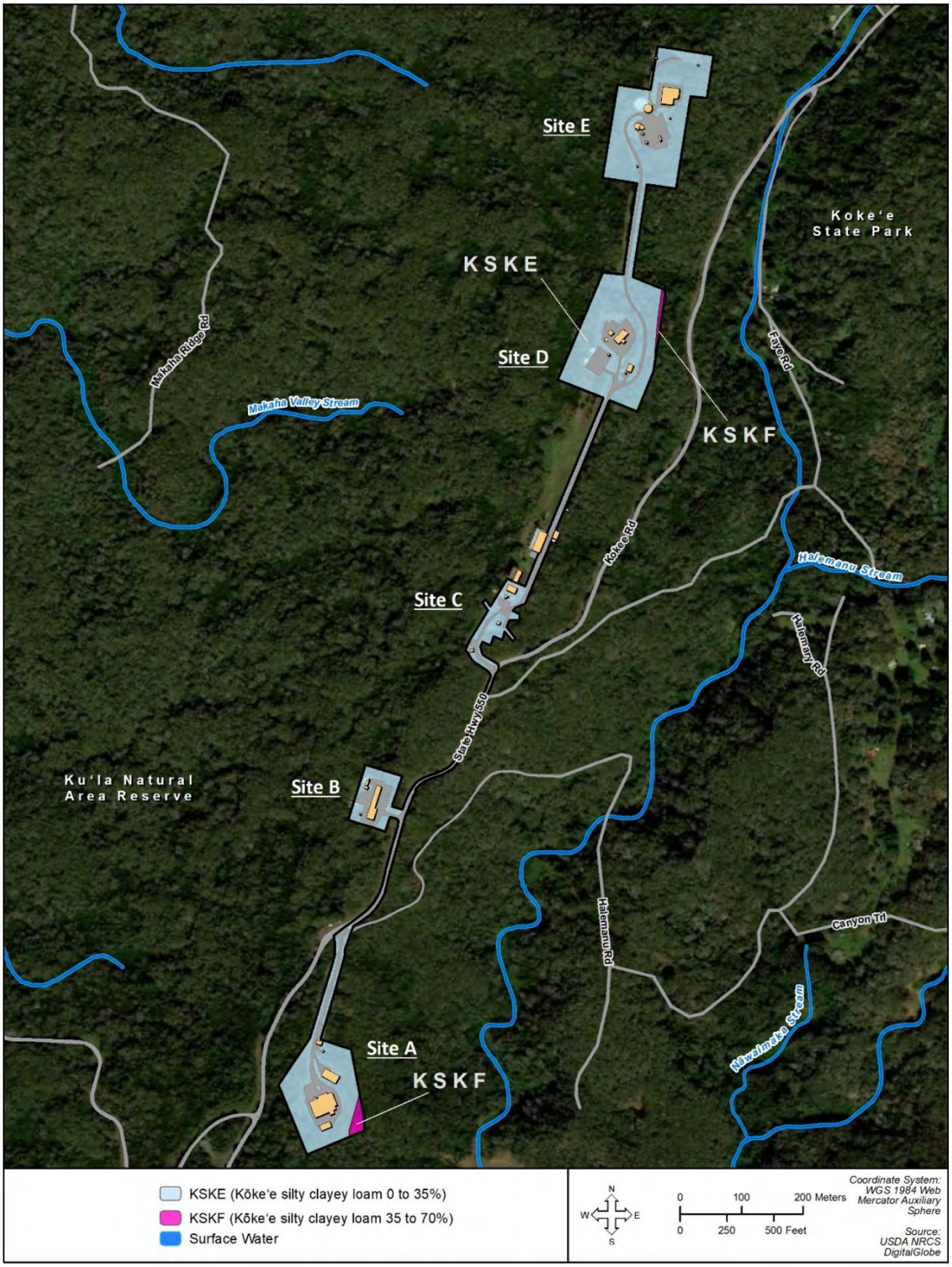


Figure 3-14. Kōke'e Sites Soils and Adjacent Wetlands and Surface Waters

Table 3-12. Soil Series at the Kōkeʻe Sites.

Map Unit Symbol	Map Unit Name	Surface Runoff	Hydric	Area ac (ha)	Percent of Area
KSKE	Kōkeʻe silty clayey loam, 0 to 35 percent slope	Medium	Non-hydric	22.8 (9.2)	98.4%
KSKF	Kōkeʻe silty clayey loam, 35 to 70 percent slope	Rapid	Non-hydric	0.4 (0.2)	2.6%
Total for Soil Survey Area				23.1 (9.3)	100%

Source: USDA NRCS 2015

rock and volcanic ash. KSKE has moderately rapid permeability, medium runoff, and slight to moderate erosion hazard (USDA SCS 1972). These sites are generally paved and surrounded by heavily wooded areas and there is no evidence of significant soil erosion. A small section of Site A contains Kōkeʻe silty clayey loam (KSKF, 35 to 70 percent slope), which is very similar to KSKE, but with a severe erosion hazard and rapid runoff.

3.5.2 Hydrology

The Kōkeʻe sites do not contain any surface water or wetland resources, though numerous streams lie at the bases of the surrounding canyons (see **Figure 3-14**).

There is one aquifer beneath the Kōkeʻe sites that is located in the Waimea Aquifer Sector within the Kekaha Aquifer System. This high-level, unconfined dike-confined aquifer (aquifer code 20301212) is considered an irreplaceable fresh water source and is highly vulnerable to contamination (Mink and Lau 1992).

3.5.3 Terrestrial Habitats, Vegetation Communities, and Land Cover

The native terrestrial ecosystem of the Kōkeʻe sites is a dry and mesic forest, woodland, and shrubland (Juvik and Juvik 1998). Botanical surveys at the Kōkeʻe sites describe the vegetation types at each of the five parcels. A total of 77 species were identified. In contrast to Barking Sands and Mākaha Ridge, which have over 50 percent non-native species, the Kōkeʻe sites are comprised of 33 (46 percent) endemic, 9 (13 percent) indigenous, and 29 (41 percent) introduced plant species. However, a number of the introduced species are considered to be among the worst invaders at Kōkeʻe State Park. Included are Strawberry Guava, Sawtooth Blackberry (*Rubus argutus*), and Kāhili Ginger (*Hedychium gardnerianum*) (Kōkeʻe Resource Conservation Program 2015).

Figure 3-15 and **Table 3-13** summarize the vegetation types in all five parcels of the Kōkeʻe sites from NAVFAC PAC mapping that was conducted in 2004. General descriptions of each of the cover types as described by Char (2000c) are provided below, but for a full list of plant species from the Kōkeʻe sites, refer to **Appendix C**.

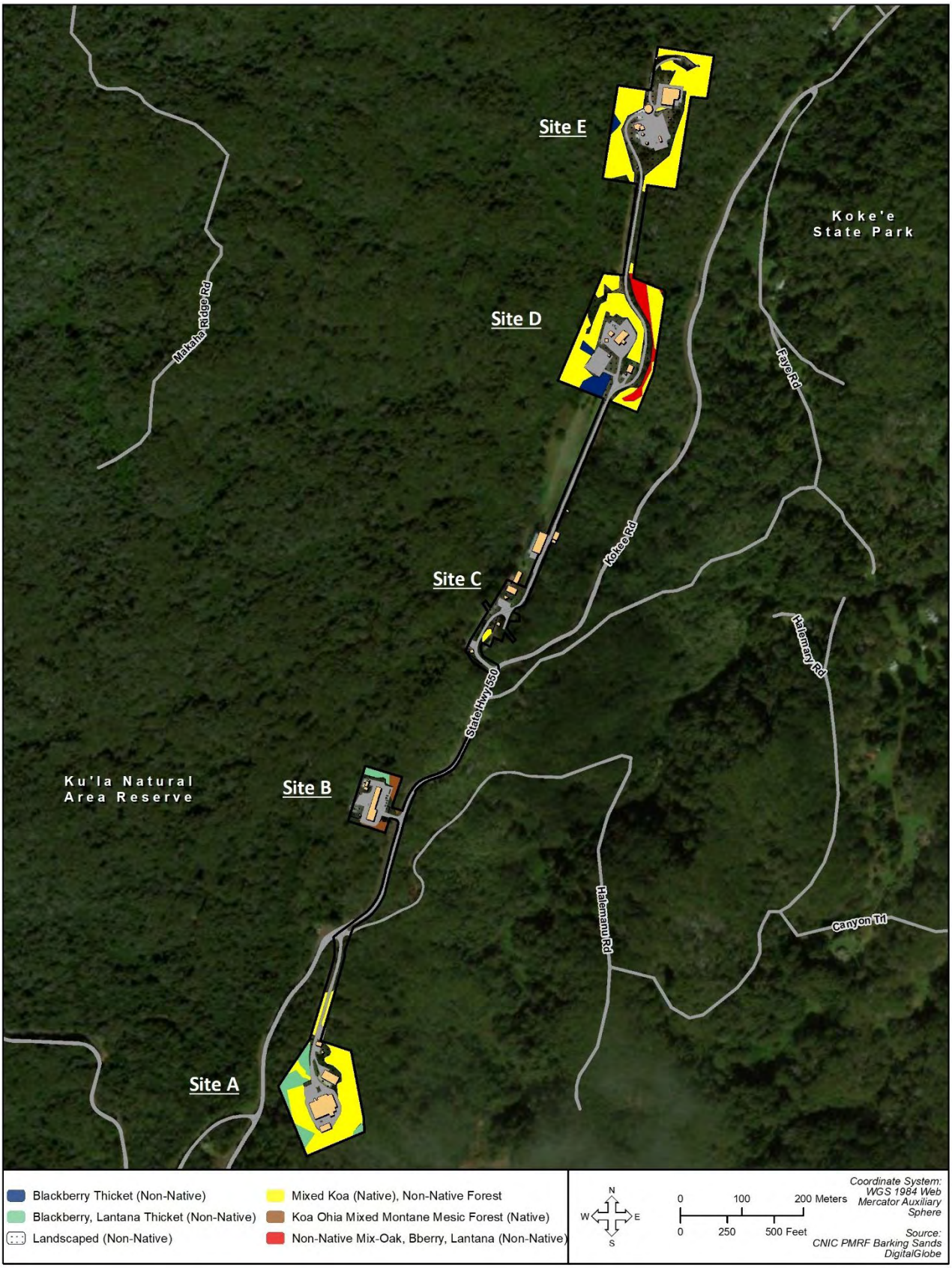


Figure 3-15. Kōkeʻe Sites Vegetation Map

Table 3-13. Vegetation Communities at the Kōkeʻe Sites

Cover Type	Native/Non-native	Area ac (ha)	Percent of Area
Blackberry Thicket	Non-native	0.4 (0.2)	2%
Blackberry, Lantana Thicket	Non-native	0.8 (0.3)	4%
Koa- ʻŌhiʻa Mixed Montane Mesic Forest	Native	0.3 (0.1)	2%
Landscaped	Non-native	8.9 (3.6)	45%
Mixed Koa, Non-Native Forest	Native	8.7 (3.5)	44%
Non-Native Mix-Oak, Blackberry, Lantana	Non-native	0.6 (0.2)	3%
Total		19.7 (7.9)	100%

Source: NAVFAC PAC 2005

Kōkeʻe Site A

Site A is mostly comprised of intact Koa-ʻŌhiʻa mesic native and non-native forest, although the invasive firetree lines the road leading up to the site and Blackberry thickets (*Rubus* sp.) are along the fences around the forest edge of the parcel (NAVFAC PAC 2006f). Non-native blackberries are considered some of the worst invasive plant species in the Kōkeʻe State Park. The Administration Building is adjacent to an area that has been graded and paved with asphalt, but inside the fence line the other buildings are surrounded by grassy lawns (Char 2000c). The vegetation lining the outside of the fence is periodically maintained and contains a strip of Kikuyu Grass (*Pennisetum clandestinum*) that is 3 to 5 ft (1 to 2 m) wide, as well as several other introduced species. Dense, prickly thickets of blackberry are located just outside the grassy strip (Char 2000c).

Native Koa-ʻŌhiʻa mesic forest

Kōkeʻe Site B

Site B is a landscaped and paved site that contains a power plant, fuel storage, and electric substation. Plum (*Prunus cerasifera* x *salicina*), Avocado (*Persea americana*), and Pear (*Pyrus communis*) trees grow at the site along with kikuyu grass and plantings of Ti Leaf (*Cordyline fruticosa*) on a small lawn behind the power plant. Inside the fence and south of the power plant is a semi-wooded sloping area (Char 2000c). The area immediately outside of the fence is dominated by dense Blackberry thickets and Kikuyu grass mats. Some remnants of the native forest also remain beyond the fence, predominantly hame (*Antidesma platyphyllum*) (NAVFAC PAC 2006f). Outside the fence on the north side of the site there are Plum, Avocado, and Banana (*Musa* x *paradisiaca*) plantings and more grassy lawn (Char 2000c).

Kōkeʻe Site C

Site C is a landscaped and paved parcel that contains the Boresight Tower, facilities building, and a microwave antenna. The site is surrounded by a fence with an entrance at the southern side. The site is

either covered in asphalt or open, grassy lawn, but just outside the fence are low Blackberry thickets, Kikuyu Grass matts, scattered Firetree and Firethorn (*Pyracantha angustifolia*), and other invasive plants (Char 2000c).

Kōkeʻe Site D

Site D contains the SCAMP Antenna and Transmitter Building and AN/FRS-16 radar building, surrounded by either pavement or Kikuyu Grass lawns. Two large ʻOheʻohe (*Tetraplasandra kavaiensis*) trees are growing to the west of Site D with Blackberry and Uluhe Fern (*Dicranopteris linearis*) in the understory. Kōkeʻe Site D contains a healthy, native forest with Koa, large ʻIliahi/Sandalwood (*Santalum freycinetianum*) trees, and othe natives. The hillside on the northeast of the AN/FRS-16 building holds a small, mostly non-native, forested area. Outside the fence line is a thick border of Blackberry, Firetree, and remnant native forests (Char 2000c). Asian Melastome, a highly invasive plant species, was found at the site in a small patch near the roadside (NAVFAC PAC 2006f); however, KISC and Navy biologists have conducted targeted invasive species control, including the treatment of Asian Melastome, in this area.

Kōkeʻe Site E

Site E is a mostly landscaped or paved parcel with the Unified S-Band Building and antenna and the Very Long Baseline Interferometry Facility. Graded pavement surrounds the buildings and antenna and leads into lawns of kikuyu grass and weeds. Hybrid roses (*Rosa* cultivar) and ʻĀkulikuli lei (*Lampranthus glomerata)* have been planted directly in front of the USB building (Char 2000c). The area directly outside the fence at Site E has similar native forest species to Site D except with fewer sandalwood trees. This area also differs because it contains fewer dense Blackberry thickets and Kikuyu Grass mats, and also contains a non-native Paperbark Tree (*Melaleuca quinquenervia*) that was not documented at any of the other Kōkeʻe sites (Char 2000c).

3.5.4 Invasive and Introduced Wildlife

Wildlife surveys conducted in 2000 and 2006 identified a number of invasive and introduced species at the Kōkeʻe sites. Feral Cats were present during the survey and signs of Feral Pigs were common. The rat species identified at the sites were the Norwegian Rat (*Rattus norvegicus*) and Black Rat or Roof Rat (Bruner 2000, NAVFAC PAC 2006c). A herpetological survey conducted in 2006 identified the Metallic Skink (*Lampropholis delicata*) at the Kōkeʻe sites (NAVFAC PAC 2006c). No other reptile or amphibian species have been documented.

Bird surveys conducted in 2000 and 2006 identified native and non-native bird species at the Kōkeʻe sites (Bruner 2000, NAVFAC PAC 2006a). Nineteen species were identified in total. Thirteen of the bird species that were observed are non-native species, while six are native.

3.5.5 Special Status Species

A total of nine state and federally listed species, including five bird, one mammal, and two insects, are known to occur on or fly over the Kōkeʻe sites (**Table 3-14**). One federally endangered native understory shrub, Halemanu ʻAkoko (*Euphorbia halemanui*), has also been documented outside of Site D, although none has been identified within the site boundaries (NAVFAC PAC 2006f).

Table 3-14. Special Status Species on or near the Kōkeʻe Sites

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Birds					
Asio flammeus sandwichensis	Short-Eared Owl	Pueo	MBTA	Year-round resident. Infrequent, one bird documented in a 2000 survey at Site E.	Breeding Season: Year-round Incubation: 21-37 days Fledges: ~ 29 days
Branta sandviciensis	Hawaiian Goose	Nēnē	E	Year-round resident. Common at Kōkeʻe sites, not known to nest on site.	Breeding Season: Aug. – April, peak Oct.–Dec. Incubation: ~30 days Fledging: ~90 days
Chlorodrepanis stejnegeri	Kauaʻi ʻamakihi	ʻAmakihi	MBTA	Year-round resident. Observed in small numbers throughout the Kōkeʻe sites, found in native ʻŌhiʻa and kKa forests.	Breeding Season: March – July Incubation: ~14 days Fledging: ~19 days
Himatione sanguinea	ʻApapane	ʻApapane	MBTA	Year-round resident. Most abundant native forest bird, observed throughout the Kōkeʻe sites, found in native ʻŌhiʻa and Koa forests.	Breeding Season: Dec. - July Incubation: ~13 days Fledging: ~ 14 days
Oceanodroma castro	Band-rumped Storm-petrel (Hawaiʻi DPS)	ʻAkēʻakē	E, MBTA	Breeding visitor. Not observed at Kōkeʻe sites but may fly-over during breeding season.	Breeding Season: May – Oct./April - June Incubation: 39 -51 days Fledging: mid Sept. – mid Dec.
Pluvialis fulva	Pacific Golden Plover	Kōlea	MBTA	Winter resident. Common, recorded at Sites A, C, D, and E (non-nesting season).	NA
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel	ʻUaʻu	E	Breeding visitor. Nest in the region, potential fly-over during breeding season.	Breeding Season: Feb. – May Incubation: ~56 days Fledging: Oct. – Dec
Puffinus auricularis newelli	Newell's Shearwater	ʻAʻo	T	Breeding visitor. Not observed at Kōkeʻe sites but may fly-over during breeding season.	Breeding Season: March - April Incubation: ~51 days Fledges: mid-Sept. - mid-Dec.

Vestiaria coccinea syn *Drepanis coccinea*	Scarlet Honeycreeper	ʻIʻiwi	FT, SE, MBTA	Year-round resident. Rare, two documented in 2000.	Breeding Season: Nov. – July Incubation: ~14 days Fledges: ~ 24 days
Mammals					
Lasiurus cinereus semotus	Hawaiian Hoary Bat	ʻŌpeʻapeʻa	E	Documented at sites A and C. Occurs year-round.	Breeding Season: Sept – Dec. Pupping: June – Aug. Mother likely stays with their pups for 6 - 7 weeks.
Insects					
Drosophila musaphilia	Hawaiian Picture-wing Fly	---	E	Documented near but not on Site B, Critical Habitat adjacent to property	Year-round, depending on availability of decomposing host plant material
Drosophila sharpi	Hawaiian Picture-wing Fly	---	E	Critical Habitat adjacent to property (unknown if occupied)	Year-round, depending on availability of decomposing host plant material
Plants					
Euphorbia halemanui syn. *Chamaesyce halemanui*	Halemanu ʻAkoko	ʻAkoko	E	Several growing just outside the boundary of Site D	Flowers: Summer

[1]Federally and State listed as E = Endangered, T = Threatened, DPS = Distinct Population Segment, SE = State Endangered only, ST = State Threatened only,
MBTA = Indigenous species protected under the Migratory Bird Treaty Act
Sources: Bonaccorso and Pinzari 2011, Bruner 2000; NAVFAC PAC 2006a, f; DoN 2010, DoN 2014b, Pyle and Pyle 2017, VanderWerf 2012

Of the five ESA-protected bird species with potential to occur, the Nēnē and the Scarlet Honeycreeper or ʻIʻiwi (*Vestiaria coccinea* syn *Drepanis coccinea*) are the only ones documented on site. A 2006 survey of birds at the Kōkeʻe sites documented Nēnē at Site C (NAVFAC PAC 2006a). Newell's Shearwaters, Hawaiian Petrels, and Band-rumped Storm-petrels have been sighted in the region and may also fly over the sites (Pyle and Pyle 2017). Several additional native MBTA-protected species have been documented at the Kōkeʻe sites. Included are the Kauaʻi ʻAmakihi (*Chlorodrepanis stejnegeri*), ʻApapane (*Himatione sanguinea*), and Pueo, all of which are endemic to Hawaiʻi, and the Pacific Golden Plover, which is a native migratory species. Non-native MBTA-protected species, which include the Northern Cardinal and House Finch, are also present in small numbers at the Kōkeʻe sites, as is the Barn Owl (NAVFAC PAC 2006a).

The federally listed endangered Hawaiian Hoary Bat was documented at Site C of the Kōkeʻe sites during a survey in 2000 (Bruner 2000) and at Sites A and C during a 2010 survey (Bonaccorso and Pinzari 2011). Hawaiian Hoary Bats were present at Kōkeʻe during each survey sampling period from July 2010 through May 2011 (Bonaccorso and Pinzari 2011).

Two species of endangered Hawaiian picture-wing fly can also be found on or near the Kōkeʻe sites: *Drosophila musaphilia* andK*Drosophila sharpi*. These picture-wing flies are single-island endemic to Kauaʻi and have USFWS-designated critical habitat near the Kōkeʻe sites. *D. musaphilia* was identified near Site B in a 2010 survey (DoN 2010). Critical habitat has been designated for these Hawaiian picture-wing flies in the vicinity surrounding the Kōkeʻe sites (**Figure 3-16**). The native Koa tree, which is located in the forested area surrounding the sites, is the host plant for *D. musaphilia*.

3.6 Kamokala Ridge Magazines Natural Resources

3.6.1 Topography, Geology, and Soils

The Kamokala Ridge Magazine area lies along the scarp between the Mānā Coastal Plain and the site has a moderate slope from east to west and ranges in elevation from 80 ft (25 m) to 760 ft (232 m) (**Figure 3-17**).

The ridge on which the magazines are located is composed of lava formations from the Nāpali formation of the Waimea Canyon series, associated with pyroclastic rocks from the flanks of the major Kauaʻi shield volcano, outside the caldera. The volcanic terrain has been highly eroded and contains numerous valleys and established drainage patterns. The cliffs at this site were formed by ancient, high sea levels in a similar but older process to that which formed the nearby Nā Pali cliffs.

This site is located at a transition between irrigated agricultural fields below and stony, silty clays collected at the base of the Nahomalu Valley. Surface water flows from north to south into ephemeral streams of the Nahomalu and Kaʻawaloa Valleys and on into the Mānā Coastal Plain. Thus, the soils in the area are silty clay from elevated alluvial fans on the Mānā Coastal Plain, but the area is also locally stony from the rubble of volcanic boulders. The four soils that can be found at the Kamokala

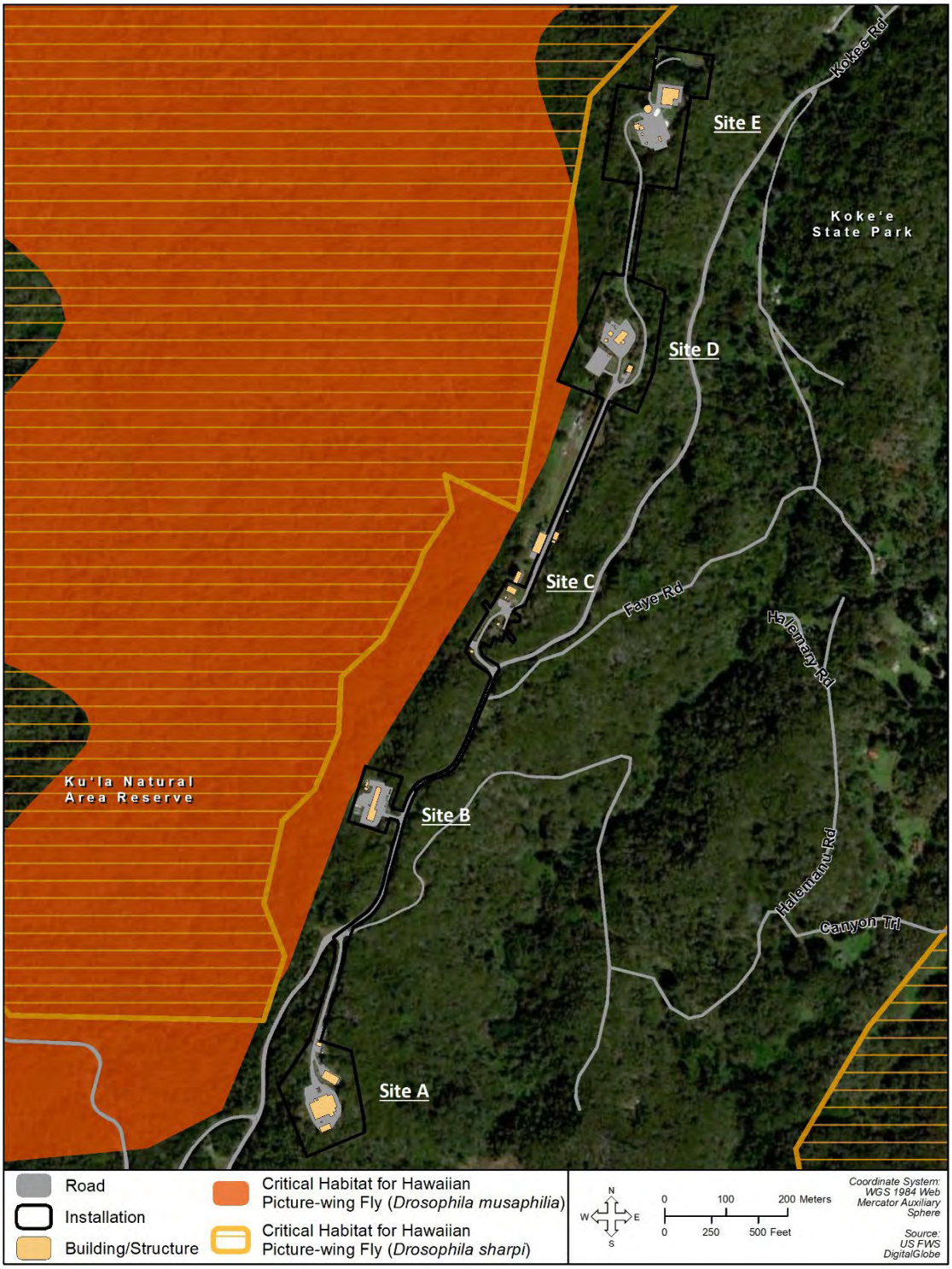


Figure 3-16. Protected Species Designated Critical Habitat near the Kōke'e Sites

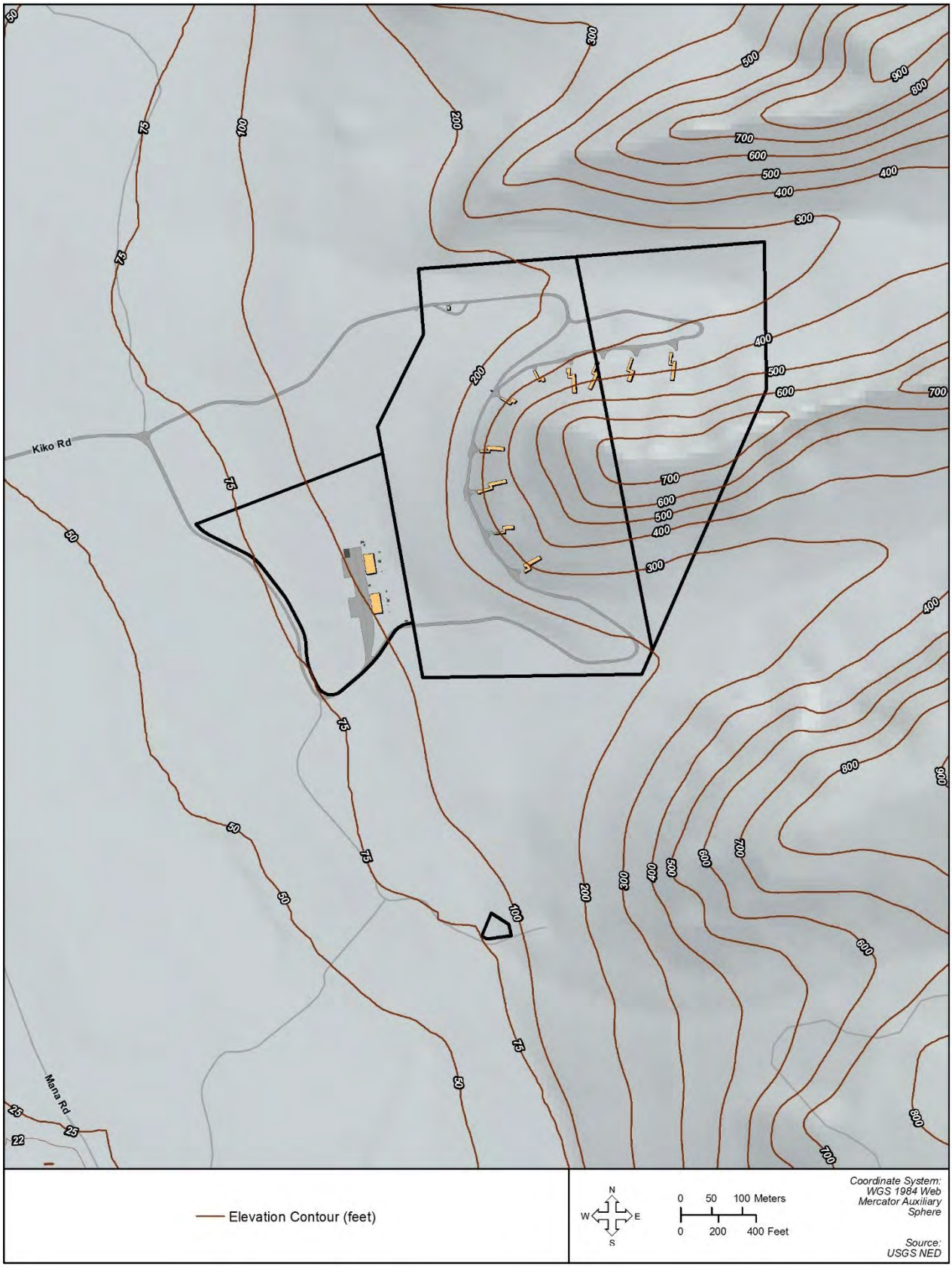


Figure 3-17. Kamokala Ridge Magazines Elevation Contours

Ridge Magazines include the Kekaha Series, Rubble Land (rRU), Rock outcrop (rRO), and the Waiawa series (**Table 3-15, Figure 3-18**).

Table 3-15. Soil Series at the Kamokala Ridge Magazines

Map Unit Symbol	Map Unit Name	Surface Runoff	Hydric	Area ac (ha)	Percent of Area
KoB	Kekaha clay, 0 to 6 percent slopes	Medium	Non-hydric	1.4 (0.6)	1.3%
KOYE	Kekaha extremely stony silty clay loam, 0 to 35 percent slopes	Slow to Medium	Non-hydric	32.2 (13.0)	30.9%
rRU	Rubble land	NA	Non-hydric	26.1 (10.6)	0.6%
rRO	Rock outcrop	NA	Non-hydric	0.6 (0.3)	25.1%
WJF	Waiwa extremely rocky clay, 30 to 80 percent slopes	Very Rapid	Non-hydric	43.9 (17.8)	42.1%
Total for Soil Survey Area				104.2 (42.2)	100%

Source: USDA NRCS 2015

Two soil types within the Kekaha Series can be found underlying the Kamokala Ridge Magazines. They are both well drained and developed as alluvium from upland soils. They can be found on alluvial fans and floodplains. Kekaha clay (KoB, 0 to 6 percent slope) is a 21 in (53 cm) thick, dark reddish-brown silty clay and clay. The soil is mildly alkaline to neutral, allows a medium runoff speed, and has a slight to moderate erosion hazard. Kekaha's extremely stony silty clay loam (KOYE, 0 to 35 percent slopes) has a slow to medium runoff speed and only moderate or lower erosion hazard (USDA 1972).

Rubble land (rRU) is any area with 90 percent stones or boulders at the surface. This land can typically be found directly below very steep to precipitous slopes with elevations between sea level and 500 ft (152 m). It occurs in locations where rainfall ranges from 22 to 55 in (56 to 140 cm) (USDA SCS 1972). The soil unit occurs on the south and west portions of this site below the magazine tunnels. At the Kamokala Ridge Magazines, some locations have boulders covering 70 to 80 percent of the terrain.

Rock outcrop (rRO) is found in areas where 90 percent of the surface is exposed bedrock, mostly basalt and andesite. The land is gently sloping to precipitous with elevations between sea level and 10,000 ft (USDA SCS 1972). The areas have a severe erosion hazard and rapid runoff. Fifty percent of the surface at the Kamokala Ridge Magazine site is covered by rock outcrops.

Only one soil type in the Waiawa Series can be found at the Kamokala Ridge Magazines, the Waiwa extremely rocky clay (WJF 30 to 80 percent slope). This is a well-drained, shallow, extremely rock soil that formed in colluvium and weathered basic igneous rock (USDA SCS 1972). The soil is slightly acidic to neutral, has moderate to moderately slow permeability, very rapid runoff, and a severe erosion hazard.

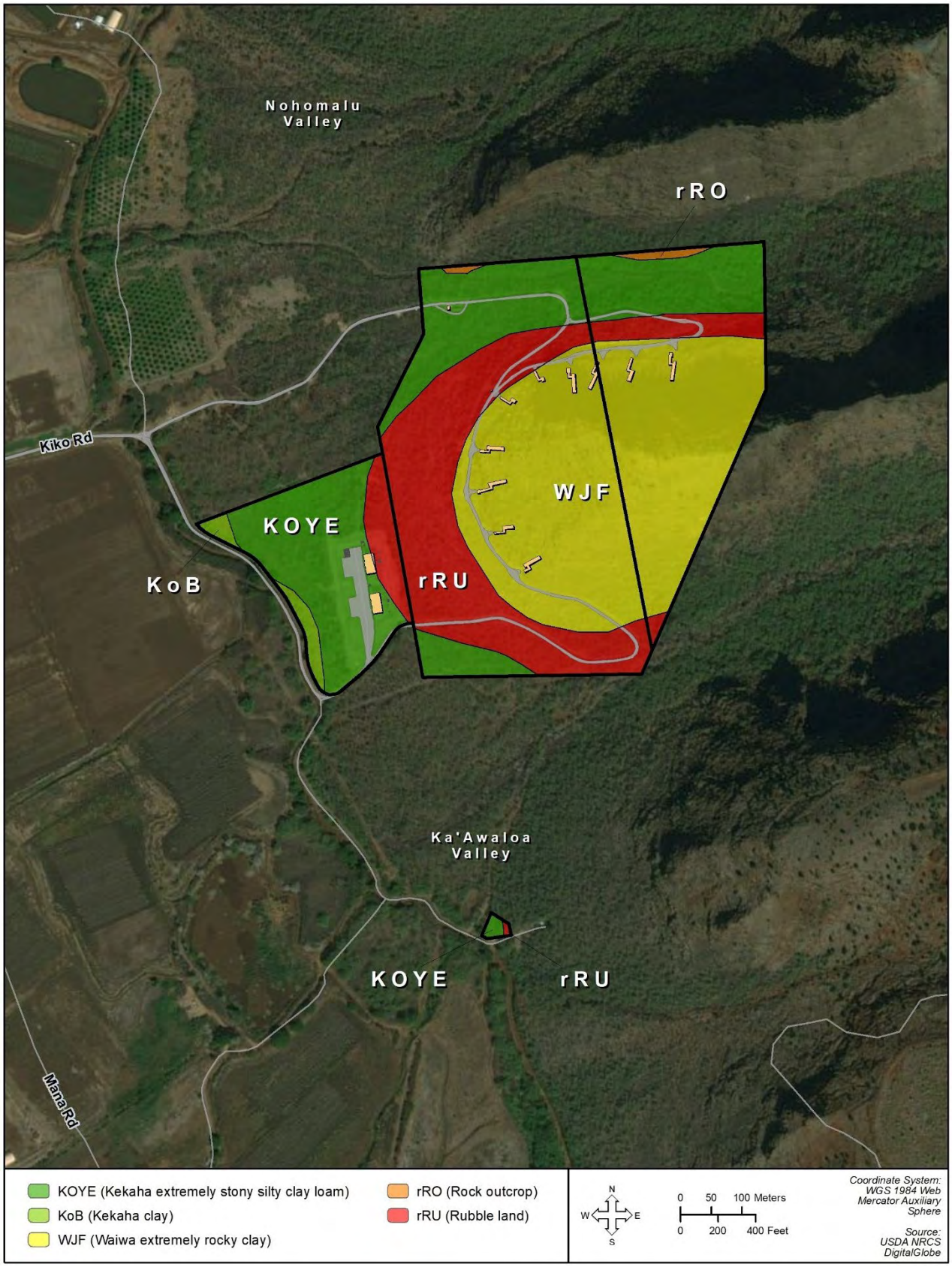


Figure 3-18. Kamokala Ridge Magazines Soils

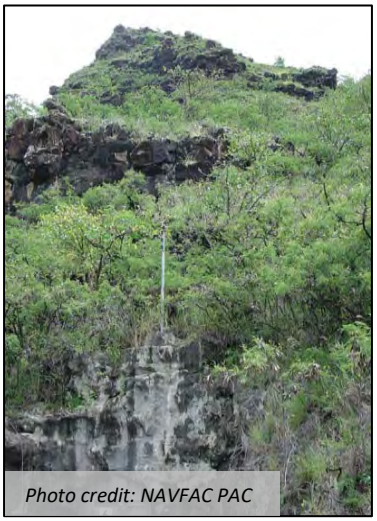
3.6.2 Hydrology

The only surface water on this site is an intermittent, boulder-strewn stream that is usually dry, but floods during heavy rains (Char 2000d, NAVFAC PAC 2006g) (**Figure 3-19**).

The magazines are located over a freshwater aquifer in the Waimea Aquifer Sector within the Kekaha Aquifer System. The aquifer (aquifer code 20301112) is fresh, so it is currently used for drinking water and is classified as an irreplaceable aquifer and is highly vulnerable to contamination (Mink and Lau 1992). This is a basal, unconfined dike aquifer.

3.6.3 Terrestrial Habitats, Vegetation Communities, and Land Cover

The Kamokala Ridge Magazines area consists of lowland dry and mesic forest, woodland, and shrubland (Juvik and Juvik 1998). The Kamokala Ridge Magazine area has approximately 50 percent vegetation cover and 50 percent is rock outcrop. Vegetation at this site is comprised largely of Koa Haole scrub forest, with scattered native dryland species including wiliwili (*Erythrina sandwicensis*), ʻAʻaliʻi, Pili (*Heteropogon contortus*), and Lance Fern (*Doryopteris decora*) with non-native Kiawe trees scattered throughout the site. Narrow bands of ruderal vegetation occur along roadsides and other paved areas. This highly disturbed site has a total of 70 identified plant speces, including one (1.4 percent) endemic species, 10 (14.3 percent) indigenous species, 58 (82.9 percent) introduced species, and one (1.4 percent) Polynesian introduction. **Table 3-16** and **Figure 3-20** provide information from NAVFAC PAC (2004) mappings of the distinct cover types within the two general vegetation types of Koa Haole scrub/forest and ruderal vegetation.



Kamokala cliffs and rock outcrop

Table 3-16. Vegetation Communities at Kamokala Ridge Magazines

Cover Type	Native/Non-native	Area ac (ha)	Percent
ʻAʻaliʻi Scrub	Native	3.9 (1.6)	4%
Cliff, Boulder Field	Non-native	0.8 (0.3)	1%
Grass, Herb, Shrub	Non-native	0.5(0.2)	0%
Greater Than 25% Wiliwili	Native	4.1 (1.6)	4%
Koa Haole Scrub, Forest	Non-native	73.4 (29.7)	75%
Koa Haole Scrub, Less Than 25% Wiliwili	Non-native	5.8 (2.4)	6%
Pili Grass	Native	4.4 (1.8)	4%
Ruderal	Non-native	4.9 (2.0)	5%
Total		97.7 (39.5)	100%

Source: NAVFAC PAC 2005

Figure 3-19. Kamokala Ridge Magazines Wetlands and Surface Waters

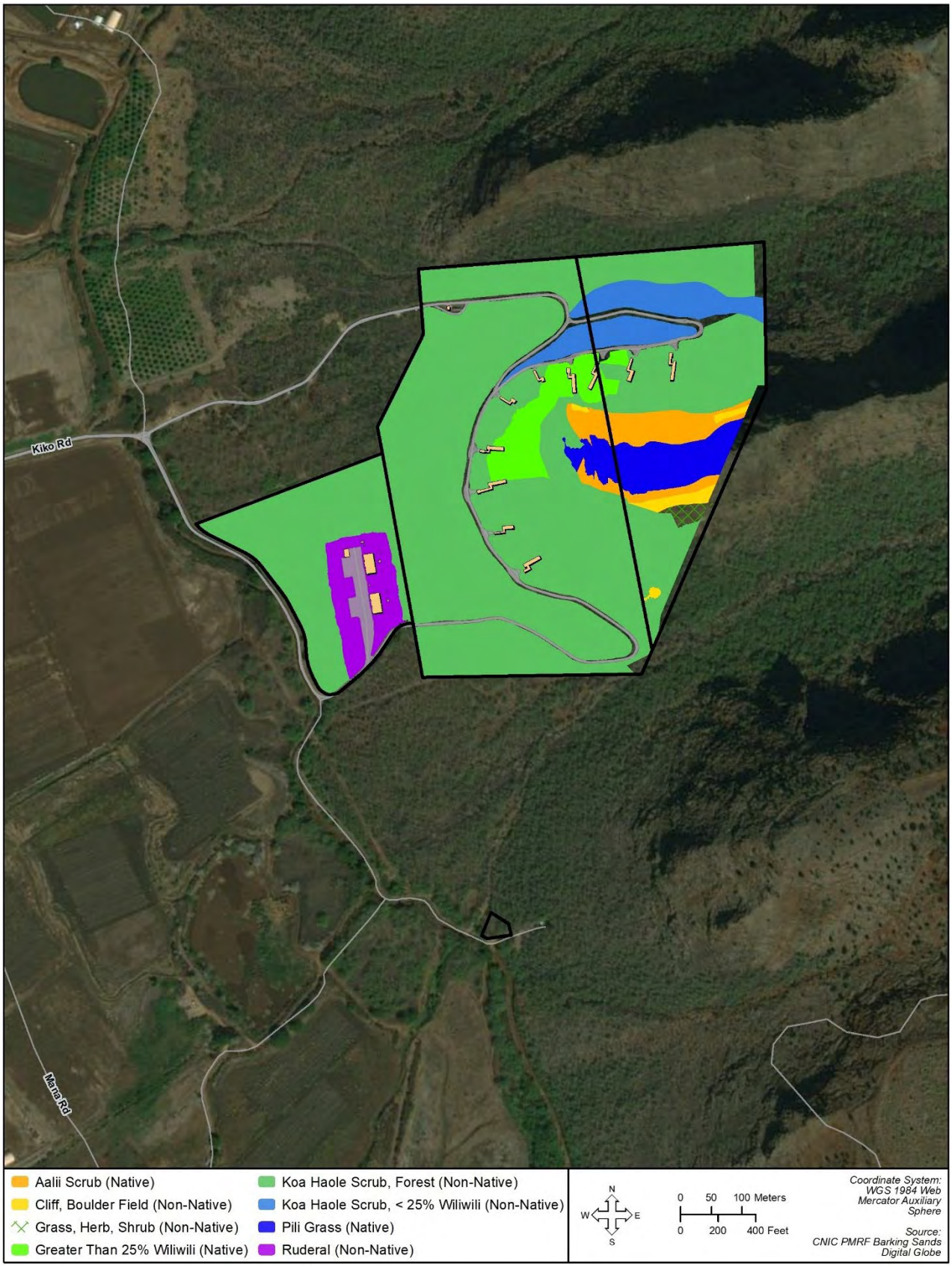


Figure 3-20. Kamokala Ridge Magazines Vegetation Map

3.6.3.1 Koa Haole Scrub/Forest

The majority of the Kamokala Ridge Magazines is Koa Haole scrub/forest vegetation, which consists primarily of 6 to 12 ft (2 to 4 m) tall Koa Haole shrubs. Vegetation consists of more open, patchy scrub on lower slopes with 20 to 30-ft (6 to 9-m) Wiliwili and Kiawe. The most abundant grass is Guinea Grass, but the area also contains small shrubs and herbaceous species at this location. The lower slopes have an abundance of non-native Lion's Ear (*Leonotis nepetifolia*), and the rock outcrops and ledges contain several native herbaceous species. *Parmelia* sp., a gray-white foliose lichen, also successfully grows on the rock outcrops (Char 2000d).

On the south and west portions of the site and Nahomalu Valley in the north, there are locations in which boulders cover 70 to 80 percent of the surface. The gently sloping terrain below the roads supports a dense 20 to 25-ft (6 to 8-m) forest with scattered Wiliwili and 30 to 45-ft (9 to 14-m) Kiawe trees (Char 2000d and NAVFAC PAC 2006g). The ground cover includes up to 3-ft (1-m) tall Guinea Grass among other species. Along the lower boundary of the site are a few large Chinese Banyan *(Ficus microcarpa)* and Be-still Tree *(Cascabela thevetia)* (Char 2000d).

The area north of the barbed wire fence that runs parallel to the access road in the Nahomalu Valley is used for cattle grazing. Therefore, this land contains much bare soil with low, patchy clumps of 0.5 to 1 ft (15 to 30 cm) tall Guinea Grass. An intermittent, boulder-strewn stream, which is usually dry, runs through the valley. This stream is lined by a few Java Plum (*Syzygium cumini*), Kiawe, Wiliwili, and Kukui (*Aleurites moluccana*) (Char 2000d).

3.6.3.2 Ruderal Vegetation

The ruderal vegetation along roadsides, loading areas, and other occasionally mowed or trimmed areas consists of low mats of grasses and weedy herbaceous species (Char 2000d). In areas with stonier soil or where pavement runs along a rocky shelf, 0.5 to 1-ft (15 to 30-cm) tall Guinea grass grows along with Koa Haole and Lantana shrubs (*Lantana camara*) (Char 2000d).

3.6.4 Invasive and Introduced Wildlife Species

The most common species identified at the magazine are Cattle Egrets, Chukars, Moa, Spotted Doves, Zebra Doves, Northern Cardinals, and Erckel's Francolins (NAVFAC PAC 2006a). Mammal surveys that were conducted in 2006 found Columbian Black-tailed Deer, Feral Pigs, Cows (family Bovidae) and Feral Cats at the Kamokala Ridge Magazines (NAVFAC PAC 2006c).

3.6.5 Special Status Species

Only one ESA-protected species, the Hawaiian Hoary Bat, has been identified at the Kamokala Ridge Magazines to date (Bonaccorso and Pinzari 2011, Bruner 2000; Char 2000d; NAVFAC PAC 2006a, c, g). The highest levels of bat occupancy were detected during the winter months. Call activity at Kamokala Ridge Magazines followed the same seasonal pattern as Barking Sands, but detectability and call activity were much lower at Kamokala, with no evidence of fall swarming activity (Bonaccorso and Pinzari 2011).

At least four native protected bird species use the Kamokala Ridge Magazines habitat, including two native MBTA-protected species, the Black-crowned Night-heron and Pacific Golden Plover. These

species were the only native protected species documented at this site during a 2006 survey (NAVFAC PAC 2006a), though Band-rumped Storm-petrel, Hawaiian Petrel, and Newell's Shearwater have potential to fly over the site. ESA-protected and native-MBTA-protected species documented at the Kamokala Ridge Magazines are listed in **Table 3-17**.

3.7 Port Allen Natural Resources

3.7.1 General Description

The Port Allen facility is located on the southwestern shore of Kauaʻi adjacent to Hanapepe Bay in the small community of Eleʻele. The greatest part of the facility is located on a pier constructed in Hanapepe Bay. PMRF leases part of a building, the north side of the pier, and a small parking lot from the State Department of Transportation Harbors Division. The lease for this property is renewed annually. PMRF also leases a paved outdoor storage area near the pier. Because of the limited land area and natural resources present at Port Allen, natural resources discussed in this INRMP will be limited to special status species that have potential to occur.

View of building and pier at Port Allen

3.7.2 Special Status Species

The pier leased by the Navy at Port Allen is in an area in which one ESA-listed species, the Newell's Shearwater, has been observed. As with other PMRF facilities, shearwaters are known to fly over Port Allen during their flights from inland breeding colonies to their at-sea foraging areas and shearwater fall out has been documented in the area (NAVFAC PAC 2014). Few other biotic resources are present on this site. Aquatic resources at Port Allen are regulated by the DLNR DAR (SOH DLNR DAR 2015).

3.8 Kaʻula Island Natural Resources

3.8.1 Topography, Geology, and Soils

Kaʻula Island formed from a crescent-shaped volcanic crater rim. Therefore, the island's structure is mostly comprised of tuff, or consolidated volcanic ash. The crater created steep-sloping walls and formed a small bay on the inner side. This inner curve has a 10 to 80-ft (3.1 to 24-m) wide rock terrace or bench along the shore that was likely formed by wave action when sea level was at a different height from the present level. The northern "horn" on the outer side of the island contains a 100-ft (30-m) deep sea cave with a 50-ft (15-m) ceiling. Kaʻula is covered by a sparse grass landscape and earthen/rock outcrops, reportedly underlain by a relatively thin soil layer with highly weathered limestone bedrock (DoN 2008a).

Table 3-17. Special Status Species on or near Kamokala Ridge Magazines

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Birds					
Nycticorax nycticorax	Black-crowned Night Heron	ʻAukuʻu	MBTA	Year-round resident. Rare, one individual observed in 2000 survey.	Breeding Season: March – Oct. Incubation: ~25 days Fledges: 50-75 days
Oceanodroma castro	Band-rumped Storm-petrel (Hawaiʻi DPS)	ʻAkēʻakē	E, MBTA	Breeding visitor. Not observed at Kamokala Ridge but may fly over during trips between nesting and foraging sites. Fledglings also fly through the area on their first trip to the sea and may fall out during fledgling season.	Breeding Season: May – Oct. /April - June Incubation: 39 -51 days Fledges: mid Sept. – mid Dec.
Pluvialis fulva	Pacific Golden Plover	Kōlea	MBTA	Winter visitor. Uncommonly observed at Kamokala Ridge.	NA
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel	ʻUaʻu	E, MBTA	Breeding visitor. Not observed at Kamokala Ridge but may fly over when traveling between nesting sites and at-sea foraging areas. Fledglings also fly through the area on their first trip to the sea and may fall out during fledgling season.	Breeding Season: Feb. – May Incubation: ~56 days Fledges: Oct. – Dec.
Puffinus auricularis newelli	Newell's Shearwater	ʻAʻo	T, MBTA	Breeding visitor. Not observed at Kamokala Ridge but may fly over when traveling between nesting sites and at-sea foraging areas. Fledglings also fly through the area on their first trip to the sea and are vulnerable to fall out during fledgling season.	Breeding Season: March - April Incubation: ~51 days Fledges: mid-Sept. - mid-Dec.
Mammals					
Lasiurus cinereus semotus	Hawaiian Hoary Bat	ʻŌpe ʻape ʻa	E	Occur year round and are particularly abundant in fall and winter.	Breeding Season: Sept – Dec. Pupping: June – Aug. Mother likely stays with their pups for 6 - 7 weeks.

[1]Federally and State listed as E = Endangered, T = Threatened, MBTA = Indigenous species protected under the Migratory Bird Treaty Act

Sources: Bonaccorso and Pinzari 2011, NAVFAC PAC 2006a

The target area has elevations as low as sea level and as high as 250 ft (76 m) above msl, but the entire island has elevations that range from sea level to 540 ft (165 m). The terrain drops steeply from the crest and steep V-shaped ravines that have been cut by ephemeral streams occur on the windward slopes, such that the island has little level terrain (Pepi et al 2009).

3.8.2 Hydrology

Surface water on the island is limited, and there are no perennial streams. Rainwater collects in small gullies and percolates downward or evaporates. However, during a deployment to the island in 1971, a freshwater source with a rate of flow of one pint per hour was discovered approximately 1,000 ft (305 m) from the southern target area used by the Navy (DoN 2010).

3.8.3 Terrestrial Habitats, Vegetation Communities, and Land Cover

Plant surveys conducted in 1932, 1976, and 1998 identified 29 species including 5 (17 percent) endemic Hawaiian species, 8 (28 percent) indigenous species, and 15 (52 percent) introduced species including 1 (3 percent) Polynesian introduction (**Appendix C**). The dominant vegetation type on the island is semi-arid and strand plants of low growing shrubs and herbaceous plants. Many areas of the island have no plant cover and the plants that do grow on the island are all adapted for arid conditions and strong winds (Pepi et al. 2009).

3.8.4 Invasive and Introduced Wildlife Species

Six of the 27 bird species identified on Kaʻula Island during bird surveys from 1932 to 2011 are non-native. Of these, the Barn Owl, House Finch, and Japanese White-eyes were the only species consistently recorded in multiple surveys (Pepi et al. 2009). Non-seabirds were not recorded in the 2009 to 2011 ship-board surveys. Non-native rodent species, including Polynesian Rats and Common House Mice, have also been documented on Kaʻula Island (Pepi et al. 2009). No introduced herpetological species have been observed on land at Kaʻula Island (Pepi et al. 2009).

3.8.5 Special Status Species

Numerous biological surveys including avian, botanical, insect, and mammal have been conducted on Kaʻula Island since the 1930s (Bishop Museum 2015). However, as land access has not been granted for surveys of Kaʻula Island since 1998, recent surveys have been conducted via aerial imagery or have been ship-based surveys (Pepi et al. 2009, Uyeyama and Hanser 2010, Richie et al. 2012, DoN 2014b). Beginning in 2013, the Navy looked to improve their seabird data gathering efforts by exploring the use of higher altitude, very high-resolution aerial imaging surveys. The first survey using this improved imagery was conducted in April 2013 and has been conducted annually since then.

Throughout the avian surveys conducted on Kaʻula from 1932 through 2017, no ESA-listed bird species has been identified; however, many native MBTA-protected bird species have been identified (**Appendix C**). Seabird surveys indicate that the seabird species composition on the island has remained very consistent over time with nine species comprising a majority of the seabird observations over the past 80 years. Seabird numbers on Kaʻula are highest in the mid-summer months (NAVFAC PAC 2016b).

Federally-listed marine mammals are known to occur in the waters near or adjacent to Kaʻula Island. The endangered Hawaiian Monk Seal frequents the shoreline (Pepi et al. 2009, Uyeyama et al. 2011, Ritchie et al. 2012), and nearby waters support three federally listed cetacean species: the Fin Whale (*Balaenoptera physalus*), the Sperm Whale or Palaoa (*Physeter microcephalus*) and the False Killer Whale (*Pseudorca crassidens*). A further 16 MMPA-protected cetacean species have been observed nearby, including 11 dolphins: the Bottlenose Dolphin, Spinner Dolphin, Rough-toothed Dolphins, Striped Dolphin, Pantropical Spotted Dolphin, Fraser's Dolphin, Risso's Dolphin, Short-finned Pilot Whales, Pygmy Killer Whale, Killer Whale And Melon-headed Whale; and five whale species: Pygmy Sperm Whale, Dwarf Sperm Whale, Humpback Whale, Blainville's Beaked Whale And Cuvier's Beaked Whale (Baird et al. 2019, Baird et al 2022, Baird et al. 2021a, Baird et al. 2021b, Pepi et al. 2009, Uyeyama et al. 2011, Richie et al. 2012, DoN 2014b).

Sea turtles are not known to bask on ledges on Kaʻula Island nor have they been identified during ship-board or aerial surveys, but since the area contains suitable habitat they might be found in the nearshore waters (NMFS and USFWS 1998b). No federally protected insect or plant species have been identified on Kaʻula either (Bishop Museum 2015, Pepi et al. 2009). **Table 3-18** summarizes ESA, MBTA, and MMPA-protected species that have been documented on or near Kaʻula Island since 1932.

3.8.5.1 Essential Fish Habitat

As with Barking Sands, EFH has been designated for numerous species that occur in the waters adjacent to Kaʻula Island. Habitat Areas of Particular Concern (HAPC), which are particularly sensitive or rare and provide important habitat for managed species have also been identified within the designated EFH. Specifically, the coral bank surrounding Kaʻula Island is designated a coral reef ecosystem HAPC by the WPRFMC (DoN 2005).

3.9 Mauna Kapu Site Natural Resources

3.9.1 Topography, Geology, and Soils

The Mauna Kapu Facility is on the uppermost ridgeline of the Waiʻanae Range on Oʻahu at an elevation of approximately 2,720 ft (829 m) above msl. Steep topography and incised valleys surround the site.

The Mauna Kapu Facility is on the western side of the island in the 22-mi-long (35-km-long) Waiʻanae Range. This range is composed of shield lava from the Koʻolau and Waiʻanae Volcanoes below a thick layer of alkaline basalt (USGS 2013). Erosion has carved out huge valleys into the Waiʻanae Range, most of which discharge in the direction of the southwest. With the exception of the eastern portion, erosion and subsidence of more than 6,000 ft (1,829 m) have destroyed the extinct Waiʻanae Volcano (Hunt 1996).

The Tropohumults-Dystrandepts Association (rTP) is the predominant soil type below the Mauna Kapu Facility (**Figure 3-21**). The rTP series is found in mountainous areas within the Waiʻanae Range with slopes anywhere from 30 to 90 percent in areas dominated by deep, V-shaped drainage ways and narrow ridges. Tropohumults are found at higher elevations on narrow ridgetops. They are well-drained, strongly acidic to extremely acidic soils with a hard, purplish crust in areas where vegetation is depleted (USDA SCS 1972). Dystrandepts are found at lower elevations on steep side slopes and

narrow ridge tops. These soils typically form in volcanic ash (giving them a dark color), are well drained, and are medium to strongly acidic (USDA SCS 1972). Histosols are poorly drained soils that are found in small, wet positions near mountain peaks. The moisture of the soil along with other factors allow organic matter to accumulate as thick as 3 ft (1 m) in this soil type (USDA SCS 1972).

Table 3-18. Special Status Species on or near Kaʻula Island

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Birds					
Anous minutus	Black Noddy	Noio	MBTA	Breeding visitor. From several individuals to 200 observed over multiple surveys.	Breeding Season: Breeding is highly variable and egg laying occurs year-round. Incubation: ~ 34 days Fledges: ~ 39 – 52 days, fledglings remain near their parents for up to 17 weeks
Anous stolidus	Brown Noddy	Noio Kōhā	MBTA	From several hundred to many thousand observed over multiple surveys.	Breeding Season: Spring and summer Incubation: ~ 30 to 37 days Fledges: ~ eight weeks
Arenaria interpres	Ruddy Turnstone	ʻAkekeke	MBTA	Winter resident. 1 to 50 individuals observed over multiple surveys.	NA
Bulweria bulwerii	Bulwer's Petrel	ʻOu	MBTA	Breeding visitor. 50 to several hundred observed over multiple surveys.	Breeding Season: April - June Incubation: ~42-46 days Fledges: early October
Fregata minor	Great Frigatebird	ʻIwa	MBTA	Migratory. From several individuals to several hundred observed over multiple surveys.	NA
Gygis alba	White Tern	Manu-o-Kū	ST, MBTA	Breeding visitor. From several individuals to 200 observed over multiple surveys.	Breeding Season: late spring and summer Incubation: ~ 36 days Fledges:~48 days
Onychoprion fuscatus	Sooty Tern	ʻEwa ʻEwa	MBTA	Breeding visitor. Typically the most abundant species with several hundred up to 130,000 observed.	Breeding Season: eggs are generally laid beginning of February Incubation: ~28 – 30 days Fledges: 8-9 weeks, may stay around colony another 2-3 weeks

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Onychoprion lunatus	Gray-backed Tern	Pākalakala	MBTA	Breeding visitor. From less than 50 to several thousand observed over multiple surveys.	Breeding Season: Feb. – March Incubation: ~ Fledges: July
Phaethon lepturus	White-tailed Tropicbird	Koaʻe Kea	MBTA	Breeding visitor. One to three individuals observed over multiple surveys.	Breeding Season: Most breeding occurs in summer, with occasional breeding during winter months Incubation: ~43 days Fledges: 70 0 85 days
Phaethon rubricauda	Red-tailed Tropicbird	Koaʻe Ula	MBTA	Vagrant. From several individuals to several hundred observed during multiple surveys.	Breeding Season: Jan. – Aug. Incubation: ~44 days Fledges: ~82 days
Pheobastria immutabilis	Laysan Albatross	Mōlī	MBTA	Breeding visitor. From several individuals to 150 observed over multiple surveys.	Breeding Season: Nov. – Dec. Fledging: June to July Incubation: 65-66 days Fledges: ~185 days
Pheobastria nigripes	Black-footed Albatross	Kaʻupu	MBTA	Breeding visitor. From several individuals to 200 observed over multiple surveys.	Breeding Season: Oct. – Jun. Incubation: ~65-66 days Fledges: ~150 days
Pluvialis fulva	Pacific Golden Plover	Kōlea	MBTA	Winter resident. From several individuals to 21 observed over multiple surveys.	NA
Procelsterna cerulean saxatilis	Blue-gray Noddy	--	MBTA	Vagrant. Observed twice, 200 in 1976 and 1 in 1998.	NA
Pterodroma hypoleuca	Bonin Petrel	--	MBTA	Migrant. One chick documented in 1932, may be a misidentification.	NA
Puffinus nativitatis	Christmas Shearwater	ʻAoʻū	MBTA	Breeding visitor. From 18 to several hundred observed over multiple surveys.	Breeding Season: March - April Incubation: ~51 days Fledges: mid-Sept. - mid-Dec.

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Puffinus pacificus	Wedge-tailed Shearwater	ʻUaʻu Kani	MBTA	Breeding visitor. From one individual to several thousand observed over multiple surveys.	Breeding Season: March - June Incubation: ~50 days Fledges: mid Nov. – early Dec.
Sula dactylatra	Masked Booby	ʻĀ	MBTA	Breeding visitor. From several hundred to many thousand observed over multiple surveys.	Breeding Season: Jan. - July Incubation: ~45 days Fledges: five months
Sula leucogaster	Brown Booby	ʻĀ	MBTA	Breeding visitor. From 1 individual to 1,700 observed over multiple surveys.	Breeding Season: Jan. – Sept. and Oct. – Dec. Incubation: ~43 days Fledges: 130 – 260 days
Sula sula	Red-footed Booby	ʻĀ	MBTA	Breeding visitor. From several hundred to many thousand observed over multiple surveys.	Breeding Season: February - April Incubation: ~44 days Fledges: five months
Tringa incana	Wandering Tattler	ʻŪlili	MBTA	Winter resident. One to five observed during multiple surveys.	NA
Mammals					
Balaenoptera physalus	Fin Whale	---	E	Considered rare, most likely to occur in fall and winter.	Breeding season: Late fall-winter.
Feresa attenuata	Pygmy Killer Whale	---	MMPA	Occurs in deeper waters year-round; may have island-associated resident populations	Calving likely peaks in summer.
Globicephala macrorhynchus	Short-Finned Pilot Whales	---	MMPA	Frequently documented by ship-board surveys between Kauaʻi, Nʻiihau, and Kaʻula.	Breeding Season: Year-round, peaks July – Aug.

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Grampus griseus	Risso's Dolphin	---	MMPA	Rarely seen, primarily in deeper waters.	No seasonality is known
Kogia breviceps	Pygmy Sperm Whale	---	MMPA	Rarely seen, primarily in deeper waters.	Calving peaks March-August
Kogia sima	Dwarf Sperm Whale	---	MMPA	May be part of an island- associated resident population; occur year-round.	Calving occurs in spring.
Lagenodelphis hosei	Fraser's Dolphin	---	MMPA	Rarely seen, but known to occur year-round in deeper waters in large pods.	Calving occurs between spring and fall
Megaptera novaeangliae	Humpback Whale	Kōholā kuapiʻo	SE, MMPA	Large pods visit the shoal area of Kaʻula every winter season.	Calving occurs in winter.
Mesoplodon desirostris	Blainville's Beaked Whale	---	MMPA	Occur in low numbers rear-round, possibly as part of a resident population.	No seasonality is known
Neomonachus schauinslandi	Hawaiian Monk Seal	ʻĪlio-holo-i-ka-uaua	E	Frequently documented basking on Kaʻula shores during multiple surveys.	Breeding Season: Breeding and pupping year-round. Peak pupping April – August. Mother nurses her pup for 5-7 weeks.
Orcinus orca	Killer Whale	---	MMPA	Hawaiian stock only; very rarely seen, typically in winter.	Breeding year-round

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Peponocephala electra	Melon-headed Whale	---	MMPA	Occur year-round.	No seasonality is known
Physeter macrocephalus	Sperm Whale	Palaoa	E	Higher occurrence in summer/ fall. Rarely recorded in adjacent waters.	Breeding season: Summer
Pseudorca crassidens	False Killer Whale	---	E – MHI Insular DPS	Frequently documented by ship-board surveys between Kauaʻi, Niʻihau, and Kaʻula.	No seasonality is known.
Stenella attenuata	Pantropical Spotted Dolphin	Kiko	MMPA	Infrequently documented ship-board surveys between Kauaʻi, Niʻihau, and Kaʻula.	Calving peaks in spring and fall.
Stenella coeruleoalba	Striped Dolphin	---	MMPA	Occur year-round, primarily in deeper waters.	Calving occurs summer to fall.
Stenella longirostris	Spinner Dolphin	Naiʻa	MMPA	Frequently documented by ship-board surveys between Kauaʻi, Niʻihau, and Kaulʻa.	Calving peaks range from spring to fall.
Steno bredanensis	Rough-toothed Dolphin	---	MMPA	Frequently documented by ship-board surveys between Kauaʻi, Niʻihau, and Kaʻula.	Unknown breeding season.
Tursiops truncatus	Bottlenose Dolphin	Naiʻa	MMPA	Frequently documented by ship-board surveys between Kauaʻi, Niʻihau, and Kaʻula.	Calving peaks range from spring to fall.

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Ziphius cavirostris	Cuvier's Beaked Whale	---	MMPA	Occur year-round, likely as part of an island-associated resident population.	Breeding occurs year-round; calving peaks in spring.
Fish					
Carcharinus lonigmanus	Oceanic Whitetip Shark	---	T	Occurs in tropical and subtropical oceans throughout the world. They live from the surface of the water to at least 500 ft (152 m) deep. Breeding is thought to be concentrated in the central Pacific between 1°N and 15°N.	Mating occurs in late spring and summer. Gestation is 12- 13 months.
Manta birostris	Giant Manta Ray	Hāhālua	T	Occurs worldwide in tropical, subtropical, and temperate waters and is commonly found offshore, in oceanic waters, and near productive coastlines. Breeding sites have been identified off the coast of Ecuador and in the Galapagos Islands.	The primary breeding season is July - August. Gestation is 12-13 months.
Reptiles					
Chelonia mydas	Green Sea Turtle	Honu	T-Central North Pacific DPS	Not documented but likely to occur	NA
Eretmochelys imbricata	Hawksbill Sea Turtle	Honuʻea	E	Not documented but likely to occur	NA

[1]Federally and State listed as E = Endangered, T = Threatened, DPS = Distinct Population Segment, SE = State Endangered only, ST = State Threatened only

Native MBTA = Species protected under the Migratory Bird Treaty Act; MMPA = Protected under Marine Mammal Protection Act

Sources: Baird et al. 2019, Baird et al 2022, Baird et al. 2021a, Baird et al. 2021b, Bonfil et al. 2009, DoN 2005, DoN 1976, DoN 2014b, NMFS 2016b,c,d, NOAA Fisheries 2018, Pepi et al. 2009, Pyle and Pyle 2017, Ritchie et al. 2012, SOH DLNR 2015, USFWS 2019c, Uyeyama and Hanser 2010

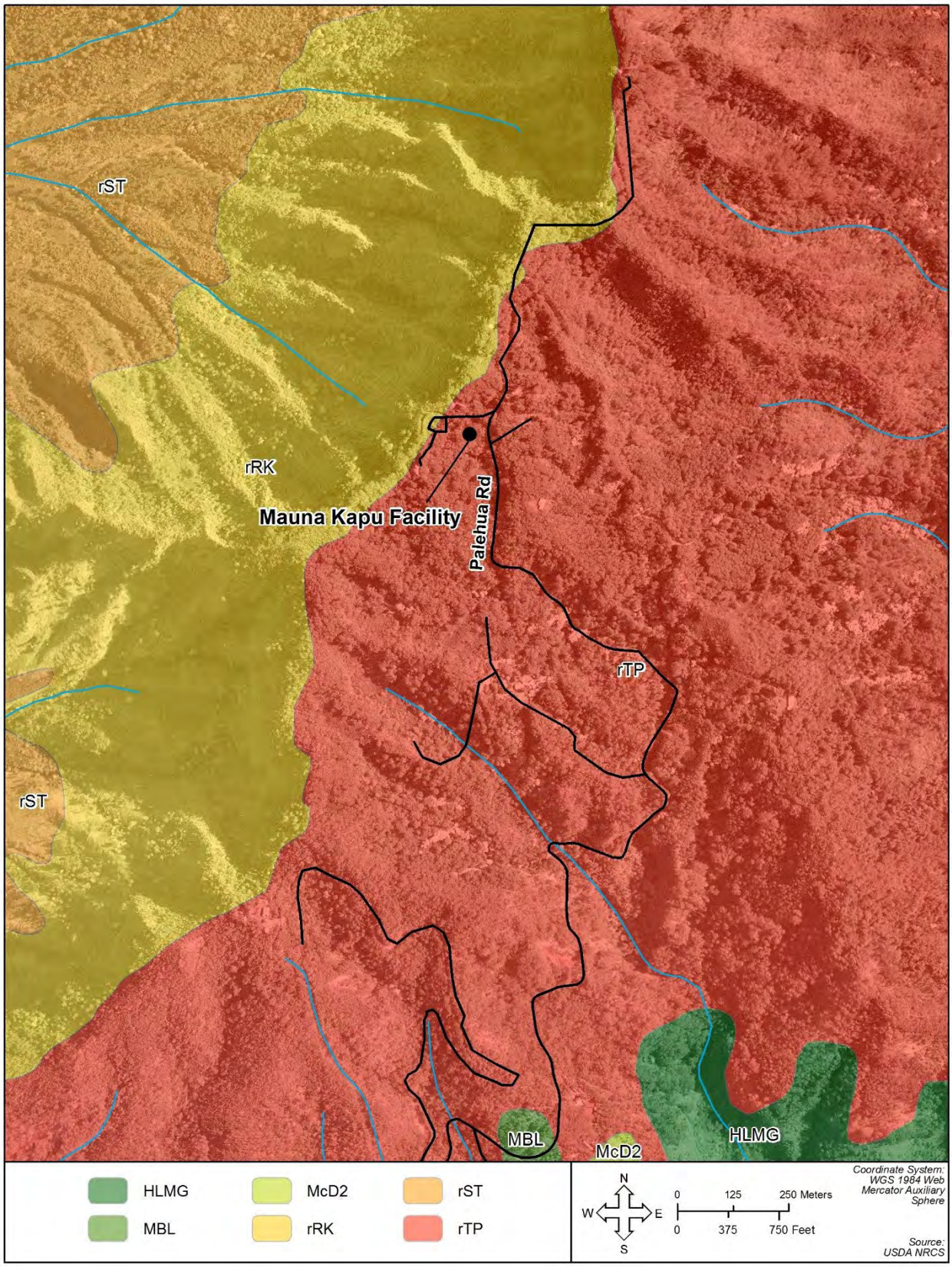


Figure 3-21. Soils and Surface Waters Adjacent to the Mauna Kapu Facility

3.9.2 Hydrology

The Mauna Kapu Facility has no surface water or wetlands (see **Figure 3-21**). The site overlies a high-level, unconfined, dike aquifer in the ʻEwa Aquifer System of the Pearl Harbor Aquifer Sector. This aquifer is classified as having irreplaceable freshwater and a high vulnerability to contamination (Mink and Lau 1992).

3.9.3 Terrestrial Habitats, Vegetation Communities, and Land Cover

The small area of Mauna Kapu Facility is dominated by non-native species and contains only discrete, enclosed lawn and some cultivars (DoN 2010). Adjacent to the facility is a wide range of introduced and native flora of mixed mesic and wet mesic forests in the Honouliuli and Nānākuli forest reserves.

3.9.4 Invasive and Introduced Wildlife Species

Although no site-specific survey information is available, typical non-native avian species such as House Finches and Northern Cardinals can be expected to occur. Additionally, rats, which are known to be a problematic predator of endangered snail species in the Honouliuli Forest Reserve (SOH DFAW 2013) are likely occur on the site. Feral dogs, cats, mice, and mongoose may also occur (Belt Collins 2014).

3.9.5 Special Status Species

The Mauna Kapu Facility does not support any known federal or state-listed threatened, endangered, or candidate animal or plant species. However, the facility is located next to the Honouliuli Forest Reserve, which supports endangered bird species such as the endangered Oʻahu ʻElepaio; two listed Oʻahu tree snail species, or Kāhuli (*Achatinella mustelina* and *Achatinella concavospira*); numerous listed plants; and the Pueo which is state-listed as endangered on Oʻahu (SOH DLNR 2009, VanderWerf 2012). Designated critical habitat for the Oʻahu ʻElepaio and 34 plant species is located to the north and west of the facility (USFWS 2019b; **Figure 3-22**).

The Oʻahu ʻElepaio (*Chasiempis sandwichensis*) (Photo 5-2) is a federally endangered, endemic, monarch flycatcher. Historically found in a variety of forest types at all elevations on the island, Oʻahu ʻElepaio are now only found in mid-elevation to high-elevation forests in portions of the Koʻolau and Waiʻanae Mountain Ranges. Steep population declines and dramatic reductions in range (only 4% of the presumed historic range is currently occupied) led to the Oʻahu ʻElepaio being listed as endangered by the USFWS in 2000. In 2012, the estimated population size for the Oʻahu ʻElepaio was 1,261 birds with 477 breeding pairs and 307 single males, demonstrating the species' very strong male-biased sex-ratio (VanderWerf and Talpas, 2017). The final rule relating to Critical Habitat for the Oʻahu ʻElepaio was published on December 10, 2001 (66 FR 63751). Within the rule, five distinct units were designated as Critical Habitat for the Oʻahu ʻElepaio totaling 65,879 acres (26,661 hectares).

The ʻIʻiwi or Scarlet Honeycreeper (*Vestiaria coccinea*) (Photo 5-3) is an endemic Hawaiian honeycreeper federally listed as threatened and state listed as endangered on the island of Oʻahu. The scarlet honeycreeper can fly long distances in search of flowering ʻŌhiʻa trees and are important ʻŌhiʻa pollinators. They are found within mesic wet forests dominated by ʻŌhiʻa and Koa (*Acacia koa*) (DLNR, 2015). On Oʻahu, scarlet honeycreepers persist in higher and cooler elevation forests (82 FR

43873) with population estimates for the island ranging from 50 birds (DLNR, 2015b) to a few individuals (82 FR 43873).

The Oʻahu ʻAmakihi (*Chlorodrepanis flava*) (Photograph 5-5) is a small, olive green, native honeycreeper considered a species of conservation concern by the USFWS (USFWS, 2008c). Endemic to the island of Oʻahu, the Oʻahu ʻAmakihi is found in a variety of habitats from wet forests in the Koʻolau Mountains to dry forests in the Waiʻanae Mountains (DLNR, 2015). In the Waiʻanae Mountains, the Oʻahu ʻAmakihi is considered relatively uncommon and is mostly found above 1,640 feet (500 meters) elevation. Confirmed citizen and scientist observations of Oʻahu ʻAmakihi report observations in high elevations and along ridgelines of the Waiʻanae mountains as recent as 2021 and 2020 (eBird, 2021).

The ʻApapane (*Himantione sanguinea*) (Photograph 5-6) is an endemic honeycreeper considered a species of conservation concern by the USFWS (USFWS, 2008). While large numbers of ʻApapane survive on several of the Main Hawaiian Islands, only a small relict population is thought to remain on Oʻahu. Historically, the species was found in forested areas across the island of Oʻahu. Today, ʻApapane occur primarily in the Koʻolau Mountains and are less common in the Waiʻanae Mountains above 1,950 feet (600 meters) (DLNR, 2015).

3.10 Niʻihau Natural Resources

3.10.1 Topography, Geology, and Soils

The highest elevations on Niʻihau Island are volcanic uplands at Pānīʻau that reach 1,281 ft (390.4 m). The island also contains 3 mi (4.8 km) of sea cliffs that are at least 1,000 ft (304.8 m) in elevation (**Figure 3-23**). However, 75 percent of Niʻihau Island is lower than 500 ft (152 m) in elevation (SOH DLNR 2015).

Niʻihau Island was formed from the remnants of a single volcano approximately 4.89 million years ago, which was since been deeply eroded. The island is mainly comprised of rejuvenated-stage Pliocene to Pleistocene-age Kiekie Basalt over shield-stage Miocene to Pliocene-age Paniau Basalt. These layers are intruded by dikes. The island has extensive alluvial deposits, some of which are consolidated (Oki et al. 1999).

The low volcanic cliffs on Niʻihau Island are weathered and shaped by marine erosion. The island also has boulder beaches, recessed sandy beach systems with 98-ft (30-m) high dunes, small littoral sandy

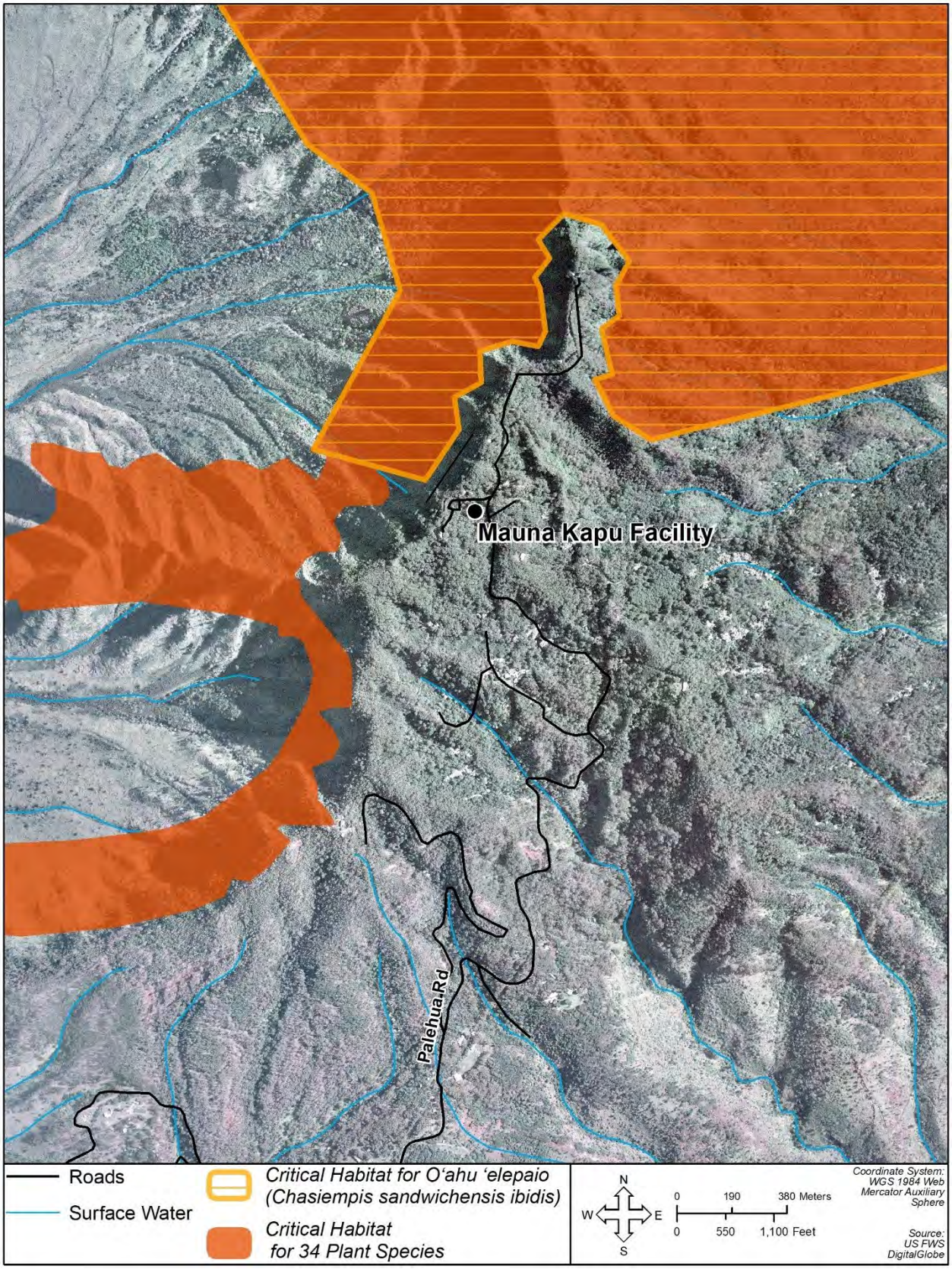


Figure 3-22. Protected Species Critical Habitat Adjacent to the Mauna Kapu Facility

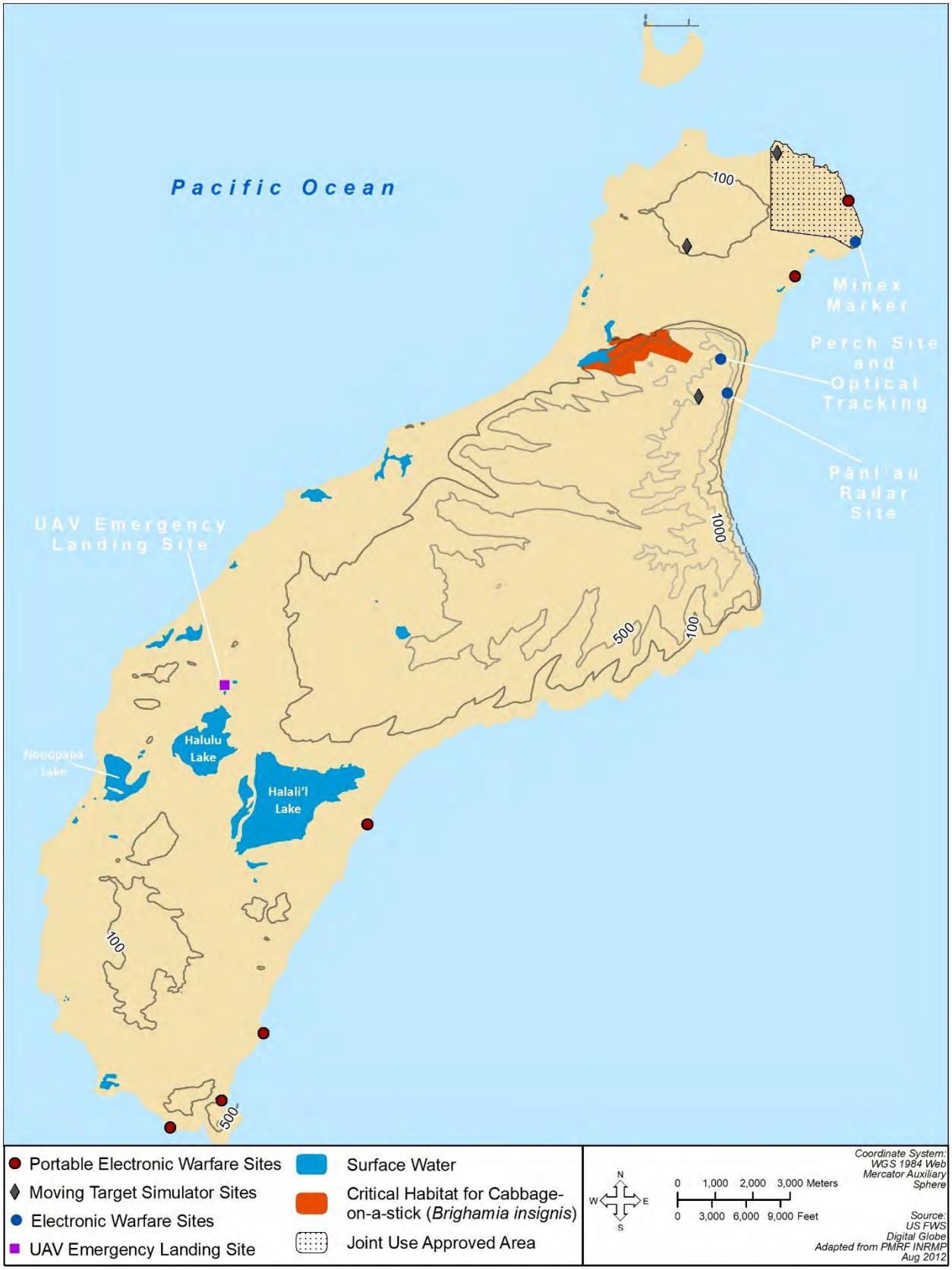


Figure 3-23. Elevation Contours, Surface Waters, and Critical Habitat on Ni'ihau Island

coves, and erosional sandy coasts with massive sections of beach rock eroded from large swells and stacked on shore (Fletcher and Fiersten 2009).

The Robinson family has not given permission for soil surveys to be conducted on Niʻihau Island (Bruland 2009) and soil data are not available from the NRCS Web Soil Survey (USDA NRCS 2015).

3.10.2 Hydrology

While there are no perennial streams on the island, there are several seasonal/ephemeral wetlands and lakes that have formed from surface runoff following winter rains, and one that receives spring inflow. However, most of the water evaporates from these lakes during dry seasons leaving the island with very little surface water. The three largest lakes include Halulu Lake, which is a natural freshwater lake approximately 182 ac (74 ha) in size, Halāliʻi Lake, which is an intermittent lake covering approximately 841 ac (340 ha) (SOH DLNR 2015), and Nonopapa Lake, which is approximately 160 ac (65 ha) (Google Earth 2018) (see **Figure 3-23**).

Several small springs and seeps can be found on the island at elevations of 500 ft (152 m) above msl and at Keanahaki and Kaumuhonu at 6.5 ft (2 m) above msl. The island has groundwater in beach sand, calcareous dunes, alluvium, eolianite, and the Kiekie and Paniau volcanic series, but only 3 out of 57 wells and waterholes that were tested yielded water with sufficiently low salt content for drinking (DoN 2012).

3.10.3 Terrestrial Habitats, Vegetation Communities, and Land Cover

The coastal and inland areas of Niʻihau Island are dominated by dense Kiawe forests, which open into mixed coastal dry communities with an extensive ʻIlima (*Sida fallax*) understory in northern lowland areas. Scattered locations with higher elevations on the island contain thick Koa Haole shrubland, a dry coastal community, with very little herbaceous understory due to the high density of the Koa Haole and the intense grazing pressure. Northeastern coastal regions contain coastal dry herbland/grassland communities. Most of the vegetation on Niʻihau is non-native, and small mixed Eucalyptus strands and Common Ironwood strands are found in sheltered areas at higher elevations. Non-native Ironwood (*Casuarina equisetifolia*) can also be found in coastal areas of the island. A native species, False Sandalwood, can also be found at higher elevations in mixed Kiawe/Koa Haole shrub associations (DoN 2012).

3.10.4 Invasive and Introduced Wildlife Species

A 1951 report on the avifauna of Niʻihau reported that at one time all native bird species had been extirpated and only exotic species such as Ring-necked Pheasant (*Phasianus colchicu*s), California Quail (*Callipepla californica*), Wild Turkey or Pelehū (*Meleagris gallopavo*) that were introduced occurred (Fisher 1951). Other introduced species such as Japanese White-eyes, Common Mynas, House Finches, and Cardinals that likely migrated from Kauaʻi were also numerous. By the 1950s however, many native species, including endangered seabirds and waterfowl, had reestablished populations on Niʻihau. Feral Cats, Feral Pigs, and rats were also noted as being ubiquitous during the 1951 study (Fisher 1951).

3.10.5 Special Status Species

Of the bird populations that have reestablished on Niʻihau Island, several endangered Hawaiian waterbirds including the Hawaiian Duck, Hawaiian Coot, and Hawaiian Stilt are known to occur (Pyle and Pyle 2017, USFWS 2011b). These species move between Niʻihau and Kauaʻi in response to changes in hydrologic conditions, as the lakes on Niʻihau are ephemeral. In addition, a large number of MBTA-protected seabird species also occur, though breeding has only been confirmed for a few of these species (Pyle and Pyle 2017).

The endangered Hawaiian Monk Seal and threatened green sea turtle frequent the beaches and occur in the nearshore waters of Niʻihau Island and are within the Navy training areas. Hawaiian Monk Seal uses the coastline to haul out, pup, and rear young. The green sea turtle has been observed basking on selected beaches and occasionally nests at some of these locations. The endangered False Killer Whale has been documented in the area by ship-board surveys (Carretta et al. 2018), and endangered sperm whale and Fin Whale have been rarely observed in adjacent waters. Dolphins that can occur in nearby or adjacent waters are: Short-finned Pilot Whale, Pygmy Killer Whale, Fraser's Dolphin, Melon-headed Whale, Pantropical Spotted Dolphin, Striped Dolphin, Spinner Dolphin, Rough-toothed Dolphin and Bottlenose Dolphin. Whales recorded in the area include the Pygmy Sperm Whale, Dwarf Sperm Whale, Humpback Whale, Blainville's Beaked Whale and Cuvier's Beaked Whale (Baird et al. 2019, Baird et al 2022, Baird et al. 2021a, Baird et al. 2021b).

No threatened, endangered, or candidate plant species are known within the Navy-used sites. However, Nihoa Pritchardia or Wāhane (*Pritchardia aylmer-robinsonii*) and Cabbage-on-a-stick or ʻŌlulu (*Brighamia insignis*) have been documented on other parts of Niʻihau Island. The endemic and endangered Nihoa Pritchardia is a fan-leaved tree about 23 to 50 ft (7 to 15 m) tall that was previously found at three sites on the island, but in 2011 it was believed that only two plants remain on Kaʻali Cliff, though not confirmed by on-site surveys (USFWS 2011a). There is no designated critical habitat for Nihoa Pritchardia (USFWS 2003). The endemic and endangered Cabbage-on-a-stick has one unit of 357 ac (144 ha) of critical habitat on Niʻihau Island for a population that was documented on Kaʻali Cliff, but has not been observed since 1947 (USFWS 1996, SOH DOFAW 2013 (see **Figure 3-23**). The only known remaining wild Cabbage-on-a-stick is on the Nā Pali coast of Kauaʻi (USFWS 2007). Threatened, Endangered, Candidate Species and other protected species known to occur on Niʻihau Island are summarized in **Table 3-19**.

Table 3-19. Special Status Species on or near Niʻihau Island

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Birds					
Anas wyvilliana	Hawaiian Duck	Koloa Maoli	E, MBTA	Year-round resident. Few individuals recorded during USFWS surveys.	Breeding Season: Year-round, peak April-Sept. Incubation: ~30 days Fledges: 50-60 days
Anous minutus	Black Noddy	Noio	MBTA	Breeding visitor. Has been recorded but is not known to breed on island.	Breeding Season: Breeding is highly variable and egg laying occurs year-round. Incubation: ~ 34 days Fledges: ~ 39 – 52 days, fledglings remain near their parents for up to 17 weeks
Arenaria interpres	Ruddy Turnstone	ʻAkekeke	MBTA	Winter resident.	NA
Asio flammeus sandwichensis	Short-eared Owl	Pueo	SE Oʻahu MBTA	Year-round resident.	Breeding Season: Year-round Incubation: 21-37 days Fledges: ~ 29 days
Bulweria bulwerii	Bulwer's Petrel	ʻOu	MBTA	Breeding visitor. Has been recorded but is not known to breed on island.	Breeding Season: April - June Incubation: ~42-46 days Fledges: early October
Fregata minor	Great Frigatebird	ʻIwa	MBTA	Migratory.	NA
Fulica alai	Hawaiian Coot	ʻAlae Keʻokeʻo	E, MBTA	Year-round resident. Over a 10-year period (1998-2007), counts averaged about 500 individuals during USFWS surveys.	Breeding Season: Year-round, peak April-Sept. Incubation: ~25 days Fledges: 50-75 days
Himantopus mexicanus knudseni	Hawaiian Stilt	Aeʻo	E, MBTA	Year-round resident. Numbers in the hundreds have occasionally been recorded during USFWS surveys.	Breeding Season: March-Aug., peak May-June Incubation: ~24 days Fledges: ~60 days

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Nycticorax nycticorax hoactli	Black-crowned Night-heron	ʻAukuʻu	MBTA	Year-round resident.	Breeding Season: March – Oct. Incubation: ~25 days Fledges: 50-75 days
Phaethon lepturus	White-tailed Tropicbird	Koaʻe Kea	MBTA	Breeding visitor. Has been recorded but is not known to breed on island.	Breeding Season: Most breeding occurs in summer, with occasional breeding during winter months Incubation: ~43 days Fledges: 70 0 85 days
Phaethon rubricauda	Red-tailed Tropicbird	Koaʻe Ula	MBTA	Vagrant. Known to breed on island.	Breeding Season: Jan. to Aug. Incubation: ~44 days Fledges: ~82 days
Phoebastria immutabilis	Laysan Albatross	Mōlī	MBTA	Breeding visitor. Up to 25 pairs recorded as breeding on island.	Breeding Season: Nov. – Dec. Fledging: June to July Incubation: 65-66 days Fledges: ~185 days
Pluvialis fulva	Pacific Golden Plover	Kōlea	MBTA	Winter resident.	NA
Puffinus auricularis newelli	Newell's Shearwater	ʻAʻo	T, MBTA	Breeding visitor. Has been recorded but is not known to breed on island.	Breeding Season: March - April Incubation: ~51 days Fledges: mid Sept. – mid Dec.
Puffinus nativitatis	Christmas Shearwater	ʻAoʻū	MBTA	Breeding visitor. Has been recorded but is not known to breed there.	Breeding Season: March - April Incubation: ~51 days Fledges: mid-Sept. - mid-Dec.
Sula dactylatra	Masked Booby	ʻĀ	MBTA	Breeding visitor. Has been recorded but is not known to breed on island.	Breeding Season: Jan. - July Incubation: ~45 days Fledges: five months
Sula leucogaster	Brown Booby	ʻĀ	MBTA	Breeding visitor. Has been recorded but is not known to breed on island.	Breeding Season: Jan. – Sept. and Oct. – Dec. Incubation: ~43 days Fledges: 130 – 260 days
Sula sula	Red-footed Booby	ʻĀ	MBTA	Breeding visitor. Known to breed on island.	Breeding Season: February - April Incubation: ~44 days

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
					Fledges: five months
Tringa incana	Wandering Tattler	ʻŪlili	MBTA	Winter visitor.	NA
Mammals					
Balaenoptera physalus	Fin Whale	---	E	Considered rare, most likely to occur in fall and winter.	Breeding season: Late fall-winter.
Feresa attenuata	Pygmy Killer whale	---	MMPA	Occurs in deeper waters year-round; may have island-associated resident populations	Calving likely peaks in summer.
Globicephala macrorhynchus	Short-Finned Pilot Whales	---	MMPA	Move over an area spanning Kauaʻi, Niʻihau, Kaʻula, and Oʻahu	Breeding Season: Year-round, peaks July – Aug.
Kogia breviceps	Pygmy Sperm Whale	---	MMPA	Rarely seen, primarily in deeper waters.	Calving peaks March-August.
Kogia sima	Dwarf Sperm Whale	---	MMPA	May be part of an island- associated resident population; occur year-round.	Calving occurs in spring.
Lagenodelphis hosei	Fraser's Dolphin	---	MMPA	Rarely seen, but known to occur year-round in deeper waters in large pods.	Calving occurs between spring and fall.
Megaptera novaeangliae	Humpback Whale	Kōholā Kuapiʻo	SE, MMPA	Occur winter / spring (Nov. – April).	Calving occurs in winter.
Mesoplodon desirostris	Blainville's Beaked Whale	---	MMPA	Occur in low numbers rear-round, possibly as part of a resident population.	No seasonality is known.
Neomonachus schauinslandi	Hawaiian Monk Seal	ʻĪlio-holo-i-ka-uaua	E	Uses the coastline to haul out, bask, and pup, observed up to terrestrial boundary and within 5-ft (1.5 m) depth zone in the ocean.	Breeding Season: Year-round. Pupping: Feb. – Aug., peaks March – April. Mother nurses her pup for 5-6 weeks.
Peponocephala electra	Melon-headed Whale	---	MMPA	Occur year-round. Occasionally observed off the coast of Niʻihau.	No seasonality is known.

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Physeter macrocephalus	Sperm Whale	Palaoa	E	Higher occurrence in summer/ fall. Rarely recorded in adjacent waters.	Breeding season: Summer.
Pseudorca crassidens	False Killer Whale	---	E- MHI Insular DPS	Frequently documented by ship-board survyes between Kauaʻi, Niʻihau, and Kaʻula.	No seasonality is known.
Stenella attenuata	Pantropical Spotted Dolphin	Kiko	MMPA	Infrequently documented ship-board surveys between Kauaʻi, Niʻihau, and Kaʻula.	Calving peaks in spring and fall.
Stenella coeruleoalba	Striped Dolphin	---	MMPA	Occur year-round, primarily in deeper waters, however rarely observed off the coast of Niʻihau.	Calving occurs summer to fall.
Stenella longirostris	Spinner Dolphin	Naiʻa	MMPA	Frequently documented by ship-board surveys between Kauaʻi, Niʻihau, and Kaʻula.	Calving peaks range from spring to fall.
Steno bredanensis	Rough-toothed Dolphin	---	MMPA	Occur year-round. Show fidelity to area near Kaʻula and Niʻihau.	No seasonality is known.
Tursiops truncatus	Bottlenose Dolphin	Naiʻa	MMPA	Frequently documented by ship-board surveys between Kauaʻi, Niʻihau, and Kaʻula.	Calving peaks range from spring to fall.
Ziphius cavirostris	Cuvier's Beaked Whale	---	MMPA	Occur year-round, likely as part of an island-associated resident population. Occasionally observed off the coast of Niʻihau.	Breeding occurs year-round; calving peaks in spring.
Reptiles					
Chelonia mydas	Green Sea Turtle	Honu	T – Central North Pacific DPS	Occur year-round. Bask on the beaches. Has been observed coming ashore and nesting on the beaches, up to terrestrial boundary and within 5-ft (1.5 m) depth zone in the ocean.	Nesting Season: May – July Incubation: ~ 60 days Hatch: July – Sept.

Scientific Name	Common Name	Hawaiian Name	Status[1]	Occurrence	Reproduction
Eretmochelys imbricata	Hawksbill Sea Turtle	Honuʻea	E	Reported in the waters off of Niʻihau.	
Fish					
Carcharinus lonigmanus	Oceanic Whitetip Shark	---	T	Occurs in tropical and subtropical oceans throughout the world and live from the surface of the water to 500 ft (152 m) deep. Breeding is thought to be concentrated in the central Pacific between 1°N and 15°N.	Mating occurs in late spring and summer. Gestation is 12- 13 months.
Manta birostris	Giant Manta Ray	Hāhālua	T	Occurs worldwide in tropical, subtropical, and temperate waters and is commonly found offshore, in oceanic waters, and near productive coastlines. Breeding sites have been identified off the coast of Ecuador and in the Galapagos Islands	The primary breeding season is July - August. Gestation is 12-13 months.

[1]Federally and State listed as E = Endangered, T = Threatened, DPS = Distinct Population Segment, SE = State Endangered only,
Native MBTA = Species protected under the Migratory Bird Treaty Act; MMPA = Protected under Marine Mammal Protection Act
Sources: Baird 2005, Baird et al. 2019, Baird et al 2022, Baird et al. 2021a, Baird et al. 2021b, Bonfil et al. 2009, DoN 2014b, NMFS 2016a,b, NOAA Fisheries 2018, Pyle and Pyle 2017; SOH DLNR 2015, USFWS 2011b, 2019c

4.0 NATURAL RESOURCE MANAGEMENT

4.1 General Natural Resources Management

4.1.1 Environmental Planning

Navy environmental planning is the process of identifying and assessing the potential environmental effects of a proposed action to allow informed decision-making (OPNAV M-5090.1). Environmental planning is essential for ensuring the integration and coordination of all base programs and tenant organizations are in compliance with NEPA, EO 12114, ESA, MBTA, and other regulatory requirements.

Specific Concerns

- Unintentional or avoidable degradation of natural resources
- Compliance with environmental regulations

Current and Historical Management

PMRF assures coordination among facilities planners, resource managers, and government agencies. The PMRF IEPD and NRM are the primary points of contact to provide relevant information on issues with potential to affect natural resources. All new construction projects or modification to existing operations at Barking Sands and other PMRF locations are vetted by the IEPD to minimize natural resource impacts while meeting operational needs. The PMRF IEPD reviews base activities to ensure compliance with natural resources laws and regulations, including wetlands protection, migratory bird protection, critical habitat protection, and erosion control.

Objective: Avoid or minimize impacts to natural resources through coordination and vetting of all new and modified development/construction projects.

Strategies:

1. Continue to implement coordination among facilities planners, resource managers, SOH, and, county officials.
2. The PMRF IEPD and NRM should continue to be the points of contact to provide relevant information on issues with potential to affect wildlife and native habitat, such as military operations and training, and tower and other construction and repair projects.

4.1.2 General Habitat Management

4.1.2.1 Erosion Management

The high wave energy along much of the Barking Sands shoreline and predicted increases in storm surges have potential to threaten the base's coastal infrastructure and natural and cultural resources.

Another soil management issue at PMRF is a result of the base's droughty soils with high wind erosion hazard. Soil movement in the Nohili Dunes area, in particular, can be excessive when plants are disturbed and could result in loss of habitat for rare species. Many areas of the Mākaha Ridge also experience severe erosion because of the steep slopes and draughty soils. Additionally, Feral Goats,

Feral Pigs and Deer browse on, wallow, trample, and root vegetation, which further exacerbates the problem of erosion.

Specific Concerns

- Native plant species protection
- Invasive species control
- Development/anthropogenic influence
- Erosion, sedimentation, and changes in sand deposition
- Climate change (e.g., more intense storms/wave action or sea level rise)

Current and Historical Management

At Barking Sands, a recent study conducted by the University of Hawai‘i indicates that some areas of the shoreline are experiencing erosion at a rate of nearly 2 ft (0.6 m) per year, though on average 0.3 to 0.6 ft (9 to 10 cm) per year have been lost (University of Hawai‘i 2013c). The study also identified areas where sand accretion is occurring. Data resulting from this study were shared with the University of Hawai‘i Sea Grant Program and the County of Kaua‘i and Woods Hole Oceanographic Institution. In order to be prepared for future coastal erosion encroachments, the interactive beaches of the PMRF and bordering coastline should continue to be monitored.

To reduce erosion and protect cultural and natural resources in the Nohili Dunes area, vehicle access is restricted to base security personnel only during emergency response and they are instructed to only use established pathways and gravel roads to access the beach from the northern area.

Erosion Control at Mākaha Ridge Tracking Station

At the Mākaha Ridge Tracking Station, areas with highly eroded soils and sparse or no vegetation that threaten base infrastructure or may impact federally protected species have been targeted for restoration. Retaining walls have been installed and some vegetation restoration has been conducted by the PMRF Public Works Department. Additionally, efforts are underway to construct a feral ungulate exclusion fence that would surround the entire installation.

<u>Objective</u>: Monitor, minimize, and restore sites where erosion and soil compaction sites.

<u>General Strategies:</u>

1. Conduct general surveys for erosion and soil compaction issues annually to prioritize restoration sites.

<u>Barking Sands Strategies</u>:

1. Mitigate and prevent erosion of coastal dune habitat by out-planting, establishing and monitoring native dune building plants in areas identified as having erosion issues.
2. Implement additional security measures such as increased signage and roping off certain areas to reduce off-road vehicle presence in the Nohili Dunes area.

3. Participate in future cooperative studies assessing potential shoreline loss that threatens base infrastructure or sensitive habitats.

Mākaha Ridge Stategies:

1. Complete ungulate exclusion fencing by developing improvements that ensure the fence is ungulate-proof, and remove all ungulates from site by parterning with the PMRF Archery Club and performing trapping as needed. Once ungulate fence is complete, ensure fence is monitored for areas vulnerable to ingress monthly and regularly monitor site for ungulate presence. Target for no ungulate presence within the ungulate proof fence surrounding the Mākaha Ridge Tracking Station: 2022.
2. Maintain Mākaha Ridge ungulate exclusion fencing for erosion control.
3. Out-plant native, drought tolerant plants in areas identified as having erosion and soil compaction issues. Ensure that a regular monitoring schedule and a sufficient irrigation system are in place until plants are well established.

4.1.2.2 Invasive Plant Management

The Navy has conducted vegetation surveys and mapping efforts at nearly every PMRF site to identify native and non-native plant populations. Results from these surveys show that nearly 50 percent of identified plant species at PMRF are non-native species, therefore invasive plant management is a major natural resources concern for PMRF.

At Barking Sands, Long-thorn Kiawe, Kiawe, Koa Haole, and Ironwood are the main species found to encroach on native plant habitat. Much of the coastal area of Barking Sands is designated critical habitat for the endangered *Panicum niihauense* grass (see **Figure 3-6**) and is negatively impacted by the presence of non-native species.

There are also substantial populations of invasive plant species intermixed with native forest species present at the Kōkeʻe sites. Especially invasive species historically observed include Asian Melastome, Strawberry Guava, and non-native Blackberry species. At Mākaha Ridge invasive plant species may contribute to erosion issues at the site.

Specific Concerns

- Unintentional introductions of invasive species (e.g., equipment, vehicle, vessel and aircraft contaminated with seeds of invasive species)
- Displacement of native species by invasive species

Current and Historical Management

The Kauaʻi Invasive Species Committee (KISC) "Black List" species are identified on the KISC website: https://www.kauaiisc.org/pono/do-not-plant-list/.

Invasive species recognized on the formal SOH Noxious Weed List (Hawaiʻi Invasive Species Council 2015a), those recognized as a priority for control by KISC, and on those on the KISC "Black List" are never used for out-planting or landscaping projects at PMRF as ensured by the PMRF IEPD review process. The Black List species are identified on the KISC website: https://www.kauaiisc.org/pono/do-not-plant-list/.

Because of its extreme invasiveness, ability to hybridize with Kiawe, and potential threats to personnel, equipment, and sensitive native species, Long-thorn Kiawe has been identified as the highest priority for control. Targeted control efforts for this species have been undertaken in critical habitat areas in the past with significant removal efforts in 2005, 2006, 2007 and 2010. Beginning in 2015, Barking Sands began a base-wide eradication program for Long-thorn Kiawe. Long-thorn Kiawe is currently being actively controlled with herbicide and machinery when necessary and monitored at PMRF.

Long-thorn Kiawe leaf and thorn

Targeted invasive species control has been conducted at the PMRF Kōkeʻe sites by Navy biologists including the treatment of invasive Asian melastome observed along the roadside near Site D.

<u>Objective</u>: Minimize and prevent encroachment of invasive species into protected species habitats and other priority native vegetation communities to the greatest extent practicable.

<u>Strategies:</u>

1. Include biosecurity requirements and provisions in Base Operating Support (BOS) and construction contracts to reduce the risk of introduction of invasive species and plant diseases.
2. Ensure that species identified as invasive in Hawaiʻi are not utilized for landscaping or erosion control projects by developing a Landscaping Guide to include in all base contracts, integrate into the installation appearance plan, and provide to project managers that specifies an approval process for species selection.
3. Ensure early detection and a rapid response to invasive plant species in sensitive areas.
4. Conduct removal of invasive plant species in sensitive areas, monitor for re-growth, and restore with out-plantings, if necessary, with a target of 80% reduction in invasive species within the areas of concern.
5. Decrease driving on dune vegetation, which can further increase the spread of invasive species into native habitats; continue to prohibit driving in designated Niʻihau Panicgrass critical habitat and culturally sensitive areas.

4.1.2.3 Native Plant Management

As a large percentage of PMRF lands are landscaped or comprised of non-native species, native plant enhancement and management are important for improving habitat sustainability and providing habitat for sensitive species and native wildlife, including birds and pollinators. Using native plants in landscaped areas also provides an opportunity to educate base personnel and visitors as well as improve wildlife habitat. The use of native Hawaiian plant species can also reduce the need for intensive maintenance and the use of fertilizers and pesticides since they are better suited to local conditions.

The PMRF NRM and IEPD can provide assistance with plant selection. Numerous local nurseries have joined the “Plant Pono” movement and are endorsed by KISC and the Plant Pono organization. Plants

listed as invasive by the Hawai‘i Invasive Species Council and KISC must be entirely avoided in accordance with EO 13751 (2016).

Specific Concerns

- Native and protected plant species habitat encroachment from development or invasive species
- Destruction of native and protected plant species and habitat from issues such as climate change resulting in possible increases in wave action and/or sea level rise and off-road vehicles driving on coastal strand vegetation.

Current and Historical Management

Natural resource managers at PMRF have strived to use regionally native vegetation in re-vegetation efforts and to the extent practicable in landscaping. Efforts to enhance native vegetation at PMRF have included planting a variety of native trees, shrubs, and ground covers in the fenced Wedge-tail Shearwater nesting colony near MWR beach cottages and planting native naupaka along a bike path. A native plant nursery located on the south end of the base is in construction, expected to be completed in 2022. This facility will provide space to germinate native seedlings, re-pot larger plants to establish supply of individuals ready for outplanting, and to provide plants for partners, tenants and outreach events.

A native plant restoration project is currently underway at Nohili Dunes, to reduce fire risk and improve the native plant community. This project will inform future restoration efforts in the area.

Objective: Conserve and enhance native plant communities to the greatest extent practicable in a manner consistent with BASH requirements.

Strategies

1. Update baseline floral surveys to improve understanding of plant community at PMRF.
2. Ensure and assist in the selection of locally sourced, non-invasive, and preferably native species, with a minimum of 50 percent native species for all new landscape planting projects by 2022 and 100 percent by 2028 while adhering to BASH requirements.
3. Ensure that post planting care, including irrigation, invasive plant/weed control, and long-term monitoring and maintenance is implemented for all native plant restoration projects.
4. Identify suitable locations for planting native Hawaiian plants, particularly those that benefit native pollinators in support of national pollinator objectives.
5. Strive to find new opportunities to collaborate with partners on removing invasive and exotic vegetation and planting opportunities.

4.1.2.4 Wildland Fire Management

Historically, wildfire was an uncommon natural occurrence in Hawai‘i and did not play a significant ecological or evolutionary role in most Hawaiian ecosystems. However, the rapid spread of non-native grasses and fire-adapted species has changed the composition of many natural communities and has markedly increased fire frequency and size (Smith and Tunison 1992). Wildfire is now a major threat to communities and natural resources in Hawai‘i. Over the past decade, an average of over 1,000 wildfires burned over 17,000 acres each year in Hawai‘i (Hawai‘i Wildfire Management Organization

[HWMO] 2017). The HWMO has conducted wildland fire risk assessments for every community in the state and has identified areas of low, moderate, high, and extreme hazard for wildfire (HWMO 2017). Barking Sands and Kamokala Ridge are located in areas currently designated as high hazard. With increasing temperatures and high fuel levels from non-native grasses and other vegetation, wildland fire intensity and frequency can be expected to increase throughout Kauaʻi.

Specific Concerns:

- Health and safety of PMRF personnel and the surrounding community
- Protection of base infrastructure
- Protection of native vegetation communities

Current and Historical Management

PMRF and its tenant commands are cognizant of the risk of wildfire and have implemented procedures to reduce these risks. Procedures to reduce the risk of ignition include clearing dry vegetation from around the launch pads and spraying vegetation adjacent to launch pads with water just before launches. Emergency fire crews are available during launches to quickly extinguish any fire and minimize its effects. An open spray nozzle is used, when possible, rather than a directed stream when extinguishing fires, to avoid erosion damage to the sand dunes and to prevent possible destruction of cultural resources (PMRF 2010).

Objective: Provide technical support to tenant commands and base planners to help identify and mitigate wildland fire issues.

Strategies:

1. Coordinate with the PMRF Fire Department on developing updates to the existing Fire Management Plan.
2. Remove deadfall in high-risk areas including near the Barking Sands missile launch site and the Kamokala Ridge Magazines and replant with native, low fire risk species.

4.1.3 General Nuisance and Invasive Animal Management

Non-native predators are the primary invasive animal management issue at PMRF. Feral Cats, Pigs, Dogs, Rats, Mice, Cattle Egrets, and Barn Owls have been recorded at PMRF and can depredate the adults or young of ESA and MBTA listed species. Barn Owls also likely displace the native owl species, the Pueo. Control efforts for these priority invasive species are ongoing.

Due to the potential for free-ranging Feral Cat populations to act as disease reservoirs, which threaten human health, native wildlife, and natural ecosystems, Navy commands do not allow trap-neuter-release or similar programs on their lands (OPNAV M-5090.1). Increasing public awareness of the problems associated with feral animals is a primary factor in controlling feral populations. In accordance with Navy policy, PMRF has adopted proactive feral animal management policies that limit the establishment of free-roaming cat and dog populations and ensure the humane capture and removal of feral animals if they occur.

Ungulates are known to disturb native plant communities on Kauaʻi; ungulates present at PMRF are Feral Goats (*Capra hircus*), Black-tailed Deer (*Odocoileus hemionus columbianus*) and Feral

Pig. Feral Goat and Deer pose a threat to the persistence of rare native plants and to the success of future habitat and native-plant restoration projects. Goats are present at the highly erosible Mākaha Ridge site and deer are found in the sensitive areas of Nohili Dunes as well as at Mākaha Ridge. Pigs may also disturb the ground in native ecosystems, including within areas designated critical habitat for *Panicum niihauense*, and at culturally sensitive areas, if not controlled.

Several species not yet established on Kauaʻi have been identified by KISC as priority species for early detection and rapid response (EDRR), due to their rapid establishment on other Pacific islands and the extensive effects they have had to native plants, animals, and/or human populations. Brown Tree Snake (*Boiga irregularis*) and small Indian Mongoose (*Herpestes javanicus*) have the potential to decimate native seabird and waterbird populations on base, and native seabird, waterbird, and forest bird populations across the island. A successful invasion of Kauaʻi by Brown Tree Snake would cause damage to human infrastructure and agriculture, as is the case in Guam where they were accidentally introduced in the 1940s (USFWS, Fritts and Leasman-Tanner, 2001). Although there have been reported sightings of mongoose at Barking Sands, none have been confirmed and no mongoose have been captured during trapping efforts. All mongoose sightings at PMRF are immediately reported to KISC.

Jackson's Chameleon (*Chamaeleo jacksonii*) predate native invertebrates and birds where introduced, and Little Fire Ant (*Wasmannia auropunctata*) produce painful bites on humans and damage agriculture, as well as blinding and killing chicks and eggs of native bird species, including Wedge-tailed Shearwaters. The Coconut Rhinoceros Beetle (*Oryctes rhinoceros*) and Coqui Frog (*Eleutherodactylus coqui*) have the potential to alter the human environment on base and across the island by affecting agricultural crops and coconut palms, and changing the sound environment with a loud night chorus, respectively. Coqui Frogs also predate native invertebrates and may compete with Endangered Hawaiian Hoary Bat for prey species (Bernard and Mautz 2016).

Specific Concerns

- Impacts to federally endangered and other protected species from non-native animals
- Nuisance wildlife related disturbances
- Introductions of invasive species
- Priority invasive species (established or potential): Feral Cats, Dogs, Goats, Pigs, Rats, Mice, Deer, Cattle Egrets, Barn Owls, Mongoose, Little Fire Ant, Jackson’s Chameleon, Coqui Frog, Coconut Rhinoceros Beetle, and Brown Tree Snake

Current and Historical Management

From 2006-2011, PMRF and USDA-WS had an interagency service agreement to control predators and other nuisance wildlife near the airfield operating area and other areas of base to eliminate BASH concerns for the airfield, nuisance species, and provide protection for protected species. Since 2012, CNIC and USDA-WS have had a Work/Financial Plan for BASH support on Navy Installations to include PMRF. In 2017, predator control efforts were increased with two full-time natural resources predator control positions being created through a cooperative agreement with the Navy and the Research Corporation for University of Hawaiʻi (RCUH) and PCSU. Predator control staff monitor and control for Feral Dogs, Cats, Goats, Rats, Barn Owls, and Pigs at the PMRF Barking Sands,

Mākaha Ridge, and Kōkeʻe sites for the protection of native and protected species and to help alleviate erosion issues. Although there are no confirmed populations of mongoose on Kauaʻi, any mongoose sightings at PMRF are to be immediately reported to KISC. Additionally, mongoose traps would be deployed in the area of the sighting by predator control personnel and left in place for two weeks. Control of non-native predators at PMRF is a required conservation measure per the 2014 PMRF Biological Opinion.

An ungulate exclusion fence, as mentioned in Section 4.1.3, has been completed at the Mākaha Ridge Tracking Station to reduce impacts from Feral Goats, Deer, Feral Dogs, and Pigs. In addition, the Navy has initiated a hunting program at the Mākaha Ridge Tracking Station to further reduce the Goat herd and other ungulate populations on the site.

The Navy has plans to develop a PMRF Biosecurity Plan that includes specific prescriptions to evaluate individual invasive species, to identify targeted species, to control further spread of those targeted species, and to develop and implement a program to monitor invasive species abundance. The plan will be coordinated with the Regional Biosecurity Plan for Micronesia and Hawaiʻi (U.S. Navy 2015).

Although the Coconut Rhinoceros Beetle has never been detected on Kauaʻi, there is potential for beetles to make their way to PMRF via air traffic from Oʻahu or Guam. These beetles lay their eggs in palm trees or piles of vegetative waste and can be devastating to palm species and agricultural products. There are currently ten Coconut Rhinoceros Beetle traps at PMRF that are checked and serviced monthly by the Hawaiʻi Department of Agriculture.

Objective: Reduce established non-native predator populations to the greatest extent practicable and reduce the risk of further introductions to protect special status species and other native wildlife.

Strategies:

1. Continue to fund control measures for non-native predator species at Barking Sands, Mākaha Ridge Tracking Station, and Kōkeʻe Site C (PMRF Biological Opinion, 2014).
2. Include biosecurity requirements and provisions in BOS and construction contracts to ensure invasive ants, frogs, and other non-native wildlife are not introduced via equipment or landscaping efforts.
3. Increase outreach to base personnel on reporting and early detection for invasive species not yet established at PMRF. Ensure all observations or reports of high-risk invasive species are communicated to KISC and to all other appropriate contacts.
4. Conduct surveys to improve baseline knowledge of populations of invasive animals at PMRF.
5. Work with partner organizations to identify sources of Feral Cats and Dogs off base so as to reduce the population of these non-native predators.
6. Consider partnering with the Department of Land and Natural Resources – Division of Forestry and Wildlife to do auditory predator deterrent studies on base and utilize the technology at PMRF if proven to be effective against predators.
7. Conduct ant surveys to assess presence of invasive ants including the little fire ants at the Nohili Dune's Wedge-tailed Shearwater colony. If Little Fire Ants are detected, report to KISC and implement active control by using granular bait after fledglings have left the area.

8. Increase outreach about the hazards of feeding feral/invasive species with all personnel on PMRF and assist in the enforcement of such policies by practicing good communication with Security.
9. Continue to partner with the Hawai‘i Department of Agriculture to ensure Coconut Rhinocerus Beetle traps are checked and maintained at PMRF.

4.1.4 Special Status Species Management

4.1.4.1 PMRF Base-wide Infrastructure, Operations, and Maintenance, Biological Opinion

A 2014 formal section 7 consultation with the USFWS resulted in the issuance of biological and conference opinions for Pacific Missile Range Facility Base-wide Infrastructure, Operations, and Maintenance, Kaua‘i, 2014-F-0066 (USFWS 2014). This Base-wide biological opinion (BO) addresses potential impacts to the federally listed endangered Hawaiian Stilt, Hawaiian Common Gallinule, Hawaiian Coot, Hawaiian Duck, Nēnē, Hawaiian Petrel, Hawaiian Hoary Bat, Band-rumped Storm-petrel, and the threatened Newell's Shearwater. A conference opinion was made in regard to the federal candidate species, Band-rumped Storm-petrel, which is now listed as endangered. The USFWS concurred with the no effect determination to the two federally protected plant species, Dwarf Iliau and Hawai‘i Scaleseed; Short-tailed Albatross, two species of-endangered Hawaiian picture-wing flies, and the critical habitat (currently unoccupied) for the endangered Ni‘ihau Panicgrass that occur at PMRF. In 2014, soon after the PMRF Base-wide BO went into affect, PMRF exceeded its take limit for Newell’s Shearwater and entered re-consulation with USFWS. In 2018, the Newell’s Shearwater portion of the BO was signed and implemented (USFWS 2018a). In addition to lighting related fledgling take, the re-consulation incorporated take estimates and limits that were determined by a USFWS produced model for adult Newell’s Shearwaters striking two communication towers at Kōke‘e Site C. The Navy proposed to contribute to the Hawaiian Seabird Conservation Account managed by USFWS and administered by the National Fish and Wildlife Foundation (NFWF) in exchange for transfer of liability of further compensatory mitigation actions and to receive credits to offset anticipated impacts. Prior to the signing of this BO, the Navy also pursued a proactive conservation initiative for Newell’s Shearwater conservation off-site through the DoD’s Readiness and Environmental Protection Integration (REPI) Program. This initiative was approved and is currently in the planning stages with NFWF acting as the lead implementation organization (See Section 5.3.2.1) Management of these federally protected species is conducted in accordance with the terms and conditions of these documents as discussed in the following sections.

4.1.4.2 Endangered Seabird Management

Newell’s Shearwater, Hawaiian Petrel, and the Band-rumped Storm-petrel are seabirds that spend a large part of the year at sea, forage in the open ocean, and come to shore to breed on Kaua‘i. Beginning in March and April, adults initiate breeding at colonial nesting grounds at high elevations in the interior portions of the island and fly over or near PMRF when traveling between nesting and foraging areas. Fledglings travel from the nesting colony to the sea in the fall, again with potential to fly near PMRF. Recent population estimates indicate there was a 94 percent decline overall in numbers of Newell’s Shearwaters (at an average rate of ~13 percent per year) and a 78 percent decline overall in numbers

of Hawaiian Petrels (at an average rate of ~6 percent per year) on Kauaʻi between 1979 and 2015 (Raine et al. 2017).

These species generally fly to and from their burrows at night and depend on the moon and starlight for navigation. Due to this, the presence of unshielded lighting along their flyways can result in confusion and disorientation. The primary threat to endangered seabird populations at PMRF is the potential for these species to "fall-out" of the sky. The risk for fall-out is especially high during their fledgling season, which occurs from 15 September to 15 December. During this time, young birds take their first flight, relying solely on instinct rather than experience to navigate their way to the ocean to feed. This inexperience causes fledgings to be in danger of falling-out more than adults. Shearwaters and petrels that have fallen-out become vulnerable to predators, dehydration, starvation, and vehicle strikes. If found, the bird may be transferred to a wildlife rehabilitator and are usally well enough to be released the next day.

Ornithological surveillance radar surveys conducted between 1993 and 2008 have been used to detect and quantify over-flights of nocturnal seabirds at various sites throughout Kauaʻi (NAVFAC PAC 2014). These studies indicate that relative to the northern and eastern sides of the island, few seabirds fly over the southern and western regions where Barking Sands is located. During surveys conducted by the DOFAW from 2004 to 2008, radar monitoring stations in Kekaha and the Mānā Plain indicated an average of 15 nocturnal seabirds per hour flew over the areas surveyed (NAVFAC PAC 2014). A similar radar study conducted by Hamer Environmental L. P. in 2015 at Barking Sands also found lower numbers of birds passing over the base compared to other sites on Kauaʻi with an average of 2.12 target species per hour for the fall fledgling season. Passage rates were found to peak in early October with eight individuals of target species per hour. Hamer estimated that cumulatively, over the fall fledging season, an estimated mean of 92 per night and an estimated 5,128 shearwater or petrel species pass over and near the base during the fall sampling period (Hamer Environmental L.P. 2016).

Specific Concerns

- Endangered seabird attraction to artificial light sources
- Seabirds striking towers, powerlines, antennaes, and guy wires

Current and Historical Management

Dark Skies Program

To reduce potential fallout at Barking Sands, PMRF issues a Base Note annually to announce the beginning of the endangered seabird fledging season and the coinciding PMRF Dark Skies Program (PMRF NOTE 10570, **Appendix E**). The note details restrictions to lighting at PMRF between 15 September and 15 December and procedures for requesting waivers for proposed lighting needed during this period. All unnecessary night lighting is turned off during the nocturnal seabird fledgling period and, when possible, night training exercises that require lighting are scheduled outside of this season. All operations at PMRF during this season must coordinate with PMRF Environmental to submit a waiver request (**Appendix E**). Each waiver is reviewed by PMRF natural resources and environmental staff to ensure that the proposed lighting is minimized and modified if needed to

minimize risk of fall-out and then forwarded ultimately to the PMRF Executive Officer for final approval.

Dark Skies Working Group Meetings

Prior to fledgling season, PMRF Environmental hosts an annual meeting with Dark Skies Program stakeholders in attendance. An overview of the purpose and importance of the Dark Skies Program and history of fall out events at PMRF is provided along with species identification, waiver procedures, and protocols for found birds. An additional meeting is held after the fledging season is over and prior to the annual note being issued to incorporate feedback from department heads and give them enough time to submit and get waivers approved prior to the season.

Approved Night Operations

For approved night training events, including RDT&E missions, that require higher risk lighting, a trained biological monitor must be present. PMRF natural resources staff provides training and a copy of appropriate standard operating procedures (SOPs) to all biological monitors designated for missions as well as Security personnel.

Education and Outreach

Additional information on the Dark Skies Program is provided to MWR, tenants, residents, and visitors via table tents and reminders to turn off outdoor lights, particularly unshielded outdoor flood/security lights, and to close blinds in all beach cottages during the fledging season. Lanyards with a contact number to call in the event of fall out have also been developed and are provided to tenant commands as needed for missions and night training events.

Surveys and Monitoring

Even with the minimization of lighting during the endangered seabird fledging season, fallout can still occur. During this period, ground surveys are conducted every weekday morning at high risk night operation areas. All fall out events are reported to natural resources staff who document the event and respond to injured birds as needed. Natural resources staff also conduct weekly night-time surveys to check for problem areas prior to and during fledging season, to confirm that all lights are covered by an approved waiver, and to identify any potential new light sources that could affect fledglings. Surveys are conducted at Barking Sands, Mākaha Ridge, and the Kōkeʻe sites following protocols provided in **Appendix E**.

Save Our Shearwaters

PMRF supports a downed seabird collection station provided by the SOS program located at the Kauaʻi Humane Society. Seabirds found injured or fallen out at PMRF are collected and brought to the PMRF SOS station. SOS staff perform a health evaluation of each seabird and treat the bird until it is ready to be released back into the wild. PMRF further supports the SOS program by hosting a training opportunity for new SOS staff to practice seabird banding and handling skills on PMRF's Wedge-tailed Shearwater colony prior to fledging season and has a contract with SOS to provide care for injured or sick native birds found at PMRF.

SOS station at Barking Sands

Tower and Antenna Strikes

A number of communication towers that are located at Barking Sands, Mākaha Ridge, or Kōkeʻe Site C may constitute a threat to seabirds. Surveys have been conducted at each of these sites to assess mortality from tower strikes. Surveys conducted in 2010 and 2015 included scavenger trials, searcher efficiency trials, and carcass searches in accordance with USFWS communication tower monitoring protocols. Results of the 2010 study indicated no mortality of Hawaiian Petrels, Newell's Shearwaters, or Band-rumped Storm-petrels within the study area (Kleidosty 2011). During the 2015 study however, one downed live adult Newell's Shearwater was found during project set up and one intact Newell's Shearwater carcass was found at the Kōkeʻe Site. Using USFWS mortality estimation calculations, the study resulted in an estimated mortality of 0.225 birds per year, indicating that PMRF communication towers, particularly at Barking Sands, present a minimal threat to nocturnal seabirds (Kleidosty 2016).

Beginning in 2017, surveys of the Kōkeʻe Site C communication towers for seabird activity using night vision were implemented and conducted by natural resources staff. In 2018, acoustic monitoring for seabird strikes on the towers was also implemented. The protocol for these surveys is modeled after the Kauaʻi Endangered Seabird Project's underline monitoring project, which monitors for the frequency of seabird strikes on telephone lines. These monitoring programs were implemented in response to USFWS concerns with adult Newell's Shearwaters striking the towers as outlined in the model produced by the agency for the re-initiation of the Newell's Shearwater portion of the BO. This model estimates that up to an average of fifty (50) adult Newell's Shearwaters per year are likely to be taken in the form of injury or death due to collisions with the communication towers.

Objective: Minimize possible negative impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.

Strategies:

1. Continue to promote base-wide awareness and implementation of the PMRF Dark Skies Program (PMRF Biological Opinion, 2018) through early annual trainings.
2. Continue to improve the Dark Skies Program lighting waiver system and grant standing waivers where applicable to stream-line the waiver process.

3. Continue Dark Skies implementation in areas adjacent to colonial nesting grounds at high elevation nesting sites during critical fledging timeframes.
4. Conduct systematic ground searches for fallen out seabirds after high risk night operations.
5. Continue to fund and implement surveys to assess mortality from tower strikes at Kōkeʻe Site C to include scavenger trials, searcher efficiency trials, and carcass searches in accordance with USFWS communication tower monitoring protocols (PMRF Biological Opinion, 2018).
6. Continue to fund and implement acoustic and visual monitoring programs of communication towers at Kōkeʻe Site C for seabird strikes to inform management and provide data to be used in the re-evaluation of the Newell's Shearwater portion of the PMRF Base-wide BO.
7. Minimize the potential for death or injury of Newell's Shearwater due to collisions with PMRF communication towers located at Kōkeʻe Site C (PMRF Biological Opinion, 2018).
8. Incorporate results of radar studies into future programs. Consider conducting additional radar studies at the Mākaha Ridge and Kōkeʻe sites.
9. Pursue avenues to provide funding to SOS to assist with seabird rehabilitation costs.
10. Continue to host a SOS shearwater aid station at PMRF and monitor station during business days with SOS monitoring on weekends and holidays (PMRF Biological Opinion, 2014).
11. Advise various tenants on base on appropriate safety lighting that is less attractive to endangered seabirds (i.e., motion sensing lights that go off after a set time period, shielded lights, facing light away from the coast, lower lumen, and lower to the ground).
12. Provide a 10-year calendar to mission planners with high-risk dates for endangered seabird fall out clearly depicted.

4.1.4.3 Nēnē Management

The number of Nēnē at PMRF has increased over the past several years, as has been generally experienced across Kauaʻi. Nēnē are primarily known to occur at Barking Sands and the Mākaha Ridge Tracking Station, with fewer known occurrences at the Kōkeʻe sites. The major threats to Nēnē at PMRF include predators, vehicles, and airfield operations.

Hawaiian Goose / Nēnē

Nēnē occur throughout Barking Sands but are most commonly observed at the PMRF oxidation pond complex, near the HIANG complex, the PMRF airfield, and just off PMRF property east of the Kinikini Ditch bridge, which is a concern because of its proximity to the airfield. Because the occurrence of Nēnē on or near the airfield increases BASH risk, they are discouraged from nesting and being present in the Airfield Operating Area (AOA) and surrounding areas. Hazing of non-breeding Nēnē is conducted in the AOA in accordance with the 2014 PMRF Base-wide BO and the 2020 Reclassification of the Hawaiian Goose with a Section 4(d) Rule. Through informal consultation with USFWS, PMRF natural resources personnel also developed an Airfield Nēnē Nest Response Protocol and Hawaiian Goose Family Hazing Standard Operating Procedure in response to nests and Nēnē with goslings being

present near the PMRF runway and roadways in 2017 and 2018, respectively. These documents are included in Appendix E.

In 2020, PMRF experienced two cases of potential organophosphate poisoning in Nēnē, which can lead to paralysis and death. PMRF does not use organophosphates for pest control, thus the determination was made that the exposure was not a result of pesticide use on the installation, however possible routes of exposure may be available on nearby properties.

At the Mākaha Ridge Tracking Station, Nēnē are usually observed near buildings on the ridge overlooking Mākaha Valley. The effects of invasive predators on Nēnē populations at Barking Sands have been observed to be minimal; however, there have been multiple observations of Nēnē attacked by Feral Pigs and possibly dogs at Mākaha Ridge likely resulting in nest failures, injuries, and mortalities. The number of nests at Mākaha Ridge has steeply declined over the last decade compared with Barking Sands, which has increased from one nest in 2009 to 39 nests in the 2021-2022 breeding season. The fence at Mākaha Ridge has been completed, and removing these predators will hopefully alleviate this issue.

Specific Concerns

- Presence near roadways and mortality or injury due to vehicular strikes
- Nest site protection
- Mortality or injury due to maintenance activities, specifically vegetation clearing
- Risk for bird/aircraft strikes (BASH) due to Nēnē feeding, loafing or breeding near the airfield
- Feeding of Nēnē or Nēnē inadvertently eating food thrown out by base personnel or visitors
- Tracking the movement of specific Nēnē to assess their behavior especially in relation to the PMRF airfield
- Exposure to pollutants carried through PMRF in the three ditches, especially Kinikini.

Current and Historical Management

Nēnē Management Plan

A Nēnē Management Plan for PMRF was provided to the USFWS and DOFAW for review and will be included in **Appendix F** when finalized. The Nēnē Management Plan serves two main functions: (1) it serves as a central source of Nēnē life history information for the DoN; and (2) it identifies management goals and recommended actions to aid in the continued recovery of the species while striving to maintain no net loss in mission capability and decrease BASH risk on the PMRF airfield. The plan is intended to be a living document subject to revisions and improvements through collaboration with partners as needed.

Nēnē Hazing

To reduce potential impacts to Nēnē and Air Ops personnel from risks associated with mission and training activities, Air Ops, and USDA-WS with the required training conduct weekday hazing of non-nesting Nēnē year-round on the airfield and the immediate surrounding area. During their breeding and nesting season (August through April), if Nēnē occur within the aforementioned area, authorized base personnel observe birds to determine whether a nest or goslings are present prior to conducting hazing

actions. USDA-WS staff notify natural resources staff when a Nēnē pair appear to be exhibiting nesting behavior so they can begin discussions with USFWS and DOFAW on further actions that can be taken to discourage nesting and as outlined in the Airfield Nēnē Nest Response Protocol. Nesting Nēnē with eggs or goslings are only hazed as outlined in the USFWS approved Airfield Nēnē Nest Response Protocol (2017) and Hawaiian Geese Family Hazing Standard Operating Procedure (2018).

Nēnē Monitoring

Regular monitoring of Nēnē is conducted by natural resources biologists to determine population trends, nesting success, and track locations and movements of banded birds. These surveys follow standardized monitoring protocols developed by natural resources staff and approved by USFWS and DOFAW **(Appendix E).**

During the Nēnē breeding season, nest searches are conducted when a male Nēnē is observed "standing guard" or routinely defending an area. Observations of all Nēnē nests or newly observed goslings are reported to the USFWS, DOFAW, and other partners via phone call or email within 24 hours. Information on goslings on base not observed to be from nests on base and those that are in need of banding are communicated to the DOFAW Kauaʻi Nēnē biologist. Natural resources biologists also communicate invasive predator activity observed during surveys to natural resources predator control staff.

Incidental Nēnē sightings of interest are also recorded. All observed Nēnē mortalities or injuries are reported to USFWS and partners within 24 hours of observation.

Nēnē Protective Measures

To discourage Nēnē nesting in high risk areas such as near roadways, near the PMRF airfield, and at the oxidation pond complex, vegetation removal is performed prior to the breeding season in August. Most Nēnē nests have been initiated on the southern portion of Barking Sands. Successful nest attempts typically produce one to four goslings. Additionally, evidence of families stealing goslings from other families with similar aged offspring has been observed at PMRF. When located, nests are flagged and reported to facilities management personnel who instruct landscaping contractors to avoid disrupting the nesters and to not remove vegetation within a 100-ft (30.5 m) radius of the nest. Signage is also used if a nest is observed close to a roadway or in an area of high human activity.

PMRF Nēnē crossing sign by HIANG building

Additionally, PMRF has installed signs and rumble strips along roadways where Nēnē are known to occur in an effort to reduce the potential for car collisions, and a 25 mile per hour limit from 1800-0600 has been enacted along the stretch of road most used by Nēnē. Vegetation along this stretch of road has been pushed back to more than 10' from the pavement to encourage Nēnē away from the road. Metal, wooden and electronic marquis signs warn drivers of Nēnē crossing areas and are actively patrolled by security.

Objective 1: Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.

Strategies:

1. Collaborate with USFWS, PMRF Air Ops, and DOFAW to continue to revise action plans for Nēnē that attempt to or successfully nest on the airfield to facilitate rapid response, based on past observations and new knowledge.
2. Coordinate with USFWS, DOFAW, PMRF Air Ops, and PMRF Public Works to annually review and update the PMRF Nēnē Management Plan (PMRF Biological Opinion, 2014).
3. Work with PMRF Air Ops and USDA-WS to insure Nēnē hazing efforts are increased prior to and during the breeding season with the possibility of including weekends especially if a Nēnē pair has been regularly observed on or near the airfield.
4. Continue to conduct regular, standardized surveys for Nēnē at PMRF Barking Sands, Mākaha Ridge, and Kōkeʻe sites to effectively detect Nēnē nests and inform management and determine habitat types that attract the species (PMRF Biological Opinion, 2014).
5. Continue to communicate with facilities maintenance personnel about Nēnē nest locations and collaborate to develop effective protective measures for the species and ensure that no vegetation removal or other persistent disturbances occur within 100 ft (30.5 m) of nest sites and goslings to reduce risk of take.
6. Support regular outreach to base visitors and personnel on the importance of not providing food and water to Nēnē (PMRF Biological Opinion, 2014), and develop outreach material aimed at increasing awareness of the species.
7. For all new construction at Barking Sands, including construction for tenant or customer DoD commands or other federal agencies, concrete, asphalt, gravel, xeriscaping, or native vegetation that does not act as a Nēnē attractant, rather than lawn, will be installed in open areas surrounding buildings and parking areas to decrease attraction of Nēnē (PMRF Biological Opinion, 2014).
8. Fund habitat modification that discourages Nēnē presence near roadways, the airfield, and construction sites at Barking Sands.
9. Supplement ongoing water quality testing to detect particulates and soluble chemicals in waters at PMRF. Testing should be conducted at least quarterly

Objective 2: Obtain life history information to inform adaptive management strategies that will provide a conservation benefit to federally endangered Nēnē.

Strategies:

1. Continue to communicate and share data with USDA-WS and DOFAW regularly.
2. Collaborate with DOFAW to have all Nēnē that hatch at PMRF banded and pursue permission and permits for PMRF natural resources staff to band birds if allowable.
3. Implement priority management actions identified in the PMRF Nēnē Management Plan. Work with partners to identify potential opportunities to collaborate on off-installation conservation efforts or research opportunites to inform Nēnē management at PMRF and ensure a holistic

approach that aligns with regional priorities for Nēnē protection and recovery (PMRF Biological Opinion, 2014).

4.1.4.4 Hawaiian Hoary Bat Management

Hawaiian Hoary Bat / ʻŌpeʻapeʻa

Acoustic surveys to determine seasonal occupancy of Hawaiian Hoary Bats were conducted from June 2010 – June 2011 at Barking Sands, Mākaha Ridge Tracking Station, Kamokala Ridge Magazines, and the Kōkeʻe Sites. These surveys documented year-round use of the installation by Hawaiian Hoary Bats, with the highest occupancy detected from September through February in all regions of PMRF. The frequency of foraging activity, as indicated by observations of feeding buzzes emitted by bats, indicates that the majority of the areas at PMRF are used year-round by foraging bats. The frequency of group activity, as indicated by calls made by more than one bat during a sound segment, indicates the importance of the Barking Sands region during the fall season, which is most likely related to fledging of pups and adult bats flocking in preparation for mating (Bonaccorso and Pinzari 2011). The likely use of the base for breeding and pup rearing indicates its importance to the success of the Hawaiian Hoary Bat. PMRF supports suitable roosting habitat, which consists primarily of woody vegetation greater than 15 ft (4.6 m) tall (SOH DOFAW 2015), and foraging habitat, including either open or densely vegetated habitats, open fields, open-ocean in bays near-shore, and streams and ponds.

The primary threats to the endangered Hawaiian Hoary Bat at PMRF include roosting habitat loss and potential mortality from barbed wire fences and radar transmissions.

Specific Concerns

- Injuries or mortalities of roosting bats due to woody vegetation removal
- Injuries or mortalities of bats due to entanglement in barbed wire fencing
- Negative impacts to bats caused by electro-magnetic frequency radiation from radar transmissions
- The decrease in or suitability of bat foraging habitat due to large-scale vegetation removal, development, or invasive species encroachment.

Current and Historical Management

Woody Vegetation Management

The loss of suitable roosting habitat is considered a primary threat to the recovery of Hawaiian Hoary Bats; therefore, impacts to this species are considered prior to conducting activities that disturb or remove potential roosting habitat. Additionally, all trimming or removal of woody plants greater than 15 ft (5 m) tall is conducted outside of the Hawaiian Hoary Bat pupping season of 1 June to 15 September per the 2014 PMRF Base-wide BO conservation measures.

Barbed Wire Fence Monitoring

In the 2014 PMRF BO, the implementation of an experiment to assess the efficacy of aluminum tags in preventing bat collisions with barbed wire at PMRF was listed as a conservation measure. As part of this implementation and prior to it, the BO stated that all barbed wire fences would be monitored at least once a month for mortalities. Beginning in 2014, surveys were conducted almost monthly by natural resources staff at Barking Sands with no mortalities observed. To decrease the likelihood of missing the observation of an entangled bat due to decomposition or scavenging, a more intensive, standardized monitoring protocol was developed by natural resources staff in 2016. The study incoproated feedback from USGS Hawaiian Hoary Bat biologists and was reviewed and approved by USFWS. The study took place at Barking Sands from September-November 2017 during the height of bat foraging activity in the region and was conducted by natural resources staff. The protocols included a scavenging trial, searcher efficiency trial, and twice weekly barbed wire fencing surveys. Zero mortalities were observed during this study. As a result, the Navy will continue to carry out periodic acoustic monitoring surveys, but does not currently have plans to implement an experiment on the effectiveness of bat deterrents along fencing at PMRF.

Pre-test Surveillance at ARDEL Facility

Electro-magnetic frequency radiation from radar transmissions are another potential threat to this endangered species. Management and operations requirements with respect to bats stem from a USFWS informal section 7 consultation letter (USFWS 2009) regarding ARDEL facility operations. The USFWS requires the area to be surveyed using ANABAT or the facilities closed circuit television cameras prior to operation of radar units at night, and if one or more bats are present in the area of impact, radio frequency emission may not begin until the bat(s) has left of its own accord.

Objective: Reduce impacts to the federally endangered Hawaiian Hoary Bat while providing maximum flexibility for training and operations.

Strategies:

1. Continue to avoid and minimize effects of base infrastructure, operations, and maintenance on Hawaiian Hoary Bats, by ensuring that trimming or removal of woody plants greater than 15 ft (5 m) tall is conducted outside of the Hawaiian Hoary Bat pupping season of 1 June to 15 September to avoid impacting bat pups (PMRF Biological Opinion, 2014).
2. Conduct follow-up acoustic surveys for Hawaiian Hoary Bats every 5 years. If bat roosting and pupping sites are of interest for management of the species, then a mist netting and tracking study could be performed if warranted (PMRF Biological Opinion, 2014).
3. Work with USFWS to develop and implement a standard operating procedure for bat roosting surveys if base operations warrant the need to remove and trim trees greater than 15 ft (5 m) tall during the Hawaiian Hoary Bat pupping season (PMRF Biological Opinion, 2014).

4.1.4.5 Migratory Bird Management

Other than threatened and endangered species, the most active MBTA species management programs undertaken at PMRF are for Laysan Albatross and Wedge-tailed Shearwaters that occur at Barking Sands. These programs are discussed in Sections 4.2.1 and 4.2.2. This section covers all other species

protected under the MBTA including shorebird species, the pueo, Black-crowned Night Heron, and non-native species such as Barn Owl, Cattle Egret, and other non-native songbird species.

PMRF's beaches provide ideal migratory shorebird habitat, especially in restricted access areas where human activity is minimal. Vagrant and winter resident MBTA species have also been observed utilizing PMRF as a stopover including Tundra Swan (*Cygnus columbianus*), Cackling Goose (*Branta hutchinsii*), Glaucous-winged Gull (*Larus glaucescens*), and Mew Gull (*Larus canus*).

The Pueo is commonly observed at Barking Sands and other PMRF sites especially during the winter months, although no confirmed instances of breeding on the base have ever been recorded.

Black-crowned Night Herons are commonly observed at all regularly monitored wetland areas including Kinikini Ditch near the PMRF airfield. The non-native Cattle Egret, Barn Owl, and other non-native songbird species are commonly observed near the airfield area and pose a significant BASH risk. USDA-WS primarily manages these species near the PMRF airfield using lethal and hazing measures to reduce risk.

Specific Concerns

- Presence of MBTA species near the PMRF airfield
- Negative impacts to species resulting from development or habitat fragmentation

Current and Historical Management

All migratory shorebird species, Black-crowned Night-Herons, and Cattle Egrets are recorded at all twice weekly monitored wetland areas on base. The Pueo and Great Frigatebird (*Fregata minor*) are also recorded when incidentally observed as well as during standardized surveys. In addition, all injured MBTA birds native to Hawai‘i are collected for treatment by SOS and natural resources staff record observations of all deceased MBTA bird species, when found, and store the remains in the natural resources freezer until shipment to a research institution for study or eventual disposal.

Due to BASH concerns for the airfield, PMRF holds a USFWS depredation permit, which covers the base for take of a small number of the native Black-crowned Night Heron and active Wedge-tailed Shearwater nests as well as non-native migratory bird species. In 2017, USFWS issued a depredation control order in Hawai‘i for the non-native Cattle Egret and Barn Owl as they are known to predate other species native to Hawai‘i (50 CFR Section 21.55). PMRF is covered for take of these two species under this control order with regards to BASH concerns and active control to reduce predation on native species.

Although natural resources staff does not regularly survey for non-native songbird species, PMRF has participated in the Audubon Christmas Bird Count since December 2017 during which all bird species at Barking Sands are recorded.

Objective: Maintain and protect nesting and foraging habitats of native bird species protected by the MBTA at PMRF when consistent with BASH and other mission constraints and discourage non-native MBTA species presence at PMRF.

Strategies:

1. Continue to incorporate monitoring of shorebirds, Cattle Egrets, and Black-crowned Night Herons at wetland sites. Record opportunistic observations of Barn Owls and Pueo at all other areas of base to inform control measures for non-native species and protective measures for native species.
2. Keep track of non-native songbird species at PMRF and their numbers by participating in the annual Audubon Christmas Bird Count.
3. Continue to advise development projects at PMRF that have potential to negatively impact native MBTA species and their habitat on how to avoid impacts.
4. Advise development projects at PMRF on how to avoid creating habitat and foraging availability for non-native MBTA species at PMRF especially near the PMRF airfield.

4.1.5 Terrestrial Invertebrate and Pollinator Management

General baseline surveys for terrestrial invertebrate species as well as additional surveys for the federally endangered *Drosophila musaphilia* and *Drosophila sharpi* were conducted at Barking Sands and Kōkeʻe Sites in 2021. While all fieldwork is complete identification of the large number of samples collected is on-going. To date, a total of 769 taxa have been found at PMRF with 675 of them identified to species. Of the 675 species identified, a significant number (347) are considered native endemics with numerous rare and undescribed species encountered. The high number of native and endemic terrestrial invertebrate species found at PMRF is noteworthy.

***Bryania bipunctata* (Diptera: Asteiidae), a rare endemic fly mostly known from the Northwest Hawaiian Islands, found at Nohili dune**

At Barking Sands the rare endemic fly *Bryania bipunctata*, previously known only from the Northwestern Hawaiian Islands and Kahoʻolawe was identified. This species was once a candidate for listing under the Endangered Species Act. Other significant finds include the full complement of native coastal midges, and a new invasive stink bug, *Agonoscelis puberula*.

***Doryonychus raptor*, a spider found only in the Halemanu area of Kōkeʻe, with inset showing the unique enlarged claw on each foreleg**

The PMRF Kōkeʻe sites, surrounded by native forest, were noted during the 2021 surveys to have a terrestrial invertebrate community that was overall highly diverse and primarily endemic with previously unrecorded species found in significant numbers. Notable finds include three species of rare false click beetles (*Dromaeolus*), the flightless stag beetle *Apterocyclus honoluluensis*, seven species of *Proterhinus* weevils, a remarkable 26 species of the parasitic wasp genus *Sierola* (all but two undescribed), and numerous specimens of a new species of the enigmatic moth genus *Tulla*, which had been previously known only from a single specimen collected on Oʻahu.

Two species of endangered Hawaiian Picture-wing Fly *Drosophila musaphilia* and *Drosophila sharpi* are known from the Kōkeʻe region. These picture-wing flies are single-island endemics on Kauaʻi and have USFWS-designated critical habitat near the facility's Kōkeʻe sites. During the surveys fermented baits for *Drosophila* were set out at all three PMRF sites. Aside from the common *D. picticornis* there were few *Drosophila* noted. The endangered *D. musaphilia* was however identified at Kōkeʻe Site E; it has previously been identified near Site B in a 2010 survey (DoN 2010). The native Koa tree (*Acacia koa*), which is located in the forested area surrounding the sites, is the host plant for *D. musaphilia.* A number of sap fluxes on Koa trees, the breeding habitat of the endangered *D. musaphilia*, were observed during the surveys especially at Kōkeʻe Site B. When *D. musaphilia* numbers are higher, it is thought that the species may show up at this site. Additionally, high elevation Ōhiʻa found at Kōkeʻe site could support native invertebrate populations.

The federally endangered picture wing fly (*Drosophila musaphilia*) found at Kōkeʻe Site E

Several introduced terrestrial invertebrate species known to occur at PMRF include: Monarch Butterfly (*Danaus plexippus plexippus*), Honeybee (*Apis mellifera*), and Sonoran Carpenter Bee (*Xylocopa sonorina*), among others identified in the PMRF Pest Management Plan.

In accordance with the Presidential Memorandum on pollinators and the MOU between the DoD and the Pollinator Partnership, in the event of available funding, the Navy could make plans for the protection and restoration of domestic populations of pollinators. To date, no native pollinator-specific protection or enhancement programs have been undertaken at PMRF; however, measures that will benefit pollinators include the increased use of native species in landscape plantings and in habitat restoration areas in accordance with other species management strategies and BASH constraints.

Specific Concerns

- Improper use of pesticides
- Native terrestrial invertebrate habitat loss

Current and Historical Management

Pest Management and Pesticide Use

Pest management at PMRF is conducted by a contracted Pest Management Technician. The PMRF Base Operations Support Contract for Pest Mangement describes known pest species present and serves as one of the few documents describing terrestrial invertebrate species present at PMRF. Overuse of pesticides, particularly neonicotinoids, is considered a primary cause of declines in pollinator populations. The neonicotinoid family includes acetamiprid, clothianidin, imidacloprid, nitenpyram, nithiazine, thiacloprid, and thiamethoxam. All pesticides used at PMRF are approved by the EPA, included on the Navy's Authorized Use List, and require approval by a Navy Pest Management Consultant (PMC). Additionally, all pesticides are used in accordance with the instructions on the label and applied by a DoD or state-certified applicator. Currently, pesticides are

reported to the NAVFAC PAC PMC for annual data submission, though use of the Navy's Online Pesticide Reporting site (NOPRs) is recommended.

Honeybees

Honeybees are known to occur at Barking Sands, with multiple swarms generally occuring each year (Currents 2016). In 2015, several bee swarms were captured, via swarm traps, and transferred to hives at the northern and southern ends of Barking Sands. The state apiarist inspected the hives for evidence of Varroa Mite (*Varroa destructor*) and other honeybee threats however found them to be in healthy condition. The hives are currently maintained by the PMRF Pest Management Technician and volunteers.

Objective: Monitor and maintain biodiversity of native terrestrial invertebrate and pollinator populations at PMRF.

Strategies:

1. Conduct species inventory at additional PMRF sites, and conduct monitoring for native invertebrate species. Consider coordinating with USFWS entomologists to identify priority species and provide expertise and training to natural resources staff.
2. Coordinate all use of pesticides by natural resources staff with the NAVFAC PAC PMC and ensure that all applicators have received appropriate certifications.
3. Ensure that treatments will not have negative effects on protected species.
4. Prohibit the use of neonicotinoids at PMRF sites.
5. Ensure that plant communities found to support native terrestrial invertebrate species are protected, enhanced, and that construction or removal projects have minimal effects on these populations.

4.1.6 Data Collection and Database and Records Management

Geographic and observational data are an integral part of natural resources protection and planning. Natural resources observational and geospatial data relating to PMRF is stored in the Natural Resources Program database which is managed by natural resources staff at PMRF and easily accessible by NAVFAC HI managers. PMRF geospatial data are also part of the NAVFAC GeoReadiness Repository maintained by Navy GeoReadiness Installation Geospatial Information and Services Program, which is the geospatial component of the Navy's Internet Naval Facilities Assets Data Store (iNFADS) authoritative database of real property assets. The repository was developed to provide geospatial information relative to the Navy's Real Property Inventory to support functional areas including facilities management, environmental management, antiterrorism/force protection, base development/planning, and regional planning. The GeoReadiness Repository provides a single source of authoritative strategic-level geospatial data for Class I (land) and Class II (facilities) properties. The GeoReadiness Repository also enforces the Spatial Data Standards for Facilities, Infrastructure, and Environment.

Specific Concerns

- Maintaining an up-to-date, easily accessible, and easily shareable database

- Lack of natural resources geospatial data in the NAVFAC GeoReadiness Repository

Current and Historical Management

All contracted and in-house projects implemented by the Natural Resources Program require electronic deliverables for geospatial data as well as detailed observational data. Beginning in 2016, an electronic natural resources database was created and stored in a shared drive which made it easily accessible by Navy personnel. Observational data, reports, records, and documents related to the PMRF Natural Resources Program are stored in this location. Also in 2016, standardized monitoring procedures and data collection standards for all endangered species found at PMRF were developed by natural resources staff and reviewed and approved by federal and state partner organizations. In 2017, standard operating procedures for predator control and monitoring were developed (**Appendix E**). Standardized monitoring and easily shareable observational data are essential for supporting USFWS reporting requirements as described in the 2014 PMRF BO, fostering effective collaboration with state partners, and ensuring that the best management decisions are made for the Natural Resources Program and PMRF as a whole.

Objective 1: Implement measures to ensure that natural resources data is collected in a consistent manner, that data is easily shared with internal and external partners, and streamline data imputing methods with the goal of decreasing errors and increasing efficiency.

Strategies:

1. Ensure that natural resources staff follow established standardized monitoring and surveying procedures.
2. Continue to require GIS deliverables for all contractors, including in-house projects that follow appropriate data collection standards and ensure that all geospatial data is incorporated into the NAVFAC GeoReadiness Repository and that it complies with the Navy Data Model (NDM) adaptation of the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) for GIS database management.
3. Consider acquiring tablets or Trimble units with excel/GIS uploading capabilities that natural resources staff can utilize for data collection in the field.
4. Acquire the ability to upload GPS data directly to government computers.
5. Coordinate data sharing with natural resources partner agencies USFWS, DLNR and NOAA; coordinate common data collection formatting as possible.

4.1.7 Outdoor Recreation

Current and Historical Management

PMRF employees, active duty, reserve and retired military and dependents have recreational access to approximately 2.0 mi (3.2 km) of coastline. Public access to the beaches and water areas along Barking Sands by vehicle from the beach along the seven-mile coastline has existed for decades, however, after the September 11, 2001, terrorist attacks, civilian beach access by vehicle was restricted. The public still accesses the beaches of PMRF from the southern and northern boundaries, however proceeding past the high tide line from the beach and within safety restricted areas without clearance is strictly prohibited and monitored by Security. PMRF currently has an MWR Guest Card Program. Guest cards

are available to U.S. citizens upon completion of a security background check. This program allows card-holding civilians to access PMRF through the main gate, travel unrestricted to Majors/Waiokapua Bay or Shenanigans, use Majors Bay and Shenanigans facilities, and access the recreational beach areas (**Figure 4-1)**. The areas accessible for fishing/surfing/recreation/and socializing extend from Shenanigans (All-Hands Club) to Kawai'ele Ditch (also known as Dry Ditch) (north of beach cottages), Monday through Friday, and into the Special Use Recreation Area (Kawai'ele Ditch [also known as Dry Ditch] to the northern windsock of the runway) on weekends and holidays, except during heightened force protection conditions or range operational periods. Beach use hours are from 5 a.m. to 10 p.m. There is the possibility for the general public to drive onto the north end of the base via the beach as no physical barriers to driving are present, although security efforts are enforced and other deterrents are being examined.

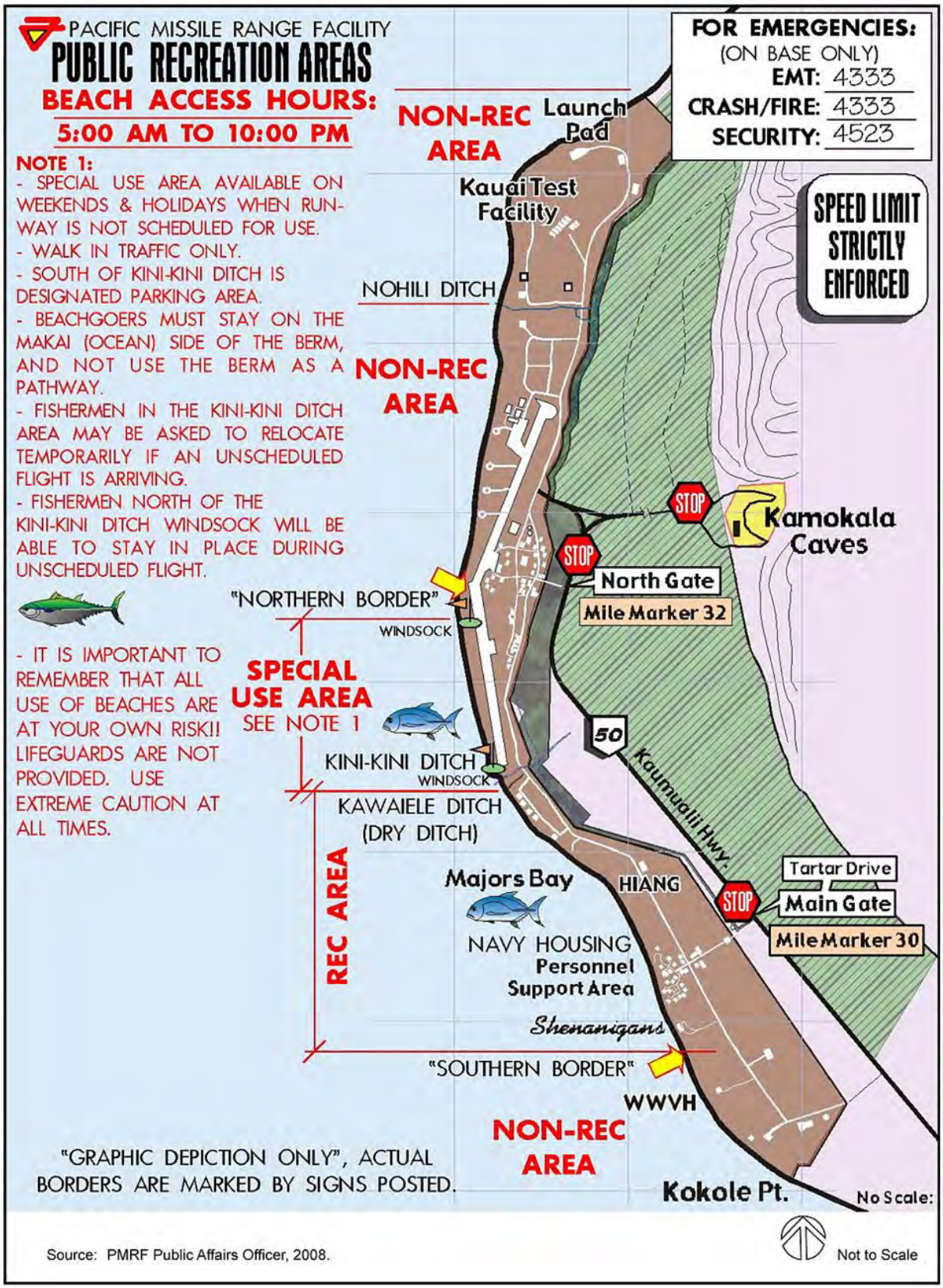


Figure 4-1. Barking Sands Recreational Areas

The Navy also maintains beach cottages adjacent to Majors/Waiokapua Bay, which provide recreational opportunities for visitors to Barking Sands. All PMRF recreational facilities are accessible to disabled persons in accordance with SECNAV Memorandum of 15 Aug 2002.

PMRF Cottages

Natural resources issues associated with the recreational beaches and beach cottages primarily involve human interaction with federally protected and sensitive species. Hawaiian Monk Seals are frequently observed at the recreational and special use beaches, and green turtles are known to occur. Nēnē and Wedge-tailed Shearwater are common in the Beach Cottage area as well.

Specific Concerns

- Public saftey
- Disturbance of sensitive species and sensitive habitats
- Dissturbance of cultural resources

<u>Objective</u>: Provide military personnel, their dependents, and the public, opportunities to participate in outdoor recreation activities that capitalize on natural resources. These activities, however, should be controlled and monitored when they interfere with natural resource management objectives and goals.

<u>Strategies</u>

1. Continue to provide public opportunities for natural resource related outdoor recreation where it does not conflict with public health and safety, the military mission, or security.
2. Ensure that the degree of access allowed for outdoor recreation is consistent with conservation of natural resources.
3. Continue to promote awareness among recreational users of the importance of resource stewardship and promote a sense of pride in the natural environment of PMRF.
4. Provide PMRF Recreation Pass Program applicants with information on pertinent natural resources information as part of the application process.
5. Continue to restore and enhance natural and cultural resource assets at PMRF for public benefit and enjoyment.
6. Develop a Natural Resources Information Center to include brochures and other materials promoting self-guided nature walks and bird watching opportunities both on base and in the surrounding areas. Information on threats to native Hawaiian ecosystems and threatened and endangered species should be included, with particular emphasis on the introduction and spread of alien plant species and the negative effects of off-road vehicles in sensitive environments and measures that can be taken to avoid such impacts.

4.1.8 Natural Resources Awareness, Education, and Training

The Natural Resources Program plays an important role in ensuring PMRF personnel, residents, and visitors are informed of important natural resource issues at PMRF.

Specific Concerns

- PMRF operations planners and facilities maintenance manager awareness of natural resources issues
- PMRF personnel, resident, and visitor awareness of natural resources issues
- Proper natural resources training for security and other appropriate personnel
- Supporting natural resources education for people on and off base

Current and Historical Management

Conducting environmental awareness, outreach, and training activities for PMRF personnel, visitors, and residents serves to raise awareness of Hawai‘i’s unique natural resources and can increase the feeling of responsibility for stewardship of installation natural resources among those at PMRF and in the community. Events such as Earth Day, National Public Lands Day, International Migratory Bird Day, and National Pollinator Week present opportunities to inform base personnel, residents, and visitors of environmental issues of importance at PMRF. Increasing awareness of Hawaiian cultural values and history as integrated into natural resources protection is another important aspect of the PMRF Natural Resources Program.

Natural resources staff is actively involved in ensuring that appropriate PMRF personnel are aware of natural resources related issues by practicing consistent communication, hosting working group meetings, and participating in indoctrination presentations for military personnel. In 2017, standard reporting and response protocols for sea turtles and their nests were developed specifically for security personnel and designed to be kept in security vehicles for quick reference.

Educational activities aimed at increasing awareness of natural resources issues at PMRF also include installing table tents in all PMRF beach cottages with seasonally appropriate info on species utilizing the cottage area and making informational materials for issues that need to be brought to the public’s attention available and visible in frequented areas of base such as the Navy Exchange, Pass and ID Gate Office, Shenanigans, and the beach cottages. The Environmental Program also provides information and updates regarding the popular Dark Skies Program and Laysan Albatross Egg Swap to local news outlets and magazines such as the Navy’s Energy and Environment magazine, *Currents*.

PMRF participation in Adopt-A-Highway program

PMRF also has a deep commitment to community involvement and sponsors and/or participates in many community activities such as the County’s Adopt-A-Highway program, community beautification service projects, and STEM Night and Career Day events at local schools. PMRF also hosts an annual Earth Day by

the Bay celebration in which local school children participate in educational presentations by local environmental organizations and work service projects such as beach cleanups and planting native plants. The base newsletter regularly highlights such activities. Community involvement programs promote the "good neighbor" concept and help the community understand PMRF's commitment to environmental conservation.

Objective 1: Promote natural resources, environmental, and cultural stewardship and awareness by providing all personnel on installation training and education related to the PMRF natural resources program and related protocols, laws, and policies.

Strategies:

1. Continue to present natural resources concerns and activities at quarterly indoctrination presentations.
2. Continue to implement trainings, educational materials, and presentations for security and other appropriate personnel on the proper response to wildlife related observations, and avoidance of driving on coastal strand vegetation and the culturally significant areas of base such as Nohili Dunes.
3. Ensure that standard reporting and response protocols for wildlife related observations are included in all security personnel vehicles.
4. Initiate a bi-annual natural resources newsletter about issues of concern as well as good news stories sent out through email, bulletin board, and social media, in coordination with the PMRF Public Affairs Office.
5. Provide the Public Affairs Office with flyers to send out by email and for posting on bulletin boards around base regarding seasonally appropriate natural resources issues.
6. Include natural resources information in Welcome Aboard packages for incoming Navy personnel.

Objective 2: Provide technical support for events that foster understanding and awareness of the environment through educational conservation programs and increase visitor and resident awareness of the PMRF natural resources program and related protocols, laws, and policies.

1. Coordinate and participate in volunteer events, educational programs, and natural resources related site visits from local schools.
2. Continue to coordinate with MWR to place natural resources related information in beach cottages, implement informational signage, and consider creating a permanent natural resources display near the beach cottages, Majors/Waiokapua Bay, and the MWR visitor check-in building.
3. Continue to work with base personnel on signage and other outreach and enforcement efforts to deter illegal feeding of animals as well as misuse of recreational areas.

4.2 Barking Sands Natural Resources Management

In addition to the base-wide natural resources management program activities described above, the Natural Resources Program has management responsibility for several other resources specific to

Barking Sands. Included are management actions for Laysan Albatross and Wedge-tailed Shearwater, four endangered Hawaiian waterbird species, marine mammals, sea turtles, and other marine resources.

4.2.1 Albatross Management

Because of their large size, tendency to soar along wind currents at high speeds, and attraction to the PMRF airfield due to its coastal orientation and favorable wind conditions, Laysan Albatross and Black-footed Albatross are considered a serious BASH concern for air operations at PMRF. Albatross are present at PMRF during their breeding season from late November to April. Laysan Albatross are the only species of albatross that currently nest at PMRF. The majority of Laysan Albatross nest within the PMRF airfield area but they also nest in areas north of the airfield and at Sandia Laboratories.

Specific Concerns

- BASH concerns
- Understanding of albatross behavior and movement at PMRF
- Predation of albatross by pigs and dogs

Current and Historical Management

Laysan Albatross Capture and Relocation

Laysan Albatross / Mōlī

In response to BASH concerns posed by the presence of Laysan Albatross near the PMRF airfield, a program of capturing and relocating Laysan Albatross and their eggs began in 1988 and is still in effect to this day. During the first few years of implementation, birds captured by USDA-WS were held until the airfield closed then released on PMRF property far from the airfield. In the 1990s, through an agreement with USFWS, PMRF began relocating birds to the Kīlauea Point NWR on the north shore of Kauaʻi. In 2014, translocations to Kīlauea Point NWR ceased and moved to the nearby Na Aina Kai Botanical Garden due to changes in the refuge's management plan. Translocations of albatross captured within all areas of base except the Sandia Laboratories area have occurred every year since the 1990s except for 2016 in which no albatross were translocated due to lack of proper staffing.

Albatross translocations began again in 2017 with natural resources staff taking responsibility for driving albatross to the north shore almost daily and only during the time period in which sub-adults are present at PMRF (January-April). USDA-WS still captures and bands albatross at PMRF with unique leg bands daily to provide positive identification on recaptures. Data recorded by USDA-WS on captured birds include: band number, date, time, location, behavior (breeding, sitting, standing, flying), presence of egg, observer action (observed, chased, captured), and location to which the bird was relocated. After captured albatross are released on the north shore, natural resources staff enter the identification information into a database shared through the Airtable app with various partners on the

island. This allows staff and partner organizations to easily track re-sights of PMRF albatross observed by partners on the north shore and at PMRF.

Mark and recapture data have been used in past years to refine what birds at Barking Sands are targeted for capture and relocation. Data analysis indicates it is less effective and efficient to capture and relocate breeding birds than capturing and relocating non-breeding sub-adult birds. Because of very high nest site fidelity and life-long bonding of breeding pairs, their removal can result in the same bird returning to the removal site multiple times, resulting in multiple captures and relocations. In contrast, capturing and relocating non-breeding sub-adult birds, generally between two and eight years old, is an efficient and effective way to reduce the number of albatross in a nesting colony. Research indicates that once a non-breeding sub-adult is removed from the airfield, there is a lower rate of return.

Albatross Egg Swap

In 2004 the PMRF Albatross Egg Swap Program was implemented in which viable PMRF eggs are placed with foster parents at Kīlauea Point NWR and other private properties. Prior to 2004, all albatross eggs at PMRF were destroyed. The Laysan Albatross surrogate parenting program prevents the fledging of chicks from Barking Sands. Because site fidelity is very strong at the time of fledging, this reduces the potential for chicks that fledge from translocated eggs to attempt to nest at Barking Sands and greatly reduces BASH concerns while still allowing for the conservation of the species.

Between 2004 and 2014, up to 40 eggs were translocated each year. However, beginning in December 2014, Kīlauea Point NWR stopped accepting albatross eggs due to changes in their management plans so the program was broadened to translocate PMRF eggs to various protected private properties on the north shore of Kauaʻi and the James Campbell NWR on Oʻahu where a new nesting colony was being established. Eggs intended for James Campbell NWR were first placed under surrogate albatross at Kaʻena Point to be incubated. 3 weeks after hatching, the chicks were taken to James Campbell NWR to be hand reared until fledging. The effort to establish the new colony on Oʻahu was a joint effort of the Navy, USFWS, and Pacific Rim Conservation, NFWF and many other partners. In 2018, Laysan Albatross eggs were no longer accepted into the James Campbell NWR colony program so that other high priorty species for conservation could be concentrated, however surrogate nests at Kaʻena Point are still used.

The PMRF Albatross Egg Swap Program involves effort from various partners and is coordinated by PMRF Natural Resources. Natural resources staff collect all eggs observed by USDA-WS in their area of operation for incubation in the natural resources office on base. In the Sandia Laboratories area, albatross eggs are left in place until just before the egg swap, when natural resources staff will search for and collect the eggs. In preparation for the egg swap occurring in early December, natural resources staff communicate with Pacific Rim Conservation who are contracted by the Navy to assist PMRF in coordinating with DOFAW, the Kauaʻi Albatross Network and private landowners and assess the fertility of eggs at PMRF and potential surrogate nests on Oʻahu and Kauaʻi. Natural resources staff are available during this time as needed to facilitate journalists requesting to write articles about the egg swap. The staff also assists with egg candling and coordinates the shipment of fertile albatross eggs to Pacific Rim Conservation on Oʻahu as needed and infertile eggs to the National Institute of Standards and Technology (NIST) for research.

In January, the natural resources staff conducts a last sweep of the base for albatross nests not detected by USDA-WS during their daily patrols and host a volunteer "Albatross Egg Hunt" day in which PMRF personnel and other partners are welcome to come assist in the search.

The number of albatross eggs laid at PMRF exhibits annual variability (average 68.7), however there is a downward trend from 2012-2022. The 2022 nesting season had the fewest eggs recorded (50), and 2013 had the most during this period (84).

Surveys and Monitoring

In 2017, during the Laysan Albatross breeding season (November – April), natural resources staff conducted surveys at Sandia Laboratories and the airfield tower to compare albatross behaviors and presence as management of the species and habitat is drastically different in the two areas. Results from those surveys were included in the Research Corporation of the University of Hawai'i, *PMRF FY17 Second Quarter Report* (Herring and Johnson 2017) and will be used to inform further research studies and management decisions.

Predator Control

Laysan Albatross mortalities caused by dogs (likely lost hunting dogs) and pigs is another management concern at Barking Sands, particularly in the Sandia area. Increased efforts to decrease these occurrences, as described in **Section 4.1.3** are expected to reduce these attacks.

Objective: Minimize impacts to Laysan Albatross while providing maximum flexibility for testing and training at PMRF and supporting regional Laysan Albatross conservation measures.

Strategies:

1. Continue the PMRF Laysan Albatross Egg Swap program.
2. Work with partners to ensure that as many albatross eggs as possible stay on Kaua'i and find new suitable egg relocation locations.
3. Continue to translocate albatross to the north shore of Kaua'i from January-April.
4. Coordinate with DOFAW on potential new albatross release sites.
5. Closely monitor re-sights of translocated albatross by working with partners on the north shore of Kaua'i to enter data into the Airtable app database.
6. Use data analysis to assess the effectiveness of albatross translocations based on location of translocation, time of year, and whether or not the albatross is a known breeder, sub-adult, or new bird to PMRF.
7. Support research on PMRF albatross populations that increases the understanding of their behavior as it relates to the PMRF airfield.
8. Continue base-wide predator control to protect MBTA-listed species including Laysan albatross; monitor for pigs, dogs, and cats in known breeding areas prior to the albatross breeding season and increase control efforts as needed.

4.2.2 Wedge-tailed Shearwater Management

Wedge-tailed Shearwaters are present along most of the coastline at PMRF during their breeding season (March-November). Primary breeding colonies are located at the Barking Sands beach cottages,

Kinikini Ditch, Nohili Dunes. Wedge-tailed Shearwaters also burrow in various isolated locations along the coastline adjacent to the airfield and near the Nohili Ditch outfall.

Specific Concerns

- Negative human interactions (e.g., burrows crushed by foot and vehicle traffic, complaints about noises and smells coming from colony)
- Habitat degradation
- BASH concerns

Current and Historical Management

Habitat Enhancement

Currently, a six-foot (1.8-meter) wood slat fence encloses a portion of the beach cottages colony on three sides to protect the birds from human disturbance. Habitat enhancement in this area, including the removal of non-native vegetation and planting a variety of native trees, shrubs, and ground covers, was conducted from 2006 to 2008. In addition, NAVFAC PAC Natural Resources staff installed artificial burrows in the cleared areas. Signs alerting the public to the presence of the colonies, the on-going restoration efforts, and restricted access to the colonies, were installed. Additional invasive plant control was conducted in 2010 and 2017 which focused on removal of Long-thorn Kiawe. By 2020 regrowth was once again intruding on colony areas and hand control reinitiated.

Wedge-tailed Shearwaters in the Kinikini Ditch and airfield area have been identified by PMRF Air Operations as a threat to night operations on the airfield, therefore enhancement of these colonies is not in the best interest of the birds or air operations.

Wedge-tailed Shearwater Protective Measures

The beach cottages Wedge-tailed Shearwater colony has received mixed feelings from cottage visitors over the years. Some visitors report enjoying watching and listening to the seabirds' nighttime calls, while others have filed complaints with MWR over the sounds and smells that emanate from the colony (R. Herring, personal communication, 2018). The presence of Wedge-tailed Shearwater burrows in the immediate vicinity of the visitor beach cottages also poses a safety risk to both the birds and people as visitors and maintenance personnel can potentially collapse the burrows and crush eggs, chicks, or adults inside. Foot traffic in sensitive areas is restricted by the use of rope fencing, signage, and wooden burrow covers to protect birds and people alike.

Wedge-tailed Shearwater in artificial burrow at Barking Sands

Discouraging Wedge-tailed Shearwaters from digging burrows in the immediate vicinity of the beach cottages is an ongoing effort at Barking Sands as this can threaten the structural integrity of the cottages, sidewalks, and other infrastructure. Habitat management, including watering the grasses to create a dense mat of vegetation and filling of unoccupied burrows has been conducted. However,

more effective measures such as installing permeable plastic pavers or concrete around the cottages should be assessed as more long-term solutions as the other measures conflict with Nēnē management strategies and are time intensive and their effectiveness has yet to be determined. Numerous predation events characteristic of cat and owl kills have been observed at the beach cottages colony therefore predator control efforts focus on this area during the breeding season.

Monitoring

In 2006, a baseline population survey of the Wedge-tailed Shearwater colony at the beach cottages was conducted to determine the geographic range, occupancy, and nesting success of the colony (Hebshi 2007). In 2007 and 2008, population monitoring using protocols recommended in the 2006 survey report and habitat assessments were conducted to assess population trends and the effectiveness of the habitat enhancements (NAVFAC PAC 2008, 2009). The data from these surveys indicate that the occupied area and number of Wedge-tailed Shearwater breeding pairs increased by 160 in 2008 compared to 2007 (NAVFAC PAC 2008 and 2009). This could be in part due to increased predator control in the area and habitat enhancement or simply due to year to year fluctuations in the numbers of birds breeding and food availability.

In 2012, KESRP biologists conducted Wedge-tailed Shearwater research in three areas of major occupancy at PMRF (Raine 2012). KESRP deployed song meters that recorded calls emanating from the colony and also counted the number of burrows in the direct vicinity of each song meter to measure colony density. The goal of the research was to test the viability of using song meters as a tool for estimating the colony size of shearwaters which is especially useful when determining the size of remote endangered seabird colonies.

In 2017 a full-scale population survey of the Wedge-tailed Shearwater population was conducted. Natural resource staff counted burrows in the beach cottages and Kinikini Ditch areas in which total numbers of unoccupied and occupied burrows were recorded. A total of 1070 burrows were identified, 340 of which were confirmed to be actively occupied. Although data from the 2006-2008 surveys and the 2017 survey is not directly comparable as monitoring protocols were likely different in 2017, it appears that the Wedge-tailed Shearwater population utilizing the beach cottages area has increased substantially over the last decade and has spread out into the surrounding areas.

In 2021 an intensive, base wide breeding census was performed. NR staff identified previously unknown colony locations and surveyed areas not included in previous years including the Nohili Dunes colony and several smaller colonies sporadically locaed along the PMRF beach line. The results of this survey estimate a base wide population of between 3101 and 4134 adult WTSH and a productivity output of up to 1366 chicks for the 2021 breeding year.

<u>Objective 1</u>: Manage, protect, and enhance Wedge-tailed Shearwater nesting colonies to ensure stable populations at appropriate nesting colonies on base while supporting maximum flexibility for testing and training at PMRF.

<u>Strategies</u>:

1. Enhance Wedge-tailed Shearwater habitat in areas far from the PMRF airfield and human presence and develop deterrent measures for burrows in areas of human traffic and near the airfield.

2. Research and work with facilities and MWR to implement methods for discouraging Wedge-tailed Shearwater burrowing in the immediate vicinity of the PMRF Beach Cottages.
3. Continue to implement protective measures that prevent the crushing of burrows in the beach cottages area (e.g., signage, temporary rope fencing, wooden burrow tents, outreach materials in cottages).

Objective 2: Improve understanding of Wedge-tailed Shearwater population dynamics at Barking Sands to guide future adaptive management decisions and support regional conservation of shearwater species.

Strategies:

1. Conduct annual Wedge-tailed Shearwater population surveys in the Kinikini Ditch, beach cottages, and Nohili Dune areas.
2. Work with partners to collect additional data that supports adaptive management on PMRF and regional conservation objectives for shearwater species.

4.2.3 Wetland and Waterbird Management

Endangered waterbirds including Hawaiian Gallinule, Hawaiian Coot, Hawaiian Duck, and Hawaiian Stilt utilize wetland areas adjacent to PMRF including the Kawai‘ele Waterbird Sanctuary and Mānā Plains Forest Reserve, as well as the Mānā Plain ditch system and ditches and ephemeral wetlands bordering PMRF property. On Barking Sands, they are generally limited to the PMRF oxidation pond complex, ditches, and beaches. Avian botulism breakouts have occurred at the PMRF oxidation pond complex and are of special concern for Hawaiian Coots and Hawaiian Ducks.

Hawaiian Stilt / Ae‘o

All species of endangered Hawaiian waterbirds, except Hawaiian Stilts, have been recorded nesting at PMRF. Successful nesting of Hawaiian Coots at PMRF has been documented annually since 2012 when one Hawaiian Coot nest was observed in the PMRF oxidation pond with two chicks successfully fledging. By 2021, there were six coot nests observed in the oxidation pond complex. Due to the risk of avian botulism at the site, strategic vegetation removal is essential for discouraging nesting at the site for protected species per USFWS recommendations. Hawaiian Gallinules, in addition to Hawaiian Coots, have been observed nesting in Kinikini Ditch. Measures must be taken to avoid negative impacts to these species and their nests in these areas.

A substantial number of very young Hawaiian ducklings have been observed at the oxidation pond complex over the past several years. Although no Hawaiian Duck nests have ever been observed at the oxidation pond complex, it is likely that Hawaiian Ducks do breed on PMRF property. Protective measures must be taken at the oxidation pond complex to avoid negative impacts to the species and their nests.

Specific Concerns

- Avian botulism
- Nest site protection
- Mortalities or injuries due to vehicle strikes
- Mortalities or injuries due to vegetation removal
- Habitat degradation
- BASH concerns
- Exposure to pollutants carried through PMRF in the three ditches, especially Kinikini.

Current and Historical Management

Surveys and Monitoring

Natural resources staff monitor all four waterbird species at all water holding areas on base and immediately bordering PMRF property at least twice weekly. Per conservation measures outlined in the 2014 PMRF BO issued by USFWS, all waterbird nests, mortalities, and injuries are reported to USFWS within 24 hours of observation. Appropriate PMRF contacts are notified of nest locations on base if an area is likely to be impacted by human activity. Signs and fencing are used if necessary to alert people to the presence of nests.

Hawaiian Coot are seen regularly, with average annual survey observations varying between 9.5 and 19.7. Hawaiian Stilt detections are more variable (average: 3.7-15.5). Hawaiian Duck and Hawaiian Gallinule are regularly seen in low numbers (4.3-5.9 and 1.1-2.6 birds per survey, respectively).

Avian Botulism

In the state of Hawai‘i, avian botulism epidemics are major catastrophic events that set back endangered waterbird recovery significantly. The most prevalent disease affecting Hawaiian waterbirds is avian botulism type C. Avian botulism is caused by a neurotoxin produced by a common bacterium (*Clostridium botulinum*). Normally dormant and not harmful, these spores release toxins only when certain conditions occur, including warm temperatures, high pH, low dissolved oxygen, and stagnant waters. Birds usually acquire the disease by eating invertebrates containing the toxin which can potentially lead to the death of the bird. Invertebrates such as maggots feeding on a deceased bird’s body can contain a concentrated amount of botulism toxin which is why removal of deceased birds from the affected areas as soon as possible is essential in stopping the spread of the disease. A significant botulism outbreak was experienced throughout Hawai‘i in 2012, which resulted in the loss of an estimated 400 – 500 birds (Pacific Joint Venture 2012).

An avian botulism outbreak occurred in the winter of 2014/2015 at Barking Sands, resulting in the loss of at least 22 birds including 20 Hawaiian Ducks and 2 Hawaiian Coots. Two additional Hawaiian Ducks were captured and rehabilitated by the SOS veterinarians and released. Since then, smaller outbreaks have occurred in the summer as well as winter but have been relatively under control due to increased monitoring efforts. When birds potentially affected by avian botulism are observed, natural resources staff follow the Botulism Response SOP developed by USFWS (**Appendix E**). The Natural

Resources Program also has avian botulism anti-toxin shots provided by SOS on-hand for emergency use in case of an avian botulism outbreak at the oxidation pond complex.

PMRF natural resources staff also work closely with Facilities Maintenance on natural resources issues at the oxidation pond complex. If an outbreak is observed or the amount of influent to the pond is abnormally low, natural resources staff will work with Facilities Maintenance to mitigate favorable avian botulism conditions by flushing it with fresh water. Any future dredging or design changes to the ponds will be coordinated through the PMRF Natural Resources Program to ensure that negative impacts to the protected species utilizing the pond are prevented.

Habitat Management

The PMRF oxidation pond at Barking Sands provides shallow water and abundant food resources that have been observed to support a substantial resident population of Hawaiian Coots year-round and Hawaiian Ducks and Hawaiian Stilts in the winter months. Other bird species such as migrant ducks and shorebirds also benefit from the pond as a migration stop-over. Since the 2014 avian botulism outbreak, vegetation at the complex has been kept at a minimum as nesting allows to aid in the location and removal of sick and deceased birds and to reduce the attractiveness of the area as a nesting site. The 2014 PMRF BO outlined conservation measures to manage the site for the benefit of waterbirds. After the outbreak in 2014, USFWS recommended that presence be discouraged at the site via vegetation maintenance.

The ditch system that runs through Barking Sands transports water from the agricultural fields and has the potential to carry pollutants harmful to waterbird species that spend much of their time in or foraging around the ditches. The components of this runoff may vary seasonally or with rainfall, making it difficult to identify exposure risk to waterbirds at PMRF, and to adaptively respond.

Vehicle Collisions

Waterbirds are struck and killed by vehicles at Barking Sands annually. Waterbird crossing caution signs have been installed along roadways where waterbirds are frequently observed to reduce potential for vehicle strikes.

Objective 1: Decrease negative interactions between Hawaiian waterbirds and PMRF operations by managing wetlands and waterbirds appropriately in order to minimize risks to waterbird and human safety.

Strategies:

1. Continue to coordinate closely with Facilities Maintenance regarding restrictions on vegetation removal practices within a 100-ft (30.5 m) radius of waterbirds or their nests.
2. Discourage waterbird presence and nesting at the oxidation pond complex by maintaining vegetation at a height of less than 6 inches and by funding the installation of exclusionary measures.
3. Continue to coordinate with Facilities Maintenance to obtain environmental data on the oxidation pond regularly to better inform causes of avian botulism outbreaks and identify high risk conditions that require management actions.

4. Coordinate with Public Works to develop oxidation pond flushing protocols in response to avian botulism outbreaks or high-risk conditions.
5. Coordinate with Facilities Maintenance on all oxidation pond complex construction and restoration plans.
6. Supplement ongoing water quality testing to detect particulates and soluble chemicals in waters at PMRF. Testing should be conducted at least quarterly.
7. Replace and improve waterbird crossing signage at PMRF as needed to reduce risk of vehicle strikes (PMRF Biological Opinion, 2014), evaluate efficacy of signs, and explore new tools to reduce vehicle strikes.

Objective 2: Improve understanding of Hawaiian waterbird population dynamics at Barking Sands to guide future adaptive management decisions.

Strategies:

1. Continue to conduct regular monitoring for Hawaiian waterbird species at Barking Sands to effectively detect and reduce impacts to nests (PMRF Biological Opinion, 2014).
2. Consider implementing a waterbird banding/telemetry program to track movement, monitor nest-site fidelity, and inform management on the base.

4.2.4 Marine Mammal and Sea Turtle Management

4.2.4.1 Hawaiian Monk Seal Management

Hawaiian Monk Seals have been documented utilizing the beaches of Barking Sands to "haul-out" or rest year-round. Beaches near the Kinikini Ditch outfall and Diver's Landing, just north of the PMRF airfield and ordnance, are popular resting beaches for the species and are both restricted access areas not frequented by humans. Seals also occasionally haul out at the publicly accessible Waiokapua (Major's) Bay beach area; signs are placed out to alert and educate the public to maintain adequate distance from the seal to avoid disturbance. One Hawaiian Monk Seal pupping event was documented in 1999, however no Hawaiian Monk Seals have been born at Barking Sands since.

Specific Concerns

- Harassment of hauled out Monk Seals
- Disturbance of Monk Seals due to military training and testing exercises
- Vehicle strikes
- Tracking individual movements
- Negative fisheries interactions
- Entanglement in or ingestion of marine debris
- Disease (i.e., toxoplasmosis transmitted by feral cat feces entering ocean)

Current and Historical Management

The majority of Barking Sands beaches are patrolled daily by security personnel and all Hawaiian Monk Seal sightings are reported to natural resources staff. Additionally, natural resources staff regularly monitor areas where security does not routinely patrol for monk seal activity. All observations of Hawaiian Monk Seals at PMRF are documented and reported to the NOAA Fisheries Hawaiian Monk Seal Hotline. SOPs developed by PMRF Natural Resources in cooperation with federal partners are followed regarding all monk seal sightings, injuries, or entanglements (**Appendix E**).

Hawaiian Monk Seal / ʻĪlio-holo-i-ka-uaua

To limit disturbance of hauled-out monk seals, security personnel erect signs around hauled-out seals in areas frequented by people to create a 150 ft. (46 m) buffer area that instructs people to stay back. Mitigation measures regarding marine mammal protection are also implemented during missile launches and beach training exercises at PMRF (DON 2008a) to ensure no endangered or threatened species are in the affected area when activities occur; beach areas are surveyed and activites moved or held until any seals present leave of their own accord.

PMRF hosts and participates in marine debris cleanups at the facility and in the surrounding community. Attendees are educated on the risks that debris poses to marine life such as ingestion and entanglement. Large nets observed washed up onshore are also removed and disposed of by natural resources staff.

The U.S. Navy funds bi-annual surveys of monk seal populations, which are performed by NOAA and DAR biologists with assistance from PMRF environmental and natural resources personnel. PMRF also supports regional conservation of the species by sharing sighting data with NOAA and DAR and working with NOAA to assist in the effective management of the species. In 2017, PMRF natural resources staff coordinated with NOAA to assist with the relocation of a young monk seal from a dangerous harbor on the east side of Kauaʻi to Waiokapua (Major's) Bay at PMRF.

Feral cat control at PMRF contributes to improving the water quality of the surrounding nearshore environment by reducing the amount of cat feces and therefore risk of toxoplasmosis to marine mammals utilizing the area. Between November 2016 and June 2019 two hundered and forty-nine feral cats were removed from PMRF sites with the majority coming from Barking Sands.

Objective 1: Maintain and enhance populations of Hawaiian Monk Seals to the greatest extent practicable.

Strategies:

1. Continue to ensure that Security reports sightings of monk seals during daily patrols at PMRF beaches and erects signage and barricades if observed where people frequent.

2. Continue to report observations of hauled-out Hawaiian Monk Seals to NOAA as soon as possible and provide high quality photos to assess seal health, ID, and aid in population abundance monitoring.
3. Collaborate with NOAA to implement Hawaiian Monk Seal recovery objectives when feasible.
4. Continue base-wide predator control to remove feral cats and collaborate with partners on studies regarding toxoplasmosis at PMRF to inform these efforts; conduct outreach about the disease and its effects on wildlife and human health.

Objective 2: Improve understanding of population dynamics to guide future adaptive management decisions and reduce probability of critical habitat designation within PMRF utilized areas.

Strategies:

1. Conduct regular surveys approximately five times per week of beaches near the Nohili Ditch outfall and Diver's Landing for monk seal presence, and all other beaches approximately twice per week.
2. Continue to conduct surveys through partnership with NOAA Fisheries for Hawaiian Monk Seals on Niʻihau.

4.2.4.2 Sea Turtle Management

Hawaiian Green Sea Turtles are known to routinely utilize PMRF's coastal waters for foraging and beaches for basking. Although no observations of Hawksbill Sea Turtle (*Eretmochelys imbricata*) activity have been recorded, there is a possibility for the species to nest at PMRF or forage in its nearshore waters. Hawaiian Green Sea Turtles are commonly observed basking on the beach and in the waters at the Nohili Ditch outfall or what is commonly referred to as the Turtle Cove area, which has a natural limestone ledge on the oceanside, rising several feet above the beach. Green Sea Turtles have also been observed basking on the beach in front of Shenanigans Restaurant. Sightings of sea turtles have been recorded during daily patrols by USDA-WS, Security, and natural resources staff since 2006. Green Sea Turtles have been documented nesting at Barking Sands relatively frequently in recent years with a total of ten confirmed nests laid between 2015 and 2021. Nests have been observed on the southern coast of Barking Sands, the beach near the southern end of the airfield and the Nohili Dunes area.

During nearshore surveys (Dollar and Brock 2007), numerous Green Sea Turtles were recorded at the surface and underwater resting off of Nohili Point, near the Nohili Ditch oufall, and directly offshore of this area four resting turtles were observed during underwater surveys. Preffered forage for Green Sea Turtles occurs along the limestone bench at Turtle Cove and abundant Limu Kohu (*Asparagopsis taxiformis*) was noted offshore. Marine nearshore surveys will be repeated in 2022 (Miller et al. 2022) and nearshore observations of sea turtles, seagrass and potential resting habitat will be reported.

Specific Concerns

- Damage to sea turtle nests by vehicles driving on beach (e.g. compaction of sand, crushing of eggs/hatchlings)
- Destruction or damage to sea turtle nests caused by the public

- Harassment of basking sea turtles
- Stranding or entanglement in marine debris or fishing gear
- Beachfront lighting

Current and Historical Management

Surveys and Monitoring

Since 2006, monitoring and reporting of sea turtle activity to federal and state partners has occurred at PMRF. All sea turtle sightings and potential sea turtle nests are documented during daily beach patrols by Security and reported to natural resources staff. If a sea turtle is observed basking in an area where people may frequent, signs and barricades are erected instructing people to stay back at least 100' (30m) during the day and 150' (46m) at night. Natural resources staff respond to all sightings to ensure the turtle is healthy and record observational data on the sighting. Observational data on basking sea turtles is reported to federal and state partners annually.

Green Sea Turtles / Honu at Nohili Ditch Outfall

During sea turtle nesting season, natural resources staff conduct one to two surveys weekly of beaches where sea turtles have the potential to nest. These surveys are conducted in accordance with the PMRF Sea Turtle Nesting Season SOP developed by PMRF natural resources staff and reviewed and approved by federal partners (**Appendix E**). All observed turtle pits are reported to USFWS, DLNR DAR, and NMFS within 24 hours and signs with ropes are set up to protect the nest from vehicles. A nighttime survey of the nest area for lights visible from the beach is conducted to ensure that turtles will not be attracted to the land upon hatching. Once the nest is observed to have hatched, natural resources staff coordinate with a DLNR DAR biologist who is authorized to excavate nests to check for any remaining unhatched eggs or hatchling turtles and determine hatching success.

<u>Objective 1</u>: Maintain, enhance, and improve understanding of sea turtle populations at Barking Sands.

<u>Strategies:</u>

1. Continue to ensure daily patrols of PMRF's beaches for sea turtles to collect observational data and check for stranded, injured, or entangled turtles are conducted by partnering with Security.
2. Conduct surveys by biologists approximately five times per week of beaches near the Nohili Ditch outfall and Diver's Landing for sea turtle presence, and ensure that marine surveys in nearshore areas quantify sea turtles and potential foraging or resting habitat.
3. Continue to survey beaches for sea turtle nesting activity during the nesting season, protect all nests observed with ropes and signage, mitigate light attraction issues on beaches, and coordinate with DAR to excavate nests.

4. Continue to encourage good communication between Security and natural resources regarding sea turtle activity on PMRF beaches to reduce negative impacts to the species from Security beach patrol vehicles.
5. Develop and use USFWS-approved outreach, educational materials, and signage with the objective to educate and provide information to residents, recreational users, visitors, and staff about proper procedures and acceptable activities within sea turtle habitat and how to act when coming in contact with sea turtles.
6. Continue to implement surveys to ensure no sea turtles are in affected areas during training exercises or in-water work.

4.2.4.3 Whale and Dolphin Management

All marine mammals known to occur in the waters adjacent to Barking Sands are protected by the ESA and/or the MMPA. At least 16 species of whales and dolphins have been observed in the waters off Barking Sands (Baird et al. 2019, Baird et al 2022, Baird et al. 2021a, Baird et al. 2021b, DoN 2014b, Uyeyama et al. 2011, Richie et al. 2012) (see **Tables 3-3** and **3-4**).

Specific Concerns

- Stranding
- Entanglement in or ingestion of marine debris
- Military training and testing exercises
- Disease (i.e., toxoplasmosis transmitted by feral cat feces entering ocean)

Current and Historical Management

Surveys and Monitoring

The waters off Barking Sands have been monitored through studies developed in cooperation with NMFS under the Pacific Fleet's Hawai'i Range Complex Monitoring Plan and the Navy's Integrated Comprehensive Monitoring Program since 2009. Observations of whales and dolphins during other, routine surveys of interest are recorded and entered into the PMRF natural resources database conducted by natural resources staff.

PMRF has also participated in the NOAA Ocean Count by hosting a survey site on the last Saturday of January, February, and March most years since 2002, in order to provide locations and frequencies of marine mammal sightings in the waters off Barking Sands. PMRF has facilitated NOAA volunteer access to the base and will continue to do so.

Stranding Reporting

There is a potential for beached and/or dead whales and other marine mammals to be found along the installation's shoreline. Any such finding is reported to NMFS, NAVFAC PAC and CPF immediately. NMFS requests the Navy provide a description of animal (s), the condition of the animal (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). Natural resources staff is available to assist with response efforts.

<u>Objective</u>: Protect and monitor populations of whales and dolphins, in waters adjacent to Barking Sands.

Strategies:

1. Continue to report all observations of marine mammal strandings or deaths to NMFS and assist in response efforts.
2. Improve coordination and communication regarding marine mammal strandings and other observations of note with NAVFAC PAC and CPF.
3. Implement and collaborate with partners on studies regarding toxoplasmosis at PMRF to inform predator control efforts and conduct outreach about the disease and its effects on wildlife and human health.
4. PMRF will coordinate with the Agribusiness Development Corporation (ADC) to ensure compliance with the Clean Water Act and other environmental regulatory requirements where there is a nexus with federal monies or property.

4.2.5 Marine Nearshore Management

PMRF employees, active duty, reserve and retired military and dependents have recreational access to approximately 2.0 mi (3.2 km) of coastline. Historically, the public also had access to the beaches and water areas along the Barking Sands shoreline, however, after the September 11, 2001 terrorist attacks civilian beach access became more restricted. A gradual lifting of restrictions occurred after 2005, and as of 2015, the public had access to all beach areas not indicated as restricted (CNIC 2015).

The Navy limits shore fishing at Barking Sands to the Recreation Area and the Special Use Area (see **Figure 4-1**). Fishing restrictions allow only for pole, throw net, and spear fishing. Fishing and beach access restrictions are enforced by installation security details, which patrol the beach.

As EFH is known to occur along the Barking Sands and Kaʻula Island shorelines, the Navy must provide a written assessment to NMFS for any activity that may adversely affect EFH. This notification will facilitate discussion of measures to conserve EFH so that NMFS can provide recommendations to minimize, offset, or mitigate impacts.

Specific Concerns

- Recreational fishing
- Operations and construction in nearshore waters
- Erosion as a result of sea-level rise

Current and Historical Management

The PMRF Natural Resources Program has conducted periodic surveys of the marine nearshore environment to assess species diversity, abundance, and demographic structure along the Barking Sands shoreline (Dollar and Brock 2000, Dollar and Brock 2007), and a further study is underway in 2022 (Miller et al. 2022).

To avoid impacting coral reefs in the coastal and nearshore environment, the Navy conducts environmental reviews of any action likely to affect U.S. coral reef ecosystems in accordance with NEPA and DoD policy.

Future nearshore surveys will be conducted to reassess the composition and extent of coral and other marine organisms and inform future management decisions.

Objective: Employ a systematic approach to managing coastal and nearshore resources, using a process that includes inventory, monitoring, modeling, management, assessment, and evaluation.

Strategies:

1. Establish a monitoring program for the nearshore environment of PMRF to inform future management decisions and monitor changes overtime.
2. Partner with DLNR DAR to incorporate regular monitoring site(s) in PMRF's nearshore waters into the state's regular monitoring schedule, as feasible.

4.2.6 Ni'ihau Panicgrass (*Panicum niihauense)* Critical Habitat Management

Much of PMRF's coastal strand habitat supports unoccupied USFWS designated critical habitat for Ni'ihau Panicgrass or Lau'ehu (*Panicum niihauense*) (see **Figure 3.6**). Threats to these areas are primarily invasive plant infestation and unauthorized off-road vehicle use.

Specific Concerns

- Unauthorized off-road vehicle use
- Coastal strand habitat restoration to remove invasive plants
- Monitoring for potential Ni'ihau panicgrass populations

Current and Historical Management

Surveys and Monitoring

The Navy conducted vegetation surveys of the base, including the two unoccupied Ni'ihau Panicgrass critical habitat areas in 2000 (Char 2000a) and in 2006 (NAVFAC PAC 2006b) to assess and monitor site conditions. The 2006 survey covered all of Nohili dunes, except where Long-thorn Kiawe forest was impassible on the eastern, inland portion of the dunes. In 2014 and 2019, follow-up surveys for Ni'ihau panicgrass were conducted with no individuals observed across the critical habitat at PMRF (NAVFAC PAC 2016a, RCUH 2019).

Access Restriction on Beaches and Dunes

Driving has been prohibited on the beach since late 2001, except by base security personnel. This significant decrease in vehicle traffic has allowed the native dune vegetation such as Pohuehue, Pōhinahina and Pa'u O Hi'iaka (*Jacquemontia ovalifolia*) to flourish and expand. Many plants become re-established in previously disturbed areas. This rebound in vegetation is positive as it encourages healthier native dune vegetation, ultimately resulting in reduced erosion. The NRC Program encourages security personnel to avoid driving over existing vegetation, allowing the vegetation to continue to recover.

Objective: Provide conservation benefit to Ni'ihau panicgrass designated critical habitat area under Section 202(a)(3) of the Sikes Act.

Strategies:

1. Work to improve protection, habitat and/or consider outplanting Ni'ihau panicgrass. Protections will be aimed at preventing unauthorized off-road vehicle use, and invasive plant removal and to demonstrate benefit to the species.

2. Out-plant native species and remove invasive species in areas with suitable Niʻihau panicgrass habitat and ensure an irrigation system is in place until plants become well established.
3. Consider undergoing the approval process to out-plant the endangered *Panicum niihauense* in the effort to remove or reduce amount of PMRF property designated as critical habitat for the species. Coordinate with Federal and State partners to secure material for outplanting if pursued.

4.3 Mākaha Ridge Tracking Station Natural Resource Management

In addition to the base-wide natural resources management issues such as erosion control, ungulate fencing, native plant enhancements, predator control, and management of protected species, as discussed in Section 4.1, the PMRF Natural Resources Program has management responsibility for two federally listed plant species that are known to occur at the Mākaha Ridge Tracking Station. Management of Dwarf Iliau and Hawaiʻi Scaleseed are addressed in this section.

4.3.1 Dwarf Iliau, Hawaiʻi Scaleseed, and Other Listed Plant Species

Substantial populations of Dwarf Iliau and Hawaiʻi Scaleseed were noted on the cliff sides of the Mākaha Ridge Tracking Station in 2006 and 2019 (see **Figure 3-12**). These individuals are primarily located outside of the Navy leased area; only Dwarf Iliau were noted inside the installation, with 128 individuals and an addition 3,507 outside the boundary. Threats to the survival of these species are habitat degradation and competition with non-native plants. Habitat degradation for these species is largely caused by erosion resulting from excessive Feral Goat, Pig, and Deer grazing and browsing. An additional threat to these rare native species is the reduced reproductive vigor as the result of limited numbers of existing individuals (Wood 2006).

Specific Concerns

- Disturbance and browsing from feral animals
- Population monitoring

Current and Historical Management

In 2000 and 2006, botanical surveys identified the locations and abundance of the federally listed endangered plants Dwarf Iliau and Hawaiʻi Scaleseed (Char 2000b, Wood 2006). Populations of both species were found on the steep slopes dropping away from the Mākaha Ridge. In 2006, 11 colonies of Dwarf Iliau were located on and around the Mākaha Ridge Tracking Station with 214 individuals observed. Follow-up surveys using unmanned aerial vehicle technology were conducted in 2019 during which 3,635 Dwarf Iliau individuals, within 21 colonies, were detected (Nyberg 2019). During the 2019 survey, other rare plant species never before recorded at Mākaha Ridge were detected. Included were the two additional endangered species Māʻoliʻoli (*Schiedea apokremnos*) and Niʻihau Lobelia (*Lobelia niihauensis*); one threatened species, Makou (*Peucedanum sandwicense*), and two at risk species, Hawaiian Red Hibiscus or Kokiʻo ʻUlaʻula (*Hibiscus kokio* subsp *saintjohnianus*) and Hawaiian Caper or Maiapilo (*Capparis sandwichiana*).

To reduce potential impacts to these species, the Navy has completed a feral ungulate exclusion fence around the facility, begun ungulate removal efforts, and is pursuing landscaping and re-vegetation.

Objective 1: Assess current populations of dwarf iliau, Hawai‘i scaleseed, mā‘oli‘oli, Ni‘ihau lobelia, and makou to monitor population health.

Strategies:

1. Implement erosion control efforts that directly benefit areas where protected species are present.
2. Conduct a reassessment of the status and condition of listed plant species on the cliffsides of Mākaha Ridge Tracking Station populations every five years and collaborate with partners to grant them access for further research and conservation efforts.

4.4 Kōke‘e Sites Natural Resource Management

In addition to the general base-wide natural resources discussed in Section 4.1, the PMRF Natural Resources Program has management responsibility for two federally listed insect species that are known to occur at or near the Kōke‘e sites, which is addressed in this section.

4.4.1 Hawaiian Picture-wing Fly

In 2006, critical habitat was designated by USFWS for 11 endangered Hawaiian picture-wing fly species in the vicinity of the PMRF Kōke‘e sites, albeit not on PMRF leased property. *Drosophila musaphilia* is the only known endangered Hawaiian picture-wing fly species detected in the immediate vicinity of the Kōke‘e sites. Native trees at the site include Koa (*Acacia koa*), which is a host plant for the larval stage of *D. musaphila*, as well as ‘Olapa (*Cheirodendron trigynum*), and ‘Ohe‘ohe (*Tetraplasandra kavaiensis*), which are suspected host species for the Hawaiian picture-wing flies. Threats include feral ungulates, wildfire, yellowjacket wasps, and ants (USFWS 2008).

Specific Concerns

- Hawaiian picture-wing fly host plant availability

Current and Historical Management

A 2010 survey, conducted by expert entomologists, captured two *D. musaphilia* specimens within 30 ft (10 m) of Kōke‘e Site B (DoN 2010). Further surveys should be considered to further assess presence of endangered Hawaiian picture-wing fly species and inform management decisions.

Current base operations and maintenance activities at the Kōke‘e sites are low-impact and do not occur in the forested areas surrounding the sites and are therefore not likely to severely impact the federally listed Hawaiian picture-wing fly species (NAVFAC PAC 2014). Regular vegetation maintenance does occur at all PMRF Kōke‘e sites within the leased boundary. Mowers and other landscaping equipment can carry seeds and other propagules, which can encourage invasive plant species ingress into adjacent habitat. Additionally, removal of native trees and vegetation necessary to support operations has the potential to impact breeding habitat for listed Hawaiian picture-wing flies.

Management actions that would provide conservation benefit to the federally listed Hawaiian picture-wing flies include improving habitat by maintaining the availability of Koa and other potential host trees that occur on site and removing invasive species from the surrounding forested areas. A native

plant restoration project is underway in the area to encourage Koa recruitment and increase suitable habitat.

Objective 1: Provide conservation benefits to federally endangered Hawaiian picture-wing flies and inform management decisions.

Strategies:

1. Conduct surveys every five years to assess presence/absence of endangered Hawaiian picture-wing fly species at and directly adjacent to PMRF Kōkeʻe sites.
2. Conduct invasive plant removals annually in areas near known Hawaiian picture-wing fly habitat to promote native tree health and propagation and reduce introductions of invasive species into adjacent habitat due to Navy operations.

4.5 Kamokala Ridge Magazines Natural Resources Management

Due to the lack of protected species present at Kamokala Ridge, little natural resource management occurs at the site. Nuisance wildlife and predators at the Kamokala Ridge Magazine area include deer, Feral Cats, Pigs, and Goats and could be targeted for control in the future if funding allows. Only one special status species, Hawaiian Hoary Bat, has been identified in the Kamokala Ridge Magazines, as discussed in Section 4.1.

Specific Concerns

- Nuisance animals

Current and Historical Management

Bird and mammal surveys conducted at the Kamokala Ridge Magazine area have identififed only two native bird species, the Hawaiian Black-crowned Night-heron and Pacific Golden Plover. The Hawaiian Hoary Bat is the only native mammal noted. An abundance of non-native species including Black-tailed Deer, Pigs, and Feral Cats have also been observed (Bruner 2000, NAVFAC PAC 2006a, NAVFAC PAC 2006c). The Kamokala Ridge site is only partially fenced allowing continuous access by nuisance animals. Organized hunts have been conducted at Kamokala Ridge for Feral Goat control, but were considered ineffective, largely because of the site's dense vegetation, which creates poor hunting conditions.

Objective: Ensure sustainable use of Navy infrastructure at Kamokala Ridge.

Strategies:

1. Work with the PMRF Archery Club to control ungulate populations at the Kamokala Ridge site by implementing trapping and baiting stations if the animals become a nuisance to Navy operations or pose a risk to protected species.
2. Conduct observations to identify feral cat use at Kamokala Ridge and consider expanding cat trapping if use is consistent or becomes a nuisance.

4.6 Port Allen Natural Resource Management

Because of the limited land area and natural resources present at Port Allen, natural resources management actions are limited to measures focused on minimizing potential impacts to federally protected nocturnal seabirds.

Newell's Shearwaters have been known to fall out in the Port Allen vicinity, but to-date, none are known to have fallen out because of attraction or disorientation to lighting on the Navy-leased property (NAVFAC PAC 2014). To minimize potential impacts to these species, the Navy limits night activities during fledgling season (mid-September through mid-December) and particularly during new moon phases.

Specific Concerns

- Lighting

Current and Hsitorical Management

Exterior lighting is required at the pier at Port Allen for AT/FP purposes and to minimize nighttime trip and fall hazards near the water. Eleven lights are mounted under the roof overhang on the north side of the building, and one light is mounted on the front (east) side of the building. The light on the front of the pier building is owned and operated by the Navy and is a full cutoff fixture. The eleven lights along the northern side of the building are operated by Navy, but the light fixtures are State property. These lights are turned on each night for security camera lighting and safety purposes. Six higher-intensity lights are turned on only when personnel are working on docked boats during nights in which fueling or upload/offload of equipment occurs. The Navy does not have the authority to replace these state-owned lights with full cutoff fixtures (NAVFAC PAC 2014).

Objective: Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species at the Navy leased portion of Port Allen while providing maximum flexibility for training and operations.

Strategies:

1. Coordinate with facilities owner and USFWS to address lighting issues and continue to implement the Dark Skies program to the extent possible at the facility.
2. Train staff to recognize, respond and report to any circling or downed seabirds seen at the facility.

4.7 Ka‘ula Island Natural Resource Management

As Ka‘ula Island is uninhabited, the primary potential threat to special status species including marine mammals, sea turtles, endangered seabirds, and migratory birds, and marine life is from military training and testing exercises. The Navy implements strict training SOPs and in support of Hawaiian Monk Seal and seabird conservation.

Specific Concerns

- Military training and testing exercises

- Predation of native bird species by barn owls

Current and Historical Management

Training/Operational Activities SOPs

Fleet Area Control and Surveillance Facility (FACSFAC), which controls air operations into Kaʻula's danger zone, checks all sorties flown to Kaʻula and issues authorization to proceed after the sortie is informed of the prohibition on dropping or firing practice munitions in the presence of marine mammals or sea turtles. Before commencing any exercises, a preliminary survey pass is flown to ensure the lack of marine mammals, sea turtles, or vessels near the island. If marine species are detected in the target area, the operation is delayed or aborted. In addition, using non-explosive rounds and limiting the firing to the southern tip of the island reduces the impact of training activities to sensitive species and marine life on the rest of the island.

Monitoring Programs

Kaʻula Island is used for inert ordnance delivery and aircraft gunnery as discussed in the Hawaii-Southern California Training and Testing (HSTT) Environmental Impact Statement (EIS). Prior to 1998, eleven land-based avian surveys were conducted on the island, but due to BASH and UXO concerns those did not continue. Boat based seabird surveys were conducted from 2009–2012 in support of US Pacific Fleet's Coastal Zone Management Act (CZMA) consultation with the State of Hawaiʻi on the HSTT EIS. Opportunistic marine mammal monitoring surveys were also conducted during that timeframe under Pacific Fleet's marine species monitoring program. Boat surveys were replaced by aerial digital surveys starting in 2013 with the goal of achieving better counts of seabirds sitting on the top of the island and Kaʻula-focused marine mammal surveys were discontinued. Survey reports are provided to the State of Hawaiʻi's Office of Planning and the frequency of the surveys may be modified through the Pacific Fleet's CZMA consultation process. Although the target species are seabirds, Hawaiian Monk Seals are regularly observed and are reported to NMFS, Pacific Islands Fisheries Science Center. Additionally, historically, Navy Region Hawaii will coordinate with the Commanding Officer and FASFAC to approve access to the water around Kaʻula Island on a not-to-interfere basis so that NMFS can conduct additional surveys from their vessels.

Objective 1: Maintain and enhance populations of special status species on Kaʻula Island.

Strategies:

1. Continue implementing all military training SOPS.

Objective 2: Improve understanding of special status species population dynamics to guide future adaptive management decisions.

Strategies:

1. Conduct aerial seabird surveys of Kaʻula Island as needed for management planning to inform species presence, location and numbers.
2. Seek authorization to conduct land-based updates to floral and faunal surveys on Kaʻula Island.
3. Partner with DOFAW and other partners to coordinate Barn Owl and other predator control efforts on Kaʻula Island if access is allowed.

4.8 Mauna Kapu Site Natural Resource Management

Natural resources management actions at the Mauna Kapu Facility are limited in scope because of the limited land area and lack of natural resources on site. However, as the facility lies adjacent the Honouliuli and Nānākuli Forest Reserves, which support several state and federally listed bird, snail, and plant species, management actions at the Mauna Kapu Facility have potential to impact listed species and must be assessed through the NEPA process.

Specific Concerns

- Protection of state and federally listed species

Current and Historical Management

Other than landscape maintenance, no natural resources management has been conducted at the leased Mauna Kapu Facility to date.

Objective: Assess the occurrence of wildlife populations utilizing the facility to better understand and manage for all wildlife species.

Strategies:

1. Conduct base-line flora and fauna surveys.

4.9 Niʻihau Natural Resource Management

Natural resources management actions on Niʻihau Island are limited in scope because of restrictions set out in the Navy's land use agreements with the landowners. Management activities that are conducted are limited to avoiding take and mitigating impacts to threatened and endangered species and species protected under the MMPA and MBTA.

Specific Concerns

- Disturbance of monk seals due to military training and testing exercises and activities
- Disturbance to endangered waterbirds due to military training and testing exercises and activities
- Disturbance to endangered seabirds due to military training and testing exercises and activities

Current and Historical Management

The Navy has supported and participated in a series of aerial, boat, and ground-based surveys along the Niʻihau coast since 2009 in support of training excersises conducted in the Hawaiʻi Range Complex. Surveys are conducted in relation to U.S. Navy training events to monitor for any potential strandings of marine mammals or sea turtles (Ampela et al. 2015, Mobley et al. 2017) in accordance with a 2008 NMFS biological opinion (NMFS 2008). The Navy has also funded a study of Hawaiian Monk Seal use and behavior in the Hawaiʻi Range Complex that included the Niʻihau coast (Ampela et al. 2015).

In 2011, the NMFS proposed to expand critical habitat areas for Hawaiian Monk Seals which included a terrestrial and marine designation on and around Niʻihau Island. As a result of this

proposal, the Navy developed an addendum to the 2010 PMRF INRMP to include monitoring for Hawaiian Monk Seals on Niʻihau Island to avoid the critical habitat designation. By funding these surveys, the Navy was able to eliminate the terrestrial environment on Niʻihau from being included in the expansion of critical habitat (NMFS 2015), which reduces potential restrictions on Navy operations. Hawaiian Monk Seal surveys on Niʻihau Island funded by the Navy are also conducted by the NOAA Fisheries Hawaiian Monk Seal Research Program and Niʻihau personnel and have involved Navy personnel participation over the years (Lopez et al. 2014). Surveys are conducted both on land and by helicopter on Niʻihau twice per year. A census-type survey in which all individual seals encountered in the survey area are recorded. Size, sex, and any identifying information are collected. These surveys indicate that a relatively large number of seals use the island for hauling out and rearing pups. Three monk seal surveys were conducted by Navy personnel in 2021, with assistance from DLNR-DAR staff. Surveys were conducted in January (54 seals), September (89 seals) and October (73 seals). There were a minimum of 20 pups born at Niʻihau in 2021.

Objective: Monitor protected species utlilizing Niʻihau to help inform operations and management of wildlife and provide conservation benefits to the species and its habitat under Section 202(a)(3) of the Sikes Act.

Strategies:

1. Continue to conduct surveys through partnership with NOAA Fisheries for Hawaiian Monk Seals on Niʻihau.
2. If proposed Navy operations have the potential to impact sea turtles or habitat, conduct surveys for listed sea turtles and nesting activity on Niʻihau to understand habitat use and trends.
3. If proposed Navy operations have the potential to impact waterbirds at Niʻihau, conduct surveys to understand habitat use and trends.

5.0 INRMP INTEGRATION AND IMPLEMENTATION

The successful implementation of an INRMP and DoD guidelines requires support of natural resources personnel, other installation staff, command personnel, and the installation tenants. The following section discusses INRMP integration with other Navy and regional planning efforts, implementation and review.

5.1 Integration with Other Installation Plans

In accordance with DoDI 4715.03 DoD must integrate mission requirements and priorities identified in the INRMP in other environmental programs and policies, where applicable, to help ensure these natural resources are maintained in the best ecological condition possible to fully support current and future mission requirements.

PMRF has several plans that specifically address land use on the installation and must be considered in the development of project prescriptions for fulfilling natural resources management objectives. The land use goals and objectives of these plans, as they relate to natural resources issues, have been incorporated and referenced throughout this INRMP.

5.1.1 Navy Region Hawai‘i Regional Integration Plan

In an effort to reduce redundant land uses and streamline master planning, all of Navy Region Hawai‘i has been combined into a single Navy Region Hawai‘i Regional Integration Plan (Commander Navy Region Hawai‘i 2012). Planned and recommended projects and renovations are identified in this plan, which must be assessed for impacts to natural resources as identified in this INRMP.

5.1.2 Integrated Cultural Resources Management Plan

The PMRF ICRMP (DoN 2012) is intended to provide procedural guidance for identifying, evaluating, and managing historic properties located at the base. The ICRMP is a management resource tool to achieve compliance with Sections 106 and 110 of the National Historic Preservation Act (NHPA) of 1966, as amended, and other federal preservation laws. The NHPA charges federal agencies to identify and evaluate historic and archaeological resources under their stewardship and to nominate eligible properties to the NRHP. In addition, the Act calls for federal agencies to consider the effects of planned activities on NRHP-listed or eligible properties. Cultural resources are those resources that represent a culture or society, either past or present, and may include landscapes, structures, traditional cultural properties, and/or archaeological sites. Historic properties are those cultural resources determined eligible for listing in the NRHP.

5.1.3 Environmental Restoration Program

PMRF recognizes that adverse impacts to natural resources addressed in this INRMP may result from the release of hazardous substances, pollutants, and contaminants into the environment or from the actual restoration of contaminated sites. The Navy Environmental Restoration (ER) program is responsible for identifying Comprehensive Environmental Response, Compensation, and Liability Act

(CERCLA) releases, Resource Conservation and Recovery Act (RCRA) releases, and releases under related provisions and reporting such releases to the EPA and SOH Department of Health.

When appropriate, the IEPD will help the ER program Remedial Project Manager (RPM) identify potential impacts to natural resources caused by the release of these contaminants. Also, when appropriate, the IEPD will make recommendations to the ER program RPM regarding cleanup strategies and site restoration. During initial monitoring protocols, the NRM may suggest sampling and testing be accomplished so as to not impact sensitive or critical areas. Also during site restoration, the IEPD has the opportunity to recommend site restoration practices that are outlined within this INRMP.

5.2 Relationship to Regional Conservation Planning Efforts

PMRF Barking Sands and several of its secondary facilities support federally and regionally significant natural resources and as such, are integral components to a variety of regional and conservation efforts. Therefore, in addition to coordinating natural resources management with other installation and range planning documents, this INRMP must consider natural resources conservation matters of national or regional significance. Regional conservation planning efforts relevant to the natural resources present on PMRF are summarized in the following subsections.

5.2.1 State Wildlife Action Plan

In 2005, the Department of Land and Natural Resources took the lead in developing a Comprehensive Wildlife Conservation Strategy (CWCS) to address the conservation needs of native fauna and flora across all islands, elevations, and habitat in the SOH (SOH DLNR 2005). The CWCS was developed through the assistance and participation of numerous organizations and interested citizens in part, to identify and generate an all-taxa list of species of greatest conservation need (SOH DLNR 2005). The list includes indigenous species of concern, over 10,000 of which are endemic to the State, federal candidate species, and species that are federally listed as threatened or endangered and are protected under the ESA.

In 2015, the CWCS was updated and renamed the State Wildlife Action Plan (SWAP) and a final edition became effective in October 2015 (SOH DLNR 2015). State-wide conservation needs, marine conservation needs, threats to specific species and communities, and island-specific conservation strategies are outlined in the SWAP. Seven primary statewide conservation objectives identified are:

- Maintain, protect, manage, and restore native species and habitats in sufficient quantity and quality to allow native species to thrive;
- Combat invasive species through a three-tiered approach combining prevention and interdiction, early detection and rapid response, and ongoing control or eradication;
- Develop and implement programs to obtain, manage, and disseminate information needed to guide conservation management and recovery programs;
- Strengthen existing and create new partnerships and cooperative efforts;
- Expand and strengthen outreach and education to improve understanding of our native wildlife resources among the people of Hawai‘i;

- Support policy changes aimed at improving and protecting native species and habitats; and
- Enhance funding opportunities to implement needed conservation actions.

Management recommendations in this INRMP are consistent with and support conservation strategies identified in the SWAP to the greatest extent practicable.

5.2.2 Hawaiian Bird Conservation Action Plan

The Hawaiian Bird Conservation Action Plan (VanderWerf 2012) identifies research needs, primary threats, and conservation goals for Hawaiian birds that are in critical need of conservation and the Hawaiian Hoary Bat. PMRF conservation measures are consistent with and support the plans conservation recommendations for:

- Endangered seabirds (Hawaiian Petrel, Newell's Shearwater, Band-rumped Storm-petrel)
- Nēnē
- Hawaiian Waterbirds (Hawaiian Coot, Hawaiian Duck, Hawaiian Stilt, Hawaiian Gallinule)
- Laysan Albatross
- Hawaiian Hoary Bat
- Scarlet Honeycreeper

Specific PMRF activities identified in the Hawaiian Bird Conservation Action Plan includes the Navy's participation in establishing a breeding colony of Laysan Albatrosses at James Campbell National Wildlife Refuge (NWR), Oʻahu, by translocating chicks hatched from excess eggs removed from PMRF as part of a BASH reduction program. Predator control at PMRF is also identified in the plan.

5.2.3 Regional Biosecurity Plan for Micronesia and Hawaiʻi

Invasive species pose a constant and costly threat to Pacific islands' native ecosystems, ecosystem functions, biodiversity, watersheds, economies, public health, cultures, and the quality of life of residents and visitors (U.S. Navy 2015). In response to this threat, the Regional Biosecurity Plan for Micronesia and Hawaiʻi (RBP) was developed by the University of Guam and the Secretariat of the Pacific Community with funding from the U.S. Navy and in full consultation with RBP Jurisdictions. The purpose of the regional biosecurity plan is to act as a tool to help enhance the coordination of current management efforts, identify remaining problem areas and gaps, and recommend additional actions that are needed to effectively address invasive non-native species issues within jurisdictions as well as regionally.

Recommendations specific to DoD entities that are applicable to PMRF and should be considered for implementation include, but are not limited to:

- INRMPs should depict invasive non-native species monitoring and surveillance, detection, rapid response actions for all taxa to ensure biosecurity efforts are planned and funding is requested.
- The military should have at least one invasive species biologist, in addition to a supporting pest control shop or equivalent contract team at each DoD facility working in conjunction with local authorities to monitor for pests, to conduct biosecurity inspections, to respond to incursions,

and to implement management efforts as needed. Improvements to existing systems, communications, and partnerships with local civilian agencies should continue to be advanced.

- The military should include biosecurity requirements and provisions in contracts to reduce the risk of introduction of animal and plant pests and diseases.
- Military aircraft and other military vehicles arriving as maritime cargo should be inspected, cleaned, and washed down at a retrograde wash facility before entry. Wash down procedures for military vehicles should target soil, plants, insects, and other wildlife. Tracked vehicles can be cleaned on shore only if they can be reloaded without recontamination of the treads; otherwise they should be cleaned on the ship's well-deck. They should be cleaned to USDA-APHIS standards (USDA-APHIS-PPQ Treatment Manual 2008) prior to shipment from the port of departure. Vehicles may be cleaned at the port of entry provided wastewater soil is collected and drained fully into an approved collection system.
- The military should establish appropriate decontamination sites for cleaning both military and civilian equipment associated with military activities.
- The military should enhance training for military personnel and their dependents about phytosanitary and general sanitary regulations and the risks of sending or receiving agricultural and wildlife materials in the mail.
- New plantings should be locally sourced, non-invasive, and preferably native species, with a minimum of 50 percent native species planted for an individual project. Existing plant species, which are either known to be invasive or at least thought to have invasive potential, should be removed or managed.

5.2.4 Kawai‘ele Bird Sanctuary

The Kawai‘ele Bird Sanctuary is located on the west side of Kaua‘i, Hawai‘i, just south of PMRF Barking Sands. The sanctuary is part of an overall effort to restore wetland habitat at the Mānā Plain, which once contained expansive wetland habitats. Prior to its drainage and conversion to agricultural lands during the early 1900s, approximately 1,700 acres ([ac]; 688 hectares [ha]) of permanent, semi-permanent, and seasonal wetlands were present on the Mānā Plain. The 36-ac (14.5-ha) sanctuary supports wetland habitat that was created in the 1990s by mining sand down to the ground water level. The Kawai‘ele site is an important feeding and nesting area for endemic and endangered waterbird species and is home to all four of Hawai‘i's endangered endemic waterbirds: the Hawaiian Stilt, Hawaiian Gallinule, Hawaiian Coot, and Hawaiian Duck. Smaller numbers of Nēnē are also known to visit and nest in the sanctuary (SOH DOFAW 2014). During the winter months, migratory birds frequent the sanctuary. In addition, many native species of plants can be found within Kawai‘ele (SOH DAR 2009).

5.2.5 Mānā Plain Forest Reserve Wetland Restoration

The Mānā Plain Wetland Restoration Project will involve 105 ac (42.5 ha) immediately north of the Kawai‘ele Waterbird Sanctuary. This project, expected to be completed in 2022, will further help restore a portion of these historic wetlands, by nearly doubling the area's wetland habitat. The restored wetlands would help to re-establish native Hawaiian plants, once common to the area, and provide an opportunity for the public to experience the endangered Hawaiian birds in their traditional habitat

(SOH DOFAW 2014). The wetland enhancement boundary is planned to lie approximately 2,000 ft (610 meters [m]) from the PMRF runway. During the NEPA process, DOFAW acknowledged and understood the Navy's concern that a breeding population of Nēnē in the vicinity of the PMRF runway poses a risk to the safe operation of an aircraft. To address this concern, the wetland restoration plan for the Mānā Plain Wetland Restoration Project was designed to provide habitat for obligate wetland species (Hawaiian Gallinule, Hawaiian Coot, Hawaiian Stilt, and Hawaiian Duck) rather than for Nēnē (SOH DOFAW 2014). Hawaiian waterbird species, which frequent the sanctuary, pose a lower BASH risk because of their restricted habitat use and sedentary terrestrial habits. Nēnē, which are considered high risk BASH threat, are currently abundant throughout the agricultural fields of the Mānā Plain and on base, and are not anticipated to increase due to the implementation of the proposed project (SOH DOFAW 2014).

5.3 Integrating Natural Resources and Mission Sustainability

5.3.1 Natural Resources Support of the Military Mission

A primary goal of natural resources management at PMRF is to preserve and sustain conditions that are compatible with the military mission. The Sikes Act states that an INRMP shall provide for "no net loss" in the capability of military installation lands to support the military mission of the installation. Therefore, mission requirements and considerations have been integrated into this INRMP and the capability to support the mission is a natural resources priority. This INRMP provides management recommendations for natural resource actions that protect federally protected species, prevent designation of additional critical habitat, reduce soil erosion, protect and restore land and waterways from invasive non-native species infestation, and promote the protection and enhancement of wetlands and floodplains. These and other natural resources management activities help achieve no net loss of the PMRF mission.

5.3.2 Sustainability Challenges

5.3.2.1 Encroachment

Per OPNAVINST 11010.40, Encroachment Management Program, encroachment is "any non-Navy or Navy action planned or executed in the vicinity of a naval activity or operational area which inhibits, curtails, or possesses the potential to impede the performance of the mission of the naval activity." An installation Encroachment Action Plan (EAP) finalized in 2014 (DoN) identified a number of encroachment issues at PMRF. The highest priority issues were identified as:

- Urban development adjacent to the base,
- Restrictive use easements,
- Lease renewal issues.

The Navy Region Hawai‘i Regional Integration Plan (Commander Navy Region Hawai‘i 2012) and the EAP recommend that the Navy proactively pursue continued real estate agreements for adjacent lands to provide buffers for mission activities and minimize encroachment issues and communicate

Navy buffer requirements to Mānā Plain landowners, the Kekaha Agriculture Association, and tenants to ensure continued PMRF training and RDT&E operations.

Encroachment issues with the greatest relevance to natural resources management are:

- Competition for air, land, and sea space,
- Threatened and endangered species and critical habitat,
- Interpretation of historical and environmental regulations, and
- Maritime issues.

Strategies for resolving the natural resource-related encroachment issues primarily include implementing the INRMP; maintaining a good working relationship with federal, state and other agencies; and informing the public and regulatory agencies of Navy efforts regarding protected species, marine mammals and their habitats.

Lease Agreements

As part of their encroachment management program, the Navy has entered into an API with the SOH and Kauaʻi County to permanently preserve approximately 5,000 ac (2,023 ha) of land in the Mānā Plain for agricultural purposes (**Figure 5-1**). The API, which is in effect until 2029, ensures that the Navy can continue to safely conduct important research and training operations at Barking Sands in the future. Portions of the lands are encumbered by exclusive use and non-exclusive restrictive use easements. The API's common infrastructure is managed by the Kekaha Agriculture Association (DoN 2014a).

The Navy also leases an approximately 200-ac (81-ha) strip of land along Barking Sands' eastern border in the area of the U.S. Highway 50. The lease of this narrow strip of land allows the Navy to repair and maintain the drainage pumps that help to minimize flooding onto PMRF property and roadways during periods of heavy rainfall. In addition, the lease of this land is required because federal law forbids using public funds to maintain infrastructure on land that is not owned or leased by the federal government. In addition, the leased area supports Antiterrorism/Force Protection (AT/FP) setback requirements. Leasing this small area provides a buffer for PMRF allowing new construction within a larger area of the original installation boundary.

Figure 5-1. Agricultural Preservation Initiative Leased Lands

Restrictive Use Agreements

Missile flight safety procedures require that the public and nonessential mission personnel be excluded from hazardous areas to protect them in the unlikely event of an early flight termination. The U.S. Government is required by DoD policy to be able to exclude nonparticipants from hazardous areas. The off-base portion of the respective missile ground hazard areas is located adjacent to Barking Sands within a restrictive easement that was acquired from the SOH by the U.S. Government. PMRF holds this restrictive easement on 2,110 ac (854 ha) of land for safety purposes. The restrictive easement allows PMRF to clear the area up to 30 times per year.

Cooperative Agreement for Federally Listed Seabird Conservation

In 2002, the U.S Government implemented the Readiness and Environmental Protection Integration (REPI) program under USC 2684a. This program provides a process for agreements to be developed with eligible entities such as State, local, and private partners that ultimately aims to limit constraints on military training, testing, and operations and encroachments on mission success. In 2018, a REPI proposal submitted by CNRH, PMRF, and NAVFAC HI with the goal of addressing anticipated endangered seabird conservation encroachment issues at PMRF was validated and identified as a priority project for the Navy. REPI funding has been transferred to the National Fish and Wildlife Foundation for undertaking the management of conservation actions in areas off-site of PMRF for the conservation benefit of the Newell's Shearwater, Band-rumped Storm-petrel, and Hawaiian Petrel with implementation likely to occur in late 2019.

5.3.2.2 Climate Change

DoD recognizes climate change will play a significant role in its ability to fulfill its mission and undermine the capacity of our military installations to support training activities. As climate change

will affect both built and natural infrastructure, which will impact readiness and environmental stewardship responsibilities at installations across the nation, the DoD must employ creative ways to address the impact of climate change. In response to this need, DoD has developed a guide, *Climate Adaptation for DoD Natural Resource Managers,* to help installation managers address climate change considerations in INRMP (Stein et al. 2019).).

Potential climate change impacts to the DoD mission and operations are identified as various forms of extreme weather such as heat waves, drought, increasing wildland fire, excessive precipitation, flooding, storm surges, increases in storm frequency and intensity, and rises in sea levels and associated storm surge (Stein et al. 2019). However, more comprehensive and region or base-specific vulnerability assessments are needed to determine what adaptive responses are the most appropriate at individual bases. Climate change vulnerability assessments are a means of preparing for and coping with the effects of climate change (Glick et al. 2011). A vulnerability assessment is a key element in identifying which species or systems are likely to be the most strongly affected by projected changes in climate and provides a framework for understanding why particular species or systems are likely to be vulnerable, often depending on factors such as exposure, sensitivity, and adaptive capacity (Stein et al. 2019). This assessment allows for informed conservation planning by identifying climate-related threats and resulting stresses that become part of the decision-making process undertaken to identify and prioritize conservation strategies. Projecting future conditions and assessing the vulnerability of target natural resources are critical steps in assessing climate vulnerabilities and developing strategies to reduce climate risks (Stein et al. 2019).

Current research shows that in the Hawai‘ian Islands, air temperatures have risen rapidly in the past thirty years, rainfall and stream flow have steadily declined, and rainfall during the heaviest downpours has intensified (Codiga and Wager 2014). Sea levels in Hawai‘i are rising because of climate change and Hawai‘i is expected to experience sea-level rise of 1 ft (30.5 centimeter [cm]) by 2050 and 3 ft (91.4 cm) by the end of the century (Codiga and Wager 2014).

In the coastal area of Kaua‘i where Barking Sands is located, the key impacts associated with sea level rise will be coastal flooding and wave inundation, erosion, and inland flooding (Codiga and Wager 2014). The extensive shoreline at several of the PMRF facilities will also be susceptible to tsunami inundation (Commander Navy Region Hawai‘i 2012). **Figure 5-2** illustrates scenarios in which sea level rises by 1 and 3-foot (30.5 and 91.4-cm) intervals at PMRF Barking Sands. Although little land loss or threats to infrastructure at PMRF are expected, other impacts from inland flooding, saltwater intrusion, and some loss of sea birds and sea turtles nesting sites will be experienced. Drainage issues from increases in inundation of adjacent wetlands are expected. Access into Barking Sands may be restricted at times if Mānā Plain and the roads leading to the base are flooded.

Climate change is identified as an issue of concern for several natural resource management elements as well a specific threat to a number of the threatened and endangered species known to occur on or in the vicinity of PMRF that are addressed in this INRMP. Multiple projects and actions identified in **Appendix D** are focused on mitigating climate risk to these resources and the base’s military mission.

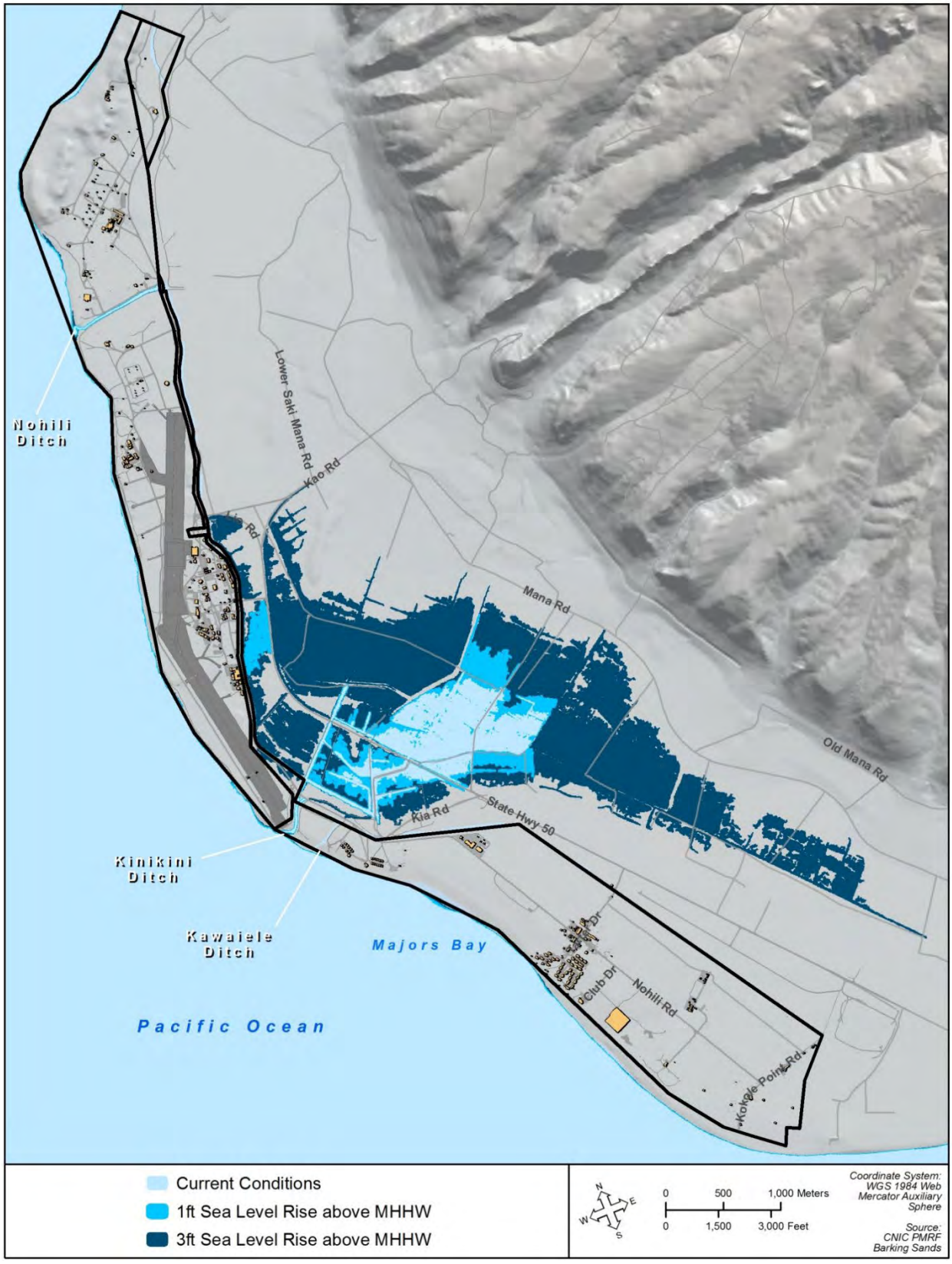
5.3.2.3 Energy Security

DoD's Energy Policy Directive, Department of Defense Directive (DoDD) 4180.01 of April 2014, which is aimed at improving DoD's energy security through increasing efficiency and diversifying energy resources will result in a major reduction in the use of fossil fuels and thereby reduce greenhouse gas emissions to help mitigate the effects of climate change greatly. The DoN's energy policy specifically requires the Navy to use all measures to minimize energy consumption, reduce energy expenditures, and utilize alternative energy resources and environmentally sustainable technologies where it is reasonable, affordable, and practical to do so (SECNAVINST 4101.3). In order to improve energy security, increase energy independence, and help lead the nation towards a clean energy economy, the DoN established energy goals that will move the Navy and Marine Corps away from a reliance on petroleum and will dramatically increase its use of alternative energy. In accordance with the Office of the Secretary of the Navy (2019), a number of goals were set and are being met:

- Energy Efficient Acquisition: DoN has issued policy guidance concerning the use of energy-related factors in acquisition planning, technology development, and source selections for platforms and weapons systems.
- Sail the "Great Green Fleet": DoN demonstrated alternative fuel blends on all ships and aircraft that participated in the 2012 Rim of the Pacific (RIMPAC) exercise. Ship and air systems operating with alternative fuel blends performed at full capability during the exercise.
- Reduce Non-Tactical Petroleum Use: DoN has significantly grown its fleet of alternative fuels-capable vehicles, is expanding its use of telematics to improve fleet performance and is working to deploy zero-emissions vehicles.
- Increase Alternative Energy Ashore: By 2020, DoN will produce at least 50 percent of shore-based energy requirements from alternative sources; 50 percent of DoN installations will be net-zero.
- Increase Alternative Energy Use DoN-Wide: The DoN has demonstrated certain alternative fuels to be effective drop-in replacements for conventional fossil fuels and qualified them to compete to supply fuel to the DoN through the Defense Logistics Agency Energy.

Preliminary site assessments being conducted for viability of regional Navy installations to be Net Zero, which means the amount of energy produced is equivalent to that which is utilized, indicate the potential for PMRF to become a Net Zero energy installation. At PMRF the two main initiatives are the Landfill Gas project and photovoltaic arrays. The Landfill Gas project will capture combustible gases from the adjacent County Kekaha Landfill and use them as fuel for energy production, whereas the photovoltaic array would use solar photovoltaic panels to produce solar electricity. These projects support Navy renewable energy goals at PMRF (Commander Navy Region Hawai‘i 2012). To ensure compliance with environmental statutes, the absence of impacts on sensitive resources, and cost effectiveness over the course of its lifetime, NEPA analysis must be conducted during the planning phase of any future projects. Natural resources personnel will have input in the site selection and review of potential impacts of any such project.

1


Nohili Ditch
Lower Saki Mana Rd
Kao Rd
Mana Rd
Old Mana Rd
Kia Rd
State Hwy 50
Kinikini Ditch
Kawaiele Ditch
Majors Bay
Pacific Ocean
Club Dr
Nohili Rd
Kokole Point Rd
Current Conditions
1ft Sea Level Rise above MHHW
3ft Sea Level Rise above MHHW
0 500 1,000 Meters
0 1,500 3,000 Feet
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Source: CNIC PMRF Barking Sands

2

Figure 5-2. Predicted One and Three-Foot Sea Level Rise at Barking Sands

5.4 INRMP Review and Revision

This INRMP is a long-term planning document that requires periodic reviews of management goals and practices in order to provide the opportunity to incorporate new science and information as well as assess the performance of management actions. The Sikes Act requires that INRMPs be reviewed for operation and effect regularly by the installation, the USFWS, and appropriate state fish and wildlife agency (in this case, the SOH DOFAW) on a regular basis, but not less often than every five years. NOAA Fisheries is included in the five-year review if it participated in the INRMP development, if listed species are included in its jurisdiction or the near-shore environment is involved, or if the INRMP will benefit from its participation and review (DoDM 4715.03). The review for operation and effect is conducted to determine whether the installation is implementing the existing INRMP to meet Sikes Act requirements and are contributing to the conservation and rehabilitation of natural resources on military installations.

The decision on whether to update or revise the INRMP is based on the results of these reviews. An INRMP revision would be required if the current INRMP no longer provides adequately for the conservation and rehabilitation of the natural resources on the base, the installation mission or physical features have changed significantly, or there are substantial natural resources effects anticipated from base realignment and closure, such as: a new species listing, new construction, new training, changes to training type or tempo, or other factors that were not addressed in the existing INRMP. An INRMP may be simply updated to accommodate changes to the information contained in the INRMP that do not require substantial changes in the way natural resources on the base are to be managed.

5.4.1 Streamlined INRMP Review

A tripartite Memorandum of Understanding (MOU) between the DoD, USFWS, and the Association of Fish and Wildlife Agencies was signed in July 2013 that streamlines the review process for INRMP updates and DoD provided guidelines on the streamlined INRMP review process.

Per the MOU and DoD *Guidelines for Streamlined INRMP Review* (Office of the Assistant Secretary of Defense 2015), procedures for the streamlined review process are as follows:

1. Once the DoD component or installation determines that an INMRP update is appropriate, personnel will notify the USFWS and/or state offices with which they coordinate regarding their INRMP.This notification should be initiated by the DoD component or installation as soon as possible, and no less than 30 days prior to submitting the draft update for review.
2. The installation will submit a draft update to the appropriate state and USFWS field offices.
    a) The USFWS staff will review the draft update and respond to the installation within 15 calendar days of receipt.
    b) The USFWS field offices and states will provide comments (if any) on the draft update to the submitting installation a maximum of 60 calendar days, but preferably within 30 days, of receipt, unless the affected parties (i.e., the DoD component or installation and the states and/or USFWS offices) agree to a longer timeline for review.

c) If either state or federal review of a draft INRMP cannot be completed in the timeframe described above, then the USFWS and/or state office will notify the DoD component or installation, and provide an alternate timeline for the INRMP update review. If the parties cannot agree to a review timeline, the field office and/or installation may contact the Regional Sikes Act Coordinator who may help the field office(s) complete its review.

d) If there is disagreement concerning the conservation, protection, and management of fish and wildlife resources proposed in an INRMP update, all efforts will be made by the DoD component or installation, involved agencies, and Regional Sikes Act Coordinator to resolve those issues within the stated review timelines.

e) If USFWS and/or the states do not provide notification that an alternative timeline is needed within 60 days, the installation may, at its discretion, finalize the update.

3. Once complete, the installation shall submit a final update to the appropriate USFWS and state field offices, and to the Sikes Coordinator.

a) The states and USFWS field offices will respond and provide signature on the final update within a maximum of 60 calendar days, but preferably within 30 days, of receipt, unless the affected parties (i.e., the DoD component or installation and the states and/or USFWS offices) agree that a longer timeline for review is acceptable.

b) If the states and/or USFWS are unable to provide signature coordination within the applicable timelines, that agency will advise the DoD component or installation and the Regional Sikes Act Coordinator, explaining why the review and signature process cannot be completed within the designated timeframe, and offering an alternate date by which the review and signature can be completed. This notification will be given to the installation and the Regional Sikes Act Coordinator within 10 days of receipt of a final update. The Regional Sikes Act Coordinator will then coordinate with the states and the USFWS field office to ensure review and comment on the final update, discuss comments with the Regional Director, and prepare the Regional Director's response to DoD, if needed.

c) Once finalized, the updated INRMP will be considered reviewed for operation and effect, and will restart the five-year window for being compliant.

4. The USFWS field office will return the original concurrence letter or signature page to the DoD component or installation, and provide a copy of such (by mail, facsimile or electronic mail) to the Regional Sikes Act Coordinator and to the states.

INRMPS are considered compliant when all Navy endorsements, documentation of mutual agreement with USFWS and appropriate state fish and wildlife agency, and a documented review of operation and effect occur at least once every five years. A Navy-endorsed INRMP may be implemented (i.e., operational) without mutual agreement from USFWS or the State fish and wildlife agency only if: (1) a delay in the cooperative preparation process is documented as outlined in reference (e), or (2) the agency has objections based on the military mission of the installation and the Sikes Act's provision for no net loss to capability of the installation lands to support the installation's military mission. As operational INRMPs are technically not compliant INRMPs, all efforts must continue to obtain mutual agreement or endorsement from the other agencies (OPNAV-M 5090.1).

5.4.2 Annual Conservation Program Metrics Review

In addition to review of the INRMP review for operation and effect, DoD and Navy policy state that INRMPs must be reviewed annually by the installation with the cooperation of the statutory partners. Annual reviews are conducted to assess the INRMP goals and objectives, establish a realistic schedule for undertaking proposed actions, and determine adjustments needed to keep INRMPs current. It is recommended that the review for operation and effect be conducted during the annual INRMP metrics review.

Metrics have been developed to assess INRMP review and implementation, measure conservation efforts, ensure no net loss of military testing and training lands, understand the conservation program's installation mission support, and indicate the success of partnerships with the USFWS and SOH DLNR. This evaluation is facilitated by the web-based Metrics tool on the Navy Conservation Website: https://conservation.dandp.com. The metrics provide the means to evaluate performance in seven focus areas:

- Natural Resources Management
- Listed species and critical habitat
- Recreational use and access
- Sikes Act cooperation
- Team adequacy
- INRMP implementation
- INRMP support of the installation mission

The Installation Commanding Officer is required to participate in the annual natural resources program and INRMP metrics review. The Commanding Officer must further send a written report to USFWS and the appropriate state fish and wildlife agency following the annual INRMP metric review no later than 31 January of each year. The report must include the following:

- A copy of the invitation to the annual INRMP metric meeting, including a list of participants,
- An explanation and summary of INRMP metric results for the previous fiscal year,
- Description of INRMP actions implemented in the previous fiscal year,
- Description of benefits INRMP implementation provided to federally threatened and endangered species and/or benefits provided by the INRMPs Ecosystem Management for species that are proposed for listing or are candidates for listing under the ESA,
- Description of changes to be made to the INRMP as a result of the annual review, if any, and whether agreement was obtained with the USFWS to recognize the annual meeting as a review of the INRMP.

Annual reviews must also be documented and signed by these parties (DoDI 4715.03). Additionally, DoD produces an end-of-year Environmental Management Review, the Defense Environmental Programs Annual Report to Congress (DEPARC), to meet Congressional and in-house requirements from data derived from the annual metrics review. The report describes DoD's accomplishments during the past year in its restoration, conservation, compliance, and pollution prevention programs.

5.5 NEPA Analysis on INRMPs

Implementation of an INRMP is considered a major federal action requiring NEPA analysis. As a result, the Navy Office of General Counsel has determined that Sikes Act requirements for INRMP implementation necessitate the preparation of NEPA documentation prior to INRMP approval. It is expected that annual updates would be covered under the original NEPA documentation and therefore neither additional NEPA analysis nor an opportunity for public comment should be necessary unless there has been a major change in installation mission or program scope. However, a Memorandum for the Record or updated FONSI may be required to identify the previous NEPA document being relied on. An INRMP revision, however; which addresses management of any changes to listed species status, change in management of listed species, or may result in a significant environmental impact, including those not anticipated by the parties to the INRMP when the plan was last approved and/or reviewed does require new or supplemental NEPA analysis (OPNAV M-5090.1).

The NEPA process may be used to meet DoD's INRMP public review requirements and to document the decision to formally implement the INRMP. The NEPA process, however, will satisfy Sikes Act public comment requirements only if the public is provided a meaningful opportunity to comment upon the draft INRMP as part of the NEPA process. Absent some extraordinary circumstance, the public should be afforded a minimum of 30 days to review and comment upon the draft INRMP, whether as part of the NEPA process or through some other process.

Because of changes in protected species status and the proposed implementation of several protected species management plans, NEPA analysis and public comment were conducted in the development of this INRMP revision. An EA analyzing the potential effects of implementation of this INRMP was developed, provided for public review in local libraries and via the PMRF base website. The EA and comments received are in **Appendix G.**

5.5.1 Environmental Planning Library and Reporting Requirements

The OPNAV (N45) Environmental Planning Library website is an online, searchable electronic repository of completed Navy environmental planning documents covering Navy actions worldwide. The library also serves as a tool for the submission of required annual environmental planning and cooperating agency reports to the Navy Secretariat and other authority. Any Navy action proponent must upload environmental planning and associated compliance documents to the OPNAV (N45) Environmental Planning Library website as per OPNAV M-5090.1. In addition, the action proponent must input mitigation it has committed to implement in environmental planning decision documents to the mitigation reporting tool in the required reporting module of the Environmental Planning Library website.

5.5.2 Navy Conservation Website

The Navy Conservation Website is the Navy's official repository of natural resources information to track INRMP status and implementation measures for regulatory review; generate official reports; record DoN measures of merit and metrics; and centralize and track other documentation. It is a web-based tool used to submit, compile, and retrieve information about the Natural Resources Conservation Program to obtain and maintain the most current information possible to track the status of various

natural resources programs, have current data to respond to various program inquiries, and generate accurate reports.

5.6 Funding Priority and Strategy

This INRMP identifies a number of strategies to meet the natural resource objectives of PMRF. These actions include compliance requirements that must be performed to maintain compliance with laws and regulations, EOs, MOAs, and MOUs, as well as conservation actions that are necessary to ensure effective stewardship of public land entrusted to the U.S. Navy. Proactive management that focuses on efforts to prevent the listing of species at risk, which, if listed under the ESA, could adversely impact military readiness, and species protected by the MBTA and MMPA, is considered a priority funding by the Navy. Although funding priority is generally given to compliance-driven actions, stewardship actions will be carried out as funding and personnel become available. Actions that rely on volunteer labor and enjoy the support of the military community or have available alternate funding sources are also likely to be implemented. Funding is routinely programmed seven years in advance of project implementation. All projects and activities in the Implementation Table in **Appendix D** are assigned an Environmental Readiness Level (ERL), but many actions are completed using on-site personnel and are not part of the program budget.

5.6.1 Environmental Readiness Levels

Four levels of Navy environmental readiness have been established, which identify the specific types and scope of the capabilities required to provide each level. These ERLs enable capability-based programming and budgeting of environmental funding and facilitate required capability. The four ERLs are summarized from OPNAV M-5090.1 as defined below:

ERL 4. Environmental Readiness Level 4 are "must fund" conservation requirements that meet recurring natural and cultural resources conservation management or current legal compliance needs. ERL 4 supports all actions specifically required by law, regulation, or EO. Implementation of the INRMP anticipates the execution of all must fund projects and activities in accordance with specific timeframes indentified in the INRMP.

ERL 3. Supports requirements derived from DoD policy, Navy policy, or proactive initiatives that could result in obvious returns on investment and support critical readiness activities by decreasing encumbrances of statutory compliance. These EPRs/proposed efforts are not mandated by law or other federal, state, or local regulations or EOs but would minimize current or future impacts (including costs) to the Navy mission.

ERL 2. Supports proactive initiatives that result in speculative returns on investments and uncertain benefits to the Navy mission. These EPRs/proposed efforts are not mandatory by law or other Federal, state or local regulators, or EOs and should be based on best available scientific or commercial data; or pending Federal, state or local regulations.

ERL 1. Supports investments in environmental leadership and general proactive environmental stewardship.

5.6.2 Funding Sources

Operations and Maintenance, Navy (O&M, N) environmental funds are the primary source of resources to support reoccurring and non-reoccurring natural resources projects. Other environmental funding may be provided from the Naval Working Capital Fund (NWCF); military construction (MILCONs); Qualified Recycling Program revenues; and the Defense Logistics Agency Energy funds. PMRF does not hold any agricultural outleases and does not have a commercial forestry program; however, limited reimbursable funds from Fish and Wildlife Access Fees could be available for stewardship activities, if a base hunting program were established. Revenue collected from access fees may be used for the protection, conservation, and management of installation wildlife habitats and the hunting, fishing, and trapping programs.

Other special DoD initiatives to fund natural resources projects also may become available on a limited basis. In addition, alternate funding sources for special projects and initiatives may be sought from cooperative grants and partnership programs such as the DoD Legacy Program, National Public Lands Day grants, and Readiness and Environmental Protection Integration program. Application for these funds require a written proposal, are competitive, and often are cost-sharing opportunities.

5.6.3 Federal Anti-Deficiency Act

All actions contemplated in this INRMP are subject to the availability of funds as authorized and appropriated under federal law. Nothing in this INRMP is intended to be, nor must beconstrued to be a violation of the Anti-Deficiency Act (31 USC §1341 et seq.).

5.7 Staffing Needs

The Sikes Act requires, to the extent practicable using available resources, the Navy ensure that sufficient numbers of professionally trained natural resources management personnel and natural resources law enforcement personnel are available and assigned responsibility to perform tasks necessary to carry out natural resources management programs.

5.7.1 Professional Development and Natural Resources Training

OPNAV M-5090.1, Chapter 3 establishes Navy implementing policy guidance regarding environmental training and identifies required training for Navy personnel (including military, civilian, active duty, and reserve) to accomplish all Navy missions in an environmentally responsible manner, and to comply with federal, state, and local laws and regulations.

The Navy Environmental Readiness Training Program (NERTP) was developed to support the ability of the U.S. naval forces to effectively operate in an environmentally responsible manner. NERTP requirements are documented in the NERTP Navy Training System Plan (NTSP). NTSP lists formal courses, electronic learning, and other training vehicles authorized within NERTP.

A variety of formal Navy environmental training courses are available through the Civil Engineer Corps Officer School (CECOS) at Port Hueneme, California and Naval Safety and Environmental Training Center at Norfolk, Virginia. Any requirement submitted for training outside of these two venues requires detailed justification as to why it cannot be accommodated within these programs. A

list of courses offered and billet-specific environmental training requirements are identified in OPNAV M-5090.1, Table 2-1.

Required courses for PMRF Environmental Program personnel include:

EIPM: (1) Basic Environmental Law (A-4A-0058) and (2) Management of multiple environmental media (completion of CECOS Advanced Environmental Management (A-4A-0063) will satisfy this requirement).

Personnel with Co-Lateral Environmental Duties: Navy environmental program orientation training (completion of CECOS Environmental Protection (A-4A-0036) will satisfy this requirement).

Other courses that may be pertinent to natural resources management at PMRF include:

- Advanced Environmental Management (A-4A-0063)
- Environmental Negotiation Workshop (A-4A-0067)
- Environmental Protection (A-4A-0036)
- Natural Resources Compliance (A-4A-0087)

Participation in the annual National Military Fish and Wildlife Associate training session, held in March in various locations across the nation, provides additional training and opportunity to interact with other natural resources managers from installations worldwide. Workshops and training sessions on emerging issues, successful management techniques, and application of new technologies and procedures are typical offerings. Other course options are also available such as DoD online training and the USFWS National Conservation Training Center.

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Appendix L

Wetland Survey Report

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Final

Wetland Delineation Report at Pacific Missile Range Facility in Support of Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate Environmental Impact Statement

Kauaʻi, Hawaiʻi

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Final
Wetland Delineation Report in Support of Pacific Missile Range Facility and Kōkeʻe Park Geophysical Observatory Real Estate EIS Kauaʻi, Hawaiʻi

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
CWA	Clean Water Act
DLNR	Department of Land and Natural Resources
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
GIS	geographic information system
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Systems Command
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
PMRF	Pacific Missile Range Facility
U.S.	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

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CHAPTER 1
INTRODUCTION

This wetland delineation report details the results of a delineation of waters of the United States (U.S.) at Pacific Missile Range Facility (PMRF) in support of the proposed PMRF and Kōkeʻe Park Geophysical Observatory (KPGO) Real Estate Environmental Impact Statement (EIS). The United States (U.S.) Department of the Navy (Navy) and National Aeronautics and Space Administration (NASA), in coordination with the Hawaiʻi Department of Land and Natural Resources (DLNR), are preparing an EIS which evaluates the potential environmental consequences of the Navy's and NASA's proposal to retain the use of approximately 8,172 acres and 23 acres, respectively, in support of the Navy's continued and ongoing operational continuity and sustainment at PMRF and NASA's continued operations at KPGO. The Navy's 8,172 acres are a part of the larger PMRF installation which includes the entire instrumented range on land and ocean areas that support surface, subsurface, air, and space operations.

Between 1964 and 2007, the Navy and NASA began leasing property from the DLNR-owned land primarily for passive encroachment buffer as well as for mission operations, access, and utilities at the following five general locations: Main Base (also referred to as Barking Sands), Kamokalā Ridge, Mānā Water Well, Miloliʻi Ridge, and Mākaha Ridge. The easement areas provide safety buffer zones for training and testing missions and prevent incompatible development. The existing Navy and NASA real estate agreements with the DLNR are set to expire between 2027 and 2030. The lease areas are illustrated in Figure 1, Appendix A.

Under the direction of Naval Facilities Engineering Systems Command (NAVFAC), and in accordance with the 19 July 2022 Statement of Work (SOW) for Task Order N6274222F0206, Stantec GS Inc. ("Stantec") performed a jurisdictional wetland delineation within the approximately 220.5-acre PMRF wetland study area (hereafter, study area). The study area is located within the Mānā Plain in portions of the Nahomalu Watershed (12,352 acres), Kaʻawaloa Watershed (8,192 acres), and the Hoʻea Watershed (9,728 acres) and is illustrated in Figure 2, Appendix A. The study area borders the developed military installation Main Base and consists of fallow agricultural areas, non-native dominated scrub areas, wetlands, and drainage ditches. Field investigations occurred from 2 through 6 October 2023. Normal to dry climatic conditions were present during the delineation fieldwork.

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CHAPTER 2
OBJECTIVE

The primary objective of the wetland delineation was to determine which areas meet the necessary criteria to be considered jurisdictional wetlands and other waters of the U.S. that are present within the study area.

2.1 DEFINITION OF WATERS OF THE UNITED STATES

Currently, the term waters of the U.S., based on 33 Code of Federal Regulations (CFR) 328.3 means:

(1) Waters which are:
  (i) Currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
  (ii) The territorial seas; or
  (iii) Interstate waters;
(2) Impoundments of waters otherwise defined as waters of the United States under this definition, other than impoundments of waters identified under paragraph (a)(5) of this section;
(3) Tributaries of waters identified in paragraph (a)(1) or (2) of this section that are relatively permanent, standing or continuously flowing bodies of water;
(4) Wetlands adjacent to the following waters:
  (i) Waters identified in paragraph (a)(1) of this section; or
  (ii) Relatively permanent, standing or continuously flowing bodies of water identified in paragraph (a)(2) or (a)(3) of this section and with a continuous surface connection to those waters;
(5) Intrastate lakes and ponds, streams, or wetlands not identified in paragraphs (a)(1) through (4) of this section that are relatively permanent, standing or continuously flowing bodies of water with a continuous surface connection to the waters identified in paragraph (a)(1) or (a)(3) of this section.

Per federal regulatory policy (33 CFR Part 328), wetland areas are defined as *"those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."*

2.2 SACKETT V. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

On 29 August 2023, the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA) announced a final rule amending the 2023 definition of "waters of the United States." The amendments conform with the U.S. Supreme Court's 25 May 2023 decision in the case of *Sackett v. USEPA.* While the USACE's and USEPA's 2023 rule defining "waters of the United States" was not directly before the Supreme Court, the decision in *Sackett v. USEPA* made clear that certain aspects of the 2023 rule are invalid. Therefore, the USACE and USEPA have amended key components of the regulatory text to conform to the Supreme Court decision. Per the USACE and USEPA, "the final rule provides clarity for protecting our nation's waters consistent with the Supreme Court's decision while advancing infrastructure projects, economic opportunities, and agricultural activities." The two major changes are as follows:

1) Revised definition of adjacent to mean "having a continuous surface connection."
2) The rule removes the significant nexus test from consideration when identifying tributaries and other waters as federally protected.

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CHAPTER 3
METHODS

3.1 DESKTOP ANALYSIS

3.1.1 Existing Data Analysis

Potentially occurring aquatic resources were identified through a synthesis of the data sources listed and described below. The desktop analysis was completed by overlaying the following geographic information system (GIS) data sources on the wetland delineation survey area: National Wetlands Inventory (NWI) Database (U.S. Fish and Wildlife Service [USFWS] 2019), U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil maps (USDA 2019), U.S. Geological Survey (USGS) topographic maps (USGS 2020), Federal Emergency Management Agency (FEMA) 100-year floodplain mapping (FEMA 2021), and available aerial photography by Maxar (2022). All desktop analysis figures are provided in Appendix A.

As part of the desktop analysis, the available GIS data were reviewed to evaluate the potential presence of aquatic features such as streams and other water bodies, wetlands, and soil types that may indicate a potential for wetlands or other waters of the U.S.

3.1.2 National Wetlands Inventory

The NWI is a program managed by the USFWS that provides geospatial information to the public regarding the extent and status of wetlands and deepwater habitats in the U.S. Aquatic features mapped in the NWI are primarily based on the interpretation of high-altitude aerial photographs and topographic maps, and as such are not necessarily accurate or up-to-date, but they indicate the presence of potential jurisdictional features. Conversely, the absence of NWI-mapped features is not sufficient to conclude that no jurisdictional water bodies or wetlands are present. NWI-mapped features in the survey area are provided in Figure 3, Appendix A.

Aquatic habitats in the NWI are classified according to the Cowardin classification system (Cowardin et al. 1979). This classification system is used to hierarchically define wetland and deepwater habitat types by system, subsystem, class, and subclass for the purposes of inventory, evaluation, and management. The Cowardin system classifies aquatic habitats by landscape position, vegetation cover, hydrologic regime, and any species modifiers. The Cowardin system applies to all aquatic habitats less than 6.6 feet (2.0 meters) deep, including unvegetated water bodies, as wetlands. Although the CWA does not consider naturally unvegetated areas to be wetlands except in problematic and/or atypical situations (USACE 1987), the Cowardin system is the most widely used classification system for wetlands and other waters of the U.S., and it provides the federal standard for wetland classification adopted by the Federal Geographic Data Committee (2009). The Cowardin system can be applied to non-jurisdictional aquatic habitats as well.

The Cowardin system includes five major wetland types: marine, estuarine, lacustrine, palustrine, and riverine. The NWI-mapped habitats and acreages in the wetland delineation survey area are provided in Table 1 and are shown in Figure 3, Appendix A.

Table 1 National Wetlands Inventory Features in the Survey Area

Mapping Attribute	*Cowardin Classification Name*	*Area (acres)*
R2UBHx	Riverine, lower perennial, unconsolidated bottom, permanently flooded, excavated	7.70
R4SBCx	Riverine, intermittent, streambed, seasonally flooded, excavated	1.90
PEM1Fd	Palustrine emergent, persistent, semi-permanently flooded, partly ditched/drained	183.90
	Total	**193.5**

The NWI mapping has classified the agricultural ditches as Riverine lower perennial and intermittent. Cowardin loosely classifies Riverine as all wetland and deepwater habitats contained within a channel, natural or manmade. The two exceptions are areas dominated by vegetation or having salt concentration in excess of 0.5 parts per thousand.

The ditches could likely be better classified as Palustrine emergent, unconsolidated bottom, permanently flooded, or semi permanently flooded and excavated (PEMUbFx or PEMUbGx), which is a more typical classification for agricultural ditches.

3.1.3 United States Department of Agriculture Soils

The soils identified in the project area were compared to the NRCS National Hydric Soils List. The soil types, acreages, and hydric ratings are presented in Table 2 and are shown in Figure 4, Appendix A.

Table 2 Soil Types Mapped in the Survey Area

Map Unit Symbol	*Map Unit Name*	*Hydric Status*	*Area (acres)*
Nh	Nohili clay	no	16.8
Fd	Fill land	no	16.4
JfB	Jaucus loamy fine sand 0-8 percent slopes	no	39.5
MnC	Mamala cobbly silty clay loam, 0-2 percent slopes	no	9.8
kf	Kaloko clay loam	yes	104.8
Kfa	Kaloko clay 0-2 percent slopes	yes	33.2
	Total Hydric Soils		138.0
	Total All Soils		**220.5**

3.1.4 United States Geological Survey Topography

The USGS topographic mapping identified numerous ditches as the only aquatic features within the survey area (see Figure 5, Appendix A).

3.1.5 Federal Emergency Management Agency

The FEMA mapping identified the entire wetland delineation survey area as occurring within the 100-year floodplain (see Figure 6, Appendix A).

3.1.6 Historic Mapping of Wetlands and Ponds

Historic mapping dated 1907 and 1921, were evaluated and they identified large wetland and pond areas within the study area. Approximately 136 acres of wetland and 43 acres of Limaloa and Kawai‘ele ponds/open water were historically mapped where the NWI wetlands and hydric soils are located, potentially confirming historic extent of wetlands (USGS 1910) (Figure 7, Appendix A).

3.1.7 Portions of the Survey Area to be Targeted for Delineation

The NWI mapping identified 193.5 acres of possible wetlands and the soils mapping identified 138 acres of potential hydric soils in the study area. NWI and NRCS Soils mapping can overestimate or underestimate wetland extent due to the types of analyses conducted for those mapping features.

Furthermore, the USGS mapping identified numerous ditches throughout the survey area. Based on the combined presence of these additional features, the entire study area was targeted and assessed in the field during the wetland delineation effort to ensure that no smaller wetland areas were missed (as required by the wetland delineation protocol).

3.2 FIELD ANALYSIS

The wetland delineation was conducted by experienced and qualified Stantec wetland delineators. The delineation followed the protocols and methodologies outlined in the *Corps of Engineers Wetlands Delineation Manual* (USACE 1987), the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Hawaii and Pacific Islands Region (Version 2)* (USACE 2012), and the USACE Regulatory Guidance Letter No. 05-05 *Ordinary High Water Mark Identification* (USACE 2005). The protocols and methodologies followed the currently accepted approach by the Honolulu District Army Corps of Engineers.

3.2.1 Delineation Procedures

Procedures and standards used for delineating and classifying aquatic habitats in the study area are described below.

3.2.1.1 Wetlands

Per USACE requirements, evidence of a minimum of one positive wetland indicator from each parameter (hydrophytic vegetation, hydric soil, and hydrology) needs to be met in order to make a positive wetland determination. Data collected at sample points was recorded on *Wetland Determination Data Forms – Hawai'i and Pacific Islands Region (Version 2.0)* (USACE 2012).

Field surveys were conducted between 2–6 October 2023 to identify the approximate extent of wetlands and other waters based on dominant vegetation type, hydrology, topography, and landscape/geomorphic position. In portions of the study area deemed to contain possible wetlands, the soil, vegetation, and hydrology were evaluated in detail at representative sample points. The completed wetland determination forms are included in Appendix B. All wetlands and drainage features were mapped in the field using a global positioning system unit with a sub-meter level accuracy receiver. After field work was completed, location data was entered into GIS software, potential jurisdictional areas were mapped, and the acreages of the delineated features were calculated.

Determination of Hydrophytic Vegetation

Hydrophytic vegetation is defined as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present (USACE 1987). Such areas are characterized by the dominance of plant species that typically occur in wetlands. Hydrophytic vegetation determinations are based on the wetland indicator status of dominant plant species.

Sample points were evaluated to determine the dominant plant species in the following strata as defined by USACE (2012).

- Tree stratum – woody plants 3 inches (7.6 centimeters) or more in diameter at breast height, regardless of height.
- Sapling/shrub stratum – woody plants less than 3 inches (7.6 centimeters) in diameter at breast height, and greater than or equal to 3.28 feet (1 meter) tall.
- Herb stratum – all herbaceous plants, including herbaceous vines, regardless of size.
- Woody vines – consists of all woody vines greater than 3.28 feet (1 meter) in height.

Hydrophytic vegetation determinations were based on the wetland indicator status (USACE 2020) of species that composed the plant communities. Wetland indicator status is a relative measure of a plant species' potential to occur in wetlands. Hydrophytic vegetation indicator status categories are defined as follows (USACE 2020):

- Obligate Wetland – almost always occurs in wetlands, rarely in uplands.
- Facultative Wetland – usually occurs in wetlands but occasionally found in uplands.
- Facultative – commonly occurs in wetlands or uplands.
- Facultative Upland – occasionally occurs in wetlands but usually occurs in uplands.
- Obligate Upland – rarely occurs in wetlands, almost always in uplands.

Hydrophytic vegetation determinations followed the standard procedures set forth in USACE (2012). Plant wetland indicator statuses used in this report are consistent with the National Wetland Plant List (USACE 2020).

Determination of Hydric Soils

Hydric soils are defined as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Hydric soil indicators are formed predominantly by the accumulation or loss of iron, manganese, sulfur, or carbon compounds in a saturated and anaerobic environment (USACE 2012).

Wetland biologists evaluated and documented the morphological characteristics of all visible soil horizons observed in excavated soil profiles at each sample point. Soil pits were excavated to depths of up to 20 inches (51 centimeters), except in instances where positive hydric soil indicators were obtained above that depth or digging was met with refusal (e.g., rock, gravel).

Soil profile analyses included descriptions of horizon thickness (depth); matrix color; texture; and type, location, abundance, and color of redoximorphic features (if present). These characteristics were used as the basis for determining the presence or absence of hydric soil indicators as set forth in USACE (2012).

Determination of Wetland Hydrology

Wetland hydrology encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season (USACE 1987). Areas with evident wetland hydrology characteristics are those where the presence of water has an overriding influence on characteristics of vegetation and soils due to anaerobic and reducing conditions, respectively. In general, this can only occur in areas inundated or saturated within 12 inches (30.5 centimeters) of the surface continuously for at least five percent of the growing season in most years (50 percent probability of recurrence) (USACE 1987).

Field verification of wetland hydrology involved positive field observation of at least one primary indicator, or two secondary indicators as defined in USACE (2012).

3.2.1.2 Non-wetland Waters of the United States

Potential non-wetland waters of the U.S. were surveyed for in accordance with the guidelines set forth by USACE (2005). The lateral limits of jurisdiction over non-tidal water bodies extend to the ordinary high water mark, in the absence of adjacent wetlands. When adjacent wetlands are present, CWA jurisdiction extends beyond the ordinary high water mark to the limits of the adjacent wetlands. All non-wetland waters of the U.S. mapped in the study area were long-established drainage ditches.

3.2.2 Photographic Documentation

Representative photographs of the upland, wetland, and ditch areas are included in Appendix C.

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CHAPTER 4
RESULTS

Results of the wetland delineation are detailed in Table 3 and are shown in Figures 8–11, Appendix A. In total, approximately 22.96 acres of wetlands and 16.25 acres of drainage ditches were delineated within the study area. Indicators of hydrophytic vegetation, wetland hydrology, and hydric soil for the wetland habitats that were delineated in the study area are provided on data sheets in Appendix B.

Table 3 Jurisdictional Delineation Results

Wetland ID	Classification*	Acres	Hectares	Jurisdictional (Yes/No)
1	PEM/PSS	0.39	0.16	Yes
2	PEM/PSS	8.27	3.35	Yes
3	PEM/PSS	0.04	0.02	Yes
4	PEM/PSS	0.23	0.09	Yes
5	PEM/PSS	0.06	0.03	Yes
6	PEM/PSS	0.70	0.28	Yes
7	PEM/PSS	1.39	0.56	Yes
8	PEM/PSS	0.10	0.04	Yes
9	PEM/PSS	0.06	0.02	Yes
10	PEM/PSS	0.11	0.05	Yes
11	PEM/PSS	0.39	0.16	Yes
12	PEM/PSS	0.32	0.13	Yes
13	PEM/PSS	0.02	0.01	Yes
14	PEM/PSS	0.14	0.06	Yes
15	PEM/PSS	0.05	0.02	Yes
16	PEM/PSS	0.08	0.03	Yes
17	PEM/PSS	10.60	4.29	Yes
	Subtotal	***22.96***	***9.30***	
Ditches	PUB3F/Hd	16.25	6.58	Yes
	TOTAL	**39.21**	**15.88**	

Notes: *PEM = Palustrine emergent wetland, PSS = Palustrine scrub shrub wetland; PUB3F/Hd = Palustrine unconsolidated bottom, mud, semi-permanently flooded/permanently flooded, partly drained/ditched.

All the wetlands and other waters of the U.S. (ditches) should be considered jurisdictional for planning purposes. The wetlands appear to be hydrologically connected to the ditches, with water likely flowing back and forth between the ditches and wetlands. Additionally, per the desktop analysis, the ditches were likely excavated/created in historic wetland areas and the ditches eventually drain to the Pacific Ocean.

Vegetation diversity in the mapped wetlands was low and nearly homogeneous. The dominant plant species within all the mapped wetlands was the emergent wetland plant sea purslane (*Sesuvium portulacastrum*), while the boundaries of nearly all of the wetlands were dominated by the scattered shrub camphorweed (*Pluchea indica)* (see typical photos in Appendix C).

The primary indicator of wetland hydrology observed in the mapped wetlands was Saturation (Indicator Code A3). Additionally, Sediment Deposits (Indicator Code B2), Surface Soil Cracks (Indicator Code B6), and Salt Deposits (Indicator Code C5) were common and noted.

The soils observed within the mapped wetland habitats met the qualifications for at least one of the field indicators of hydric soils. The majority of hydric soils in the mapped wetlands displayed a matrix with low chroma (2 or less) with a value of 4 or more with a Depleted Matrix (Indicator Code F3).

All the ditches in the study area are clearly defined, linear, open water areas and vary in width from approximately 10 to 30 feet (3 to 9 meters). As the historic mapping in Figure 7 (Appendix A) indicates, the study area was likely an historic complex of wetlands and ponds. Therefore, the excavation of the original ditch network was likely in a wetland complex, and because the ditch network drains to the Pacific Ocean, they should be considered jurisdictional for planning purposes.

The Cowardin classification of the wetlands is Palustrine Emergent (PEM) and Palustrine Scrub Shrub (PSS), and the classification of the ditches is Palustrine Unconsolidated Bottom, Mud, Permanently or Semi-permanently Flooded, Partially Ditched/Drained (PUB3F/Hd).

CHAPTER 5
CONCLUSION

Based on the results of the wetland delineation, there are 17 individual PEM/PSS wetlands in the study area, comprising approximately 22.96 acres, which exhibited the necessary parameters to be considered jurisdictional wetlands and 16.25 acres of ditches that should be considered potential waters of the U.S. (see Table 3 and Figures 8–11 in Appendix A).

The USACE, under the authority of Section 404 of the CWA and Section 10 of the Rivers and Harbors Act, has the authority to make the final determination of the jurisdictional status and extent of waters of the U.S., including wetlands, within the study area. This report represents the best scientific judgement and opinions of the Stantec biologists that conducted the delineation and should be considered preliminary until concurrence has been obtained from the USACE Honolulu District in the form of a Jurisdictional Determination.

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CHAPTER 6
REFERENCES

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Appendix A
Figures

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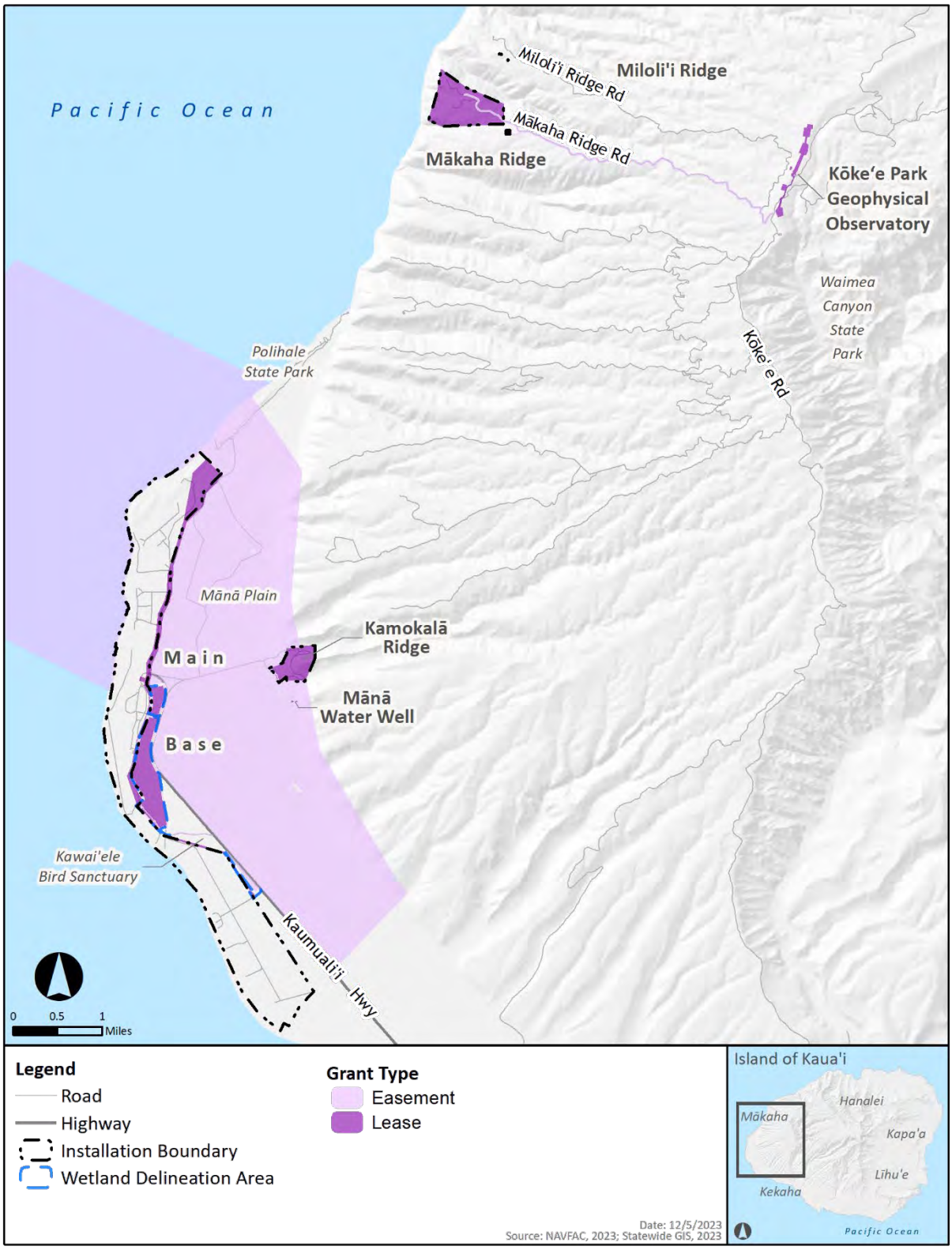

Figure 1 PMRF Lease Areas Map

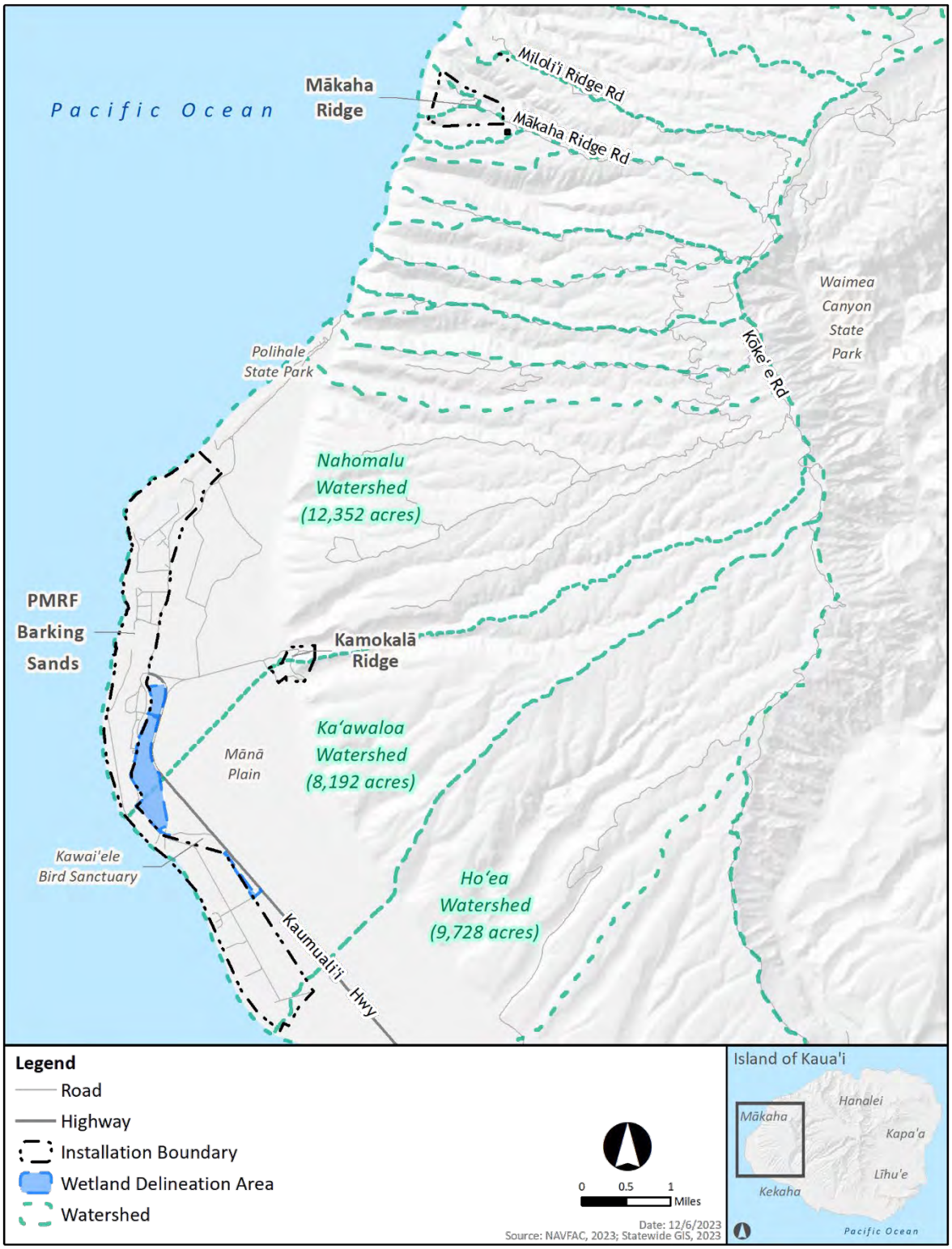

Figure 2 Wetland Delineation Study Area Map

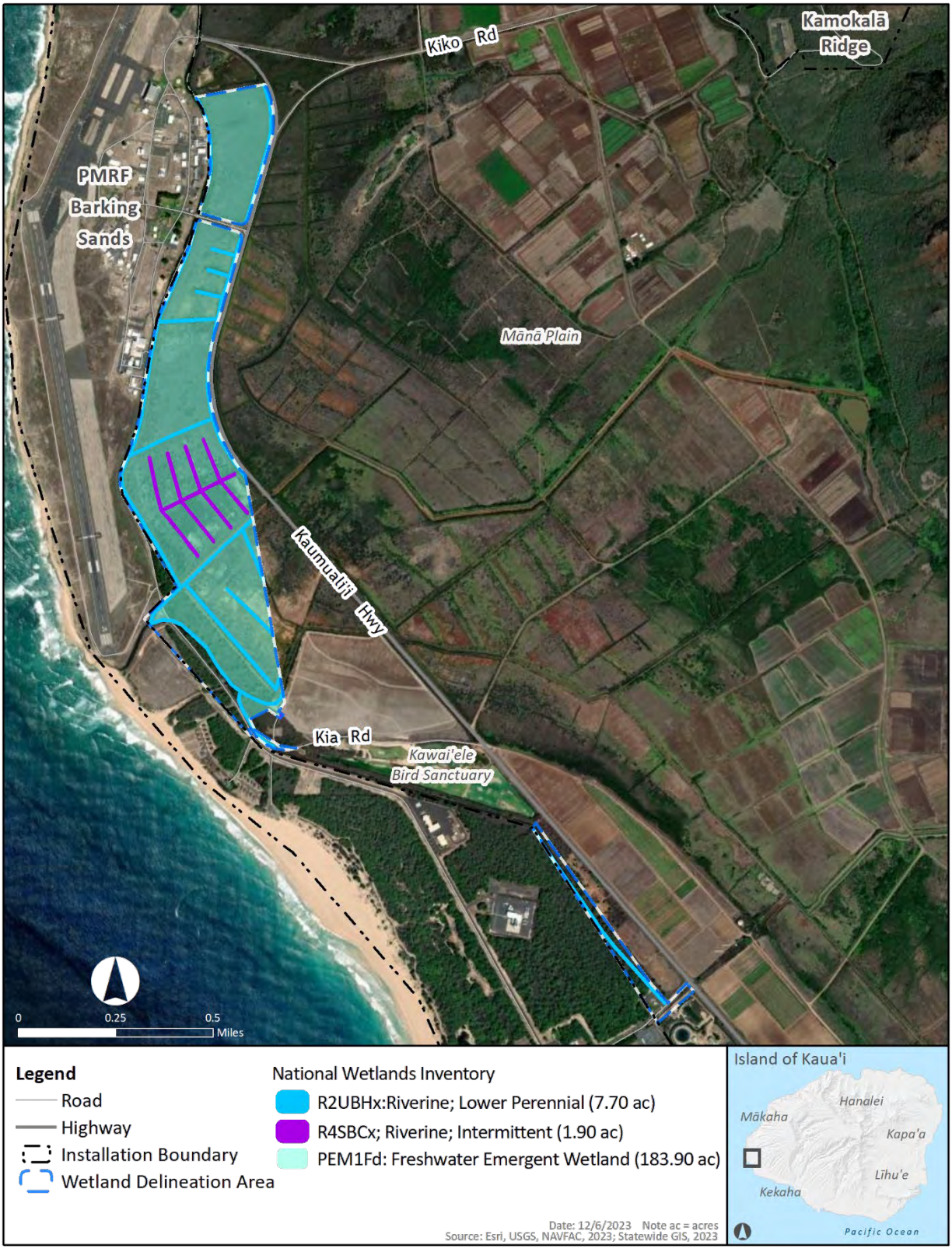

Figure 3 Wetland Delineation NWI Wetlands Map

Figure 4 Wetland Delineation NRCS Soils and Hydric Soils Map

Figure 5 Wetland Delineation USGS Topographic Map

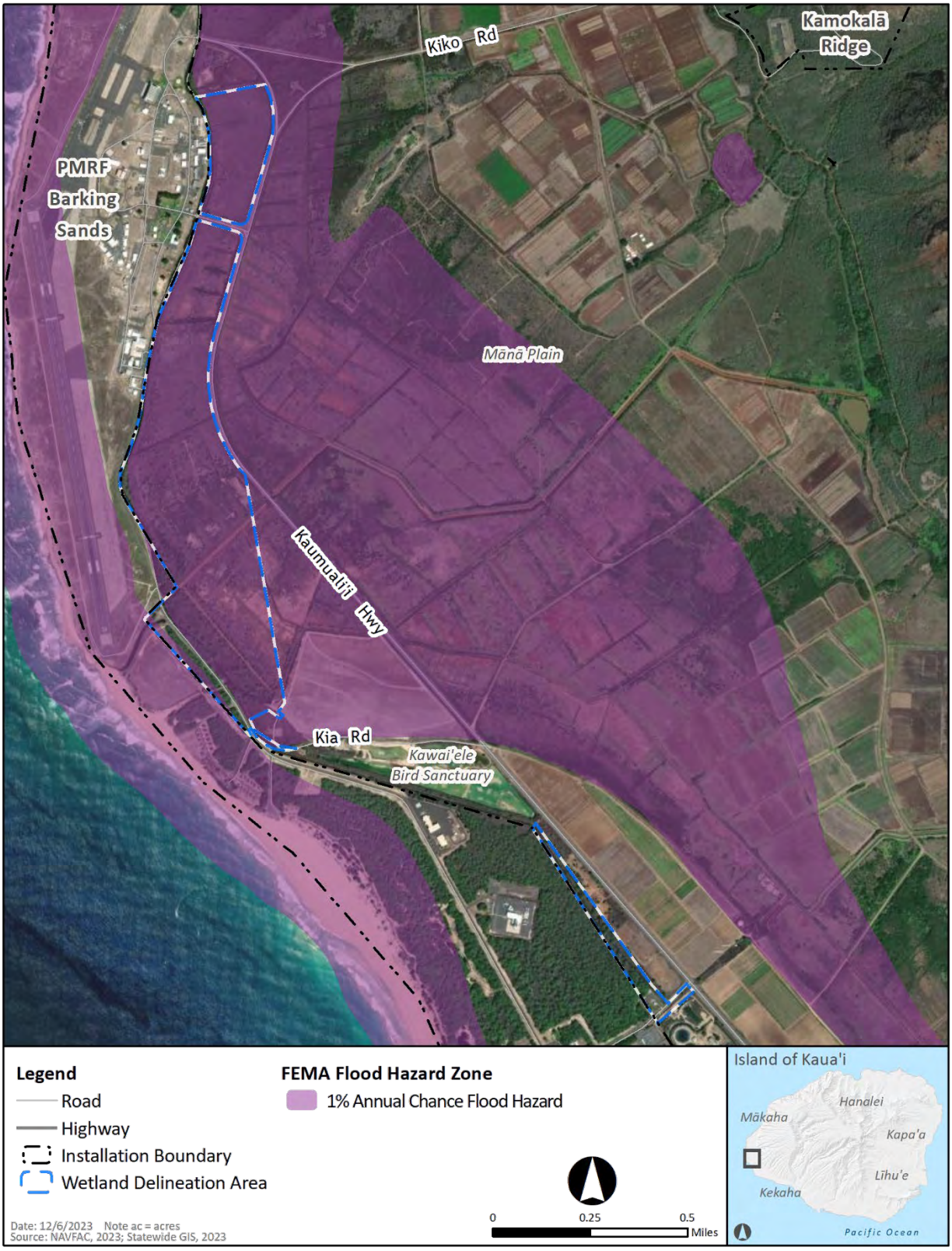

Figure 6 Wetland Delineation FEMA Map

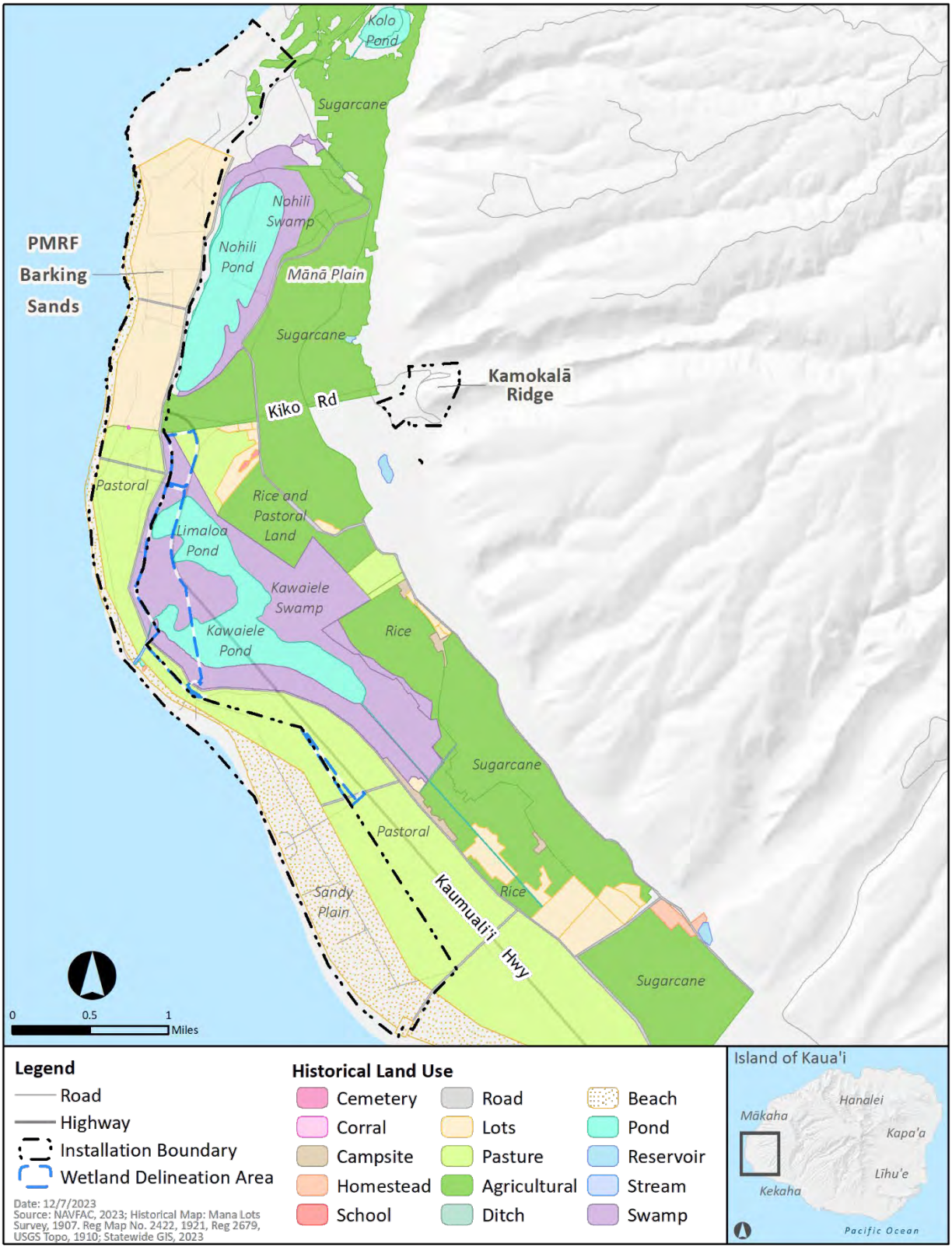

Figure 7 1907 and 1921 Historical Land Use Map

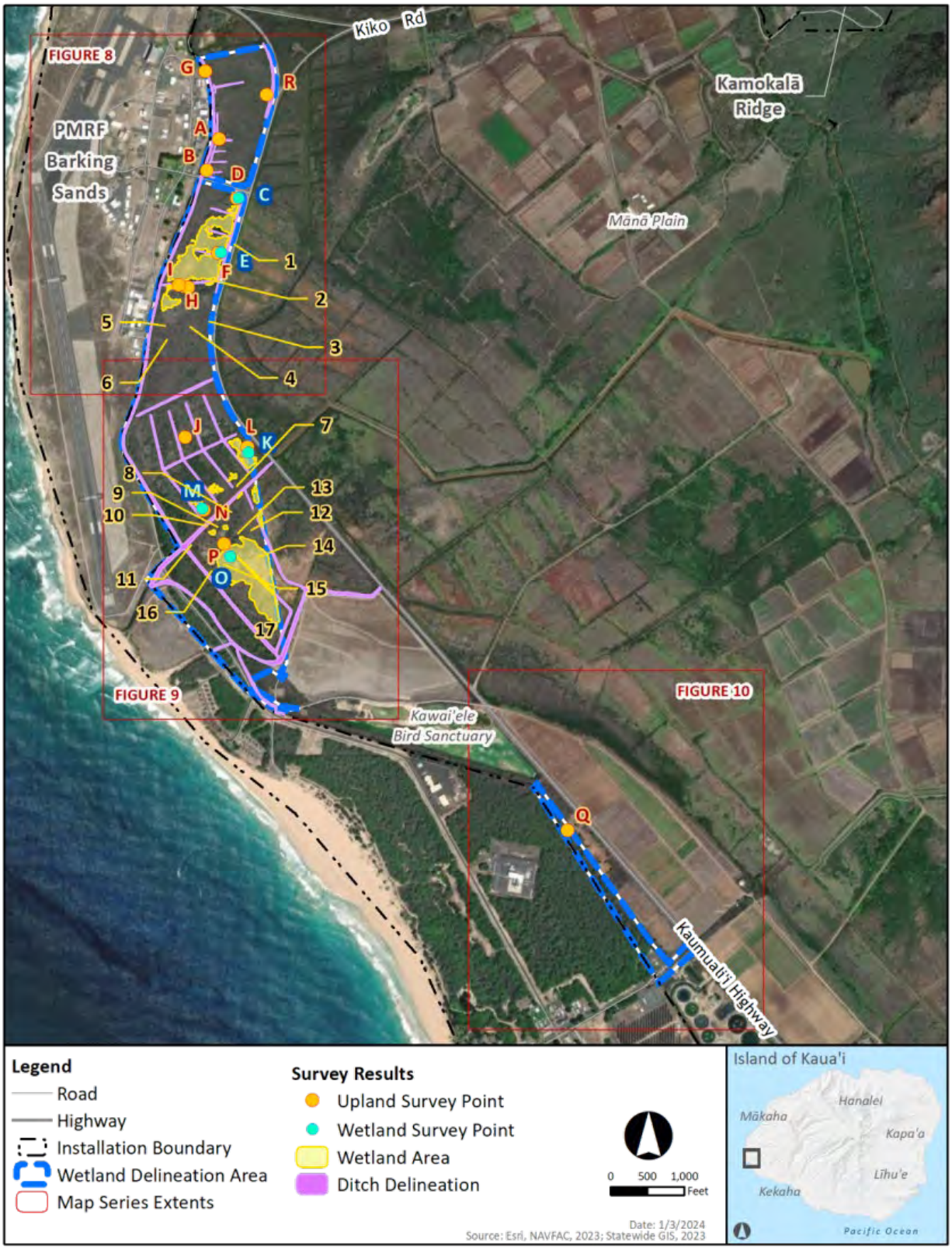

Figure 8 Wetland Delineation Survey Overview

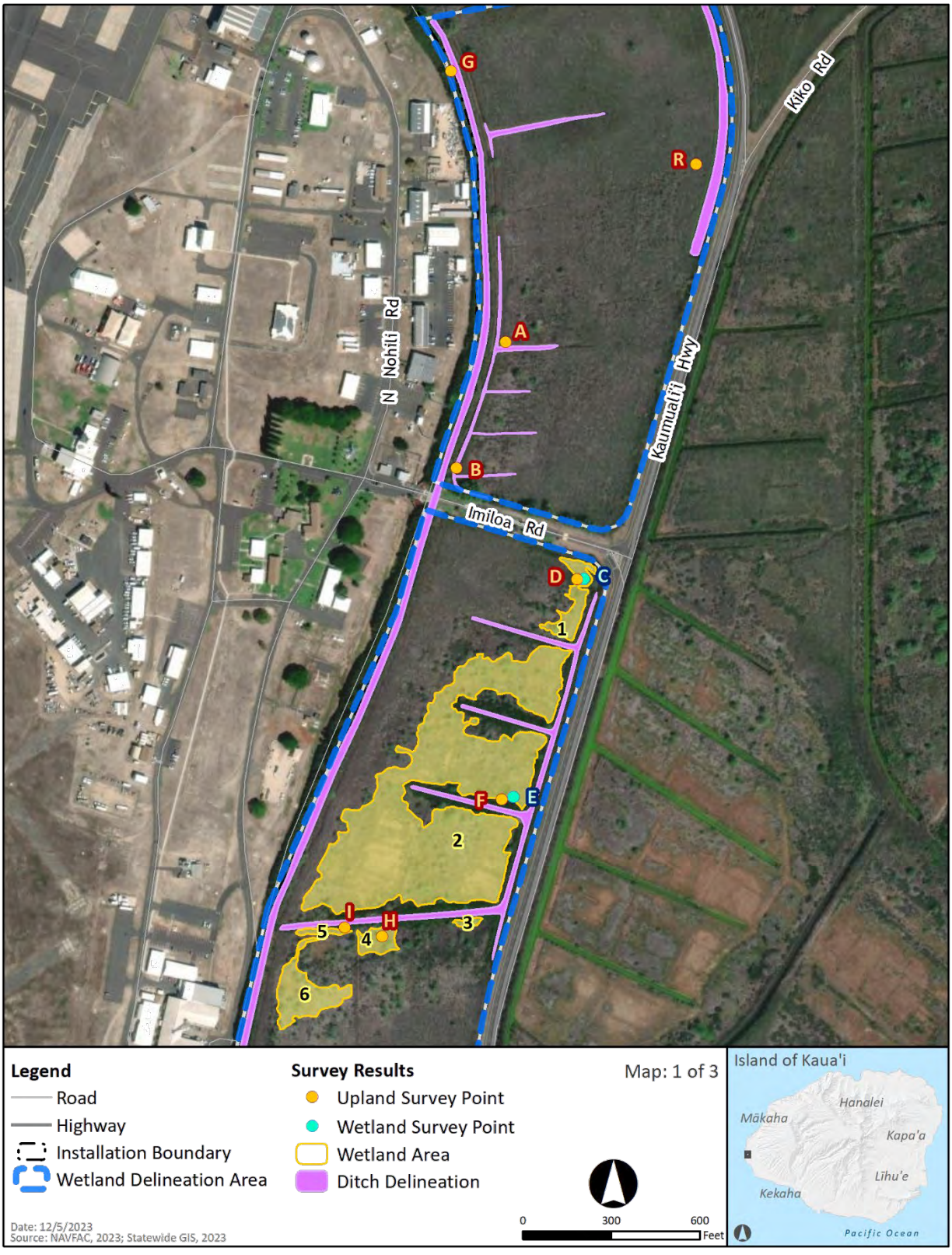

Figure 9 Wetland Delineation Survey 1 of 3

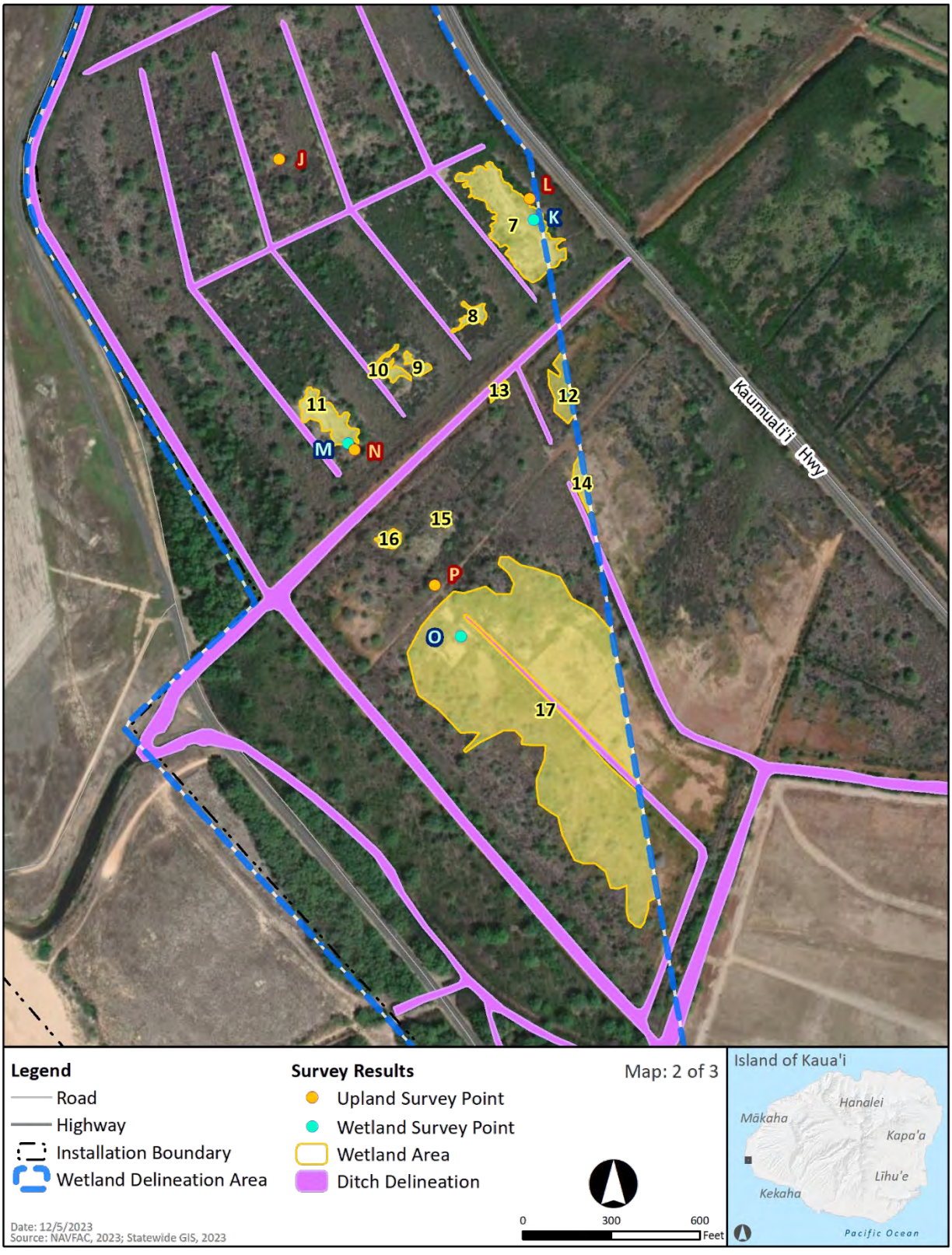

Figure 10 Wetland Delineation Survey 2 of 3

Figure 11 Wetland Delineation Survey 3 of 3

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Appendix B
Data Sheets

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/2/2023 Time: 11:17
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: A
Investigator(s): Scheuerman, De Guzman TMK/Parcel:
Landform (hillside, coastal plain, etc.): terrace Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:
Terrace above/adjacent to agriculture ditch.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 3m radius)			
1. *Pluchea indica*	15	Yes	FAC
2. *Leucaena leucocephala*	10	Yes	UPL
3.			
4.			
5.			
	25 =Total Cover		
Herb Stratum (Plot size: 1m radius)			
1. *Megathyrsus maximus*	95	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	95 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	110	x 3 =	330
FACU species	0	x 4 =	0
UPL species	10	x 5 =	50
Column Totals:	120 (A)		380 (B)
Prevalence Index = B/A =			3.17

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

ENG FORM 6116-6, JUL 2018 Hawai'i and Pacific Islands – Version 2.0

SOIL Sampling Point: A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-14	7.5YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: _____
Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

ENG FORM 6116-6, JUL 2018 Hawai'i and Pacific Islands – Version 2.0

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/2/2023 Time: 14:10
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: B
Investigator(s): Scheuerman, De Guzman TMK/Parcel:
Landform (hillside, coastal plain, etc.): slope Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 20
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:
Slope above agricultural ditch channel.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 3m radius)			
1. *Pluchea indica*	40	Yes	FAC
2. *Leucaena leucocephala*	25	Yes	UPL
3. *Pluchea carolinensis*	2	No	FAC
4.			
5.			
	67 =Total Cover		
Herb Stratum (Plot size: 1 m radius)			
1. *Heliotropium curassavicum*	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	5 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	47	x 3 =	141
FACU species	0	x 4 =	0
UPL species	25	x 5 =	125
Column Totals:	72 (A)		266 (B)
Prevalence Index = B/A =			3.69

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	7.5YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

ENG FORM 6116-6, JUL 2018 Hawai'i and Pacific Islands – Version 2.0

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/2/2023 Time: 15:25
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: C
Investigator(s): Scheuerman, De Guzman TMK/Parcel:
Landform (hillside, coastal plain, etc.): depression Local relief (concave, convex, none): slightly concave
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes X No
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes X	No	

Remarks:
Depressional wetland with large areas devoid of vegetation.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 1m radius)			
1. *Sesuvium portulacastrum*	60	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	60 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	60	x 3 =	180
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	60 (A)		180 (B)
Prevalence Index = B/A =			3.00

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

ENG FORM 6116-6, JUL 2018 Hawai'i and Pacific Islands – Version 2.0

SOIL Sampling Point: C

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	5YR 3/1	100					Muck	
2-4	7.5YR 3/3	100					Loamy/Clayey	
4-12	7.5YR 3/4	100					Loamy/Clayey	
12-18	5YR 4/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- X Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- X Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- X Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- X Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/3/2023 Time: 8:11
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: D
Investigator(s): Scheuerman, De Guzman TMK/Parcel:
Landform (hillside, coastal plain, etc.): terrace Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area**
Hydric Soil Present?	Yes	No X	**within a Wetland?** **Yes** **No X**
Wetland Hydrology Present?	Yes	No X	

Remarks:
Upland terrace adjacent to wetland area.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 3x1m)			
1. *Pluchea indica*	70	Yes	FAC
2.			
3.			
4.			
5.			
	70 =Total Cover		
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	=Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	70	x 3 =	210
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	70 (A)		210 (B)
Prevalence Index = B/A =			3.00

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X** **No**

Remarks:

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SOIL Sampling Point: D

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	7.5YR 3/2	100					Loamy/Clayey	
4-16	7.5YR 3/3	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: _____
Depth (inches): _____

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ? Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/3/2023 Time: 9:46
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: E
Investigator(s): Scheuerman, De Guzman TMK/Parcel:
Landform (hillside, coastal plain, etc.): depression Local relief (concave, convex, none): slightly concave
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes X No
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes X	No	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 1m radius)			
1. *Sesuvium portulacastrum*	80	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	80 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	80	x 3 =	240
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	80 (A)		240 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: E

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	5YR 3/1	100					Muck	
2-16	7.5YR 3/3	100					Mucky Loam/Clay	
16-24	10R 6/2	70	7.5YR 6/8	30	C	M	Mucky Loam/Clay	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
_X_ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
___ Dark Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Stratified Layers (A5)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: _____
Depth (inches): _____

Hydric Soil Present? **Yes** _X_ **No** ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

_X_ Surface Soil Cracks (B6)
_X_ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
_X_ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
_X_ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No _X_	Depth (inches): ____
Water Table Present?	Yes ____	No _X_	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No _X_	Depth (inches): ____

Wetland Hydrology Present? **Yes** _X_ **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

ENG FORM 6116-6, JUL 2018 Hawai'i and Pacific Islands – Version 2.0

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/3/2023 Time: 10:00
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: F
Investigator(s): Scheuerman, De Guzman TMK/Parcel:
Landform (hillside, coastal plain, etc.): slope Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 5
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:
Upland adjacent to ditch and palustrine emergent wetland.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 3x1 m)			
1. *Pluchea indica*	90	Yes	FAC
2.			
3.			
4.			
5.			
	90 =Total Cover		
Herb Stratum (Plot size: 1x1 m)			
1. *Sesuvium portulacastrum*	20	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	20 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	110	x 3 =	330
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	110 (A)		330 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: F

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-5	7.5YR 3/2	100					Loamy/Clayey	
5-16	7.5YR 3/3	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

ENG FORM 6116-6, JUL 2018 Hawai'i and Pacific Islands – Version 2.0

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/3/2023 Time: 11:47
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: G
Investigator(s): Scheuerman, De Guzman TMK/Parcel:
Landform (hillside, coastal plain, etc.): terrace Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:
Terrace above ditch channel.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5m radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Syzygium cumini*	25	Yes	FAC
2.			
3.			
4.			
5.			
	25	=Total Cover	
Sapling/Shrub Stratum (Plot size: 3 m radius)			
1. *Leucaena leucocephala*	40	Yes	UPL
2. *Pluchea carolinensis*	20	Yes	FAC
3.			
4.			
5.			
	60	=Total Cover	
Herb Stratum (Plot size: 1m radius)			
1. *Cenchrus ciliaris*	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	15	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	45	x 3 =	135
FACU species	15	x 4 =	60
UPL species	40	x 5 =	200
Column Totals:	100 (A)		395 (B)
Prevalence Index = B/A =			3.95

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: G

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	7.5YR 3/3	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
___ Dark Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Stratified Layers (A5)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: _____
Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? Yes ____ No X Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/3/2023 Time: 12:48
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: H
Investigator(s): Scheuerman, De Guzman TMK/Parcel:
Landform (hillside, coastal plain, etc.): depression Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes	No X	

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 1m radius)			
1. *Sesuvium portulacastrum*	95	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	95 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	95	x 3 =	285
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	95 (A)		285 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: H

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-9	7.5YR 3/3	100					Loamy/Clayey	
9-16	10R 6/2	85	7.5YR 6/8	15	C	M	Mucky Loam/Clay	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
___ Dark Surface (S7)
___ Loamy Gleyed Matrix (F2)
_X_ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Stratified Layers (A5)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: _____
Depth (inches): _____

Hydric Soil Present? **Yes** _X_ **No** ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No _X_	Depth (inches): ____
Water Table Present?	Yes ____	No _X_	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No _X_	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** _X_

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 6/3/2023 Time: 1:00
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: 1
Investigator(s): Scheuerman, De Guzman TMK/Parcel:
Landform (hillside, coastal plain, etc.): hillslope Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 5
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:
Slope of channelized ditch.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 3x1 m)			
1. *Pluchea indica*	100	Yes	FAC
2.			
3.			
4.			
5.			
	100 =Total Cover		
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	=Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species 0	x 1 = 0
FACW species 0	x 2 = 0
FAC species 100	x 3 = 300
FACU species 0	x 4 = 0
UPL species 0	x 5 = 0
Column Totals: 100 (A)	300 (B)
Prevalence Index = B/A =	3.00

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: I

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	7.5YR 3/3	100					Loamy/Clayey	sandy

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
___ Dark Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Stratified Layers (A5)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: _____
Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? Yes ____ No X Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrolgy.

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 6/4/2023 Time: 9:08
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: J
Investigator(s): Scheuerman, De Guzman, Chaplin TMK/Parcel:
Landform (hillside, coastal plain, etc.): terrace Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
Terrace area adjacent to and above channelized ditch system.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 3x1 m)			
1. *Pluchea carolinensis*	15	Yes	FAC
2. *Pluchea indica*	5	Yes	FAC
3.			
4.			
5.			
	20 =Total Cover		
Herb Stratum (Plot size: 1x1 m)			
1. *Atriplex semibaccata*	20	Yes	FAC
2. *Sesuvium portulacastrum*	10	No	FAC
3. *Chloris barbata*	35	Yes	FACU
4.			
5.			
6.			
7.			
8.			
	65 =Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	50	x 3 =	150
FACU species	35	x 4 =	140
UPL species	0	x 5 =	0
Column Totals:	85 (A)		290 (B)

Prevalence Index = B/A = 3.41

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL Sampling Point: J

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-18	7.5YR 3/3	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology.

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 6/5/2023 Time: 8:30
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: K
Investigator(s): Scheuerman, Gabitzer TMK/Parcel:
Landform (hillside, coastal plain, etc.): depression Local relief (concave, convex, none): slightly concave
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes X No
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes X	No	

Remarks:
Depressional area, similar to other wetlands in the area.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 1x1 m)			
1. *Sesuvium portulacastrum*	60	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	60 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	60	x 3 =	180
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	60 (A)		180 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: K

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	5YR 3/1	100					Muck	
1-10	7.5YR 3/3	100					Loamy/Clayey	
10-16	10R 6/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- _X_ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _X_ **No** ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- _X_ High Water Table (A2)
- _X_ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- _X_ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No _X_	Depth (inches): ____
Water Table Present?	Yes _X_	No ____	Depth (inches): 10
Saturation Present? (includes capillary fringe)	Yes _X_	No ____	Depth (inches): 8

Wetland Hydrology Present? **Yes** _X_ **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 6/5/2023 Time: 8:45
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: L
Investigator(s): Scheuerman, Gabitzer TMK/Parcel:
Landform (hillside, coastal plain, etc.): terrace Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5 m radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Prosopis pallida*	40	Yes	FACU
2.			
3.			
4.			
5.			
	40	=Total Cover	
Sapling/Shrub Stratum (Plot size: 3 m radius)			
1. *Pluchea indica*	75	Yes	FAC
2. *Pluchea carolinensis*	10	No	FAC
3.			
4.			
5.			
	85	=Total Cover	
Herb Stratum (Plot size: 1 m radius)			
1. *Sesuvium portulacastrum*	20	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	20	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	105	x 3 =	315
FACU species	40	x 4 =	160
UPL species	0	x 5 =	0
Column Totals:	145 (A)		475 (B)
Prevalence Index = B/A =			3.28

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

SOIL Sampling Point: L

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	7.5YR 3/3						Loamy/Clayey	sandy

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
___ Dark Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Stratified Layers (A5)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: _____
Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? Yes ____ No X Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology.

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 6/5/2023 Time: 9:34
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: M
Investigator(s): Scheuerman, Gabitzer TMK/Parcel:
Landform (hillside, coastal plain, etc.): depression Local relief (concave, convex, none): slightly concave
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** Yes X No
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes X	No	

Remarks:
Depressional wetland, similar to other wetlands in the area.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 1 m radius)			
1. *Sesuvium portulacastrum*	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	70 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species 0	x 1 = 0
FACW species 0	x 2 = 0
FAC species 70	x 3 = 210
FACU species 0	x 4 = 0
UPL species 0	x 5 = 0
Column Totals: 70 (A)	210 (B)
Prevalence Index = B/A =	3.00

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: M

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	7.5YR 3/2	92	2.5YR 5/6	8	C	M	Loamy/Clayey	Prominent redox concentrations
10-12	10R 6/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
___ Dark Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
X Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
X Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Stratified Layers (A5)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: ____
Depth (inches): ____

Hydric Soil Present? **Yes** X **No** ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

X Surface Soil Cracks (B6)
X Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
X Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): ____
Water Table Present? Yes ____ No ____ Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches): ____

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Surface soil cracks, sparse vegetation, and salt deposits are consistent with other similar wetlands in the area.

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS | City: Kekaha | Sampling Date: 6/5/2023 | Time: 9:52
Applicant/Owner: U.S. Navy | State/Terr/Comlth.: Hawai'i | Island: Kauai | Sampling Point: N
Investigator(s): Lowenthal, Scheuerman, De Guzman, Gabitzer | TMK/Parcel:
Landform (hillside, coastal plain, etc.): terrace | Local relief (concave, convex, none): none
Lat: | Long: | Datum: | Slope (%): 0
Soil Map Unit Name: | NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5 m radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Prosopis pallida*	20	Yes	FACU
2.			
3.			
4.			
5.			
	20 =Total Cover		
Sapling/Shrub Stratum (Plot size: 3 m radius)			
1. *Pluchea indica*	15	Yes	FAC
2.			
3.			
4.			
5.			
	15 =Total Cover		
Herb Stratum (Plot size: 1 m radius)			
1. *Atriplex semibaccata*	30	Yes	FAC
2. *Chloris barbata*	10	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	40 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	45	x 3 =	135
FACU species	30	x 4 =	120
UPL species	0	x 5 =	0
Column Totals:	75 (A)		255 (B)
Prevalence Index = B/A =			3.40

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: N

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	7.5YR 3/2	100					Loamy/Clayey	sandy

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
___ Dark Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Stratified Layers (A5)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? Yes ____ No X Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology.

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/2/2023 Time: 15:25
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: O
Investigator(s): Lowenthal Gabitzer TMK/Parcel:
Landform (hillside, coastal plain, etc.): depression Local relief (concave, convex, none): slightly concave
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No
Hydric Soil Present?	Yes X	No
Wetland Hydrology Present?	Yes X	No
Is the Sampled Area within a Wetland?	**Yes X**	**No**

Remarks:
Depressional wetland with large areas devoid of vegetation.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 1m radius)			
1. *Sesuvium portulacastrum*	60	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	60 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	60	x 3 =	180
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	60 (A)		180 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X** **No**

Remarks:

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SOIL Sampling Point: O

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	5YR 3/1	100					Muck	
2-5	7.5YR 3/2	100					Loamy/Clayey	
5-12	7.5YR 3/1	100					Loamy/Clayey	
12-18	5YR 4/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ? Stratified Layers (A5)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- X Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- X Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- X Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches) ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

ENG FORM 6116-6, JUL 2018 Hawai'i and Pacific Islands – Version 2.0

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/2/2023 Time: 11:47
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: Q
Investigator(s): Lowenthal Gabitzer TMK/Parcel:
Landform (hillside, coastal plain, etc.): terrace Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:
Terrace above ditch channel.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5m radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Syzygium cumini*	25	Yes	FAC
2.			
3.			
4.			
5.			
	25	=Total Cover	
Sapling/Shrub Stratum (Plot size: 3 m radius)			
1. *Leucaena leucocephala*	40	Yes	UPL
2. *Pluchea carolinensis*	20	Yes	FAC
3.			
4.			
5.			
	60	=Total Cover	
Herb Stratum (Plot size: 1m radius)			
1. *Cenchrus ciliaris*	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	15	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	45	x 3 =	135
FACU species	15	x 4 =	60
UPL species	40	x 5 =	200
Column Totals:	100 (A)		395 (B)
Prevalence Index = B/A =			3.95

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: Q

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	7.5YR 3/4	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
___ Dark Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Stratified Layers (A5)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____
Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/2/2023 Time: 11:47
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: Q
Investigator(s): Lowenthal Gabitzer TMK/Parcel:
Landform (hillside, coastal plain, etc.): terrace Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:
Terrace above ditch channel.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5m radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Syzygium cumini*	25	Yes	FAC
2.			
3.			
4.			
5.			
	25	=Total Cover	
Sapling/Shrub Stratum (Plot size: 3 m radius)			
1. *Leucaena leucocephala*	40	Yes	UPL
2. *Pluchea carolinensis*	20	Yes	FAC
3.			
4.			
5.			
	60	=Total Cover	
Herb Stratum (Plot size: 1m radius)			
1. *Cenchrus ciliaris*	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	15	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	45	x 3 =	135
FACU species	15	x 4 =	60
UPL species	40	x 5 =	200
Column Totals:	100 (A)		395 (B)
Prevalence Index = B/A =			3.95

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: Q

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	7.5YR 3/4	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
___ Dark Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Stratified Layers (A5)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____
Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Hawai'i and Pacific Islands Region
See ERDC/EL TR-12-5; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: PMRF Land Lease EIS City: Kekaha Sampling Date: 10/2/2023 Time: 10:23
Applicant/Owner: U.S. Navy State/Terr/Comlth.: Hawai'i Island: Kauai Sampling Point: 1
Investigator(s): Scheuerman, Lowenthal, De Guzman, Gabitzer TMK/Parcel:
Landform (hillside, coastal plain, etc.): terrace Local relief (concave, convex, none): none
Lat: Long: Datum: Slope (%): 0
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?** Yes No X
Hydric Soil Present?	Yes	No X	
Wetland Hydrology Present?	Yes	No X	

Remarks:
Terrace area adjacent to agriculture ditch.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 3m radius)			
1. *Leucaena leucocephala*	50	Yes	UPL
2.			
3.			
4.			
5.			
	50 =Total Cover		
Herb Stratum (Plot size: 1 m radius)			
1. *Megathyrsus maximus*	75	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	75 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	75	x 3 =	225
FACU species	0	x 4 =	0
UPL species	50	x 5 =	250
Column Totals:	125 (A)		475 (B)
Prevalence Index = B/A =			3.80

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	7.5YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6) **(Guam, CNMI, and American Samoa)**
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: _____
Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) **(Guam, CNMI, and American Samoa)**
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

ENG FORM 6116-6, JUL 2018 Hawai'i and Pacific Islands – Version 2.0

Appendix C
Site Photographs

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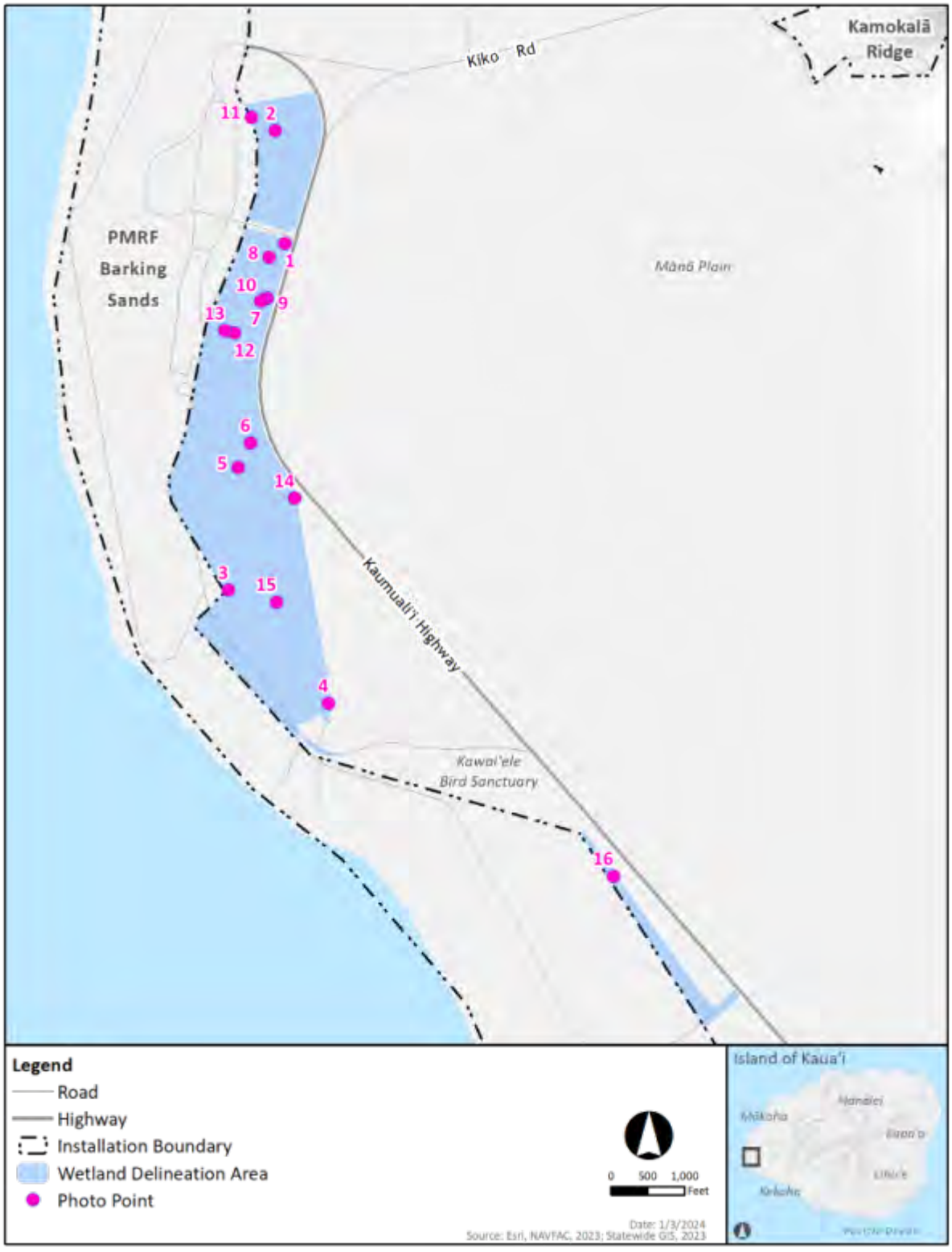

Figure 12 Location of Photo Points

Photo 1. Data Point C, Wetland

Photo 2. Smaller Ditch, Typical

Photo 3. Larger Ditch, Typical

Photo 4. Larger Ditch, Typical

Photo 5. Smaller Ditch, Typical

Photo 6. Smaller Ditch, Typical

Photo 7. Smaller Ditch, Typical

Photo 8. Smaller Ditch, Typical

Photo 9. Data Point E, Wetland

Photo 10. Data Point F, Upland

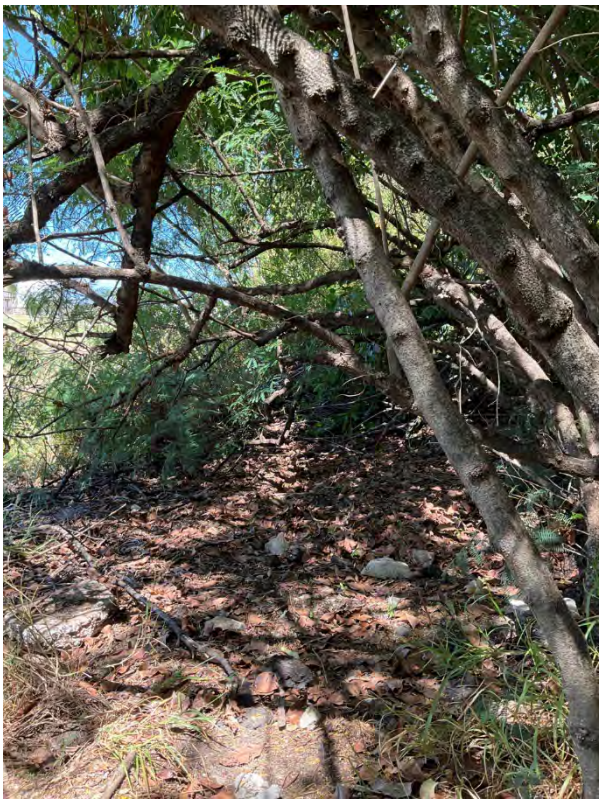

Photo 11. Data Point G, Upland

Photo 12. Data Point H, Upland

Photo 13. Data Point I, Upland

Photo 14. Data Point K, Wetland

Photo 15. Data Point O, Wetland

Photo 16. Data Point Q, Upland

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