APPENDICES

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APPENDIX A – KEY FEDERAL STATUTES RELATED TO NATURAL RESOURCES MANAGEMENT

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Sikes Act, as amended 1997 (16 USC 670a – et seq.)

The Sikes Act requires each military installation to manage natural resources for multipurpose uses and public access appropriate for those uses, as well as ensuring no net less to training, testing or other defined missions of the installation. Management of these resources is accomplished through development and implementation of an INRMP. Each INRMP must be prepared in consultation with the USFWS and the cognizant state fish and wildlife agency. The public must be afforded an opportunity to review and comment on INRMPs prior to their finalization. The Sikes Act also requires, to the extent practicable using available resources, sufficient numbers of professionally-trained natural resource management personnel and natural resources law enforcement personnel, be available and assigned responsibility to perform tasks necessary to carry out Title I of the Sikes Act, including preparing and implementing INRMPs.

Endangered Species Act of 1973, as amended (16 USC 1531 et seq.)

The Endangered Species Act (ESA) of 1973 (16 USC §1531 et seq.), as amended, is the primary federal regulatory protection for threatened and endangered species on federal lands. The law is administered by the USFWS and NMFS**,** depending on the species. The ESA is federal legislation that is intended to provide a means to conserve the ecosystems upon which endangered and threatened species depend and provide programs for the conservation of those species to prevent extinction of plants and animals. Endangered species include any species that is in danger of extinction throughout all or a significant portion of its range. Threatened species include any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Candidate species are those species that are actively being considered for listing as endangered or threatened under ESA, as well as those species that USFWS and/or NMFS has initiated an ESA status review announced in the Federal Register (FR). The designation of candidate species does not carry any procedural or substantive protections under the ESA (50 Code of Federal Regulations [CFR] §424.02 and 69 FR 19975).

A guide to Section 7 consultations is available at:

http://www.fws.gov/endangered/what-we-do/consultations-overview.html

Section 7 of the ESA requires all federal agencies to consult with USFWS and/or NMFS to ensure that their actions are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of critical habitat. The proponent of a proposed action must conduct an analysis for actions that "may affect" listed species. If the action is determined likely to have an adverse effect, a formal consultation is initiated. Consultations conclude with a jeopardy or non-jeopardy determination and the issuance of a biological opinion (BO) and incidental take statement by the USFWS and/or NMFS. Section 7(a)(1) of the Act further 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.

Section 9 of the ESA prohibits the take of endangered or threatened species without special exemption. Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. However, Section 7 affords some flexibility through exemptions from the Section 9 prohibitions on take. In the case of non-jeopardy determinations for actions, incidental take statements exempt federal agencies from the Section 9 prohibitions on take if they comply with the reasonable and prudent measures and terms and conditions of an incidental take statement. This exemption allows takings of listed species that are incidental to otherwise lawful military activities, thus providing the military with the flexibility to accommodate new missions.

Section 4(a)(3)(B)(i) of the ESA exempts military installations from critical habitat designations as long as an INRMP acceptable to the Secretary of the Interior is in place. In order to qualify for the exemption, INRMPs must provide for the implementation of effective conservation measures that will sustain and advance the recovery of listed species. Department of Defense Manual (DoDM) 4715.03 summarizes the criteria to determine if an INRMP provides adequate special management or protection to obviate the need for critical habitat designation as follows:

- The INRMP provides a conservation benefit to the listed species. The cumulative benefits of the management activities identified in the INRMP for its duration maintains or provides for an increase in a species' population or the enhancement or restoration of its habitat within the area included in the INRMP (i.e., those areas essential to the conservation of the species). A conservation benefit may result from reducing habitat fragmentation, maintaining or increasing populations, insuring against catastrophic events, enhancing and restoring habitats, buffering protected areas, or testing and implementing new conservation strategies.

- The INRMP provides certainty that relevant agreed-on actions will be implemented. Persons implementing the INRMP can accomplish its goals and objectives, have adequate funding to implement agreed upon activities, have implementation authority, and have obtained all the necessary authorizations or approvals. The INRMP includes an implementation schedule, including completion dates, for the conservation effort.

- The INRMP provides certainty that the conservation effort will be effective. The USFWS considers the following criteria when determining the effectiveness of the conservation effort:
    - Biological goals, which are broad guiding principles for the program, and objectives, which are measurable targets for achieving the goals.
    - Quantifiable, scientifically valid parameters that demonstrate achieving objectives and standards measuring progress.
    - Provisions for monitoring and, where appropriate, adaptive management.
    - Provisions for reporting progress on implementation based on compliance with the implementation schedule and effectiveness based on evaluation of quantifiable parameters of the conservation effort.
    - A period of time sufficient to implement the actions and achieve the benefits of its goals and objectives.

Pursuant to the ESA, contemplated actions at PMRF with potential to impact a protected species must be assessed via a biological assessment (BA) to determine whether the proposed action is likely to adversely affect a listed species, proposed species, or designated critical habitat. After review of the BA, the USFWS and/or NMFS issue a BO stating their opinion on whether or not the action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. Management requirements that ensure a non-jeopardy determination may be identified by the USFWS or NMFS during the consultation process. Additionally, the terms and conditions under which incidental take may occur may be identified.

PMRF has worked with the USFWS and NMFS for many years to facilitate the conservation and management of listed species and critical habitat and requests formal and/or informal consultations whenever a proposed action has potential to affect a federally listed species.

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 BO addresses potential impacts to the federally listed endangered Hawaiian Black-necked Stilt or Ae’o (*Hinumtopus mexicanus knudseni*), Hawaiian Moorhen or ‘Alae ‘ula (*Gallinula chloropus sandvicensis*), Hawaiian Coot or Alae ke‘oke‘o (*Fulica alai*), Hawaiian Duck or Koloa Maoli (*Anas wyvilliana*), Hawaiian Goose or Nēnē (*Branta sandvicensis*), Hawaiian Petrel or ‘Ua‘u (*Pterodroma phaeopygia sandwichensis*), and Hawaiian hoary bat or ope ‘ape ‘a (*Lasiurus cinereus semotus*), and the threatened Newell's Shearwater or ‘A‘o (*Puffinus auricularis newelli*). The conference opinion was made in regards to the federal candidate species, Band-rumped Storm-petrel or ‘Ake’ake (*Oceanodroma castro*) (now listed as endangered). The USFWS concurred with the no effect determination to the two federally protected plant species, dwarf ili’au (*Wilkesia hobdyi*) and Hawai‘i scaleseed (*Spermolepis hawaiiensis*); 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 Ni‘ihau panicgrass or lau’ehu plant (*Panicum niihauense*) that occur at PMRF. Potential impacts to the federally listed endangered Hawaiian monk seal *(Neomonachus schauinslandi*), which is under the jurisdiction of the NMFS, were not addressed.

In order to be exempt from the prohibition of take of endangered or threatened species, under section 9 of the ESA, the Navy must comply with a number of terms and conditions set forth in the Base-wide BO. Included are the amount of anticipated incidental take for each species addressed in the BO (Table 1) and reporting requirements to monitor the impact of incidental take. Reporting requirements are as follow:

USFWS will be notified by telephone and email within 24 hours (hrs) 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, HawaiianDuck, 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 will provide USFWS a written notification, summarizing the event, within 30 days.

- USFWS will be notified by telephone and email within 24 hrs upon the discovery of an abandoned Hawaiian goose nest or listed Hawaiian waterbird nest. The Navy will provide USFWS a written notification, summarizing the event, within 30 days.
- Access to any of the PMRF sites will be provided by the Navy to USFWS with 24 hour notification so that they may independently monitor for downed seabirds and retrieve reported carcasses.
- The Navy will submit annual reports detailing the implementation of 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 non-discretionary conservation measures developed by the USFWS and Navy as well as the reasonable and prudent measures, which are necessary to minimize impacts of incidental take, identified in the Base-wide BO were used to guide and inform the development of management actions presented in this INRMP. A number of discretionary conservation measures recommended to avoid or minimize impacts to listed and/or candidate species have also been incorporated into threatened and endangered species management at PMRF.

Table 1. Anticipated Take as Per Pacific Missile Range Facility Base-wide Infrastructure, Operations, and Maintenance

Scientific Name	Common/Hawaiian Name	Anticipated Take
Anas wyvilliana	Hawaiian Duck or Koloa Maoli	Up to an average of one Hawaiian Duck per year and a maximum of two 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.
Branta sandvicensis	Hawaiian Goose or Nēnē	Up to an average of two Hawaiian Geese per year and a maximum of four 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 eggs or goslings may also be incidentally taken indirectly in the form of injury or mortality due to nest failure or abandonment of two nests (five eggs per nest) as a result of inadvertent hazing of nesting adults. Fifty eggs or goslings may be taken indirectly in the form of injury or mortality due to nest failure or reduced breeding success of ten nests laid in sub-optimal, unprotected habitats of Hawaiian Geese which were precluded from nesting at PMRF as a result of hazing activities.
Fulica alai	Hawaiian Coot or Alaekeʻokeʻo	Up to an average of one Hawaiian Coot per year and a maximum of two 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.
Gallinula chloropus sandvicensis	Hawaiian Moorhen or ʻAlae ʻula	Up to an average of two Hawaiian Moorhen per year and a maximum of four 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.

Hinumtopus mexicanus knudseni	Hawaiian Black-necked Stilt or Ae‘o	Up to an average of one Hawaiian Stilt per year and a maximum of two 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 eggs or chicks may be taken indirectly in the form of injury or mortality due to nest failure or reduced breeding success of five nests (four 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.
Lasiurus cinereus semotus	Hawaiian Hoary Bat or ope ‘ape ‘a	Up to an average of one Hawaiian hoary bat every three years and a maximum of three Hawaiian hoary bats in one year may be taken in the form of injury or death due to entanglement on barbed-wire fences.
Oceanodroma castro	Band-rumped Storm-petrel or ‘Ake‘ake	Up to an average of two fledgling Band-rumped Storm-petrels every ten years and a maximum of four 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.
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel or ‘Ua‘u	Up to an average of one fledgling Hawaiian Petrel every ten years and a maximum of two 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.
Puffinus auricularis newelli	Newell’s Shearwater or ‘A‘o	Up to an average of three fledgling Newell’s Shearwaters per year and a maximum of nine 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.

Migratory Bird Treaty Act (16 USC 703–712)

The current list of MBTA-protected species is available at:

http://www.fws.gov/migratorybirds/regulationspolicies/mbta/MBTANDX.HTML

Migratory birds includes a large, diverse group of birds that utilize breeding grounds in the United States and Canada, and overwinter in southern North America, Central and South America, the West Indies, and the Caribbean. The Migratory Bird Treaty Act (MBTA) of 1918 (16 USC §703-711), as amended, is the primary legislation in the United States established to conserve migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds their eggs, parts, and nests unless permitted by regulation. As of November 2013, 1,026 species were included on the list of migratory birds (78 FR 65844). Non-native species that were introduced into the United States, such as House Sparrow (*Passer domesticus*), Common Myna or Piha'ekelo (*Acridotheres tristis*), Rock Pigeon (*Columba livia*), and Japanese White-eyes (*Zosterops japonicas*) are not protected by the MBTA. Note, though, that native species that are introduced into parts of the United States where they are not native are still protected under the MBTA regardless of where they occur in the United States or its territories. The MBTA also does not apply to various other species including Red Junglefowl or Moa (*Gallus gallus*), Francolin or Kokee (*Francolinus* sp.), Wild Turkeys or Pelehu (*Meleagris gallopavo*), and other non-migratory game species (78 FR 65844). A complete list of bird species known to occur at PMRF and their protected status under the MBTA is in Appendix C.

Section 315 of the 2003 National Defense Authorization Act and the Military Readiness Rule (50 CFR Part 21) authorize, with certain limitations, the incidental take of migratory birds during military readiness activities. Military readiness activities include all training and operations of the Armed Forces that relate to combat, and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Military readiness does not include the routine operation of installation support functions, such as: administrative offices, military exchanges, commissaries, water treatment facilities, storage facilities, schools, housing, motor pools, laundries, MWR activities; shops, mess halls; the operation of industrial activities; or, the construction or demolition of facilities used for training and testing operations (72 FR 8931). If the DoD determines that a proposed or an ongoing military readiness activity may result in a significant adverse effect on a population of a migratory bird species, they must confer and cooperate with the USFWS to develop appropriate and reasonable conservation measures to minimize or mitigate identified significant adverse effects. During annual INRMP reviews, the Navy must report any migratory bird conservation measures that have been implemented and the effectiveness of the conservation measures in avoiding, minimizing, or mitigating take of migratory birds.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 USC §1361), as amended, prohibits the taking of marine mammals and defines "take" as "the act of hunting, killing, capture, and/or harassment of any marine mammal; or, the attempt at such." In regards to military readiness activities, the National

Defense Authorization Act (NDAA) of 2004 amended the MMPA to define harassment to mean: 1) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or 2) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered (Level B harassment) (NDAA 2004, Sect. 319).

All marine mammals, including those not listed under the ESA, are protected by the MMPA. The NMFS has jurisdiction over cetaceans (whales, dolphins, porpoises) and most pinnipeds (seals and sea lions), whereas the USFWS has jurisdiction over polar bears, sea otters, walruses, manatees, and dugong (*Dugong dugon*).

The Navy is required to assess potential impacts to marine mammals from training and testing, construction, and other in-water activities an effects analysis must be conducted in cases where naval activities may introduce high levels of sound or explosive energy into the marine environment. Authorization may be obtained by NMFS or USFWS to "take" marine mammals incidental to Navy activities if it is determined Navy action will: (1) have a negligible impact on the species or stock(s), and (2) include measures to mitigate adverse impacts on the availability of the species or stock(s) for subsistence uses (OPNAV M-5090.1).

The MMPA requires NMFS to ensure that activities with a potential to impact marine mammal populations are conducted in a manner, time, and location most appropriate to minimizing possible adverse effects to those populations. The NMFS may authorize the incidental take of marine mammals under a Letter of Authorization (LOA), which authorizes take for harassment or serious injury and may be valid for a specific training event or for a period of up to five years (NMFS 2015a). If a proposed action has no potential for serious injury or mortality, an Incidental Harassment Authorization (IHA) may be sought.

If an action proponent determines incidental takes are likely due to Navy-generated effects of the action on land or in the water, the action proponent must notify and receive concurrence from OPNAV (N45) via the chain of command prior to notifying the regulatory agencies. The action proponent must also notify the appropriate region commander and or the Navy area environmental coordinator.

National Environmental Policy Act of 1969 (42 USC 4321 et seq.)

Pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 USC §4321 et seq.), as amended, and in accordance with the regulations of the Council on Environmental Quality (CEQ) that implement NEPA procedures (40 CFR parts 1500-1508), all federal agencies must take into consideration the potential environmental consequences of proposed actions in their decision-making process. The objectives of NEPA are to ensure that the government makes informed decisions and the public is included in the decision-making process and that all reasonable alternatives for an action are considered.

The Secretary of the Navy Instruction (SECNAVINST) 5090.6A and OPNAVINST 5090.1E establish Navy policy, procedures, and responsibilities for NEPA documentation for Navy actions. It is Navy policy to initiate the NEPA processes at the earliest possible time to be an effective decision-making tool in the course of identifying a proposed action and to develop and carefully consider a reasonable range of alternatives for achieving the purpose of the proposed action. The IEPD at PMRF is responsible for implementing the requirements of NEPA. NAVFAC HI provides extra staffing and support for NEPA review on an as needed basis. The Environmental Program also supports the NEPA environmental impact analysis process through providing subject matter expertise and reviewing or contributing to NEPA documents, as required. The IEPD reviews all proposed projects to determine the appropriate level of NEPA analysis and works with project proponents to minimize or avoid impacts through the development of practicable alternatives and/or project modifications.

Project Approval Process

OPNAVINST 11010.20H - Navy Facilities Projects requires a thorough sites approval process be conducted for active and reserve Navy projects, regardless of general type of construction (i.e., permanent, semi-permanent, demolition, or temporary), work classification, and funding source. PMRF Environmental Program staff follows a routine procedure to assure coordination among facilities planners, resource managers, and government agencies. The PMRF IEPD is the primary point of contact to provide relevant information on issues with potential to affect natural resources. All new construction projects at Barking Sands and other PMRF locations are vetted by the IEPD to minimize natural resource impacts while meeting operational needs. The PMRF IEPD specifically reviews planned actions to ensure compliance with natural resources laws and regulations, including avoidance of protected species and their habitats, wetlands protection, migratory bird protection, critical habitat protection, and erosion control. New facilities are sited preferentially in ruderal or developed land-use categories.

Levels of Documentation: CEQ regulations prescribe three levels of NEPA documentation: categorical exclusions (CATEX), Environmental Assessments (EAs), or Environmental Impact Statements (EISs), depending on the expected significance of impacts from a proposed action and its alternatives.

Categorical Exclusions

A CATEX includes a category of actions that do not individually or cumulatively have a significant effect on the human environment, do not result in any significant change from existing conditions, or whose effect is primarily economic or social, and therefore do not require an EA or an EIS. Procedures on how to record a CATEX and the current list of CATEXs are provided in OPNAVIST 5090.1E Reference (c), Chapter 10, Section 10-3.14.

Environmental Assessments

An EA is a concise public document for which a federal agency is responsible that serves to briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact

statement or a finding of no significant impact (FONSI) and aids an agency's compliance with NEPA when no EIS is necessary. It may further facilitate preparation of a statement when one is necessary. An EA must include brief discussion of the need for the proposal, alternatives for the action, environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted. OPNAVIST 5090.1E, Reference (c), Chapter 10, Section 10-3.15 provides guidance on procedures, a list of actions that would generally require and EA, and a description of the core components of an EA.

Environmental Impact Statements

An EIS is an environmental document prepared for major federal actions that may have a significant impact on the quality of the human environment. According to 40 CFR part 1502, "The primary purpose of an EIS is to serve as an action-forcing device to insure that the policies and goals defined in NEPA are infused into the ongoing programs and actions of the Federal Government. It shall provide full and fair discussion of significant environmental impacts and shall inform decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment". A list of actions that would require preparation of an EIS and detailed Navy guidance on EIS procedures are provided in OPNAVINST 5090.1E Reference (c), Chapter 10, Section 10-3.16.

Mitigation Measures: The purpose of mitigation is to reduce or eliminate potential negative impacts of an action on affected resources. CEQ regulations (40 CFR part 1508.20) state that mitigation includes:

- Avoiding the impact altogether by not taking a certain action or parts of an action,
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation,
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment,
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, and
- Compensating for the impact by replacing or providing substitute resources or environments.

Regulations established by CEQ state that all relevant reasonable mitigation measures that could alleviate the environmental effects of an action must be identified, even if they are outside the jurisdiction of the lead agency or the cooperating agencies. This serves to alert agencies or officials who can implement these extra measures, and will encourage them to do so.

Clean Water Act (Federal Water Pollution Control Act) as amended 1987 (33 USC 1251 et seq.)

The Clean Water Act (CWA) of 1972 (33 USC §1251 et seq.), as amended, establishes the basic structure for regulating discharges of pollutants into the waters of the U.S. and regulating quality standards for surface waters. Under Section 404 of the CWA, discharge of dredge and fill material into waters of the United States is prohibited unless a permit is issued by the U.S. Army Corps of Engineers (USACE). Waters of the U.S. include all surface waters such as all navigable waters and their tributaries, all interstate waters and their tributaries, all wetlands adjacent to these waters, and all impoundments of these waters (40 CFR 230.3).

A determination of waters of the United States under the jurisdiction of the USACE requires on-site documentation of indicators of hydrophytic vegetation, hydric soils, and wetland hydrology in accordance with criteria set out in the *Corps of Engineers Wetlands Delineation Manual* (USACE 1987) and *Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Hawai'i and Pacific Region, Version 2.0* (USACE 2012). These criteria are mandatory and must all be met for an area to be identified as wetland, except under circumstances when a wetland is considered a disturbed area or problem wetland. Jurisdictional determinations are generally valid for a period of five years, but may differ as site conditions and policies can change. Any Navy Facilities or other activities with the potential to disturb waters of the United States, including wetlands, must be reviewed individually with regard to impacts, state and federal permits are sought as needed.

Section 402 of the CWA establishes the National Pollutant Discharge Elimination System (NPDES) permit program to regulate point source discharges of pollutants into waters of the U.S. A NPDES permit sets specific discharge limits for point sources discharging pollutants into waters of the United States and establishes monitoring and reporting requirements, as well as special conditions. The NPDES permit program, administered by the Environmental Protection Agency (EPA), controls such discharges. However, the EPA may approve state administration of the program and the state assumes permitting authority in lieu of EPA.

Section 401 of the CWA requires additional certification from the appropriate state regulatory agency. In accordance with Section 401, federal agencies must obtain a water quality certificate from the state for any action requiring a federal license or permit.

In Hawai'i, the Hawai'i Department of Health, Clean Water Branch has regulatory authority over the discharges of pollutants to the waters of the U.S. under Section 402 of the CWA, the NPDES Program, and Section 401 of the CWA. These authorities require an applicant for any federal permit covering an activity that may result in a discharge into the state's waters to first obtain a state certification, to ensure that the project will comply with state water quality standard.

State Water Protection Laws

Additional state laws regulate stream channel alterations and stream channel diversions in order to protect stream channels from alteration whenever practicable to provide for fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses (Hawai'i Administrative Rules 13-169). Stream Channel Alteration Permits (SCAP) and Stream Diversion Works Permits (SDWP) are required for activities with potential to impact these resources. The SOH DLNR, Commission of Water

Resources administers this program. Routine streambed and drainage way maintenance activities and the repair of existing facilities are exempt from the SCAP and SDWP requirements (SOH DLNR, Commission of Water Resources 2015).

Coastal Zone Management Act of 1972 (16 USC 1451-1456)

The federal Coastal Zone Management Act (CZMA) of 1972 (16 USC §1451 et seq.) establishes a policy to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife supported by those habitats. The CZMA provides for state implementation of coastal zone management upon federal approval of the state plan. The Office of Planning (OP) oversees Hawai‘i’s Coastal Zone Management (CZM) Program, although county authorities administer Special Management Area (SMA) permits and shoreline setback provisions. The SMA permitting system is part of the CZM Program approved by state and federal agencies. The entire shorelines of Kaua‘i, excluding Barking Sands, and Ni‘ihau are defined as SMAs under the state’s CZM Program (SOH OP 2015).

Although federal lands and actions are exempt from state law jurisdiction, the CZMA requires federal consistence with the enforceable policies of the SOH CZM Program. To ensure consistency, the Navy must consult with the SOH OP when the proposed action has the potential for reasonably foreseeable direct or indirect effects on any coastal use or resource of the state’s coastal zone. Objectives of the state CZM Program are to:

- Provide coastal recreational opportunities accessible to the public;
- Protect, preserve, and where desirable, restore those natural and man-made historic and pre-historic resources in the coastal zone management area that are significant in Hawaiian and American history and culture;
- Protect, preserve and where desirable, restore or improve the quality of coastal scenic and open space resources;
- Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems;
- Provide public or private facilities and improvements important to the state’s economy in suitable locations;
- Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence;
- Improve the development review process, communication, and public participation in the management of coastal resources and hazards;
- Stimulate public awareness, education, and participation in coastal management

- Protect beaches for public use and recreation, and
- Implement the state's ocean resources management plan.

The Navy must provide the state with a consistency determination for any activity that is in, or affects land use, water use or any natural resource in the coastal zone, if the activity is conducted by or on behalf of a federal government agency, requires a federal license or permit, or receives federal funding.

Magnuson-Stevens-Fishery Conservation and Management Act (16 USC 1801 et seq.)

The Magnuson-Stevens-Fishery Conservation and Management Act, frequently referred to as the Magnuson-Stevens Act (MSA) of 1976 (16 USC §1801 et seq.), as amended, is the principal law governing marine fisheries in the United States. It sets mandates for the NMFS, regional fishery management councils, and federal action agencies to identify and protect important marine and anadromous fish habitat. The Hawai‘i archipelago is under the jurisdiction of the Western Pacific Regional Fishery Management Council (WPRFMC). In addition to overseeing fishing activities, the WPRFMC, with assistance from NMFS, is required to delineate essential fish habitat (EFH) of all managed species in fishery ecosystem plans (previously, fishery management plans). EFH includes both waters and substrate necessary to a species or species group or complex, for spawning, breeding, feeding or growth to maturity. EFH may be designated for a species' complete life cycle, including spawning, feeding, and growth to maturity, or may be specific for each life stage (e.g., eggs, larvae).

Pursuant to the MSA, the Navy must consult with NMFS prior to undertaking any action that may reduce the quality or quantity of EFH. A written evaluation of the effect of the proposed action on EFH may be submitted as part of a draft environmental planning document (EA or EIS, as appropriate) if an action is likely to result in minimal adverse effects on EFH. However, a stand-alone EFH assessment should be prepared if an action is likely to have more than minimal adverse effects on EFH (OPNAV M-5090.1).

Marine Debris Act

The Marine Debris Act (33 USC 1951 et seq.), as amended, established the Interagency Marine Debris Coordinating Committee, which is a multi-agency body responsible for streamlining the federal government's efforts to address marine debris. As a member of this committee, the Navy participates in research, educational efforts, and developing strategies and recommendations to reduce the sources and impacts of marine debris to the Nation's marine environment.

In support of the Marine Debris Act, the Navy has completed installation of upgraded plastic waste processors on all surface warships. The plastic waste processors have greater capacity and reliability than previous versions and have limitations on their use. In addition, the Navy has begun to examine methods and equipment to be integrated into new design warships to enable zero discharge of paper, cardboard, metal, and glass in order to fully comply with new domestic and international discharge regulations.

At the local level, the Navy partners with state and local authorities to assist in the removal of marine debris, as well as conduct beach and shore clean-ups at its installations (Interagency Marine Debris Coordinating Committee 2014).

Clean Air Act (42 USC 7401 et seq.)

The Clean Air Act (CAA) of 1970 (42 USC §7401 et seq.), as amended, is the comprehensive federal law that regulates air emissions from stationary and mobile sources. Among other things, this law authorizes the EPA to establish National Ambient Air Quality Standards to protect public health and public welfare and to regulate emissions of hazardous air pollutants. The PMRF Air Program Manager is responsible for ensuring compliance with the CAA at the installation. The IEPD discusses potential CAA impacts related to natural resources projects with the Air Program Manager as necessary. CAA consultation, if required, would be conducted by the Air Program Manager.

EXECUTIVE ORDERS AND OTHER DIRECTIVES

EO 11990 – Protection of Wetlands

The term "wetlands" means those areas that are inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. This EO was issued to avoid long- and short-term adverse impacts associated with the destruction or modification of wetlands. EO 11990 requires that federal agencies provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands (42 FR 26961). A national policy directive that requires that federal agency actions avoid resulting in a net loss of wetlands supports this EO.

EO 11988 – Floodplain Management

Floodplains receive protection through this EO, which instructs federal agencies to restore and preserve floodplains and to reduce the risk of flood-related loss. EO 11988 specifically directs federal agencies to:

- Avoid actions located in or adversely affecting floodplains unless there is no practicable alternative,
- Take action to mitigate losses if avoidance is not practicable,
- Establish a process for flood hazard evaluation based upon the 100-year base flood standard of the National Flood Insurance Program, and
- Issue implementing procedures (42 FR 26951).

EO 12962 – Recreational Fisheries

Federal agencies, to the extent permitted by law and where practicable, should improve the quality, function, and sustainable productivity and distribution of U.S. aquatic resources for increased

sustainable recreational fishing opportunities. Among other activities, this EO requires federal agencies to:

- Foster sound aquatic conservation and restoration endeavors to benefit recreational fisheries,
- Provide access to and promoting awareness of opportunities for public participation and enjoyment of U.S. recreational fishery resources, and
- Support outreach programs designed to stimulate angler participation in the conservation and restoration of aquatic systems.

EO 13089 – Coral Reef Protection

Coral reef ecosystems are unique and among the earth's most complex and diverse ecosystems. However, coral reef resources have become over exploited by fishing, recreation, and other uses, and degraded by dredging and shoreline modifications, decreases in water quality, sedimentation, aquatic nuisance species or invasive native species, destructive fishing practices, vessel groundings and anchoring, disease outbreaks, and global climate change (U.S. Coral Reef Task Force 2000).

In response to this growing global coral reef crisis, EO 13089 on Coral Reef Protection was issued in 1998 (64 FR 32701). Through the policies set forth in the EO, federal agencies are directed to identify their actions that may affect U.S. coral reef ecosystems, utilize their programs and authorities to protect and enhance the conditions of these ecosystems and ensure that any actions they authorize, fund, or carry out will not degrade the conditions of coral reef ecosystems. In support of this EO, DoD developed the *Department of Defense Coral Reef Protection Implementation Plan* (DoD 2000), sates DoD policy is:

- To protect U.S. and International coral reef ecosystems and to avoid impacting coral reefs to the maximum extent feasible.
- To responsibly manage and restore coral reef ecosystems in carrying out the terms of all laws, regulations, and policies concerning coastal zone management and coral reef protection.
- To conduct an environmental review of any action likely to affect U.S. coral reef ecosystems in accordance with the National Environmental Policy Act, EO 12114 - Environmental Effects Abroad of Major Federal Actions, and current DoD policies. Mitigating measures are required where coral reef impacts are unavoidable.

EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds

This EO encourages incorporation of comprehensive migratory bird management objectives in agency management plans and requires federal agencies to enter into a Memorandum of Understanding (MOU) on migratory birds with the USFWS. The DoD-USFWS MOU on migratory birds, originally signed in 2006, directs DoD and USFWS to strive to protect, restore, enhance, and manage habitat of migratory birds on DoD-managed lands; and to promote collaborative projects such as the Monitoring Avian Productivity and Survivorship (MAPS), Breeding Bird Survey (BBS), Christmas Bird Counts, bird atlas projects, or game bird surveys on DoD lands. The MOU is a five-year agreement that must

be reviewed and renewed by the participating parties every five years. Responsibilities identified in the MOU specific to DoD include:

- Incorporating conservation measures addressed in Regional or State Bird Conservation Plans in INRMPs,
- When consistent with safety and security, allowing USFWS and other partners reasonable access to military lands for conducting surveys,
- Engaging in early planning and scoping with the USFWS prior to starting any activity that is likely to affect populations of migratory birds in order to proactively address migratory bird conservation and in order to initiate appropriate actions to avoid or minimize the take of migratory birds, and
- Managing military lands and non-military readiness activities in a manner that support migratory bird conservation.

PMRF participates in regional projects including State of Hawai‘i biannual waterbird surveys and annual Nēnē surveys as well as incorporates measures from the Hawaiian Bird Conservation Action Plan (VanderWerf 2012) into their migratory bird management efforts.

EO 13751 – Safeguarding the Nation from the Impacts of Invasive Species

Invasive species are any species that are not native to a given ecosystem, and whose introduction causes, or is likely to cause, economic or environmental harm and/or harm to human health. EO 13751 specifically addresses the control of invasive nonnative species on federal lands and requires federal agencies, to the extent practicable and subject to the availability of appropriations, to:

- prevent the introduction, establishment, and spread of invasive species;
- detect and respond rapidly to eradicate or control populations of invasive species in a manner that is cost-effective and minimizes human, animal, plant, and environmental health risks;
- monitor invasive species populations accurately and reliably;
- provide for restoration of native species and habitats that have been impacted by invasive species;
- conduct research on invasive species and develop and apply technologies to prevent their introduction, and provide for environmentally sound methods of eradication and control of invasive species;
- promote public education on invasive species; and coordinate with and complement similar efforts of States, territories, federally recognized American Indian tribes, Alaska Native Corporations, Native Hawaiians, local governments, nongovernmental organizations, and the private sector.

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, the state has a list of high-profile species that are informally considered to be invasive due to their ability or potential to cause harm to Hawai‘i’s environment, economy, or way of life and is in the process of drafting and adopting administrative rules to formally define species that are invasive in Hawai‘i. The

SOH DOA's Plant Pest Control Branch conducts statewide programs to eradicate or control plant pests and develops new pest advisories (SOH DOA 2015b).

On Kaua'i, KISC has identified a number of invasive plant and animal species that are highly invasive species of concern that are thought to be in limited distribution and are a priority for control. KISC requests sightings of these pests be reported immediately. KISC also identifies invasive species that are commonly found or widespread on Kaua'i. Their removal is recommended, but is not conducted by KISC (KISC 2015).

Presidential Memorandum on Pollinators

Pollinators are fundamental to functioning ecosystems and are essential to both agriculture and natural ecosystems as they are responsible for the reproduction of 75 percent of the world's flowering plants, including thousands of fruit and vegetable crops (USFWS 2013). A Presidential Memorandum of June 2014, *Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators*, directs Federal agencies to take steps to protect and restore domestic populations of pollinators. The Memorandum states:

"Executive departments and agencies shall, as appropriate, take immediate measures to support pollinators during the 2014 growing season and thereafter. These measures may include planting pollinator-friendly vegetation and increasing flower diversity in plantings, limiting mowing practices, and avoiding the use of pesticides in sensitive pollinator habitats through integrated vegetation and pest management practices."

Information on the DoD Pollinator Initiatives is available at:

http://www.dodpollinators.org/index.html

An MOU between the DoD and the Pollinator Partnership, a collaboration of partners working to promote awareness and scientific understanding of pollinators, was signed in 2015. The MOU further directs DoD to undertake activities that help, conserve, protect and restore pollinators and their habitats, subject to the availability of resources. The MOU also stresses that pollinator management should be incorporated into INRMPs, where practicable.

DoD has made pollinator conservation a natural resources priority in order to meet its readiness and stewardship obligations. In support of pollinator conservation, the DoD Natural Resources Program has developed and distributed pollinator fact sheets, formed the DoD Pollinator Working Group, funded Legacy grants benefiting pollinator research and conservation, funded National Public Lands Day events, and is a partner in the North American Pollinator Protection Campaign (NAPPC).

Primary recommendations for pollinator conservation developed by the DoD Natural Resources Program include:

- Reducing pesticide use (particularly neonicotinoids, which strongly impact bees),
- Controlling invasive plants using an integrated pest management approach,
- Restoring land with native plants that attract pollinators, and integrate pollinator friendly plants into gardens,
- Creating corridors between pollinator habitats to minimize fragmentation, and
- Monitoring sites over time, and make note of pollinator species habitat composition.

Monarch butterflies (*Danaus plexippus plexippus*), which are under review for ESA listing (USFWS 2017b), would also benefit from pollinator conservation. Monarchs occurring in Hawai‘i are considered to be the same subspecies as the migratory populations of eastern and western North America, *D. p. plexippus*.

APPENDIX B – MEMORANDA OF UNDERSTANDING AND AGREEMENTS

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MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF DEFENSE AND THE U.S. FISH AND WILDLIFE SERVICE AND THE ASSOCIATION OF FISH AND WILDLIFE AGENCIES FOR A COOPERATIVE INTEGRATED NATURAL RESOURCE MANAGEMENT PROGRAM ON MILITARY INSTALLATIONS

A. PURPOSE

The purpose of this Memorandum of Understanding (MOU) is to further a cooperative relationship between the U.S. Department of Defense (DoD), U.S. Department of the Interior-Fish and Wildlife Service (FWS), and state fish and wildlife agencies (states) acting through the Association of Fish and Wildlife Agencies (AFWA) (hereafter referred to as the Parties) in preparing, reviewing, revising, updating and implementing Integrated Natural Resource Management Plans (INRMPs) for military installations.

B. BACKGROUND

In recognition that military lands have significant natural resources, Congress enacted the Sikes Act in 1960 to address wildlife conservation and public access on military installations. The 1997 amendments to the Sikes Act require the DoD to develop and implement an INRMP for each military installation with significant natural resources. A 2012 amendment to the Sikes Act now authorizes the preparation of INRMPs for state-owned National Guard installations used for training pursuant to chapter 5 of title 32 of the United States Code. DoD must prepare all INRMPs in cooperation with the FWS and states. Each INRMP must reflect the mutual agreement of the Parties concerning conservation, protection, and management of fish, wildlife, plants and their habitats on military lands.

INRMPs provide for the management of natural resources, including fish and wildlife and their habitats. To the maximum extent practicable, they incorporate ecosystem management principles, and describe procedures and projects that manage and maintain the landscapes necessary to sustain military-controlled lands for mission purposes. INRMPs also allow for multipurpose uses of resources, including public access appropriate for those uses, provided such access does not conflict with military land use, security requirements, safety, or ecosystem needs, including the needs of fish and wildlife resources. Effective communications and coordination among the Parties, initiated early in the planning process at national, regional, and the military installation levels, is essential to developing, reviewing, and implementing comprehensive INRMPs. When such partnering involves the participation and coordination of all Parties regarding existing FWS and state natural resources management plans or initiatives, such as threatened and endangered species recovery plans or State Wildlife Action Plans, the mutual agreement of all Parties is achieved more easily. INRMPs provide for the conservation and rehabilitation of natural resources on military lands in ways that help ensure the readiness of the Armed Forces. Thus, a clear understanding of land use objectives for military lands should enable the Parties to have a common understanding of DoD's land management requirements.

This MOU addresses the responsibilities of the Parties to facilitate optimum management of natural resources on military installations. It replaces a DoD-FWS-AFW A MOU for *Cooperative Integrated Natural Resources Management Program on Military Installations* dated January 31, 2006, which expired January 31, 2011.

C. AUTHORITIES

This MOU is established under the authority of the Sikes Act, as amended, 16 U.S.C. 670a-670f, which requires the Secretary of Defense to carry out a program to provide for the conservation and rehabilitation of natural resources on military installations in cooperation with the FWS and states. The DoD's primary mission is national defense. DoD manages approximately 28 million acres of land and waters under the Sikes Act to support sustained military activities while conserving and protecting biological resources.

The FWS manages approximately 150 million acres of the National Wildlife Refuge System, and administers numerous fish and wildlife conservation and management statutes and authorities, including the: Fish and Wildlife Coordination Act, Migratory Bird Treaty Act of 1918, Endangered Species Act, Marine Mammal Protection Act, Bald and Golden Eagle Protection Act, Anadromous Fish Conservation Act, Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, Federal Noxious Weed Act, Alien Species Prevention Enforcement Act of 1992, North American Wetland Conservation Act, and Coastal Barrier Resources Act.

The states in general possess broad trustee and police powers over fish and wildlife within their borders, including - absent a clear expression of Congressional intent to the contrary - fish and wildlife on federal lands within their borders. Where Congress has given federal agencies certain conservation responsibilities, such as for migratory birds or species listed as threatened or endangered under the Endangered Species Act, the states, in most cases, have cooperative management responsibilities.

The Sikes Act (16 U.S.C. 670c-l) allows the Secretary of a military department to enter into cooperative agreements with the states, local governments, Indian tribes, nongovernmental organizations, and individuals to provide for the maintenance and improvement of natural resources, or to benefit natural and historic research, both on and off DoD installations.

The Sikes Act (16 U.S.C. 670a(d)(2) also encourages the Secretary of Defense, to the greatest extent practicable, to enter into agreements to use the services, personnel, equipment, and facilities, with or without reimbursement, of the Secretary of the Interior or states in carrying out the provisions of this section.

The Economy Act (31 U.S.C. 1535 and 1536) allows a federal agency to enter into an agreement with another federal agency for services, when those services can be rendered in a more convenient or cost effective manner by another federal agency.

D. RESPONSIBILITIES

The Parties to this agreement hereby enter into a cooperative program of INRMP development, review, and implementation with mutually agreed-upon fish and wildlife conservation objectives to satisfy Sikes Act goals.

1. The DoD, the FWS and AFWA (Parties) mutually agree:

a. To meet at least annually at the headquarters' level to discuss implementation of this MOU. The DoD and FWS will alternate responsibilities for coordinating this annual meeting and any other meetings related to this MOU. Proposed amendments to the MOU should be presented in writing to the parties at least 15 days prior to the annual meeting. The terms of this MOU and any proposed amendments may be reviewed at the annual meeting. The meeting may also review mutual Sikes Act research and technology needs, accomplishments, and other emerging issues.

b. To participate in a Sikes Act Tripartite Core Group consisting of representatives from the Parties. This Core Group will meet at least quarterly, coordinated by the DoD, to discuss and develop projects and guidance to help prepare and implement INRMPs and to discuss Sikes Act issues of national importance.

c. To engage in sound management practices for natural resource protection and management pursuant to this MOU with full consideration for military readiness; native fish and wildlife; threatened, endangered and at-risk species; and the environment.

d. To promote the sustainable multipurpose use of natural resources on military installations - including hunting, fishing, trapping, and non-consumptive uses such as wildlife viewing, boating, and camping - in ways that are consistent with DoD's primary military mission and to the extent reasonably practicable.

e. To develop and implement supplemental Sikes Act MOUs or other agreements, as needed, at the regional and/or state level.

f. To recognize the most current DoD and FWS Sikes Act Guidance as the guidance for communication and cooperation of the Parties represented by this MOU.

g. To post current DoD, FWS, and state Sikes Act guidance documents within 14 days of completion on the following sites:

   i. For DoD: https://www.denix.osd.mil/nr

   ii. For FWS: http://www.fws.gov/habitatconservation/sikes_act.html

iii. For the states: http://www.fishwildlife.org

h. To cooperatively prepare and conduct full reviews of all new INRMPs in a timely manner.

i. To require the DoD Components and appropriate FWS and state offices to conduct a review for operation and effect of each INRMP no less often than every five years, as required by the Sikes Act, and to document these reviews. As a means of facilitating and streamlining this statutory requirement, use the annual progress review of each INRMP as conducted by each DoD Component per DoD policy.

j. To encourage collaboration in annual progress reviews between representatives from each military installation with an INRMP and appropriate representatives from the other Parties.

i. The Parties shall discuss the performance of each military installation in meeting relevant DoD Natural Resources Focus Area metrics, and potential improvements to INRMP implementation, such as new projects or management practices.

ii. Meetings may be in person or by another mutually acceptable means.

iii. The Parties shall discuss methods and projects that the FWS and states can implement that support INRMP goals and objectives.

k. To streamline and expedite the review of INRMP updates or revisions, and to effectively address review for critical habitat exclusions based on the INRMP conservation benefit, when feasible:

i. DoD and the FWS will develop and implement a streamlined review process within six months of signature of this MOU that will allow for expedited review and approval (new signatures) of updated sections of each INRMP.

ii. DoD will provide a means of easily identifying all changes to each updated or revised INRMP when forwarding it for review.

iii. FWS will focus review on those parts of updated INRMPs that reflect changes from the previously reviewed version.

iv. FWS and the appropriate states will review all INRMPs with major revisions (e.g., changes required by mission realignments, the listing of new species or other significant action that has the

potential to affect military operations or readiness).

v. DoD, FWS, and the states (acting through AFWA) will continue to seek opportunities to make INRMP review processes more efficient while sustaining and enhancing INRMP conservation effectiveness.

vi. The DoD Components may submit to the USFWS, a priority INRMP list to address those installations seeking critical habitat exclusions to facilitate coordination with USFWS Endangered Species office.

vii. To ensure consistency, the Parties accept the following definitions:

a) Compliant INRMP: An INRMP that has been both approved in writing, and reviewed, within the past five years, as to operation and effect, by authorized officials of DoD, DOI, and each appropriate state fish and wildlife agency.

b) Review for operation and effect: A comprehensive, joint review by the parties to the INRMP, conducted no less often than every five years, to determine whether the plan needs an update or revision to continue to address adequately Sikes Act purposes and requirements.

c) INRMP update: Any change to an INRMP that, if implemented, is not expected to result in consequences materially different from those in the existing INRMP and analyzed in an existing NEPA document. Such changes will not result in a significant environmental impact, and installations are not required to invite the public to review or to comment on the decision to continue implementing the updated INRMP.

d) INRMP revision: Any change to an INRMP that, if implemented, 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 as to operation and effect. All such revisions require approval by all parties to the INRMP, and will require a new or supplemental NEPA analysis.

l. That none of the Parties to the MOU is relinquishing any authority, responsibility, or duty established by law, regulation, policy, or directive.

m. To designate the officials listed below, or their delegates to participate in the activities

pursuant to this MOU.

i. DoD: Deputy Director, Natural Resources Conservation Compliance, ODUSD (I&E) ESOH
ii. FWS: National Sikes Act Coordinator, Fish and Aquatic Conservation
iii. AFWA: Director, Government Affairs

2. DoD agrees to:

a. Communicate the establishment of this MOU to all DoD Components.

b. Take the lead in developing policies and guidance related to INRMP development, updates, revisions, and implementation, and to ensure the involvement, as appropriate, in these processes of the FWS and state fish and wildlife agencies.

c. Ensure distribution of the DoD and FWS Sikes Act Guidance to all appropriate DoD Components.

d. Encourage DoD Components to invite appropriate FWS and state fish and wildlife agency offices to participate in annual INRMP reviews. All such invitations should be extended at least 15 business days in advance of the scheduled review to facilitate meaningful participation by all three Parties. Meetings may be in person or by other mutually agreed upon means.

e. Encourage DoD Components to take full advantage of FWS and state fish and wildlife agency natural resources expertise through the use of Economy Act transfers and cooperative agreements. Encourage DoD Components and FWS to explore the use of the Fish and Wildlife Coordination Act for technical assistance, fish stocking, and other conservation projects. Priority should be given to projects that:

i. Sustain the military mission.

ii. Effectively apply ecosystem management principles.

iii. Consider the strategic planning priorities of the FWS and the state fish and wildlife agency.

f. Encourage DoD Components to give priority to INRMP requirements that:

i. Sustain military mission activities while ensuring conservation of natural resources.

ii. Provide adequate staffing with the appropriate expertise for updating, revising, and implementing each INRMP within the scope of DoD Component responsibilities, mission, and funding constraints.

g. Encourage DoD Components to discuss with the FWS and state fish and wildlife agencies all issues of mutual interest related to the protection, conservation, and management of fish and wildlife resources on DoD installations.

h. Subject to mission, safety, security, and ecosystem requirements, provide public access to military installations to facilitate the sustainable multipurpose use of its natural resources.

i. Identify natural resource research needs, and develop research proposals with input from the Parties.

j. Identify opportunities to work with the DoD Components to facilitate:

i. Cooperative regional and local natural resource conservation partnerships and initiatives with FWS and state fish and wildlife agency offices.

ii. Natural resources conservation technology transfer and training initiatives between the DoD Components, federal land management agencies, and state fish and wildlife agencies.

k. Provide law enforcement support to protect fish, wildlife, and plant resources on military installations consistent with jurisdiction and authority.

3. FWS agrees to:

a. Communicate the establishment of this MOU to each FWS Regional Office and appropriate field offices in close proximity to military installations.

b. Distribute the DoD and FWS Sikes Act Guidelines to each FWS Regional Office and appropriate field office in close proximity to military installations.

c. Designate regional and field office FWS liaisons to develop partnerships and help DoD implement joint management of ecosystem-based natural resource management programs, and provide a list of those liaisons to the DoD as needed.

d. Provide technical assistance with the appropriate expertise to the DoD in managing

its resources within the scope of FWS responsibilities and funding constraints.

e. Encourage field offices to coordinate current and proposed FWS natural resource initiatives and research efforts with those that may relate to DoD installations, and to provide applicable installations with new and relevant information pertaining to distribution and/or research regarding listed and candidate species and species at-risk.

f. Inform DoD Components and affected installations regarding upcoming and reasonably foreseeable proposed listing and critical habitat designations that may potentially affect military installations in a timely manner before publication of such proposals in the Federal Register.

g. Encourage regional and field offices to expedite pending INRMP reviews that may affect foreseeable proposed listing of threatened and endangered species and critical habitat designations.

h. Provide law enforcement support as appropriate to protect fish, wildlife, and plant resources on military installations within the jurisdiction of the FWS.

i. Identify FWS refuges and other potential federal management areas in close proximity to military installations, and, where appropriate, participate in the joint management of ecosystem-based natural resource management projects that support INRMP and other planning goals, objectives, and implementation.

4. AFWA agrees to:

a. Communicate the establishment of this MOU to each state fish and wildlife agency director and appropriate personnel.

b. Distribute the DoD and FWS Sikes Act Guidelines to each state fish and wildlife agency director and appropriate staff.

c. Facilitate and coordinate with the states to encourage them to:

i. Participate in developing, reviewing, updating, revising, approving and, as appropriate implementing INRMPs in a timely way upon request by military installation personnel.

ii. Designate state liaisons to help develop partnerships and to help DoD installation staff implement natural resource conservation and management programs.

iii. Identify state wildlife management areas in close proximity to military installations and, where appropriate, participate in the joint management

of ecosystem-based natural resources projects that support INRMP goals, objectives, and implementation.

iv. Provide technical assistance to DoD installation staff in adaptively managing natural resources within the scope of state responsibilities, funding constraints, and expertise.

v. Identify state personnel needs to develop, review, update/revise, approve, and implement INRMPs, and facilitate the identification of funding opportunities to address the fulfillment of state priorities.

vi. Coordinate current and proposed state natural resources research efforts with those that may relate to DoD installations.

vii. Coordinate with DoD installations to develop new, and implement existing, conservation plans and strategies, including, but not limited to State Wildlife Action Plans; the National Fish, Wildlife and Plants Climate Adaptation Strategy; goals or initiatives of the North American Bird Conservation Initiative (NABCI) and/or Partners in Amphibian and Reptile Conservation (PARC); and the National Fish Habitat Action Plan.

E. STATEMENT OF NO FINANCIAL OBLIGATION

This MOU does not impose any financial obligation on the part of any signatory.

F. ESTABLISHMENT OF COOPERATIVE AGREEMENTS

The Parties are encouraged to enter into cooperative or interagency agreements to coordinate and implement natural resource management on military installations. If fiscal resources are required, the Parties must develop a separately funded cooperative or interagency agreement. Such cooperative or interagency agreements may also be entered into under the authority of the Sikes Act (16 U.S.C. 670c-l). Interagency agreements may be entered into under the authority of the Economy Act (31 U.S.C. 1535 and 1536). The Parties should also explore opportunities to utilize the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-666c) to facilitate agreements for FWS technical assistance, fish stocking, and other conservation activities. Each funded cooperative or interagency agreement shall include a work plan and a financial plan that identify goals, objectives, and a budget and payment schedule. A cooperative or interagency agreement to accomplish a study or research also will include a study design and methodology in the work plan. It is understood and agreed that any funds allocated via these cooperative or interagency agreements shall be expended in accordance with its terms and in the manner prescribed by the fiscal regulations and/or administrative policies of the party making the funds available.

G. AMENDMENTS

This MOU may be amended at any time by mutual written agreement of the Parties.

H. TERMINATION

Any party to this MOU may remove itself upon sixty (60) days written notice to the other parties.

I. EFFECTIVE DATE AND DURATION

This MOU will be in effect upon date of final signature, and will continue for ten years from date of final signature. The parties will meet six (6) months prior to the expiration of this MOU to discuss potential modifications and renewal terms.

7-29-13
Date

John Conger
Acting Deputy Under Secretary of Defense
(Installations and Environment)
U.S. Department of Defense

6.24.13
Date

Dan Ashe
Director
Fish and Wildlife Service
U.S. Department of Interior

7-15/2013
Date

Ron Regan
Executive Director
Association of Fish and Wildlife Agencies

MEMORANDUM OF UNDERSTANDING BETWEEN THE DEPARTMENT OF DEFENSE AND THE POLLINATOR PARTNERSHIP

This Memorandum of Understanding (MOU) is entered into by and between the Department of Defense, hereinafter written as DoD, and the Pollinator Partnership (the "Parties").

ARTICLE I - BACKGROUND AND OBJECTIVES

The objective of this MOU is to establish a framework for cooperative programs that promote the conservation and management of pollinators, their habitats and associated ecosystems.

The DoD has a long history of commitment to protecting the environment and the natural resources that have been entrusted to its care, while at the same time accomplishing its primary mission of national defense.

Through federal law and regulations, DoD is responsible for the conservation and management of natural and cultural resources, ecological processes, and threatened, endangered and sensitive or rare plant and animal species and their habitats.

Cooperative relationships are essential to the effectiveness of resource management on and off military owned lands.

The Pollinator Partnership's mission is to act as a catalyst for stewardship, working to improve the health and survival of all species by promoting the health of pollinating animals, and by protecting and restoring their habitats. The Pollinator Partnership coordinates the North American Pollinator Protection Campaign (NAPPC), a unique, tri- national collaboration working to promote awareness and scientific understanding of pollinators; to gather, organize and disseminate information about pollinators; to provide a forum to identify and discuss pollinator issues; and to promote projects, initiatives and activities that enhance pollinators and their habitats.

It is the goal of both Parties to cooperate with each other in matters relating to the management and conservation of pollinators and the ecosystems they depend upon. The framework for cooperation and coordination is especially important to ensure that pollinator management activities are incorporated, where practicable, into installation integrated natural resource management plans (INRMPs) and practices.

ARTICLE II - AUTHORITIES

This MOU is made and entered into pursuant to the provisions of the Sikes Act (16 U.S.C. 670a-670o, as amended), and supports the Presidential Memorandum *Creating* a *Federal Strategy to Promote the Health of Honey Bees and Other Pollinators* (June 2014). In addition, requirements under other applicable laws, regulations, and specific DoD directives and guidance also apply.

ARTICLE III - RESPONSIBILITIES

A. DoD will, subject to the availability of resources and under the terms of separately funded sub-agreements to this MOU, and consistent with requirements and activities described in its INRMPs, undertake such tasks as:

1. Support and, as feasible, undertake activities that help, conserve, protect, and restore pollinators and their habitats in accordance with DoD mission and policies.

2. Conserve and manage pollinators and their habitats in accordance with applicable federal laws and regulations to foster conservation.

3. Enter into supplemental sub-agreements with the Pollinator Partnership, including but not limited to special use permits, research permits, cooperative agreements, or contracts to accomplish work projects agreed upon by both Parties.

4. Provide unclassified/publicly releasable information on DoD mission requirements and constraints that will assist the understanding of for Pollinator Partnership personnel performing activities on DoD lands.

5. Meet annually, or as necessary, to identify projects and activities of mutual benefit and to plan and implement agreed to projects.

6. Work with the INRMP signatories to identify pollinator management activities in support of the Presidential Memorandum.

B. The Pollinator Partnership will:

1. Cooperate with DoD to implement actions that both Parties have agreed upon.

2. Provide DoD with expertise to implement agreed upon projects.

3. Enter into appropriate sub-agreements with DoD to accomplish specific projects agreed upon by both Parties.

4. Meet annually, or as necessary, to identify projects/activities of mutual benefit and to plan and implement agreed upon projects.

5. Help implement specific projects on DoD lands that support both Parties' missions while conserving pollinators and their habitats in accordance with DoD policies.

6. Inform the general public about DoD pollinator conservation projects.

7. Help train DoD personnel about pollinators and pollinator habitat conservation and management.

ARTICLE IV- DELEGATION

A. Authorized representatives of NAPPC and the DoD may execute special use authorizations, and enter into supplemental sub-agreements within the scope of this MOU.

B. Any supplemental sub-agreement negotiated under the authority of this MOU will remain in full force and effect, unless and until modified or terminated by local signatory Parties, per the terms of said supplemental sub-agreements.

ARTICLE V - TERMS OF AGREEMENT

This MOU will remain in effect from the date of final signature until it is terminated pursuant to Article VII.

ARTICLE VI - KEY OFFICIALS

Key officials are essential to ensure maximum coordination and communication among the Parties regarding the work being performed. The designated officials are:

Department of Defense
L. Peter Boice
Deputy Director, Natural Resources Program

Office of the Assistant Secretary of Defense (Energy, Installation & Environment)
4800 Mark Center Drive, 16G14
Alexandria, VA 22350-0001
Phone: 571-372-6905
Fax:703-607-4237
E-mail: L.P.Boice.civ@mail.mil

Pollinator Partnership
Laurie Davies Adams
Executive Director
Pollinator Partnership
423 Washington Street, 5tn Floor
San Francisco, CA 94111-2339
Phone:415-362-1137
FAX: 415-362-3070
E-mail: LDA@pollinator.org

ARTICLE VII - MODIFICATION AND TERMINATION

A. This MOU will remain in effect until one of the Parties executes item B or C under this article.

B. This MOU may be amended upon written request of either the DoD or the Pollinator Partnership, and the subsequent written concurrence of the other.

C. Either Party may terminate this MOU by providing the other Party with sixty (60) days advance written notice.

ARTICLE VIII - STANDARD CLAUSES

- A. Public Information Release

1. The Pollinator Partnership will not publicize or otherwise circulate promotional material (such as advertisements, sales brochures, press releases, speeches, pictures, still and motion pictures, articles, manuscripts, or other publications) that states or implies federal government, departmental, bureau, or federal government employee endorsement of a product, service or position that the Pollinator Partnership represents. No release of information relating to this MOU may state or imply that the federal government approves of the work product of the Pollinator Partnership or considers the Pollinator Partnership's work product to be superior to other products or services.

2. The Pollinator Partnership will ensure that all information submitted for publication or other public releases of information regarding this project will carry the following disclaimer:

   'The views and conclusions contained in this document are those of the authors, and should not be interpreted as representing the opinions or policies of the U.S. Government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Government."

3. The Pollinator Partnership will obtain prior DoD approval from the key DoD official for this MOU for any DoD-wide public information release that refers to DoD, the Military Services, offices, programs, or employee (by name or title), or to this MOU. For specific installation information, the Pollinator Partnership will obtain prior approval form that installation's public affairs office. The specific text, layout, photographs, etc., of the proposed release must be submitted to the MOU's technical representative, who will forward such materials to the public affairs office, along with the request for approval, or from the specific DoD installation public affairs office.
4. The Pollinator Partnership agrees to include the above provisions of this Article in any sub-award, except for a sub-award to a state government, a local government, or to a federally recognized Indian tribal government.

8. **Freedom of Information Act (FOIA).** Any information furnished to DoD under this MOU is subject to the Freedom of Information Act (5 U.S.C. 552).

C. **Participation in Similar Activities.** This MOU in no way restricts DoD or the Pollinator Partnership from participating in similar activities with other public or private agencies, organizations, or individuals.

D. **Non-Fund Obligating Document.** Nothing in this MOU shall require either DoD or the Pollinator Partnership to obligate, expend, or transfer any funds. Specific work projects or activities that involve the transfer of funds, services or property among the various agencies

and offices of DoD and the Pollinator Partnership will require execution of separate agreements and be contingent upon the availability of appropriated funds. Such activities must be independently authorized by appropriate statutory authority. This MOU does not provide such authority. Negotiation, execution and administration of each such agreement must comply with all applicable statutes and regulations.

E. **Establishment of Responsibility** This MOU is not intended to, nor does it, create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity, by a Party against the United States, its agencies, its officers, or any person.

F. **Authorized Representatives.** By signing below, the individuals listed in this document certify that they are representatives of their organizations, and are authorized to act in their respective areas for matters related to this MOU.

THE PARTIES HERETO have executed this MOU:

POLLINATOR PARTNERSHIP

Laurie Davies Adams

Laurie Davies Adams
Executive Director
Pollinator Partnership

02/09/15
Date

DEPARTMENT OF DEFENSE

John Conger

John Conger
Performing the Duties of the Assistant Secretary of Defense
(Energy, Installations & Environment)
Department of Defense

1/28/2015
Date

MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF DEFENSE AND THE U.S. FISH AND WILDLIFE SERVICE TO PROMOTE THE CONSERVATION OF MIGRATORY BIRDS

This Memorandum of Understanding (MOU) is entered into between the U.S. Department of Defense (DoD) and the U.S. Fish and Wildlife Service (FWS) (hereinafter "the Parties").

Purpose and Scope

This MOU is entered into pursuant to Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (66 FR 3853 [January 17, 2001]). The purpose of this MOU is to promote the conservation of migratory bird populations while sustaining the use of military managed lands and airspace for testing, training, and operations.

This MOU does not address incidental take resulting from military readiness activities or active DoD airfield operations. Military readiness activities are covered by 50 CFR 21.15 (Authorization of take incidental to military readiness activities). Bird-related management activities with a potential to affect airfield operations or safety will be managed according to DoDI 4165.57 and the airfield's Bird/Wildlife Aircraft Strike Hazards (BASH) Program.

Installation commanders responsible for military airfields will not implement wildlife conservation prescriptions set forth in this MOU if they conclude that such actions will negatively impact military mission or combat capability, or if such action will increase the possibility of aircraft-wildlife strikes. Should installation commanders choose to implement wildlife conservation measures, they must follow BASH guidelines, and consider military mission impacts and elevated risk to aircraft and aircrew.

This MOU specifically pertains to the following categories of DoD activities:

1) Natural resource management activities, including, but not limited to, habitat management, erosion control, forestry activities, hunting, fishing, agricultural out leasing, conservation law enforcement, invasive-weed management, and prescribed burning [1]

2) Installation support activities, including, but not limited to, administration, retail sales, food service, health care, water and sewage treatment, supply and storage, education, housing, equipment maintenance, base transportation, laundry and dry cleaning, recreation, and religious activities;

3) Operation of industrial activities;

[1] Vegetation management within the airfield environment shall be governed by the installation Integrated Natural Resource Management Plans (INRMP) and associated Bird/Wildlife Aircraft Strike Hazard (BASH) Plan.

4) Construction, maintenance, renovation, or demolition of facilities that support the activities described in items 1 through 3; and

5) Prevention or abatement of pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable.

This MOU identifies specific activities where cooperation between the Parties will contribute substantially to the conservation of migratory birds and their habitats. This MOU does not alter or waive any responsibilities ofDoD or FWS, as applicable, under the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (Eagle Act), and the Endangered Species Act (ESA); nor does it authorize the take of migratory birds.

Authorities

The Parties' responsibilities under the MOU are authorized by provisions of the following laws and authorities:

- Alaska National Interest Lands Conservation Act of 1980 (16 U.S.C. 410hh-3233)
- Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. 668-668d)
- Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544)
- Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds, 2001 (66 FR 3853 [January 17, 2001])
- Fish and Wildlife Act of 1956, as amended (16 U.S.C. 791a *et seq.)*
- Fish and Wildlife Conservation Act of 1980, as amended (16 U.S.C. 2901-2911)
- Fish and Wildlife Coordination Act of 1980, as amended (16 U.S.C. 661-667)
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715 *et seq.)*
- Migratory Bird Treaty Act, of 1918, as amended (16 U.S.C. 703-711)
- National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347)
- Sikes Act Improvement Act of 1997 (16 U.S.C. 670a-670o)
- Agreements to limit encroachments and other constraints on military training, testing, and operations (10 U.S.C. 2684a)

Background

Department of Defense

The DoD mission is to provide for the Nation's defense. DoD's Natural Resources Program works to ensure continued access to land, air, and water resources for realistic military training and testing, while ensuring that the natural and cultural resources entrusted to DoD's care are sustained in a healthy condition.

The DoD is an active participant in international bird conservation partnerships including Partners in Flight (PIF) and the North American Bird Conservation Initiative (NABCI). Through PIF and NABCI, DoD works in partnership with numerous federal and state agencies and nongovernmental organizations to conserve migratory and resident birds and to enhance their survival. Military lands frequently provide some of the best remaining habitat for migratory and resident bird species, and DoD plans to continue supporting bird conservation activities.

Integrated Natural Resources Management Plans (INRMPs) offer a coordinated approach for incorporating habitat conservation efforts into installation management. INRMPs provide significant baseline information that can be used when preparing National Environmental Policy Act (NEPA) documents for all DoD management activities. This linkage helps to ensure that appropriate conservation and mitigation measures are identified in NEPA documents and committed to, when appropriate, in final decision documents.

The DoD develops INRMPs cooperatively with the FWS and appropriate state fish and wildlife agencies. DoD's strategy focuses on inventorying and long-tenn monitoring to determine changes in migratory bird populations on DoD installations. Effective on-the-ground management may then be applied to those areas identified as having the highest conservation value. DoD's goal is to support military training and testing by providing for no net loss of an installation's military readiness capability and capacity. DoD implements cooperative projects and programs on military lands to benefit the health and well-being of birds and their habitats, when consistent with the military mission, military readiness, and the safety of DoD personnel.

The DoD has a cooperative network of natural resources personnel and others from military installations across the United States that provides technical assistance, including how to incorporate landbird, shorebird, and waterbird habitat management efforts into INRMPs. These bird conservation experts work collaboratively to conserve migratory and resident birds and their habitats on DoD lands.

The DoD implements bird inventories and monitoring programs in numerous ways, including Next Generation Radar (NEXRAD) for studying bird movements in the atmosphere, and maintains an integrated pest management (1PM) program designed to reduce the use of pesticides, herbicides, fungicides, etc. In addition, the management of natural resources on DoD properties benefits migratory birds through efforts such as invasive-species control, habitat enhancement/restoration, water-quality improvement, and wetland conservation.

Fish and Wildlife Service

As a federal agency within the U.S. Department of the Interior, the FWS mission is to work with others to conserve, protect, manage, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The FWS Migratory Bird Program serves as a focal point in the United States for policy development and strategic planning, program implementation, and evaluation of actions designed to conserve migratory birds and their habitats.

The FWS is legally mandated to implement the conservation provisions of the MBTA, which includes responsibilities for managing migratory bird populations, domestic and international coordination, and the development and enforcement of regulations that govern authorized take of migratory birds. The Migratory Bird Conservation Act established the Migratory Bird Conservation Commission to approve land acquisition with Migratory Bird Conservation Funds. The Fish and Wildlife Coordination Act (FWCA) requires consultation under certain circumstances and added provisions to recognize the important contribution of wildlife resources to the Nation. The FWCA requires consideration and coordination of wildlife conservation, including habitat protection, through acquisition, enhancement, and/or management and avoidance and minimization of avian stressors related to federal activities.

The following FWS programs have responsibilities with regards to bird conservation activities:

1) The Division of Migratory Bird Management and the Migratory Bird Programs in FWS Regional Offices serve as focal points for policy development and strategic planning. These offices develop and implement monitoring and management initiatives that help maintain healthy populations of migratory birds and their habitats, and provide continued opportunities for citizens to enjoy bird-related recreation.

2) The Division of Bird Habitat Conservation is instrumental in supporting habitat conservation partnerships through the administration of bird conservation grant programs and development of Joint Ventures that serve as major vehicles for implementing the various bird conservation plans across the country.

3) Ecological Services Field Offices across the country serve as the primary contacts for technical assistance and environmental reviews involving migratory bird issues. The Field Offices coordinate with the Regional Migratory Bird Offices, as necessary, regarding permits and overall migratory bird conservation coordination.

4) The Office of Law Enforcement is the principal FWS program that enforces the legal provisions of the MBTA, Eagle Act, ESA, and other laws pertaining to migratory birds.

5) The National Wildlife Refuge (NWR) System manages NWRs and Waterfowl Production Areas across the country, many of which were established to protect and conserve migratory birds. NWRs not only protect important bird habitat, but also focus on monitoring migratory bird populations, restoring and maintaining native habitats, and educating the public on recreational and economic benefits of migratory birds.

6) The Science Applications program works with other FWS programs and partners to ensure that the necessary science, tools, and capacity are available for planning and implementing the most efficient and effective conservation actions to protect fish and wildlife, including migratory birds. The office facilitates regional self-directed science management partnerships called Landscape Conservation Cooperatives to develop and apply shared science capacity to conservation.

Statement of Mutual Interest and Benefit

The Parties have a common interest in the conservation and management of America's natural resources. The Parties agree that migratory birds are important components of biological diversity, and that the conservation of migratory birds will help sustain ecological systems and help meet the public demand for conservation education and outdoor recreation, such as wildlife viewing and hunting opportunities. The Parties also agree that it is important to focus on reducing stressors on bird populations, restore and enhance habitat where actions can benefit specific ecosystems and migratory birds dependent upon them, and recognize that actions taken to benefit some migratory bird populations may adversely affect other migratory bird populations. The Parties also agree that while it is the FWS' aim to ensure biologically diverse, thriving habitat for migratory birds away from airfields, it is DoD's aim to ensure flight safety by making airfield environments as unattractive as possible to migratory birds while supporting FWS' efforts away from airfields.

Responsibilities of Both Parties

The Parties agree that this MOU shall be implemented to the extent permitted by law and in harmony with evolving requirements of agency missions, subject to the availability of appropriations and budgetary limits. Both Parties shall:

1) Support the conservation intent of Executive Order 13186, and the migratory bird conventions by:

    a) Integrating bird conservation principles, measures, and practices into agency planning and actions; and

    b) Avoiding or minimizing, to the extent practicable, the exposure of birds and their resources to avian stressors that result in take.

2) Emphasize an interdisciplinary, collaborative approach to migratory bird conservation in cooperation with other governments, state and federal agencies, and non-federal partners within the geographic framework of the NABCI Bird Conservation Regions.

3) Work to protect, restore, and enhance migratory bird habitats, as practicable, on DoD-managed lands, in ways that do not conflict with or impede military training and testing, by:

    a) Designing and executing actions to minimize, to the extent practicable and consistent with the military mission, avian stressors on migratory bird populations, including impacts to breeding, migration, or wintering habitats; and by developing and implementing, as appropriate, conservation measures that could reduce the take of migratory birds or enhance the quality of the habitats they use;

    b) Working to identify, conserve, and manage significant bird conservation sites that occur on DoD-managed lands;

    c) Preventing or abating pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable; and

    d) Preventing the introduction and establishment of, and controlling and reducing the spread of existing, non-native invasive species that may be harmful to native flora and fauna, including migratory bird populations, as required by Executive Order 13112 on Invasive Species.

4) Work with willing landowners to prevent or minimize the loss or degradation of migratory bird habitats on lands adjacent or near military installation boundaries.

This cooperative conservation may include:

a) Participating in efforts to identify, protect, and conserve important migratory bird habitats or other significant bird conservation sites and ecological conditions that occur in landscapes or watersheds that may be of conservation value to migratory
birds found on DoD lands, and that also buffer one or more installations from adverse impacts to DoD mission or resource-management activities;

b) Providing information on migratory bird resources found on DoD lands for partners to include and integrate into their outreach and education materials and activities; and

c) Using available authorities to enter into agreements with federal, state, tribal, or other governmental entities, or nongovernmental organizations to conserve and enhance habitats in a manner compatible with military operations.

5) Promote collaborative projects such as:

a) Developing or using existing inventory and monitoring programs, at appropriate scales, with national or regional standardized protocols, to assess the status and trends of bird populations and habitats, including migrating, breeding, and wintering birds;

b) Designing management studies and research/monitoring projects using national or regional standardized protocols and programs to identify the habitat conditions needed by applicable species of concern, to understand interrelationships of co- existing species, and to evaluate the effects of management activities on habitats and populations of migratory birds;

c) Sharing inventory, monitoring, research, and study data for breeding, migrating, and wintering bird populations and habitats in a timely fashion with national data repositories such as the Avian Knowledge Network, National Point Count Database, and Monitoring Avian Productivity and Survivorship (MAPS);

d) Working in conjunction with each other and federal and state agencies to

develop reasonable and effective conservation measures for actions that reduce the exposure of birds and their habitats to avian stressors;

e) Participating in or promoting the implementation of existing regional or national inventory and monitoring programs such as Breeding Bird Survey (BBS), Christmas Bird Counts, bird atlas projects, or game-bird surveys (e.g., mid-winter waterfowl surveys) on DoD lands where practicable and feasible;

f) Using existing partnerships and exploring opportunities for expanding and creating new partnerships to facilitate combined funding for inventory, monitoring, management studies, and research; and

g) Improving habitat on lands adjacent to DoD-managed lands through programs such as the DoD Readiness and Environmental Protection Integration and Land and Water Conservation Fund programs.

6) Work cooperatively to identify and utilize existing conservation measures to avoid or minimize the effects of avian stressors, and develop new conservation measures as needed.

7) Per Executive Order 13186 (Sec. 3(12)), provide training opportunities to appropriate personnel on responsibilities under the MBTA, the Eagle Act, and other regulations protecting birds, current processes for coordination on bird conservation issues, strategies for properly assessing how actions effect bird populations, and recommended approaches on how to avoid or minimize the exposure of birds and their habitats to avian stressors.

8) Participate annually in the interagency Council for the Conservation of Migratory Birds. The duties of the Council include the following:

a) Sharing resource information to help conserve and manage migratory birds;

b) Fostering partnerships to further the goals of Executive Order 13186;

c) Reporting annually on Executive Order accomplishments and recommendations; and

d) Selecting an annual recipient of a Presidential Migratory Bird Federal Stewardship Award.

9) Promote migratory bird conservation nationally and internationally through activities such as National Public Lands Day and International Migratory Bird Day.

Department of Defense Responsibilities

1) Follow all migratory bird permitting requirements for intentional take under 50 CFR 21.22 (banding or marking), 21.23 (scientific collecting), 21.26 (special Canada Goose permit), 21.27 (special purposes), or 21.41 (depredation). Though no permit is required to take birds in accordance with *50* CFR 21.43 - 21.47 (depredation orders), follow all regulatory requirements set forth in those sections when applicable.

2) Consistent with military mission requirements, encourage incorporation of comprehensive migratory bird management objectives into relevant DoD planning documents, including INRMPs, Integrated Pest Management Plans (IPMPs), Installation Master Plans, NEPA analyses, and other relevant documents. Comprehensive planning efforts for migratory birds include PIF Bird Conservation Plans, the North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, North American Waterbird Conservation Plan, and associated regional plans where available.

3) Consistent with current and emerging mission requirements, manage military lands and non-military readiness activities in a manner that supports migratory bird conservation, habitat protection, restoration, and enhancement.

4) Inventory and monitor bird populations on DoD lands to the extent feasible to facilitate decisions about the need for, and effectiveness of, conservation efforts

5) In accordance with DoD *INRMP Implementation Manual* (DoDM 4715.03, 2013), work cooperatively with FWS and state and fish and wildlife agencies to promote timely development, effective review, and revisions of INRMPs, including any potential revisions to promote the conservation of migratory birds.

6) Incorporate conservation measures addressed in regional or state bird conservation plans in the INRMP development process.

7) Consistent with safety and security requirements, allow the FWS and other

partners reasonable access to military lands for conducting sampling or survey programs, including but not limited to MAPS, BBS, International Shorebird Survey, game-bird surveys, and breeding bird atlases.

8) Consistent with safety and security requirements and bird conservation responsibilities, support the economic and recreational benefits of bird-related activities by allowing public access to military lands for recreational uses, such as bird watching and other non-- consumptive activities.

9) Develop policies and procedures for facilities design that will promote the conservation of migratory bird populations and habitat, including:

    a) Mitigating the negative impacts of reflective glass in building design by considering building location and orientation with respect to migratory bird areas, and use of other mitigation techniques, such as reducing the amount of reflective glass on buildings;

    b) Maximizing the use of native landscaping to promote migratory bird habitat, except in areas subject to BASH hazards.

    c) Turning off interior building lighting at night, especially lighting in offices with exterior windows that face outward to exterior building surfaces that may be visible to migratory or resident birds.

10) Prior to implementing any activity that has, or is likely to have, a measurable negative effect on migratory bird populations:

    a) Identify the migratory bird species likely to occur in the area of the proposed action, and determine if any species of concern could be affected by the activity;

    b) Assess and document, through the project planning process (e.g., NEPA), the potential effects of the proposed action on species of concern. Use best available demographic, population, or habitat-association data in the assessment of effects upon species of concern; and

    c) Engage in early planning and scoping with the FWS to proactively address migratory bird conservation, and to initiate appropriate actions to avoid or minimize the exposure of birds and their habitats to avian stressors that may

result in the take of migratory birds.

11) Continue to promote the conservation of migratory birds on military lands, to the extent permitted by law, subject to the availability of appropriations, within Administration budgetary limits, and where in harmony with DoD missions.

a) Fire and fuels-management practices. Fire plays an important role in shaping plant and animal communities, and is a valuable tool in restoring habitats altered by decades of fire suppression. Fire management may include fire suppression, fire prevention, fuels treatment, and prescribed burning. Prescribed burning is one of the most effective tools in managing grassland and longleaf pine/wiregrass ecosystems. Fire-management planning efforts will consider the effects of fire management strategies on the conservation of migratory bird populations, and should be combined with monitoring to properly assess fire management on relevant habitats and species.

b) Management practices for invasive and aquatic nuisance species. Invasive and aquatic nuisance species are a threat to native plants and wildlife throughout the United States, including on military lands. Efforts to prevent, control, and contain these species must take into account both the impacts from invasive species and the effects of the control efforts on migratory bird populations. Invasive species that can threaten migratory birds and their habitats include, but are not limited to, exotic grasses, trees and weeds, terrestrial and aquatic insects and organisms, non- native birds, and stray and feral cats.

c) Communications towers, utilities, and energy development. Increased communications demand, changes in technology, and the development of alternative energy sources have resulted in additional exposure of migratory birds and their resources to avian stressors. DoD will review best practices outlined in FWS Guidance, and consult with FWS as needed when considering the development of these technologies on military lands. Construction of new utility and energy systems and associated infrastructure should avoid or minimize the exposure of birds and their resources to avian stressors. Consideration also may be given to retrofitting existing utilities to reduce impacts. Available guidance includes (but is not limited to):

I. Avian Power Line Interaction Committee - *Suggested Practices for Avian Protection on Power Lines* (2006)

II. Avian Power Line Interaction Committee - *Reducing Avian Collisions with Power Lines* (2012)

III. U.S. Fish and Wildlife Service *Land-based Wind Energy Guidelines*

(2012)

iv. U.S. Fish and Wildlife Service *Guidance on the Siting, Construction, Operation, and Decommissioning of Communication Towers* (2000) and FWS comments to the FCC on towers and lighting (2007)

12) To the extent reasonable and practicable, use a best-practices approach for routine maintenance, retrofitting, and management actions to the extent they do not diminish military readiness, including:

a) Turning out lights in buildings, especially multiple-story buildings, at night, except where needed for safety or security reasons;

b) Reducing or eliminating activities that can attract invasive species, including feeding or managing outdoor or feral cats;

c) Minimizing or eliminating the use of pesticides (e.g., insecticides, herbicides, rodenticides);

d) Covering open pipes in which birds may be able to enter but not escape (e.g., in- ground pipes, outhouses, roofs);

e) Minimizing exposure to hazardous chemicals, including covering or removing open pits containing oil or other chemicals; and

f) Minimizing vegetation removal and manipulation during the breeding season, as practicable and when not in conflict with airfield BASH management.

Responsibilities of the Fish and Wildlife Service

1) Work with DoD by providing recommendations to minimize the effects of avian stressors on migratory birds from DoD actions.

2) Through the Division of Migratory Bird Management, maintain a Web page of permits that provides links to all offices responsible for issuing migratory bird take permits and permit applications.

3) Provide essential background information to DoD, when requested, to ensure sound management decisions. This may include information on migratory bird distributions, status, key habitats, conservation guidelines, and risk factors within each BCR. FWS will regularly update its *Birds of Conservation Concern* publication so it can be reliably referenced.

4) Work to identify special migratory bird habitats (e.g., nesting, stopover, migration corridors), and the ecological conditions important in those habitats.

5) Using the Points of Contact list (Appendix A), the FWS will continue to provide general guidance and information regarding migratory birds and their habitats to DoD, upon request. This guidance includes technical assistance for avoiding or minimizing project- related impacts on migratory birds.

6) The Migratory Bird Program will develop and provide FWS guidance to the Ecological Services Field Offices to ensure consistency in the interpretation and implementation of the MBTA as it applies to all federal actions.

7) In accordance with FWS Guidelines for Coordination with DoD and Implementation of the 1997 Sikes Act, promote timely and effective review of INRMPs, including any potential recommendations and revisions related to the conservation of migratory birds.

8) Review and comment on NEPA and other planning documents forwarded by military installations.

9) Notify installations of any proposed or current actions that may result in a significant take of migratory birds.

Dispute Resolution

Preventing potential conflicts or resolving disagreements between *the* Parties will be attempted first at staff levels and elevated through the respective organizational levels if necessary. If staff level resolution is not possible, the conflict will be addressed through Alternative Dispute Resolution processes.

Mutual Agreement

1) This MOU will not change or alter requirements associated with the MBTA, Eagle Act, ESA, NEPA, Sikes Act, or other statutes or legal authority. This MOU is intended to provide internal guidance to federal agency staff.

2) The discretionary responsibilities established by this MOU may be incorporated into planned DoD actions; however, DoD may not *be* able to implement these discretionary responsibilities until DoD has successfully included them in formal planning, programming, and budgeting processes. This MOU is intended to be implemented when new actions are initiated as well as when INRMPs, IPMPs, and BASH plans are initiated or revised, and if the MOU's discretionary responsibilities are successfully included in formal planning, programming, and budgeting processes.

3) This MOU in no way restricts either Party from participating in similar activities with other public or private agencies, governments, organizations, or individuals.

4) This MOU is neither a fiscal nor a funds-obligation document. Any endeavor involving reimbursement, contribution of funds, or transfer of anything of value between the Parties will be handled in accordance with applicable laws, regulations, and procedures, including those for government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the Parties, and shall *be* independently authorized by appropriate statutory authority.

5} The Parties shall schedule periodic meetings to review progress and identify opportunities for advancing the principles of this MOU.

6) This MOU is intended to improve the internal management of the executive branch, and does not create any right or benefit, substantive or procedural, separately enforceable as law or equity by a party against the United States, its agencies or instrumentalities, its officers or employees, or any other person.

7) Modifications to the MOU's scope shall be made by the Parties' mutual consent, through issuance of a written modification, signed and dated by the Parties, prior to any changes.

8) Either Party may terminate this MOU, in whole or in part, at any time before the expiration date by providing the other Party with a written statement to that effect.

Definitions

Action - a program, activity, project, official policy, rule, regulation, or formal plan directly carried out by one of the Parties.

Airfield Environment - UFC 3-260-01 defines what an airfield is and all of its component parts, and defines clearance criteria. DoDI 4165.57 AICUZ describes the acceptable land uses for component parts of the airfield. The Airfield's BASH Program is responsible for maintaining hazard-free airfields.

Avian Knowledge Network - an international organization of government and non-government institutions focused on understanding the patterns and dynamics of bird populations across the Western Hemisphere (www.avianknowledge.net).

Avian Stressor - any alteration of or addition to the environment that affects birds or their resources.

Bird/Wildlife Aircraft Strike Hazard (BASH) an actual or potential collision between wildlife (i.e., a bird, mammal, or reptile) and an aircraft (e.g., plane or helicopter).

Breeding Bird Survey (BBS) - a standardized international survey that provides information on population trends of breeding birds, through volunteer observations located along randomly selected roadside routes in the United States, Canada and Mexico (www.mbr-pwrc.usgs.gov/bbs/bbs.html).

Bird Conservation Region (BCR)- a geographic unit used to facilitate bird conservation actions under the North American Bird Conservation Initiative (www.nabci-us.org/bcrs.htm).

Birds of Conservation Concern - a list that is published and periodically updated by the FWS Division of Migratory Bird Management intended to identify the migratory and non-migratory bird species that-- in addition to species already listed under the ESA, proposed or candidate-- represent the FWS's highest conservation priorities, including ESA candidate species. The most current version of the list, Birds of Conservation Concern 2008, is available at www.fws.gov/migratorybirds/CurrentBirdIssues/Management?BBC.html.

Cantonment Area - the principal built-up area of a DoD installation, typically containing housing, barracks, military organizational areas, and community support infrastructure.

Comprehensive Planning Efforts for Migratory Birds - includes Partners in Flight, North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, Western Hemisphere Shorebird Reserve Network, North American Waterbird Conservation Plan, and other partnership planning efforts integrated through the North American Bird Conservation Initiative.

Conservation Measure - any action undertaken to address project-related stressors/impacts that ultimately improve the conservation status of one or more migratory bird species. Conservation measures split into two categories: Ecological/Habitat measures (driven by EO 13186) and Avian Mortality measures (driven by MBTA). Conservation measures work to avoid or minimize an impact, reduce the impact over time, or rectify or compensate for the impact. Conservation Measures are also referred to as Mitigation, Best Practices, and Best Management Practices.

Conservation Planning - strategic and tactical planning of agency activities for the long-term conservation of migratory birds and their habitats.

Council for the Conservation of Migratory Birds - an interagency council established by the Secretary of the Interior to oversee the implementation of Executive Order 13186.

Ecological Condition - the composition, structure, and processes of ecosystems over time and space. This includes the diversity of plant and animal communities, the productive capacity of ecological systems and species diversity, ecosystem diversity, disturbance processes, soil productivity, water quality and quantity, and air quality. Often referred to in terms of ecosystem health, which is the degree to which ecological factors and their interactions are reasonably complete and functioning for continued resilience, productivity, and renewal of the ecosystem.

Effect (adverse or beneficial) - the biological consequences of an impact or the implementation of a conservation measure. Effects can be adverse (habitat avoidance) or beneficial (improved habitat quality). The effect is determined by the exposure of the bird or resource to the stressor/impact and the response to the impact. Effects may be direct, indirect, or cumulative, and refer to effects from actions or categories of actions on migratory birds, their populations, habitats, ecological conditions, and significant bird conservation sites.

Impact - the combined result of an action/project, all of its associated activities and components, and the stressors (see below) produced by those actions.

Integrated Natural Resources Management Plan (INRMP) - an integrated plan based, to the maximum extent practicable, on ecosystem management that shows the interrelationships of individual components of natural resources management (e.g., fish and wildlife, forestry, land management, outdoor recreation) to military mission requirements and other land use activities affecting an installation's natural resources. INRMPs are required for all DoD installations with significant natural resources, pursuant to the Sikes Act.

International Shorebird Survey- a monitoring program started in 1974 to survey shorebirds (sandpipers, plovers, etc.) across the Western Hemisphere (www.pwrc.usgs.gov/iss/iss.html).

International Migratory Bird Day (IMBD) - IMBD celebrates, brings attention to, and educates people about the migration of nearly 350 species of migratory birds that nest and breed throughout the Western Hemisphere. IMBD is celebrated in Canada, the United States, Mexico, Central and South America, and the Caribbean (http://birdday.org/birdday).

Management Action- an activity by a government agency that could cause a positive or negative impact to migratory bird populations or habitats. Conservation measures to mitigate potential activity-related stressors may be required.

Migratory Bird - an individual of any species protected by the Migratory Bird Treaty Act (MBTA) as listed in 50 CFR § 10.13.

Military Readiness Activity - all Armed Forces training and operations that relate to combat, including but not limited to the adequate and realistic testing of military equipment, vehicles, flight operations, weapons, and sensors for proper operation and suitability for use in combat.

Monitoring Avian Productivity and Survivorship (MAPS) - a program that uses the banding of birds during the breeding season to track the changes and patterns in the number of young produced, and the survivorship of adults and young (www.birdpop.org/maps.htm).

National Environmental Policy Act (NEPA) - a federal statute that requires federal agencies to prepare a detailed analysis of the environmental impacts of a proposed action and alternatives, and to include public involvement in the decision making process for major federal actions significantly affecting the quality of the human environment 42 U.S.C. 4321, et seq.

North American Bird Conservation Initiative (NABCI) - a partnership to align the avian conservation community to implement bird conservation through regionally-based, biologically driven, landscape-oriented partnerships across the North American continent. NABCI includes

federal agencies of Canada, Mexico and the United States, as well as most landbird, shorebird, waterbird, and waterfowl conservation initiatives (www.nabci-us.org).

North American Waterbird Conservation Plan- a partnership of federal and state government agencies, non-governmental organizations, and private interests focusing on the conservation of waterbirds, primarily including marshbirds and inland, coastal, and pelagic colonial waterbirds (www.waterbirdconservation.org/plans.html). The partnership's vision is that the distribution, diversity, and abundance of breeding, migratory, and nonbreeding waterbirds are sustained throughout the lands and waters of North America, Central America, and the Caribbean.

North American Waterfowl Management Plan - a partnership of federal and state agencies, non- governmental organizations, and private interests focusing on the restoration of waterfowl populations through habitat restoration, protection, and enhancement (http://birdhabitat.fws.gov/NAWMP/nawmphp.htm).

Partners in Flight (PIF) - a cooperative partnership of more than 300 partners including federal and state government agencies, non-governmental organizations, conservation groups, foundations, universities, and industry focusing on the conservation of landbirds. DoD was an original signatory to the 1991 PIF Federal Agencies' MOA (www.partnersinflight.org).

Ranges & Training Areas (RTAs)- as defined within each installation's INRMP.

Species of Concern - refers to several categories of birds including: 1) species listed in the periodic report, *Birds of Conservation Concern,* published by the FWS Division of Migratory Bird Management (www.fws.gov/migratorybirds); 2) priority migratory bird species documented in the comprehensive bird conservation plans (North American Waterbird Conservation Plan, United States Shorebird Conservation Plan, Partners in Flight Bird Conservation Plans); 3) species or populations of waterfowl identified as high, or moderately high, continental priority in the North American Waterfowl Management Plan; 4) listed threatened and endangered bird species in 50 CFR § 17.11; and 5) MBTA-listed gamebirds of management concern, as listed in the *Birds of Management Concern* list (www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BMC.html).

Take - to pursue, hunt, shoot, wound, kill, trap, capture or collect or attempt to pursue, hunt, wound, kill trap, capture or collect (50 CFR § 10.12). The Executive Order 13186 further defines "take" to include intentional take, meaning take that take is the purpose of the activity in question, and unintentional (incidental) take, meaning take that results from, but is not the purpose of, the activity in question. Both intentional and unintentional take constitute take as defined by the MBTA. The regulations implementing the Eagle Act define take to mean pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb bald and golden eagles (50 CFR § 22.3).

U.S. Shorebird Conservation Plan - a partnership of federal and state government agencies, non- governmental organizations, and private interests focusing on restoring and protecting stable and self-sustaining populations of all shorebird species (www.shorebirdplan.org).

K. Agreement Contacts and Execution

The principal contacts for this instrument are as follows:

Brad Bortner, Chief Division of Migratory Bird Management US Fish and Wildlife Service	L. Peter Boice, Deputy Director Natural Resources Program Office of the Secretary of Defense

This MOU is executed as of the last date signed below and expires no later than five (5) years thereafter, at which time it is subject to review and renewal, or expiration.

The Parties hereto have executed this agreement as of the date shown below:

Dan Ashe Director US Fish and Wildlife Service	John Conger Acting, Deputy Under Secretary of Defense (Installations & Environment) US Department of Defense
9.5.2014	7/10/2014
Signature Date	Signature Date

MEMORANDUM OF UNDERSTANDING BETWEEN THE DEPARTMENT OF DEFENSE AND BAT CONSERVATION INTERNATIONAL

PREFACE

1. This agreement establishes a policy of cooperation and coordination between the Department of Defense (DoD) and Bat Conservation International (BCI) to identify, document and maintain bat populations and their habitats on DoD installations.

2. The DoD has a long history of commitment to protection of the environment and the natural resources that have been entrusted to its care while at the same time accomplishing its primary mission of national defense.

3. DoD wishes to receive technical assistance in techniques for improving management of bat populations and their habitats, and to gain access to a nationwide network of compatible data and support that can be used to assess the significance of bat populations and habitat found on DoD lands.

4. BCI was formed to promote conservation, education, and research initiatives involving bats and the ecosystems they serve. BCI provides information and service to scientists, land managers, and the public.

5. Both BCI and the DoD have responsibilities and interests in the management of wildlife and their habitats. Both parties agree that wildlife habitats need to be conserved and managed to protect wildlife and to meet the growing public demand for wildlife conservation and related scientific opportunities. Furthermore, BCI and DoD desire to assist each other in conducting inventories, monitoring, and research; initiating actions which will increase the productivity of bats and enhance their habitats; and educating the public about the roles and values of bats in ecosystems on lands managed or used by the DoD.

PURPOSE

The purpose of this MOU is to establish procedures for planning and conducting cooperative efforts by BCI and DoD on DoD lands. It also establishes policies and procedures for BCI to provide technical assistance to DoD to maintain or increase the productivity of bats and their habitats on DoD lands; to keep once-common bat species from being Federally-listed as threatened or endangered; and to work to recover presently listed species of bats and prevent species extinction.

RESPONSIBILITIES

The Department of Defense and Bat Conservation International do mutually agree that:

1. The DoD will, subject to the availability of resources and under the terms of separately funded subagreements to this MOU, undertake such tasks as:

a. Provide leadership for the planning, implementation, and monitoring of work undertaken pursuant to this agreement and supplemental subagreements.

b. Designate a point of contact for coordination of BCI activities at the Service Headquarters, major command, and/or installation, as deemed appropriate by each Service.

c. Provide BCI representatives at the end of each fiscal year with a summary report of project accomplishments executed supplemental to this agreement.

d. Identify and evaluate appropriate proposed bat conservation proposals and existing projects for possible implementation as partnership initiatives with BCI.

e. Coordinate project planning with appropriate Federal and State agencies to ensure that planned projects are consistent with Federal and State management objectives for bats and other Federal and State legal and statutory requirements.

f. Identify a DoD representative to serve as liaison for any proposal field study.

g. Compensate BCI for their assistance, as mutually agreed upon in supplemental subagreements.

h. Communicate the establishment of this MOU to all Military Departments, major commands, and appropriate installations.

2. Bat Conservation International will, subject to the availability of resources and under the terms of separately funded subagreements to this MOU, undertake such tasks as:

a. Provide expertise, as well as labor, materials, and/or funds for the implementation of agreed-upon inventory, monitoring, and habitat improvement projects; education and public awareness efforts; or research efforts; as feasible and in accordance with BCI policy.

b. Designate a point of contact for coordination of DoD initiatives at BCI, as

deemed appropriate.

c. Enter into separate subagreements (e.g. specific collection or donation agreements, volunteer agreements, or contracts) with the DoD to accomplish agreed-upon work developed supplemental to

this agreement Such work may include training, consultation, inventories, monitoring, habitat improvement projects, education. or research projects.

d. Refrain from referring to this MOU in commercial advertising in a manner which states or implies that the activities of the BCI are approved or endorsed by the DoD.

e. Submit for review to the DoD prior to release any proposed releases to the public media which reference this MOU or any employee of the DoD.

f. Communicate the establishment of this MOU to appropriate BCI cooperative

units.

g. Make training available for DoD personnel in the survey, inventory and monitoring of bats.

3. DoD and BCI will hold an annual meeting to review progress made under this document and to discuss new project proposals within the purposes of this MOU.

4. Each project requiring a payment of funds by BCI to the DoD will be documented and signed by the responsible organizational unit line officer of the DoD and a BCI representative using an appropriate agreement.

5. Special matching fund projects will be documented via cooperative agreements and signed by the responsible DoD official and BCI representatives.

6. The implementation of this MOU and subsequent supplemental subagreements is subject to required funds being available to both parties of the MOU. Nothing in this MOU shall be construed as obligating the DoD to the expenditure of funds.

7. Nothing herein contained shall be construed as limiting or affecting in any way the delegated authority of the Department of Defense.

8. Nothing herein shall impede the parties from using other mechanisms to accomplish the purposes set out above.

DELEGATION

1. Authorized representatives of BCI and the DoD may execute special use authorizations and enter into supplemental subagreements within the scope of this document

2. Any supplemental subagreement negotiated under the authority of this MOU will remain in full force and effect, unless and until modified or terminated by local signatory parties, per the terms of said supplemental subagreements.

MODIFICATION AND TERMINATION

1. This MOU may be modified or amended upon written request of either party and the written concurrence of the other. The MOU may be terminated with 60-day written notice of either party; however, sufficient attempts should be made to modify, rather than to terminate, the MOU.

2. Five years after signature by both parties, this MOU shall be reviewed and considered for renewal. Signatures must be obtained from both parties to fully execute the renewal.

IMPLEMENTATION

This MOU becomes effective when signed by both parties.

Alex Albert Beehler 10/11/06

Assistant Deputy Under Secretary of Defense Date
(Environment, Safety and Occupational Health)

Mark D. Fuller 10/2/06

Executive Director Date
Bat Conservation International

MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF DEFENSE AND BAT CONSERVATION INTERNATIONAL TO PROMOTE BAT CONSERVATION

The Memorandum of Understanding (MOU) between the Bat Conservation International and the Department of Defense (hereinafter referred to "the Parties"), signed in 2006, expired on October 11, 2011. Both Parties have agreed to extend the MOU as currently written for eight years to meet its stated purpose, scope and responsibilities.

The principal contacts for this instrument are as follows:

Mylea Bayless
Conservation Programs Manager
Bat Conservation International
PO Box 162603
Austin, Texas 78716

Deputy Director, Natural Resources
Office of the Secretary of Defense
1225 S. Clark St.
Suite 1500
Arlington, VA 22202-4336

The Parties hereto have extended this agreement as of the date shown below to remain effective through October 11, 2019.

Nina Fascione
Executive Director
Bat Conservation International

12/19/11
Signature Date

VP Operations
David L. Waldien
for
Nina Fascione

John Conger
Assistant Deputy Under Secretary of Defense
(Installations and Environment)
U.S. Department of Defense

12/9/2011
Signature Date

APPENDIX C – PMRF FLORAL AND FAUNAL SPECIES LISTS

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PMRF PLANT SPECIES BY BASE

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Malvaceae	*Abutilon grandifolium*	hairy abutilon	Mao	Barking Sands	10	Intro		K,R
Fabaceae	*Acacia farnesiana*	sweet acacia	Klu	Barking Sands	10	Intro		K,A,R
Agvaceae	*Agave sisalana*	sisal	Malina	Barking Sands	10	Intro		K,S
Liliaceae	*Aloe vera*	aloe		Barking Sands	10	Intro		S
Amaranthaceae	*Alternanthera sessilis*	sessile joyweed		Barking Sands	10	Intro		R
Fabaceae	*Alysicarpus vaginalis*	alysicarpus		Barking Sands	10	Intro		R
Amaranthaceae	*Amaranthus spinosus*	spiny amaranth	Pakai kuku	Barking Sands	10	Intro		R
Amaranthaceae	*Amaranthus viridis*	slender amaranth	Pakai	Barking Sands	10	Intro		A
Ploygonaceae	*Antigonon leptopus*	Mexican creeper		Barking Sands	10	Intro		K
Acanthaceae	*Asystasia gangetica*	chinese violet		Barking Sands	10	Intro		K,R
Chenoppdiaceae	*Atriplex semibaccata*	Australian saltbush		Barking Sands	10	Intro		PND,S,D,R
Asteraceae	*Bidens cynapiifolia*	West Indian beggar's tick		Barking Sands	10	Intro		K
Asteraceae	*Bidens pilosa*	hairy beggarticks	Ki, Ki nehe	Barking Sands	10	Intro		K,A,PND,R
Nyctaginaceae	*Boerhavia coccinea*	scarlet spiderling	Pohapoha	Barking Sands	10	Intro		K,A,S,R
Nyctaginaceae	*Boerhavia repens*	anena		Barking Sands	10	Ind		A,PND,S,R

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Cyperaceae	*Bolboschoenus maritimus spp Paladosus*	cosmopolitan bulrush	Kaluha	Barking Sands	10	Ind		D
Poaceae	*Bothriochloa sp*	beardgrass		Barking Sands	10	Intro		R
Poaceae	*Brachiaria mutica*	California grass		Barking Sands	10	Intro		
Asclepiadaceae	*Calotropis procera*	small crown flower		Barking Sands	10	Intro		S
Lauraceae	*Cassytha filiformis*	Kaunaoa pehu	Kaunaoa pehu	Barking Sands	10	Ind		K,PND,S
Casuarinaceae	*Casuarina equisetifolia*	Ironwood	Paina	Barking Sands	10	Intro		PND,S,D
Poaceae	*Cenchrus ciliaris*	buffelgrass		Barking Sands	10	Intro		
Poaceae	*Cenchrus echinatus*	common sandbur	Ume, Ale	Barking Sands	10	Intro		
Euphorbiaceae	*Chamaesyce celastroides*	ekoko	Akoko	Barking Sands	10	End		PND
Euphorbiaceae	*Chamaesyce hirta*	hairy spurge, garden spurge		Barking Sands	10	Intro		A,R
Euphorbiaceae	*Chamaesyce hypericifolia*	graceful spurge		Barking Sands	10	Intro		R
Euphorbiaceae	*Chamaesyce hyssopifolia*	spurge		Barking Sands	10	Intro		R
Chenoppdiaceae	*Chenopodium carinatum*	clammy goosefoot		Barking Sands	10	Intro		A,R
Chenoppdiaceae	*Chenopodium murale*	Goosefoot	Aheahea	Barking Sands	10	Intro		K,PND,S,R
Poaceae	*Chloris barbata*	swollen fingergrass	Mauʻu lei	Barking Sands	10	Intro		
Capparaceae	*Cleome gynandra*	wild spider flower	Hohohina	Barking Sands	10	Intro		A,R
Poaceae	*Coix lachryma-jobi*	Job's tears		Barking Sands	10	Intro		

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Asteraceae	*Conyza bonariensis*	hairy horseweed	Ilioha	Barking Sands	10	Intro		K,A
Fabaceae	*Crotalaria pallida*	smooth rattlebox	Pikakani	Barking Sands	10	Intro		R
Cucurbitaceae	*Cucumis dipsaceus*	wild cucumber, hedgehog gourd		Barking Sands	10	Intro		K,S
Cuscutaceae	*Cuscuta sandwichiana*	kaunaoa	Kaunaoa	Barking Sands	10	End		S
Poaceae	*Cynodon dactylon*	Bermuda grass	Manienie	Barking Sands	10	Intro		
Cyperaceae	*Cyperus rotundifolia*	nutgrass, nut sedg		Barking Sands	10	Intro		A,R
Poaceae	*Dactyloctenium aegyptium*	beach wiregrass		Barking Sands	10	Intro		
Fabaceae	*Desmanthus pernambucanus*	Slender mimosa		Barking Sands	10	Intro		
Fabaceae	*Desmodium incanum*	Spanish clover	Ka'imi	Barking Sands	10	Intro		
Poaceae	*Digitaria insularis*	sourgrass		Barking Sands	10	Intro		
Poaceae	*Digitaria setigera*	East Indian crabgrass	Kukarpuaa	Barking Sands	10	Intro		
Poaceae	*Digitaria sp.*	crabgrass		Barking Sands	10	Intro		
Sapindaceae	*Dodonaea viscosa*	Florida hopbush	A`ali`i	Barking Sands	10	Intro		K,A,PND,S,D
Poaceae	*Eleusine indica*	wiregrass, goosegrass		Barking Sands	10	Intro		
Poaceae	*Eragrostis amabilis*	lovegrass		Barking Sands	10	Intro		
Euphorbiaceae	*Euphorbia cyathophora*	wild poinsettia		Barking Sands	10	Intro		A
Cyperaceae	*Fimbristylis cymosa*	hurricanegrass		Barking Sands	10	Ind		A,S

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Asteraceae	*Gaillardia pulchella*	blanket flower	Melekuli wai	Barking Sands	10	Intro		A
Asteraceae	*Galinsoga parviflora*	gallant soldier	Galinsoga	Barking Sands	10	Intro		R
Asteraceae	*Gamochaeta purpurea*	purple cudweed		Barking Sands	10	Intro		R
Boraginaceae	*Heliotropium procumbens* var. *depressum*	fourspike heliotrope		Barking Sands	10	Intro		R
Asteraceae	*Heterotheca grandiflora*	telegraph plant		Barking Sands	10	Intro		R
Lamiaceae	*Hyptis pectinata*	comb hyptis		Barking Sands	10	Intro		D,R
Fabaceae	*Indigofera suffruticosa*	Indigo	Iniko	Barking Sands	10	Intro		
Convolvulaceae	*Ipomoea imperati*	Hunakai	Hunakai	Barking Sands	10	Ind		PND,S,R
Convolvulaceae	*Ipomoea indica*	Oceanblue morning glory	Koali'awania	Barking Sands	10	Ind		K
Convolvulaceae	*Ipomoea obscura*	field bindweed		Barking Sands	10	Intro		K,R
Convolvulaceae	*Ipomoea pes-caprae*	Beach morning glory	Pohuehue	Barking Sands	10	Ind		PND,S,R
Convolvulaceae	*Jacquemontia ovalifolia ssp. Sandwicensis*	oval-leaf clustervine	Pauohiiaka	Barking Sands	10	End		S,R
Verbenaceae	*Lantana camara*	lantana	lkana, l'au kalakala	Barking Sands	10	Intro		K,A,R
Lamiaceae	*Leonotis nepetifolia*	lion's ear		Barking Sands	10	Intro		K,A,R
Fabaceae	*Leucaena leucocephala*	koa haole	Koa haole	Barking Sands	10	Intro		
Fabaceae	*Macroptilium atropurpureum*	purple bushbean		Barking Sands	10	Intro		

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Fabaceae	*Macroptillium lathyroides*	wild bushbean		Barking Sands	10	Intro		
Malvaceae	*Malva parviflora*	cheeseweed		Barking Sands	10	Intro		R
Malvaceae	*Malvastrum coromandelianum*	false mallow	Hauuoi	Barking Sands	10	Intro		K,R
Fabaceae	*Medicago polymorpha*	bur clover		Barking Sands	10	Intro		
Poaceae	*Melinis minutiflora*	molasses grass		Barking Sands	10	Intro		
Poaceae	*Melinis repens*	natal redtop, natal grass		Barking Sands	10	Intro		
Convolvulaceae	*Merremia aegyptia*	hairy merremia	Koali kua hulu	Barking Sands	10	Intro		K
Nyctaginaceae	*Mirabilis jalapa*	four-o' clock	Nani ahiahi	Barking Sands	10	Intro		K,A
Cucurbitaceae	*Momordica charantia*	wild bitter melon		Barking Sands	10	Intro		K,A
Hydrophyllaceae	*Nama sandwicensis*	nama	Nama	Barking Sands	10	End	SOC,	A,PND,R
Lamiaceae	*Ocimum gratissimum*	wild basil		Barking Sands	10	Intro		K
Ophioglossaceae	*Ophioglossum polyphyllum*	pololei	Pololei	Barking Sands	10	Ind		A
Cactaceae	*Opuntia ficus-indica*	pricklypear	Papipi, Panini	Barking Sands	10	Intro		K
Poaceae	*Panicum maximum*	Guinea grass		Barking Sands	10	Intro		
Poaceae	*Panicum niihauense*	Niihau panicgrass	Lau'ehu	Barking Sands	10	End	FE, SE	
Poaceae	*Paspalum conjugatum*	hilo grass	Mauu Hilo	Barking Sands	10	Intro		
Poaceae	*Paspalum vaginatum*	seashore paspalum		Barking Sands	10	Intro		

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Passifloraceae	*Passiflora foetida*	running pop	Pohapoha	Barking Sands	10	Intro		A,S,R
Passifloraceae	*Passiflora suberosa*	corkystem passionflower	Huehue haole	Barking Sands	10	Intro		K
Arecaceae	*Phoenix sp.*	date plam		Barking Sands	10	Intro		K,S
Fabaceae	*Pithecellobium dulce*	opiuma		Barking Sands	10	Intro		
Asteraceae	*Pluchea carolinensis*	sourbush		Barking Sands	10	Intro		K,PND,D,R
Asteraceae	*Pluchea fosbergii*	pluchea hybrid		Barking Sands	10	Intro		R
Asteraceae	*Pluchea indica*	Indian fleabane		Barking Sands	10	Intro		K,A,S,D,R
Portulacaceae	*Portulaca oleraceae*	little hogweed	Akulikuli kula, ihi	Barking Sands	10	Intro		K,S
Portulacaceae	*Portulaca pilosa*	kiss me quick		Barking Sands	10	Intro		A,PND,S,R
Fabaceae	*Prosopis juliflora*	long-thorn kiawe		Barking Sands	10	Intro		
Fabaceae	*Prosopis pallida*	kiawe	Kiawe	Barking Sands	10	Intro		
Euphorbiaceae	*Ricinus communis*	castor bean	P‘aila, Ka‘apeh	Barking Sands	10	Intro		K,R
Phytolaccaceae	*Rivina humlis*	coral berry		Barking Sands	10	Intro		K
Goodneiaceae	*Scaevola sericea*	naupaka	Naupaka kahaki	Barking Sands	10	Ind		A,PND,S,D,R
Anacardiaceae	*Schinus terebinthifolius*	Christmas berry		Barking Sands	10	Intro		A
Fabaceae	*Sesbania tomentosa*	Oahu riverhemp	Ōhai	Barking Sands	10	End	FE, SE	
Aizoaceae	*Sesuvium portulacastrum*	sea purslane	Akulikuli	Barking Sands	10	Ind		PND,S

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Poaceae	*Setaria verticillata*	bristly foxtail	Mauu pilipili	Barking Sands	10	Intro		
Cucurbitaceae	*Sicyos pachycarpus*	kupala	Kupala	Barking Sands	10	End		K
Malvaceae	*Sida fallax*	ilima	Ilima	Barking Sands	10	Ind		K,A,PND,S,R
Malvaceae	*Sida rhombifolia*	Cuba jute		Barking Sands	10	Intro		R
Solanaceae	*Solanum americanum*	glossy nightshade	Popolo	Barking Sands	10	Ind		K,A
Solanaceae	*Solanum lycopersicon* var. *cerasiforme*	currant tomato		Barking Sands	10	Intro		K,PND
Asteraceae	*Sonchus oleraceus*	sowthistle	Pualele	Barking Sands	10	Intro		A,PND,S,R
Rubiacaea	*Spermacoce assurgens*	buttonweed		Barking Sands	10	Intro		R
Poaceae	*Sporobolus virginicus*	beach dropseed	Akiaki	Barking Sands	10	Ind		
Lamiaceae	*Stachys arvensis*	staggerweed		Barking Sands	10	Intro		R
Verbenaceae	*Stachytarpheta jamaicensis*	Jamaican vervian	Owi, oi	Barking Sands	10	Intro		D,R
Myrtaceae	*Syzygium cumini*	Java plum, jambolan plum		Barking Sands	10	Intro		D,R
Malvaceae	*Thespesia populnea*	milo	Milo	Barking Sands	10	PI?		D
Zygophyllaceae	*Tribulus terrestris*	puncture vine, goat head		Barking Sands	10	Intro		S,R
Asteraceae	*Tridax procumbens*	coat buttons		Barking Sands	10	Intro		A
Verbenaceae	*Verbena litoralis*	seashore vervain	Owi, Oi	Barking Sands	10	Intro		K

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Asteraceae	*Verbesina encelioides*	golden crown-beard		Barking Sands	10	Intro	Invasive	K,A,PND,S,D,R
Verbenaceae	*Vitex rotundifolia*	beach vitex	Pohinahina	Barking Sands	10	Ind		A,PND,S
Sterculiaceae	*Waltheria indica*	uhaloa	Uhaloa, hialoa	Barking Sands	10	Ind		K,A,PND,S,R
Asteraceae	*Xanthium strumarium* var. *canadense*	cocklebur	Kikania	Barking Sands	10	Intro		S,R
Malvaceae	*Abutilon grandifolium*	hairy abutilon	Mao	Kamokala	9, 11	Intro		K
Malvaceae	*Abutilon incanum*	hoary abutilon	Mao	Kamokala	9, 11	Ind		K,R
Fabaceae	*Acacia farnesiana*	sweet acacia	Klu	Kamokala	9, 11	Intro		K
Asteraceae	*Ageratum conyzoides*	tropical whiteweed	Maile honohono	Kamokala	11	Intro		R
Euphorbiaceae	*Aleurites moluccanus*	indian walnut	Kukui	Kamokala	9, 11	PI		K
Amaranthaceae	*Amaranthus spinosus*	spiny amaranth	Pakai kuku	Kamokala	11	Intro		R
Acanthaceae	*Barleria cristata*	barleria		Kamokala	11	Intro		K
Asteraceae	*Bidens pilosa*	hairy beggarticks	Ki,ki nehe	Kamokala	11	Intro		K,R
Nynctaginaceae	*Boerhavia coccinea*	scarlet spiderling		Kamokala	11	Intro		R
Poaceae	*Bothriochloa sp*	beardgrass		Kamokala	11	Intro		K,R
Fabaceae	*Caesalpinia bonduc*	yellow nicker	Kakalaioa	Kamokala	11	Ind		K
Asteraceae	*Calyptocarpus vialis*	straggler daisy		Kamokala	11	Intro		R
Solanaceae	*Capsicum frutescens*	chili pepper	Nioi	Kamokala	11	Intro		K

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Apocyaceae	*Cascabela thevetia*	be-still tress		Kamokala	11	Intro		K
Poaceae	*Cenchrus ciliaris*	buffelgrass		Kamokala	9, 11	Intro		K,R
Euphorbiaceae	*Chamaesyce hirta*	hairy spurge, garden spurge		Kamokala	11	Intro		R
Euphorbiaceae	*Chamaesyce hypericifolia*	graceful spurge		Kamokala	11	Intro		R
Poaceae	*Chloris barbata*	swollen fingergrass	Mau‘u lei	Kamokala	11	Intro		R
Commelinaceae	*Commelina benghalensis*	Benghal dayflower	Hairy honohono	Kamokala	11	Intro		K
Fabaceae	*Crotalaria pallida*	smooth rattlebox	Pikakani	Kamokala	11	Intro		K,R
Poaceae	*Cynodon dactylon*	Bermuda grass	Manienie	Kamokala	11	Intro		R
Apiaceae	*Daucus pusillus*	American carrot		Kamokala	11	Intro		R
Fabaceae	*Desmanthus pernambucanus*	slender mimosa		Kamokala	11	Intro		K,R
Poaceae	*Digitaria insularis*	sourgrass		Kamokala	11	Intro		K,R
Poaceae	*Digitaria sp.*	crabgrass		Kamokala	11	Intro		R
Sapindaceae	*Dodonaea viscosa*	Florida hopbush	A`ali`i	Kamokala	9, 11	Intro		K
Pteridaceae	*Doryopteris decora*	lance fern	Kumuniu	Kamokala	9	End		
Asteraceae	*Emilia fosbergii*	Florida tasselflower	Paulele	Kamokala	9	Intro		K
Poaceae	*Eragrostis amabilis*	lovegrass		Kamokala	11	Intro		R
Fabaceae	*Erythrina sandwicensis*	Wiliwili	Wiliwili	Kamokala	9, 11	End		K

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Moraceae	*Ficus mircocarpa*	Chinese banyan		Kamokala	11	Intro		K
Asteraceae	*Gamochaeta purpurea*	purple cudweed		Kamokala	11	Intro		R
Proteaceae	*Grevillea robusta*	silk oak	‘Oka kilika, Ha‘ik ke‘oke‘o	Kamokala	11	Intro		K
Boraginaceae	*Heliotropium procumbens* var. *depressum*	fourspike heliotrope		Kamokala	11	Intro		R
Poaceae	*Heteropogon contortus*	pili grass	Pili, Lule	Kamokala	9, 11	Ind		K
Lamiaceae	*Hyptis pectinata*	comb hyptis		Kamokala	11	Intro		K
Fabaceae	*Indigofera suffruticosa*	indigo	Iniko	Kamokala	11	Intro		K
Convolvulaceae	*Ipomoea indica*	Oceanblue morning glory	Koali'awania	Kamokala	9, 11	Ind		K
Convolvulaceae	*Ipomoea obscura*	field bindweed		Kamokala	11	Intro		K
Verbenaceae	*Lantana camara*	lantana	Ikana, L‘au kalakala	Kamokala	9, 11	Intro		K,R
Lamiaceae	*Leonotis nepetifolia*	lion’s ear		Kamokala	9, 11	Intro		K,R
Fabaceae	*Leucaena leucocephala*	koa haole	Koa haole	Kamokala	9, 11	Intro		K,R
Malvaceae	*Malva parviflora*	cheeseweed		Kamokala	11	Intro		R
Malvaceae	*Malvastrum coromandelianum*	false mallow	Hauuoi	Kamokala	11	Intro		K,R
Poaceae	*Melinis repens*	natal redtop		Kamokala	9	Intro		
Convolvulaceae	*Merremia aegyptia*	hairy merremia	Koali kua hulu	Kamokala	11	Intro		K,R

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Cucurbitaceae	*Momordica charantia*	wild bitter melon		Kamokala	11	Intro		K,R
Cactaceae	*Opuntia ficus-indica*	pricklypear	Papipi, Panini	Kamokala	9, 11	Intro		K
Poaceae	*Panicum maximum*	Guinea grass		Kamokala	11	Intro		K,R
Poaceae	*Panicum maximum* var.*trichoglume*	green panicgrass		Kamokala	11	Intro		K,R
Passifloraceae	*Passiflora suberosa*	corkystem passionflower	Huehue haole	Kamokala	11	Intro		K
Piperaceae	*Peperomia leptostachyon*	Polynesian peperomia	Ala`ala`wainui	Kamokala	9, 11	Ind		K
Euphorbiaceae	*Phyllanthus debilis*	niruri	Niruri	Kamokala	11	Intro		K
Asteraceae	*Pluchea carolinensis*	sourbush		Kamokala	11	Intro		R
Plumbaginaceae	*Plumbago zeylanica*	wild leadwort	Ilie`e	Kamokala	9, 11	Ind		K
Portulacaceae	*Portulaca oleraceae*	little hogweed	Akulikuli kula	Kamokala	9, 11	Intro		K,R
Portulacaceae	*Portulaca pilosa*	kiss me quick		Kamokala	9, 11	Intro		K,R
Fabaceae	*Prosopis pallida*	kiawe	Kiawe	Kamokala	9, 11	Intro		K
Euphorbiaceae	*Ricinus communis*	castor bean	P‘aila, Ka‘apeh	Kamokala	11	Intro		R
Poaceae	*Setaria gracilis*	yellow foxtail	Mauu kaleponi	Kamokala	11	Intro		R
Poaceae	*Setaria verticillata*	bristly foxtail	Mauu pilipili	Kamokala	11	Intro		K
Malvaceae	*Sida fallax*	Ilima	Ilima	Kamokala	9, 11	Ind		K
Malvaceae	*Sida rhombifolia*	Cuba jute		Kamokala	11	Intro		R

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Sapindaceae	*Solanum americanum*	glossy nightshade	Popolo	Kamokala	9, 11	Ind		R
Solanaceae	*Solanum lycopersicon* var. *cerasiforme*	currant tomato		Kamokala	11	Intro		K
Solanaceae	*Solanum seaforthianum*	blue potato vine		Kamokala	11	Intro		K
Asteraceae	*Sonchus oleraceus*	sowthistle	Pualele	Kamokala	11	Intro		R
Myrtaceae	*Syzygium cumini*	Java plum		Kamokala	11	Intro		K
Asteraceae	*Tridax procumbens*	coat buttons		Kamokala	9, 11	Intro		R
Asteraceae	*Verbesina encelioides*	golden crown-beard		Kamokala	11	Intro	Invasive	R
Sterculiaceae	*Waltheria indica*	uhaloa	Uhaloa	Kamokala	9, 11	Ind		K,R
Amaranthaceae	*Amaranthus viridis*	slender amaranth		Kaula Island	3, 4, 5	Intro		
Chenoppdiaceae	*Atriplex semibaccata*	Australian saltbush		Kaula Island	3, 4	Intro		
Nyctaginaceae	*Boerhavia diffusa*	red spiderling	Alena	Kaula Island	3, 5	Ind		
Capparaceae	*Capparis sandwichiana*	Native caper	Maiapilo	Kaula Island	3, 4, 5	End	SOC, State	
Gramineae	*Cenchrus echinatus*	common sandbur	Ume'alu	Kaula Island	3, 4	Intro		
Euphorbiaceae	*Chamaesyce celastroides*	ekoko	Akoko	Kaula Island	3, 4, 5	End		
Chenoppdiaceae	*Chenopodium oahuense*	Alaweo	Alaweo	Kaula Island	3, 4, 5	End		
Poaceae	*Chloris barbata*	swollen fingergrass	Mau‘u lei	Kaula Island	3, 4	Intro		
Gramineae	*Digitaria setigera*	East Indian crabgrass	Kakaipau'a	Kaula Island	3, 4	Intro		

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Gramineae	*Echinochola colonum*	jungle rice		Kaula Island	3, 4	Intro		
Asteraceae	*Erigeron canadensis*	horseweed		Kaula Island	3, 4	Intro		
Boraginaceae	*Heliotropium curassavicum*	nena	Nena	Kaula Island	3, 4, 5	Ind		
Convolvulaceae	*Ipomoea cairica*	Mile-a-minute vine	Sweet koalai	Kaula Island	3, 4	Ind		
Convolvulaceae	*Ipomoea indica*	Oceanblue morning glory	Koali'awania	Kaula Island	5	Ind		
Leguminosae	*Leuceana luecocephala*	koa haole	Koa haole, Koa, Lilikoa	Kaula Island	3, 4	Intro		
Solanaceae	*Lycium sandwicense*	Hawaii desert-thorn	Ohelo kai	Kaula Island	3, 4	Ind		
Cactaceae	*Opuntia megacantha*	mission pricklypear	Pa nini	Kaula Island	3, 5	Intro		
Poaceae	*Panicum lanaiense*			Kaula Island	5	Intro		
Poaceae	*Panicum torridum*	torrid panicgrass	Hkonakona (Niʻihau)	Kaula Island	3, 4	End		
Plumbaginaceae	*Plumbago zeylanica*	wild leadwort	Ilie`e	Kaula Island	3, 4	Ind		
Portulacaceae	*Portulaca lutea*	native yellow purslane	Ihi	Kaula Island	3, 5	Ind		
Portulacaceae	*Portulaca oleraceae*	little hogweed	Akulikuli kula, Ihi	Kaula Island	3, 4, 5	Intro		
Portulacaceae	*Portulaca villosa*	hairy purslane	Ihi	Kaula Island	3, 4, 5	End		
Gramineae	*Setaria verticillata*	bristly foxtail	Mauu pilipili	Kaula Island	3, 4	Intro		

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Malvaceae	*Sida fallax*	ilima	Ilima	Kaula Island	3, 4, 5	Ind		
Solanaceae	*Solanum nigrum*	black nightshade	Popolo	Kaula Island	3, 4, 5	Ind		
Asteraceae	*Sonchus oleraceus*	sowthistle	Pualele	Kaula Island	3, 4	Intro		
Malvaceae	*Thespesia populnea*	milo	Milo	Kaula Island	4	PI?		
Zygophyllaceae	*Tribulus cistiodes*	Jamaican feverplant	Nohu	Kaula Island	3, 4, 5	Ind		
Fabaceae	*Acacia koa*	koa	Koa	Koke'e	8	End		
Rhamnaceae	*Alphitonia ponderosa*	Kauila	Kauila	Koke'e	8	End		
Apocynaceae	*Alyxia oliviformis*	Maile	Maile	Koke'e	8	End		
Euphorbiaceae	*Antidesma platyphyllum*	Hame	Hame	Koke'e	8	End		
Poaceae	*Axonopus fissifolius*	common carpetgrass		Koke'e	7	Intro		
Rubiaceae	*Bobea brevipes*	`Ahakea	`Ahakea	Koke'e	8	End		
Cyperaceae	*Carex meyenii*	Meyen's sedge		Koke'e	8	Ind		
Cyperaceae	*Carex wahuensis*	O'ahu sedge		Koke'e	8	Ind		
Amaranthaceae	*Charpentiera elliptica*	Papala	Papala	Koke'e	8	End		
Araliaceae	*Cheirodendron trigynum*	Olapa	Olapa	Koke'e	8	End		
Euphorbiaceae	*Clayoxylon sandwicense*	Laukea	Laukea	Koke'e	8	End		
Rubiaceae	*Coprosma kauaensis*	Pilo	Pilo	Koke'e	8	End		
Agavaceae	*Cordyline fruticosa*	Ti plant	K, Ti	Koke'e	7	PI		PPMS

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Corynocarpaceae	*Corynocarpus laevigatus*	karaka nut		Koke'e	7	Intro		
Poaceae	*Dactylis glomerata*	orchardgrass		Koke'e	7	Intro		
Liliaceae	*Dianella sandwicensis*	‘uki‘uki	‘Uki‘uki, ‘Uki	Koke'e	8	Ind		
Gleicheniaceae	*Dicranoptorus linearis*	Uluhe	Uluhe	Koke'e	8	Ind		
Sapindaceae	*Dodonaea viscosa*	Florida hopbush	A`ali`i	Koke'e	8	Intro		
Dryoteridaceae	*Dryopteris fuscoatra*	crowned woodfern	`I`i	Koke'e	8	End		
Dryoteridaceae	*Dryopteris glabra*	kilaw	Kilau	Koke'e	8	End		
Poaceae	*Eragrostris variabilis*	kawelu	Kāwelu, ‘Emoloa	Koke'e	8	End		
Asteraceae	*Erigeron karvinskianus*	Latin American fleabane		Koke'e	7	Intro		
Euphorbiaceae	*Euphorbia halemanui*	Halemanu ‘akoko	‘Akoko	Koke'e	8	Intro	FE, SE	C
Cyperaceae	*Gahnia beecheyi*	forest sawsedge	Uki	Koke'e	8	End		
Proteaceae	*Grevillea robusta*	silk oak	‘Oka kilika, Ha‘ik ke‘oke‘o	Koke'e	8	Intro		
Rubiaceae	*Hedyotis terminalis*	Manono	Manono	Koke'e	8	End		
Hydrangeaceae	*Hydrangea macrophylla*	French hydrangea		Koke'e	7	Intro		
Asteraceae	*Hypochaeris radicata*	hairy cat's-ear		Koke'e	7	Intro		
Aquifoliaceae	*Ilex anomala*	Hawai'i holly	`Aiea	Koke'e	8	Ind		

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Cyperaceae	*Kyllinga brevifolia*	shortleaf spikesedge		Koke'e	7	Intro		
Aizoaceae	*Lampranthus glomeratus*	ice plant	Akulikuli lei	Koke'e	7	Intro		
Rosaceae	*Malus sp.*	apple		Koke'e	7	Intro		
Myrtaceae	*Melaleuca quinquenervia*	Paperbark		Koke'e	8	Intro		
Melastomataceae	*Melastome candidum*	Asian melastome		Koke'e	8	Intro	Invasive	
Rutaceae	*Melicope anisata*	Mokihana	Mokihana	Koke'e	8	End		
Rutaceae	*Melicope barbigera*	U`ahiapele	U`ahiapele	Koke'e	8	End		
Poaceae	*Melinis minutiflora*	molasses grass		Koke'e	7	Intro		
Myrtaceae	*Metrosideros polymorpha*	`Ohia	`Ohia lehua	Koke'e	8	End		
Dennstaedtiaceae	*Microlepia strigosa*	Palapalai	Palapalai	Koke'e	8	Ind		
Musaceae	*Musa x paradisiaca*	French plantain		Koke'e	7	Intro		
Myoporaceae	*Myrica faya*	Firetree		Koke'e	8	Intro	Invasive	
Myrsinaceae	*Myrsine alyxifolia*	forest colicwood		Koke'e	8	End		
Myrsinaceae	*Myrsine lanaiensis*	Kolea	Kolea	Koke'e	8	End		
Oleaceae	*Nestigis sandwicensis*	Hawaii olive	Olopua	Koke'e	8	End		
Poaceae	*Paspalum dilatatum*	dallis grass		Koke'e	7	Intro		
Poaceae	*Paspalum scrobiculatum*	kodo millet		Koke'e	7	Intro		
Passifloraceae	*Passiflora mollissima*	banana poka		Koke'e	8	Intro	Invasive	

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Poaceae	*Pennisetum clandestinum*	Kikuyu grass		Koke'e	7	Intro		R
Piperaceae	*Peperomia sp.*	Ala`ala`wai nui	Ala`ala`wai nui	Koke'e	8	Ind		
Lauraceae	*Persea americana*	avocado		Koke'e	7	Intro		
Pittosporaceae	*Pittosporum glabrum*	koolau range cheesewood	Hoawa	Koke'e	8	End		
Plantaginaceae	*Plantago lanceolata*	narrowleaf plantain, English plantain		Koke'e	7	Intro		C,R
Agavaceae	*Pleomele aurea*	golden hala pepe	Halapepe	Koke'e	8	End		
Sapotaceae	*Pouteria sandwicensis*	Ala`a	Ala`a	Koke'e	8	End		
Rosaceae	*Prunus cerasifera x salicina*	Plum tree		Koke'e	7	Intro		
Myrtaceae	*Psidium cattleianum*	strawberry guava		Koke'e	8	Intro	Invasive	
Rubiaceae	*Psychotria greenwelliae*	Kauai wild coffee	Kopiko	Koke'e	8	End		
Rubiaceae	*Psychotria mariniana*	forest wild coffee	Kopiko	Koke'e	8	End		
Rosaceae	*Pyracantha angustifolia*	narrowleaf firethorn		Koke'e	7	Intro	Invasive	
Rosaceae	*Rosa cultivar*	planted rose		Koke'e	7	Intro		
Rosaceae	*Rubus argatus*	Florida blackberry		Koke'e	7	Intro	Invasive	
Rosaceae	*Rubus communis*	common pear		Koke'e	7	Intro		
Rosaceae	*Rubus sp.*	Blackberry		Koke'e	8	Intro		
Poaceae	*Sacciolepis indica*	glenwood grass		Koke'e	7	Intro		

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Santalaceae	*Santalum freycinetianum*	sandalwood	`Iliahi	Koke'e	8	End		
Goodeniaceae	*Scaevola gaudichaudiana*	mountain naupaka		Koke'e	7	End		
Goodeniaceae	*Scaevola procera*	naupaka kuahiwi	Naupaka kuahiwi	Koke'e	8	End		
Poaceae	*Sporobolus indicus*	smut grass		Koke'e	7	Intro		
Moraceae	*Streblus pendulinus*	A`ai`a	A`ai`a	Koke'e	8	Ind		
Epacridaceae	*Styphelia tameiameiae*	Pu`kiawe	Pu`kiawe	Koke'e	8	Ind		
Asteraceae	*Taraxacum officinale*	common dandelion		Koke'e	7	Intro		
Araliaceae	*Tetraplasandra kavaiensis*	Ohe`ohe	Ohe`ohe	Koke'e	8	End	SOC, State	
Fabaceae	*Trifolium repens*	white clover		Koke'e	7	Intro		
Ericaceae	*Vaccinium sp*	blueberry	Ohelo	Koke'e	8	End		
Verbenaceae	*Verbena litoralis*	seashore vervain	Owi, Oi	Koke'e	7	Intro		
Thymelaeceae	*Wikstroemia furcata*	forest false ohelo	Akia	Koke'e	8	End		
Flacourtaceae	*Xylosma hawaiiense*	Maua	Maua	Koke'e	8	End		
Rutaceae	*Zanthoxylum dipetalum*	kawa'u	A`e	Koke'e	8	End		
Fabaceae	*Acacia confusa*	formosa koa		Makaha Ridge	2, 6	Ind		
Fabaceae	*Acacia koa*	koa	Koa	Makaha Ridge	2, 6	End		PPMS
Asteraceae	*Acanthospermum australe*	spiny bur, Paraguay bur	Kkaehipa,'Ihi kkae hipa	Makaha Ridge	2, 6	Intro		R

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Pteridaceae	*Adiantum hispidulum*	rough maidenhair fern		Makaha Ridge	6	Intro		
Pteridaceae	*Adiantum raddianum*	delta maidenhair		Makaha Ridge	6	Intro		
Asteraceae	*Ageratina riparia*	spreading mist flower	Hamakua pamakani	Makaha Ridge	6	Intro		
Asteraceae	*Ageratum conyzoides*	tropical whiteweed	Maile hohono	Makaha Ridge	2, 6	Intro		R
Asteraceae	*Ageratum houstonianum*	floss flower	Maile hohono	Makaha Ridge	2, 6	Intro		R
Primulaceae	*Anagallis arvensis*	scarlet pimpernel		Makaha Ridge	6	Intro		R
Poaceae	*Andropogon glomeratus*	bushy bluestem		Makaha Ridge	6	Intro		
Papaveraceae	*Argemone glauca*	smooth pricklypoppy	Pua kala, kala	Makaha Ridge	12	End		C
Asteraceae	*Artemisia australis*	Oahu wormwood	‘Hinahina, Hinahina	Makaha Ridge	2, 6	End		C
Asteraceae	*Bidens sandvicensis*	Shrubland beggarticks	Ko‘oko‘olau	Makaha Ridge	6, 12	End		R, C
Asteraceae	*Bidens pilosa*	hairy beggarticks	K, K nehe, K pipili, Nehe	Makaha Ridge	2, 6	Intro		R
Blechnaceae	*Blechnum appendiculatum*	palm fern		Makaha Ridge	6, 12	Intro		C
Blechnaceae	*Blechnum occidentale*	blechnum		Makaha Ridge	2	Intro		PPMS
Nyctaginaceae	*Boerhavia coccinea*	scarlet spiderling		Makaha Ridge	2, 6	Intro		R
Poaceae	*Bothriochloa pertusa*	pitted beardgrass		Makaha Ridge	2, 6	Intro		C,PPMS,R
Poaceae	*Bromus hordeaceus*	soft chess		Makaha Ridge	6	Intro		

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Asteraceae	*Calyptocarpus vialis*	straggler daisy		Makaha Ridge	6	Intro		R
Capparaceae	*Capparis sandwichiana*			Makaha Ridge	12	End	SOC, State	C
Cyperaceae	*Carex wahuensis*	O'ahu sedge		Makaha Ridge	2, 6	End		PPMS
Casuarinaceae	*Casuarina cunninghamiana*	River-oak casuarina		Makaha Ridge	2, 6	Intro		PPMS
Gentianaceae	*Centaurium erythraea*	bitter herb, European centaury		Makaha Ridge	12	Intro		C
Fabaceae	*Chamaecrista nictitans var. glabrata*	partridge pea	Lauk	Makaha Ridge	2, 6, 12	Intro		PPMS,R, C
Euphorbiaceae	*Chamaesyce hirta*	hairy spurge, garden spurge	Koko kahiki	Makaha Ridge	2, 6, 12	Intro		C
Euphorbiaceae	*Chamaesyce hyssopifolia*	spurge		Makaha Ridge	2, 6	Intro		C
Poaceae	*Chloris barbata*	swollen fingergrass	Mau‘u lei	Makaha Ridge	6	Intro		
Thelypteridaceae	*Christella parasitica*	parasitic maiden fern		Makaha Ridge	12	Intro		C
Poaceae	*Chrysopogon aciculatus*	golden beardgrass	Mnienie ‘ula	Makaha Ridge	2, 6, 12	Intro		C,PPMS
Apiaceae	*Ciclospermum leptophyllum*	fir-leaved celery		Makaha Ridge	2, 6	Intro		C
Asteraceae	*Cirsium vulgare*	bull thistle	Pua kala	Makaha Ridge	2, 6	Intro		C,PPMS,R
Menispermaceae	*Cocculus orbiculatus*	huehue, hue	Huehue, hue	Makaha Ridge	2, 6	Ind		PPMS
Asteraceae	*Conyza bonariensis*	hairy horseweed	Ilioha, ‘aw‘aw, pua mana	Makaha Ridge	2, 6	Intro		C,R
Agavaceae	*Cordyline fruticosa*	Ti plant	K, Ti	Makaha Ridge	2, 6	PI		PPMS

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Fabaceae	*Crotalaria incana*	fuzzy rattlepod	Kkaehoki, Kolomona	Makaha Ridge	2, 6	Intro		R
Fabaceae	*Crotalaria pallida*	smooth rattlebox	Pikakani, Kolomona	Makaha Ridge	2, 6	Intro		R
Asteraceae	*Cyanthillium cinereum*	little ironweed		Makaha Ridge	2, 6, 12	Intro		PPMS, C
Poaceae	*Cynodon dactylon*	Bermuda grass	Manienie	Makaha Ridge	2, 6	Intro		R
Cyperaceae	*Cyperus polystachyos*	manyspike flatsedge		Makaha Ridge	2, 6	Ind		R
Cyperaceae	*Cyperus sp.*	flatsedge		Makaha Ridge	2	Intro		R
Apiaceae	*Daucus pusillus*	American carrot		Makaha Ridge	12	Intro		C
Fabaceae	*Desmanthus pernambucanus*	slender mimosa		Makaha Ridge	12	Intro		C
Fabaceae	*Desmodium incanum*	Spanish clover	Ka‘imi	Makaha Ridge	2, 6	Intro		PPMS,R
Fabaceae	*Desmodium sandwicense*	Spanish clover, chili clover	Pua pilipili, Kknia pipili	Makaha Ridge	2, 6	Intro		R
Fabaceae	*Desmodium triflorum*	tick trefoil		Makaha Ridge	2, 6	Intro		C
Liliaceae	*Dianella sandwicensis*	‘uki‘uki	‘Uki‘uki, ‘Uki	Makaha Ridge	2, 6	Ind		PPMS
Poaceae	*Digitaria sp.*	crabgrass		Makaha Ridge	2	Intro		R
Poaceae	*Digitaria ciliaris*	Henry's crabgrass	Kukaepua‘a	Makaha Ridge	2, 6	Intro		PPMS,R
Poaceae	*Digitaria pentzil*	panola grass		Makaha Ridge	2	Intro		R

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Poaceae	*Digitaria setigera*	East Indian crabgrass	Kukaepua'a, Mau'u	Makaha Ridge	6, 12	Intro		C
Sapindaceae	*Dodonaea viscosa*	Florida hopbush	A`ali`i	Makaha Ridge	2, 6	Intro		C,PPMS,R
Pteridaceae	*Doryopteris decipiens*	triangleleaf lipfern	Kumuniu, 'Iwa'iwa	Makaha Ridge	2, 6	End		C
Asteraceae	*Emilia fosbergii*	Florida tasselflower	Pualele	Makaha Ridge	2, 6	Intro		C,R
Asteraceae	*Emilia sonchifolia* var. *javanica*	Flora's paintbrush	Purple pualele	Makaha Ridge	2, 6	Intro		R
Poaceae	*Eragrostis variabilis*	kawelu	Kāwelu, 'emoloa	Makaha Ridge	2, 6	End		C
Asteraceae	*Erigeron karvinskianus*	Latin American fleabane		Makaha Ridge	2, 6	Intro		R
Geraniaceae	*Erodium cicutarium*	pin clover		Makaha Ridge	6	Intro		
Myrtaceae	*Eucalyptus sp.*	gum		Makaha Ridge	2, 6	Intro		PPMS
Cyperaceae	*Gahnia beecheyi*	forest sawsedge		Makaha Ridge	2, 6	End		PPMS
Asteraceae	*Gamochaeta purpurea*	purple cudweed		Makaha Ridge	2, 6	Intro		R
Proteaceae	*Grevillea robusta*	silk oak	'Oka kilika	Makaha Ridge	6	Intro		C,PPMS
Poaceae	*Heteropogon contortus*	pili grass	Pili, Lule	Makaha Ridge	2, 6	Ind		C
Malvaceae	*Hibiscus kokio subsp saintjohnianus*	Hawaiian red hibiscus	Koki'o, Koki'o 'ula	Makaha Ridge	12	End	SOC, State	C
Poaceae	*Hyparrhenia rufa*			Makaha Ridge	12	Intro		C

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Asteraceae	*Hypochaeris glabra*	smooth cat's-ear		Makaha Ridge	2, 6, 12	Intro		C
Asteraceae	*Hypochaeris radicata*	hairy cat's-ear, gosmore		Makaha Ridge	6, 12	Intro		C
Fabaceae	*Indigofera suffruticosa*	indigo	Iniko	Makaha Ridge	2, 6	Intro		C,R
Verbenaceae	*Lantana camara*	lantana	lkana, L‘au kalakala	Makaha Ridge	2, 6	Intro		C,PPMS,R
Epacridaceae	*Leptecophylla tameiameiae*		Pūkiawe, ‘A‘ali‘i mahu	Makaha Ridge	12	Ind		C
Fabaceae	*Leucaena leucocephala*	koa haole	Koa haole	Makaha Ridge	2, 6	Intro		R
Asteraceae	*Lipochaeta connata var acris*	nehe	Nehe	Makaha Ridge	12	End		C
Campanulaceae	*Lobelia niihauensis*	Ni‘ihau lobelia		Makaha Ridge	12	End	FE, SE	C
Onagraceae	*Ludwigia octovalvis*	primrose willow	Kmole, Alohalua	Makaha Ridge	6	Ind		R
Solanaceae	*Lycium sandwicense*	Hawai'i desert-thorn	Ohelo kai	Makaha Ridge	12	Ind		C
Fabaceae	*Macroptilium lathyroides*	wild bushbean		Makaha Ridge	2, 6	Intro		C
Fabaceae	*Medicago lupulina*	black medick		Makaha Ridge	2, 6	Intro		R
Meliaceae	*Melia azedarach*	chinaberry	‘Nia	Makaha Ridge	2, 6	Intro		PPMS
Poaceae	*Melinis minutiflora*	molasses grass		Makaha Ridge	2	Intro		C,PPMS,R
Poaceae	*Melinis repens*	natal redtop		Makaha Ridge	2, 6	Intro		C,PPMS,R
Fabaceae	*Mimosa pudica var. unijuga*	sensitive plant, sleeping grass	Hilahila, Pua	Makaha Ridge	2, 6	Intro		R

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Cucurbitaceae	*Momordica charantia*	balsam pear, bitter melon		Makaha Ridge	12	Intro		C
Myoporaceae	*Myoporum sandwicense*	bastard sandalwood	Naio, Naeo, Naieo	Makaha Ridge	2, 6	End		C,PPMS
Nephrolepidaceae	*Nephrolepis multiflora*	hairy swordfern	Okupukupu	Makaha Ridge	2, 6	Intro		PPMS
Oleaceae	*Olea europaea*	olive	‘Oliwa, ‘Oliwa haole	Makaha Ridge	2, 6, 12	Intro		PPMS, C
Poaceae	*Oplismenus hirtellus*	basketgrass	Honohono kukui	Makaha Ridge	2, 6, 12	Intro		PPMS
Cactaceae	*Opuntia ficus-indica*	pricklypear	Pānini, Pāpipi	Makaha Ridge	12	Intro		C
Oxalidaceae	*Oxalis corniculata*	yellow wood sorrel	‘Ihi ‘ai, ‘Ihi ‘awa	Makaha Ridge	2, 6	PI?		C,PPMS,R
Oxalidaceae	*Oxalis debilis*	pink wood sorrel	‘Ihi pehu	Makaha Ridge	6, 12	Intro		C
Poaceae	*Panicum maximum*	Guinea grass		Makaha Ridge	12	Intro		C
Poaceae	*Panicum torridum*	torrid panicgrass	Kākonakona, Hākonakona	Makaha Ridge	12	End		C
Poaceae	*Paspalum fimbriatum*	Panama paspalum, Colombia grass		Makaha Ridge	2, 6	Intro		R
Poaceae	*Pennisetum clandestinum*	Kikuyu grass		Makaha Ridge	2, 6	Intro		R
Apiaceae	*Peucedanum sandwicense*	makou	Makou	Makaha Ridge	12	End	FT, ST	C
Arecaceae	*Phoenix hybrid*			Makaha Ridge	12	Intro		C
Euphorbiaceae	*Phyllanthus debilis*		Niruri	Makaha Ridge	12	Intro		C

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Pinaceae	*Pinus elliottii Engelm.*	slash pine		Makaha Ridge	12	Intro		C
Pinaceae	*Pinus radiata*	Monterey Pine		Makaha Ridge	6	Intro		PPMS
Pteridaceae	*Pityrogramma calomelanos*	Dixie silverback fern		Makaha Ridge	6	Intro		C
Plantaginaceae	*Plantago lanceolata*	narrowleaf plantain		Makaha Ridge	12	Intro		C
Plantaginaceae	*Plantago major*	broad-leaved plantain	Laukahi, Khkili	Makaha Ridge	2, 6	Intro		C,R
Asteraceae	*Pluchea carolinensis*	sourbush		Makaha Ridge	2, 6	Intro		R
Caryophyllaceae	*Polycarpon tetraphyllum*			Makaha Ridge	12	Intro		C
Portulacaceae	*Portulaca oleraceae*	little hogweed	Akulikuli kula, Ihi	Makaha Ridge	2, 6	Intro		R
Myrtaceae	*Psidium cattleianum*	strawberry guava	Waiaw ‘ula‘ula	Makaha Ridge	2, 6	Intro		PPMS
Myrtaceae	*Psidium cattleianum* var. *littorale*	strawberry guava	Waiawi	Makaha Ridge	2	Intro		PPMS
Myrtaceae	*Psidium guajava*	common guava	Kuawa, Kuawa ke‘oke‘o	Makaha Ridge	2, 6	Intro		PPMS
Psilotaceae	*Psilotum nudum*	upright whiskfern	Moa, Moa nahele	Makaha Ridge	6	Ind		
Rubiaceae	*Psydrax odorata*	alahe‘e	Alahe‘e, ‘He‘e, Walahe‘e	Makaha Ridge	2, 6	Ind		C,PPMS
Dennstaedtiaceae	*Pteridium aquilinum var. decompositum*			Makaha Ridge	12	End		

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Pteridaceae	*Pteris vittata*	ladder brake, cliff brake		Makaha Ridge	12	Intro		C
Rubiaceae	*Richardia brasiliensis*	tropical Mexican clover		Makaha Ridge	2, 6	Intro		R
Euphorbiaceae	*Ricinus communis*	castor bean	P‘aila, Ka‘apeh	Makaha Ridge	2, 6	Intro		R
Goodeniaceae	*Scaevola gaudichaudii*	ridgetop naupaka	Naupaka kuahiwi	Makaha Ridge	2, 6	End		PPMS
Caryophyllaceae	*Schiedea apokremnos*	Kauai schiedea	Ma‘oli‘oli	Makaha Ridge	12	SIE	FE, SE	C
Poaceae	*Schizachyrium condensatum*	little bluestem, beardgrass		Makaha Ridge	2, 6	Intro		C,PPMS
Selaginellaceae	*Selaginella arbuscula*	dwarf spikemoss	Lepelepe a moa	Makaha Ridge	6	End		
Poaceae	*Setaria gracilis*	marsh bristlegrass	Mau‘ kaleponi	Makaha Ridge	2	Intro		PPMS,R
Poaceae	*Setaria parviflora*	yellow foxtail, perennial foxtail	Mau‘ kaleponi	Makaha Ridge	12	Intro		C
Malvaceae	*Sida fallax*	‘ilima	‘Ilima	Makaha Ridge	2, 6	Intro		PPMS
Solanaceae	*Solanum americanum*	glossy nightshade	Popolo	Makaha Ridge	2, 6	Ind		R
Asteraceae	*Sonchus oleraceus*	sow thistle	Pualele	Makaha Ridge	12	Intro		C
Rubiaceae	*Spermacoce assurgens*	buttonweed		Makaha Ridge	2, 6	Intro		R
Apiaceae	*Spermolepis hawaiiensis*			Makaha Ridge	12	End	SE	C
Asteraceae	*Sphagneticola trilobata*	wedelia		Makaha Ridge	2, 6	Intro		PPMS,R

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Poaceae	*Sporobolus indicus*	smut grass		Makaha Ridge	2, 6, 12	Intro		R, C
Epacridaceae	*Styphelia tameiameiae*	Pu`kiawe	Pu`kiawe	Makaha Ridge	6	Ind		PPMS
Myrtaceae	*Syzygium cumini*	Java plum		Makaha Ridge	12	Intro		C
Thelypteridaceae	*Thelypteris parasitica*	Woodfern		Makaha Ridge	2, 6	Intro		PPMS,R
Verbenaceae	*Verbena litoralis*	vervain	W, O, Haʻuoi	Makaha Ridge	2, 6	Intro		R
Verbenaceae	*Verbena litoralis*	vervain	Ōwī, Oī, Haʻuoi	Makaha Ridge	12	Intro		C
Poaceae	*Vulpia bromoides*	brome fescue		Makaha Ridge	2, 6	Intro		C
Sterculiaceae	*Waltheria indica*	uhaloa	Uhaloa, Hialoa	Makaha Ridge	2, 6	Ind		C,PPMS,R
Asteraceae	*Wilkesia hobdyi*	dwarf iliau		Makaha Ridge	2, 6, 12	SIE	FE, SE	C
Asteraceae	*Youngia japonica*	Oriental hawksbeard		Makaha Ridge	2, 6	Intro		R
Lauraceae	*Cassytha filiformis*	Kaunaoa pehu		Nohili dunes	1	Ind		
Casuarinaceae	*Casuarina equisetifolia*	Ironwood	Paina	Nohili dunes	1	Intro		
Euphorbiaceae	*Chamaesyce celastroides* var. *celastroides*	Akoko	Akoko	Nohili dunes	1	End		
Poaceae	*Chloris barbata*	swollen fingergrass	Mauʻu lei	Nohili dunes	1	Intro		
Poaceae	*Cynodon dactylon*	Bermuda grass	Manienie	Nohili dunes	1	Intro		
Sapindaceae	*Dodonaea viscosa*	Florida hopbush	A`ali`i	Nohili dunes	1	Intro		
Boraginaceae	*Heliotropium anomalum*	Hinahina	Hinahina	Nohili dunes	1	Ind		

Family	Scientific Name	Common name	Hawaiian Name	Location	Reference	Origin	Status	Vegetation Type
Convolvulaceae	*Ipomoea imperati*	Hunakai	Hunakai	Nohili dunes	1	Ind		
Convolvulaceae	*Ipomoea pes-caprae*	Beach morning glory	Pohuehue	Nohili dunes	1	Ind		
Fabaceae	*Leucaena leucocephala*	koa haole	Koa haole	Nohili dunes	1	Intro		
Asteraceae	*Pluchea carolinensis*	sourbush		Nohili dunes	1	Intro		
Fabaceae	*Prosopis pallida*	kiawe	Kiawe	Nohili dunes	1	Intro	Noxious Weed	
Goodneiaceae	*Scaevola sericea*	naupaka	Naupaka kahaki	Nohili dunes	1	Ind		
Aizoaceae	*Sesuvium portulacastrum*	sea purslane	Akulikuli	Nohili dunes	1	Ind		R
Malvaceae	*Sida fallax*	Ilima	Ilima	Nohili dunes	1	Ind		
Poaceae	*Sporobolous virginicus*	beach dropseed	Akiaki	Nohili dunes	1	Ind		
Asteraceae	*Verbesina encelioides*	golden crown-beard		Nohili dunes	1	Intro	Invasive	
Verbenaceae	*Vitex rotundifolia*	beach vitex	Pohinahina	Nohili dunes	1	Ind		

Key for origin:

End=Endemic; Intro=Introduced; Ind=Indigenous; PI=Polynesian intro;PI?=likely Polynesian intro; SIE=Single Island Endemic

Key for vegetation type:

K= Kiawe-Koa Haole Scrub; A= Aalii-Name Scrub; PND= Pohinahina-Naupaka Dune; S= Strand; D= Drainage/Wetlands; C= cliff; PPMS= Planted Pine/Mixed scrub; R=Ruderal

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PMRF AVIAN SPECIES BY BASE

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Acridotheres tristis	Common Myna		Barking Sands	2, 3, 5	Non-native		Abundant
Alauda arvensis	Eurasian Skylark		Barking Sands	2	Non-native	MBTA	Unknown
Amandava amandava	Red Avadavat		Barking Sands	5	Non-native	MBTA	
Anas acuta	Northern Pintail	Koloa māpu	Barking Sands	5	Winter visitor	MBTA	Rare
Anas clypeata	Northern Shoveler	Koloa moha	Barking Sands	2, 3	Winter visitor	MBTA	Rare
Anas crecca	Green-winged Teal		Barking Sands	2	Winter visitor	MBTA	Very Rare
Anas wyvilliana	Hawaiian Duck	Koloa maoli	Barking Sands	2, 3, 5	Native	FE, SE, MBTA	Abundant
Arenaria interpres	Ruddy Turnstone	‘Akekeke	Barking Sands	2, 3	Native	MBTA	Common
Asio flammeus sandwichensis	Short -eared Owl	Pueo	Barking Sands	5	Native	SE Oahu, MBTA	Common
Branta hutchinsii	Cackling Goose		Barking Sands	5	Winter visitor	MBTA	Rare
Branta sandvicensis	Hawaiian Goose	Nene	Barking Sands	5	Native	FE, SE, MBTA	Abundant
Bubulcus ibis	Cattle Egret		Barking Sands	2, 3, 5	Non-native	USFWS Control Order, MBTA	Abundant
Calidris alba	Sanderling	Hunakai	Barking Sands	2, 3	Winter visitor	MBTA	Common
Cardinalis cardinalis	Northern Cardinal		Barking Sands	2, 3, 5	Non-native	MBTA	Abundant
Carpodacus mexicanus	House Finch		Barking Sands	2, 3, 5	Non-native	MBTA	Abundant
Cettia diphone	Japanese Bush Warbler		Barking Sands	5	Non-native		Rare

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Columba livia	Rock Pigeon		Barking Sands	2, 3	Non-native		Rare
Copsychus malabaricus	White-rumped Shama		Barking Sands	2, 3, 5	Non-native		Uncommon
Cygnus columbianus	Tundra Swan		Barking Sands	5	Vagrant	MBTA	Very Rare
Euodice cantans	African Silverbill		Barking Sands	5	Non-native		
Francolinus erckelii	Erckel's Francolin		Barking Sands	2, 3, 5	Non-native gamebird		Common
Francolinus francolinus	Black Francolin		Barking Sands	2, 3, 5	Non-native gamebird		Common
Fregata minor	Great Frigatebird	ʻIwa	Barking Sands	5	Breeding visitor	MBTA	Common
Fulica americana alai	Hawaiian Coot	ʻAlae keʻokeʻo	Barking Sands	2, 3, 5	Native	FE, SE, MBTA	Abundant
Gallinula chloropus sandvicensis	Hawaiian Moorhen	ʻAlae ʻula	Barking Sands	2, 3, 5	Native	FE, SE, MBTA	Common
Gallus gallus	Red Junglefowl	Moa	Barking Sands	2, 3, 5	Non-native		Abundant
Garrulax canorus	Chinese Hwamei		Barking Sands	2, 3, 5	Non-native		Uncommon
Geopelia striata	Zebra Dove		Barking Sands	5	Non-native		Abundant
Himantopus mexicanus knudseni	Hawaiian Stilt	Ae'o	Barking Sands	2, 3, 5	Native	FE, SE, MBTA	Common
Larus atricilla	Laughing Gull		Barking Sands	3, 5	Vagrant	MBTA	Rare
Larus canus	Mew Gull		Barking Sands	5	Vagrant	MBTA	Very Rare
Larus glaucescens	Glaucous-winged Gull		Barking Sands	5	Winter visitor	MBTA	Rare

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Lonchura atricapilla	Chestnut Munia		Barking Sands	2, 5	Non-native		Common
Lonchura malacca	Chestnut Mannikin		Barking Sands	3	Non-native		Common
Lonchura oryzivora	Java Finch		Barking Sands	5	Non-native		
Lonchura punctulata	Nutmeg Manikin		Barking Sands	3, 5	Non-native		Common
Melegris gallopavo	Wild Turkey	Pelehu	Barking Sands	2	Non-native		Rare
Mimus polyglottos	Northern Mockingbird		Barking Sands	2, 3, 5	Non-native	MBTA	Common
Nycticorax nycticorax	Black-crowned Night-heron	ʻAukuʻu	Barking Sands	2, 3, 5	Native	MBTA	Abundant
Oceanodroma castro	Band-rumped Storm-petrel	ʻAkeʻake	Barking Sands	6	Native	FE, SE, MBTA	
Paroaria coronata	Red-crested Cardinal		Barking Sands	2, 3, 5	Non-native		Abundant
Passer domesticus	House Sparrow		Barking Sands	2, 3, 5	Non-native	MBTA	Common
Phasianus colchius	Ring-necked Pheasant		Barking Sands	2, 3, 5	Non-native gamebird		Common
Phoebastria albatrus	Short-tailed Ablatross		Barking Sands		Native	FE, SE, MBTA	Very Rare
Phoebastria immutabilis	Laysan Albatross	Mōlī	Barking Sands	2, 3, 5	Breeding visitor	MBTA	Abundant
Phoebastria nigripes	Black-footed Albatross	Kaʻupu	Barking Sands	2	Native	MBTA	Very Rare
Pluvialis fulva	Pacific Golden Plover	Kōlea	Barking Sands	2, 3, 5	Winter visitor	MBTA	Common
Pluvialis squatarola	Black-bellied Plover		Barking Sands	2	Winter visitor	MBTA	Rare

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel	ʻUaʻu	Barking Sands	6	Native	FE, SE, MBTA	
Puffinus auricularis newelli	Newell's Shearwater	ʻAʻo	Barking Sands	6	Native	FT, ST, MBTA	
Puffinus pacificus	Wedge-tailed Shearwater	ʻUaʻu kani	Barking Sands	2, 5	Breeding visitor	MBTA	Abundant
Streptopelia chinensis	Spotted Dove		Barking Sands	5	Non-native gamebird		Abundant
Sturnella neglecta	Western Meadowlark		Barking Sands	3, 5	Non-native	MBTA	Uncommon
Sula leucogaster	Brown Booby	ʻĀ	Barking Sands	2, 5	Breeding visitor	MBTA	Common
Tringa incana	Wandering Tattler	ʻŪlili	Barking Sands	2, 3, 5	Breeding visitor	MBTA	Common
Tyto alba	Barn Owl		Barking Sands	5	Non-native	USFWS Control Order, MBTA	Common
Zosterops japonicus	Japanese White-eye		Barking Sands	2, 3, 5	Non-native		Common
Acridotheres tristis	Common Myna		Kamokala Ridge	2	Non-native		Common
Alectoris chukar	Chukar Partridge		Kamokala Ridge	2	Non-native gamebird		Unknown
Bubulcus ibis	Cattle Egret		Kamokala Ridge	2	Non-native	USFWS Control Order, MBTA	Rare
Cardinalis cardinalis	Northern Cardinal		Kamokala Ridge	2	Non-native	MBTA	Common
Carpodacus mexicanus	House Finch		Kamokala Ridge	3	Non-native	MBTA	Common
Copsychus malabaricus	White-rumped Shama		Kamokala Ridge	2	Non-native		

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Francolinus erckelii	Erckel's Francolin		Kamokala Ridge	2	Non-native gamebird		Uncommon
Gallus gallus	Red Junglefowl	Moa	Kamokala Ridge	2	Non-native		Common
Garrulax canorus	Chinese Hwamei		Kamokala Ridge	2	Non-native		Uncommon
Geopelia striata	Zebra Dove		Kamokala Ridge	2	Non-native		Common
Lonchura malacca	Chestnut Mannikin		Kamokala Ridge	3	Non-native		Common
Lonchura punctulata	Nutmeg Manikin		Kamokala Ridge	3	Non-native		Abundant
Mimus polyglottos	Northern Mockingbird		Kamokala Ridge	2	Non-native	MBTA	Common
Nycticorax nycticorax	Black-crowned Night-heron	ʻAukuʻu	Kamokala Ridge	3	Native	MBTA	Rare
Paroaria coronata	Red-crested Cardinal		Kamokala Ridge	3	Non-native		Unknown
Pluvialis fulva	Pacific Golden Plover	Kōlea	Kamokala Ridge	3	Winter visitor	MBTA	Uncommon
Streptopelia chinensis	Spotted Dove		Kamokala Ridge	2	Non-native gamebird		Abundant
Tyto alba	Barn Owl		Kamokala Ridge	3	Non-native	USFWS Control Order, MBTA	Unknown
Zosterops japonicus	Japanese White-eye		Kamokala Ridge	2	Non-native		Abundant
Anous minutus	Black Noddy	Noio	Kaula Island	1	Breeding visitor	MBTA	Common
Anous stolidus	Brown Noddy	Noio kōhō	Kaula Island	1, 4	Breeding visitor	MBTA	Abundant
Arenaria interpres	Ruddy Turnstone	ʻAkekeke	Kaula Island	1	Winter visitor	MBTA	Uncommon

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Bulweria bulwerii	Bulwer's Shearwater	ʻOu	Kaula Island	1, 4	Breeding visitor	MBTA	Common
Cardinalis cardinalis	Northern Cardinal		Kaula Island	1	Non-native	MBTA	
Carpodacus mexicanus	House Finch		Kaula Island	1	Non-native	MBTA	Uncommon
Fregata minor	Great Frigatebird	ʻIwa	Kaula Island	1, 4	Breeding visitor	MBTA	Common
Gygis alba	White Tern	Manu-o-kū	Kaula Island	1, 4	Breeding visitor	ST, MBTA	Uncommon
Lonchura punctulata	Nutmeg Manikin		Kaula Island	1	Non-native		Uncommon
Mimus polyglottos	Northern Mockingbird		Kaula Island	1	Non-native	MBTA	Rare
Onychoprion fuscatus	Sooty Tern	ʻEwa ʻewa	Kaula Island	1, 4	Breeding visitor	MBTA	Abundant
Onychoprion lunatus	Gray-backed Tern	Pakalakala	Kaula Island	1	Breeding visitor	MBTA	Common
Phaethon lepturus	White-tailed Tropicbird	Koaʻe kea	Kaula Island	1	Breeding visitor	MBTA	Rare
Phaethon rubricauda	Red-tailed Tropicbird	Koaʻeʻula	Kaula Island	1, 4	Breeding visitor	MBTA	Common
Phoebastria immutabilis	Laysan Albatross	Mōlī	Kaula Island	1	Breeding visitor	MBTA	Common
Phoebastria nigripes	Black-footed Albatross	Kaʻupu	Kaula Island	1	Breeding visitor	MBTA	Uncommon
Pluvialis fulva	Pacific Golden Plover	Kōlea	Kaula Island	1	Winter visitor	MBTA	Uncommon
Procelsterna cerulea	Blue-gray Noddy		Kaula Island	1, 4	Breeding visitor	MBTA	Rare
Pterodroma hypoleuca	Bonin Island Petrel		Kaula Island	1	Breeding visitor	MBTA	Rare
Puffinus nativitatis	Christmas Island Shearwater		Kaula Island	1, 4	Breeding visitor	MBTA	Common

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Puffinus pacificus	Wedge-tailed Shearwater	ʻUaʻu kani	Kaula Island	1	Breeding visitor	MBTA	Abundant
Sula dactylatra	Masked Booby	ʻĀ	Kaula Island	1, 4	Breeding visitor	MBTA	Common
Sula leucogaster	Brown Booby	ʻĀ	Kaula Island	1, 4	Breeding visitor	MBTA	Common
Sula sula	Red-footed Booby	ʻĀ	Kaula Island	1, 4	Breeding visitor	MBTA	Abundant
Tringa incana	Wandering Tattler	ʻŪlili	Kaula Island	1	Breeding visitor	MBTA	Rare
Tyto alba	Barn Owl		Kaula Island	1	Non-native	USFWS Control Order, MBTA	Rare
Zosterops japonicus	Japanese White-eye		Kaula Island	1	Non-native		Rare
Acridotheres tristis	Common Myna		Kokee	2, 5	Non-native		Uncommon
Asio flammeus sandwichensis	Short -eared Owl	Pueo	Kokee	3	Native	SE Oahu, MBTA	Rare
Cardinalis cardinalis	Northern Cardinal		Kokee	2, 5	Non-native	MBTA	Common
Carpodacus mexicanus	House Finch		Kokee	3	Non-native	MBTA	Uncommon
Cettia diphone	Japanese Bush Warbler		Kokee	2	Non-native		
Chasiempis sclateri	Oahu Elepaio	Kaua'i 'Elepaio	Kokee	2, 5	Native		Rare
Copsychus malabaricus	White-rumped Shama		Kokee	2	Non-native		Rare
Drepanis coccinea	Scarlet Honeycreeper	I'iwi	Kokee	3	Native	FT, SE, MBTA	Rare
Francolinus erckelii	Erckel's Francolin		Kokee	2	Non-native gamebird		Unknown

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Gallus gallus	Red Junglefowl	Moa	Kokee	2, 5	Non-native		Uncommon
Garrulax canorus	Chinese Hwamei		Kokee	2	Non-native		Rare
Geopelia striata	Zebra Dove		Kokee	2, 5	Non-native		Rare
Hemignathus kauaiensis	Kauai Amakihi	Amakihi	Kokee	2	Native	MBTA	Rare
Lonchura punctulata	Nutmeg Manikin		Kokee	3	Non-native		Rare
Oceanodroma castro	Band-rumped Storm-petrel	ʻAkeʻake	Kokee	6	Native	FE, SE, MBTA	
Paroaria coronata	Red-crested Cardinal		Kokee	2, 5	Non-native		Common
Pluvialis fulva	Pacific Golden Plover	Kōlea	Kokee	2, 5	Winter visitor	MBTA	Common
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel	ʻUaʻu	Kokee	6	Native	FE, SE, MBTA	
Puffinus auricularis newelli	Newell's Shearwater	ʻAʻo	Kokee	6	Native	FT, ST, MBTA	
Streptopelia chinensis	Spotted Dove		Kokee	2	Non-native gamebird		Rare
Zosterops japonicus	Japanese White-eye		Kokee	2	Non-native		Abundant
Himatione sanguinea	Apapane	ʻApapane	Kokee Site	2	Native	MBTA	Unknown
Tyto alba	Barn Owl		Kokee Sites	5	Non-native	USFWS Control Order, MBTA	Common
Acridotheres tristis	Common Myna		Makaha Ridge	2, 3, 5	Non-native		Common
Alectoris chukar	Chukar Partridge		Makaha Ridge	2, 3	Non-native gamebird		Abundant

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Branta sandvicensis	Hawaiian Goose	Nēnē	Makaha Ridge	2, 5	Native	FE, SE, MBTA	Common
Bubulcus ibis	Cattle Egret		Makaha Ridge	2, 5	Non-native	USFWS Control Order, MBTA	Rare
Cardinalis cardinalis	Northern Cardinal		Makaha Ridge	2, 3, 5	Non-native	MBTA	Abundant
Carpodacus mexicanus	House Finch		Makaha Ridge	2, 3	Non-native	MBTA	Common
Cettia diphone	Japanese Bush Warbler		Makaha Ridge	2	Non-native		
Francolinus erckelii	Erckel's Francolin		Makaha Ridge	2, 3, 5	Non-native gamebird		Common
Francolinus francolinus	Black Francolin		Makaha Ridge	2, 5	Non-native gamebird		Common
Gallus gallus	Red Junglefowl	Moa	Makaha Ridge	2, 3	Non-native		Uncommon
Garrulax canorus	Chinese Hwamei		Makaha Ridge	2, 3	Non-native		Rare
Geopelia striata	Zebra Dove		Makaha Ridge	2, 3, 5	Non-native		Common
Lonchura punctulata	Nutmeg Manikin		Makaha Ridge	3	Non-native		Abundant
Mimus polyglottos	Northern Mockingbird		Makaha Ridge	2, 3, 5	Non-native	MBTA	Common
Oceanodroma castro	Band-rumped Storm-petrel	ʻAkeʻake	Makaha Ridge	6	Native	FE, SE, MBTA	
Paroaria coronata	Red-crested Cardinal		Makaha Ridge	2, 5	Non-native		Common
Phaethon lepturus	White-tailed Tropicbird	Koaʻe kea	Makaha Ridge	2, 5	Breeding visitor	MBTA	Common
Phasianus colchicus	Ring-necked Pheasant		Makaha Ridge	2, 3	Non-native gamebird		Rare

Scientific Name	Common Name	Hawaiian Name	Location	Reference	Origin	Status	Current Abundance
Pluvialis fulva	Pacific Golden Plover	Kōlea	Makaha Ridge	2, 5	Winter visitor	MBTA	Uncommon
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel	ʻUaʻu	Makaha Ridge	6	Native	FE, SE, MBTA	
Puffinus auricularis newelli	Newell's Shearwater	ʻAʻo	Makaha Ridge	6	Native	FT, ST, MBTA	
Streptopelia chinensis	Spotted Dove		Makaha Ridge	2, 3, 5	Non-native gamebird		Common
Zosterops japonicus	Japanese White-eye		Makaha Ridge	2, 3	Non-native		Abundant

Key for Status:

MBTA = Migratory Bird Treaty Act; FE= Federal Endangered; FT= Federal Threatened; SE= State Endangered; ST= State Endangered;
USFWS Control Order 50 CFR Section 21.55

Sources:

1. Pepi, V.E., A. Kumar, M.E. Laut, J. Hallman, J. Kim, and A.D. Anders. 2009. Kaula Island ship-based seabird and marine mammal surveys, 21-22 July 2009. Prepared for Commander, Pacific Fleet. NAVFAC Pacific.
2. Naval Facility Engineering Command Pacific (NAVFAC PAC). 2006. Summary of Bird Species Observed at PMRF. May 2006.
3. Bruner, Phillip L. 2000. Survey of avifauna and feral mammals for the Integrated Natural Resources Management Plan (INRMP) Pacific Missile Range Facility (PMRF) Barking Sands, Kauai, Hawaii.
4. Fujimoto, J. 2012. Kaula ship-based seabird surveys, 30 June 2011. Prepared by Naval Facilities Engineering Command Pacific for Commander, U.S. Pacific Fleet.
5. Incidental Observation by Natural Resources Program biologists

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PMRF TERRESTRIAL WILDLIFE

Family	Scientific Name	Common name	Location	Origin	Status	Abundance
Bovidae	*Capra hircus*	Feral Goat	Makaha Ridge	Introduced		Common
Bufonidae	*Bufo marinus*	Marine Toad	Barking Sands	Introduced		Uncommon
Canidae	*Canis familaris*	Feral Dog	Kokee, Barking Sands	Introduced		Uncommon
Cervidae	*Odocoileus hemionus*	Black-tailed Deer	Kokee, Makaha Ridge, Kamokala	Introduced		Common
Dactyloidae	*Anolis carolinensis*	Green Anole	Makaha Ridge	Introduced		Common
Drosophilidae	*Drosophila musaphilia*	Hawaiian Picture-wing Fly	Kokee	Single Island Endemic	FE, SE	Rare
Drosophilidae	*Drosophila sharpi*	Hawaiian Picture-wing Fly	Kokee	Endemic	FE, SE	Rare
Felidae	*Felis catus*	Feral Cat	Barking Sands, Makaha Ridge, Kokee, Kamokala	Introduced		Common
Gekkonidae	*Hemidactylus frenatus*	House Gecko	Barking Sands, Makaha Ridge	Introduced		Common
Gekkonidae	*Lepidodactylus lugubrus*	Mourning Gecko	Barking Sands, Makaha Ridge	Introduced		Uncommon
Muridae	*Mus muscalus*	Common House Mouse	Barking Sands	Introduced		Rare
Muridae	*Rattus norvegicus*	Norwegian Rat	Kokee	Introduced		Rare
Muridae	*Rattus rattus*	Roof Rat	Kokee, Barking Sands	Introduced		Common
Muridae	*Rattus exulans*	Polynesian Rat	Barking Sands, Kaula	Introduced		Uncommon
Scincidae	*Cryptoblepharus poecilopleurus*	Snake-eyed Skink	Barking Sands	Introduced		Uncommon
Scincidae	*Lampropholis delicata*	Metalic Skink	Kokee	Introduced		Common

Family	Scientific Name	Common name	Location	Origin	Status	Abundance
Suidae	*Sus scrofa*	Feral Pig	Kokee, Makaha Ridge, Kamokala	Introduced		Common
Vespertilionidae	*Lasiurus cinereus semotus*	Hawaiian Hoary Bat	Kokee, Barking Sands, Makaha Ridge, Kamokala	Endemic	FE, SE	Uncommon

Key for Status:

FE= Federal Endangered; FT= Federal Threatened; SE= State Endangered; ST= State Endangered

Sources:

1. Naval Facility Engineering Command Pacific (NAVFAC PAC). 2006. Pacific Missile Range Facility Barking Sands INRMP Herpetological and Mammal Survey. April 2006.

2. Bruner, P. 2000. Survey of avifauna and feral mammals for the Integrated Natural Resources Management Plan (INRMP) Pacific Missile Range Facility (PMRF) Barking Sands, Kauai, Hawaii.

3. Incidental Observation by Natural Resources Program biologists

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PMRF MARINE MAMMALS

Family	Scientific Name	Common name	Hawaiin Name	Special Status	Location	Reference
Balaenopteridae	*Megaptera novaeangliae*	Humpback Whale	Koholā	ESA	O	2
Delphinidae	*Feresa attenuata*	Pygmy killer whale		Protected	O potentially	2
Delphinidae	*Globicephala macrorhynchus*	Pilot whale		Protected	O potentially	2
Delphinidae	*Peponocephala electra*	Melon-headed whale		Protected	O potentially	2
Delphinidae	*Psuedorca crassidens*	False killer whale		Protected	O potentially	2
Delphinidae	*Stenella artenuata*	Spotted dolphin	Naiʻa	Protected	O potentially	2
Delphinidae	*Stenella longirostris*	Spinner dolphin	Naiʻa	Protected	O	2
Delphinidae	*Tursiops truncatus gilli*	Bottlenose dolphin	Naiʻa	Protected	O potentially	2
Phocidae	*Monachus schauinslandi*	Hawaiian Monk Seal	ʻIlio-holo-i-ka-uaua	ESA	K, BS 1, BS 2, BS 3, O	1, 2

Key:
K= Ka'ula Island, BS 1= Nohili, BS 2= Mana, BS 3= Majors, O= Offshore

Sources:

1. Incidental Observation by Natural Resources Program biologists
2. Miller, J., Dollar, S., Millan, A., Ericksen, M., Conger, C., Tumino, G. 2022. Biological and Benthic Habitat Surveys in Support of the Pacific Missile Range Facility (PMRF), Barking Sands Integrated Natural Resource Management Plan (INRMP). Kauai, Hawaii.

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PMRF AQUATIC WILDLIFE

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Acanthuridae	*Acanthurus achilles*	Achilles tang	Paku'iku'i		BS 1	2, 5
Acanthuridae	*Acanthurus blochii*	Ringtail surgeonfish	Pualu		K, BS 1, BS 2, BS 3, O	1, 2, 3, 5
Acanthuridae	*Acanthurus dussumieri*	Eyestripe surgeonfish	Palani		BS 1, BS 2, BS 3, O	2, 3, 5
Acanthuridae	*Acanthurus glaucopareius*	Gold-rim tang	--		BS 1	3
Acanthuridae	*Acanthurus leucoparieus*	Whitebar surgeonfish	Maikoiko		K, BS 1, BS 2	1, 2, 3, 5
Acanthuridae	*Acanthurus nigrofuscus*	Brown surgeonfish	Ma'i'i'		BS 1, BS 2, BS 3, O	2, 3, 5
Acanthuridae	*Acanthurus nigroris*	Blue-hued surgeonfish	Maiko		BS 1, BS 2, O	2, 3,
Acanthuridae	*Acanthurus olivaceus*	Orangeband surgeonfish	Naenae		BS 1, BS 2, BS 3, O	2, 3, 5
Acanthuridae	*Acanthurus triostegus*	Convict tang	Manini		K, BS 1, BS 2	1, 2, 3, 5
Acanthuridae	*Acanthurus xanthopterus*	Yellowfin surgeonfish	Pualu		BS 1, BS 2, O	2, 3, 5
Acanthuridae	*Ctenochaetus hawaiiensis*	Chevron tang	--		BS 1	3
Acanthuridae	*Ctenochaetus strigosus*	Goldring surgeon	Kole		BS 1, BS 2, O	2, 3, 5
Acanthuridae	*Naso brevirosrtis*				BS 1, O	2, 3
Acanthuridae	*Naso hexacanthus*	Sleek unicornfish	Kala holo		BS 1, O	2, 3, 5
Acanthuridae	*Naso lituratus*	Orangespine unicornfish	Umaumalei		BS 1, BS 2, O	2, 3, 5
Acanthuridae	*Naso unicornis*	Bluespine unicornfish	Kala		BS 1, BS 2, O	2, 3
Acanthuridae	*Zebrasoma flavescens*	Yellow tang	Lau'ipala		BS 1, BS 2	2, 3, 5
Acroporidae	*Montipora capitata*				BS 1, BS 2, BS3, O	3, 5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Acroporidae	*Montipora flabellata*				BS 1, BS 2, BS3, O	3, 5
Acroporidae	*Montipora patula*	Ringed rice coral	--		BS 1, BS 2, BS3, O	3, 5
Acroporidae	*Montipora verrilli*				BS 1, BS 2, BS3, O	3
Agariciidae	*Pavona duerdeni*				BS 1, BS 2, BS3, O	3, 5
Agariciidae	*Pavona varians*				BS 1, BS 2, BS3, O	3, 5
Albulidae	*Albula glossodonta*				BS 3	3
Algea	*Amansia glomerata*				BS 1, BS 2	2, 3
Algea	*Acanthophora sp.*				BS 1, BS 2	5
Algea	*Asparagopsis taxiformis*	--	Limu kohu		BS 1, BS 2	2, 3, 5
Algea	*Cladymenia pacifica*				BS 3	3
Algea	*Corallina sp.*				BS 1, BS 2, BS 3, O	3, 5
Algea	*Cyanobacteria*				BS 1, BS 2, BS 3	5
Algea	*Dasya iridescens*				BS 2	5
Algea	*Desmia hornemannii (genus change to portieria?)*				BS 1,BS 2, BS 3, O	2, 3
Algea	*Dictyosphaeria cavernosa*				BS 3	5
Algea	*Dictyota sp.*				BS 1, BS 2, BS 3	5
Algea	*Galaxaura sp.*				BS 1, BS 3	5
Algea	*Gibsmithia hawaiiensis*				BS 1, BS 2, BS 3	5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Algea	*Halimeda opuntia*				BS 2, BS 3	3
Algea	*Halimeda sp*				BS 1, BS 2, BS 3	5
Algea	*Jania sp.*				BS 1, BS 3	3
Algea	*Laurencia sp.*				BS 1, BS 2, BS 3	5
Algea	*Liagora sp.*				BS 1, BS 2, BS 3	5
Algea	*Lithophyllum sp.*				BS 1, BS 2, BS 3	5
Algea	*Lobophora variegata*				BS 1, BS 2, BS 3	5
Algea	*Lyngbya majuscula*				BS 1, BS 2, BS 3	5
Algea	*Martensia flabelliformis*				BS 1, BS 2, BS 3	5
Algea	*Microdictyon sp.*				BS 1, BS 2	5
Algea	*Neomeris sp.*				BS 1, BS 2, BS 3	5
Algea	*Padina sp.*				BS 1, BS 2	5
Algea	*Peyssonellia rubra*				BS 1	3
Algea	*Plocamium sandvicense*				BS 1, BS 2	5
Algea	*Porolithon onkodes*				BS 1, BS 2	3
Algea	*Portiera harnemannii*				BS 1, BS 2	5
Algea	*Predaea sp.*				BS 1, BS 2	5
Algea	*Sarcinochrysis marina*				BS 1, BS 2	5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Algea	*Spyridia filamentosa*				BS 2	5
Algea	*Symploca hynoides*				BS 1, BS 2, BS 3	5
Algea	*Tolypiocladia sp.*				BS 3	3
Algea	*Thrichogloea requenii*				BS 2	5
Algea	*Turbinaria ornata*				BS 2	5
Annelida	*Loimia medusa*				BS 1, BS 2, O	2, 5
Annelida	*Spirobranchus giganteus*	Christmas tree worm	--		BS 1, BS 3, O	3
Annelida	*Sabellastarte spectabilis*				BS 1	5
Annelida	*Unknown Tube Worm*				BS 1, BS 2	5
Antipathidae	*Antipathes griggi*	black coral	--		BS 1, BS 2, BS3, O	3
Antipathidae	*Cirrhipathes anguina*	wire coral	--		BS 1, BS 2, BS3, O	3
Apogonidae	*Apogon kallopterus*	Iridescent cardinalfish	ʻUpapalu		BS 1, BS 2, BS 3, O	2, 3, 5
Arthropoda	*Panulirus marginatus*	Spiny lobster	Ula		BS 1, BS 2, BS 3	2, 3
Arthropoda	*Paribaccus antarcticus*	Slipper lobster	ʻUlaʻpapa		BS 1, O	2, 3
Arthropoda	*Paribaccus penicillatus*	Spiny lobster	Ula		BS 2	3
Arthropoda	*Rhinolambrus sp.*				BS 3	5
Arthropoda	*Stenopus hispidus*				BS 2	5
Arthropoda	*Crab*				BS 1	5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Aulostomidae	*Aulostomus chinensis*	Trumpetfish	Nunu		BS 1, BS 2, BS 3	2, 3
Balistidae	*Cantherhines dumerili*	Barred filefish	Oʻili		BS 1, BS 3	3
Balistidae	*Cantherhines sandwichiensis*	Squaretail filefish	Oʻili lepa		BS 1, BS 2	2, 3
Balistidae	*Canthigaster cornata*	Crown toby	Puu oiai		K, BS 1, BS 3, O	1, 2, 3
Balistidae	*Canthigaster jactator*	Hawaiian whitespotted toby	--		BS 1, BS 2, BS 3, O	2, 3
Balistidae	*Canthigaster rivulata*				BS 2	3
Balistidae	*Melichthys niger*	Black durgon	Humuhumu		BS 1, BS 2, O	2, 3, 5
Balistidae	*Melichthys vidua*	Pinktail durgon	Humuhumu		BS 1, BS 2, BS 3,O	2, 3, 5
Balistidae	*Ostracion meleagris*	Spotted boxfish	Moa		K, BS 1, BS 3, O	1, 2, 3,
Balistidae	*Rhinecanthus rectangulus*	Reef triggerfish	Humuhumu nukunuku	State Fish	K, BS 1, BS 2, BS 3, O	1, 2, 3,5
Balistidae	*Sufflamen bursa*	Lei triggerfish	Humuhumu		BS 1, BS 2, O	2, 3, 5
Balistidae	*Sufflamen fraenatus*	Bridled triggerfish	Humuhumu mimi		BS 1, BS 3, O	2, 3
Balistidae	*Xanthichthys auromarginatus*	Gilded triggerfish	--		O	2, 3
Balistidae	*Xanthichthys mento*	Crosshatch triggerfish	--		O	3
Blenniidae	*Exallias brevis*	Shortbodied blenny	Paoʻo kauila		BS 1, BS 2	3,5
Blenniidae	*Plagiotremus ewaensis*				O	2
Blenniidae	*Plagiotremus goslinei*	Biting blenny	--		BS 1, BS 2, O	2, 3

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Bryozoa	*Bryozoan spp.*				BS 2	5
Caracanthinae	*Caracanthus sp*	Coral councher	--		K	1
Carangidae	*Carangoides orthogrammus*	Island trevally	Papio		BS 1	2, 3
Carangidae	*Caranx cheilio*				O	2
Carangidae	*Caranx melampygus*	Bluefin trevally	ʻOmilu		BS 1, BS 2, O	2, 3, 5
Carangidae	*Decapterus macarellus*	Mackerel scad	ʻOpelu		BS 1, O	2, 3
Carangidae	*Gnathanodon speciosus*	Yellow jack or golden travally	Ulua paʻopaʻo		BS 2, O	2, 3
Carcharhinidae	*Carcharhinus galapagensis*	Galapagos shark	Mano	Cultural Sign.	K	1
Carcharhinidae	*Carcharhinus plumbaus*	Sandbar shark	Mano	Cultural Sign.	K	1
Carcharhinidae	*Carcharinus lonigmanus*	Oceanic whitetip shark	--	FT, ST	BS 1, BS 2, BS3, O	4
Chaetodontidae	*Chaetodon auriga*	Threadfin butterflyfish	Kikakapu		K, BS 1, BS 2, O	1, 2, 3, 5
Chaetodontidae	*Chaetodon ephippeum*				BS 1	5
Chaetodontidae	*Chaetodon fremblii*	Bluestripe butterflyfish	Kikakapu		BS 1	2
Chaetodontidae	*Chaetodon kleini*	Butterflyfish	Kikakapu		BS 2,O	2, 3, 5
Chaetodontidae	*Chaetodon lunula*	Raccoon butterflyfish	Kikakapu		BS 1, BS 2	2, 3, 5
Chaetodontidae	*Chaetodon milliaris*	Milletseed butterflyfish	Lau wiliwili		BS 1, BS 2, O	2, 3, 5
Chaetodontidae	*Chaetodon multicinctus*	Multiband butterflyfish	Kikakapu		BS 1, BS 2, O	2, 5
Chaetodontidae	*Chaetodon ornatissimus*	Ornate butterflyfish	Kikakapu		BS 1, BS 2	2, 3, 5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Chaetodontidae	*Chaetodon quadrimaculatus*	Fourspot butterflyfish	Lauhau		BS 1, BS 2,BS 3, O	2, 3, 5
Chaetodontidae	*Chaetodon unimaculatus*	Teardrop butterflyfish	Lauhau		BS 1	2, 3, 5
Chaetodontidae	*Forcipiger flavissimus*	Longnose butterflyfish	Lau wiliwili nukunuku		BS 1, BS 2, O	2, 3, 5
Chaetodontidae	*Forcipiger longirostris*				BS 1	5
Chaetodontidae	*Hemitaurichthys polylepis*	Pyramid butterflyfish	--		O	2, 3
Chaetodontidae	*Heniochus diphreutes*	Pennantfish	--		O	2, 3
Cheloniidae	*Chelonia mydas*	Green sea turtle	Honu	FT - Central North Pacific DPS, ST	BS 2, BS 3	4, 5
Chordata	*Colonial Tunicate*				BS 1	5
Cnidaria	*Cyphastrea agassizi*				BS 1	5
Cnidaria	*Halocordyle disticha*	Christmas tree hydroid	--		BS 3	3
Cnidaria	*Hydroid sp.*				BS 1	5
Cnidaria	*Lobactis scutaria*				BS1, BS 2	5
Cnidaria	*Pennaria disticha*				BS 1, BS 3	5
Cnidaria	*Sertularella diaphana*				BS 1	5
Cirrhitidae	*Cirrhitops fasciatus*	Red-barred hawkfish	--		BS 1, BS 2, BS 3, O	2, 3, 5
Cirrhitidae	*Cirrhitus pinnulatus*	Stocky hawkfish	Poʻopaʻa		BS 1, O	2, 3,
Cirrhitidae	*Paracirrhites arcatus*	Arc-eye hawkfish	Pilikoa		BS 1, BS 2, BS 3, O	2, 3, 5
Cirrhitidae	*Paracirrhites forsteri*	Blackside hawkfish	Hilu pilikoa		BS 1, BS 2, O	2, 3, 5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Diodontidae	*Diodon hysrix*	Porcupine fish	Kokala		K	1
Echinodermata	*Acanthaster planci*	Crown-of-thorns starfish	--		BS 1	3
Echinodermata	*Actionpyge mauritana*	Sea cucumbers	--		BS 1	2, 3
Echinodermata	*Culcita novaeguineae*				O	2, 3
Echinodermata	*Echinometra matheai*				O	2
Echinodermata	*Echinostrephus aciculatus*	Sea urchin	--		BS 1, BS 2, O	2, 3, 5
Echinodermata	*Echinothrix calamaris*	Sea urchin	--		BS 1, BS 2, BS 3, O	2, 3, 5
Echinodermata	*Echinothrix diadema*	Sea urchin	--		BS 1, O	2, 3
Echinodermata	*Eucardus metularia*				O	2
Echinodermata	*Holothuria atra*	Sea cucumber	--		BS 1, BS 2, BS 3, O	2, 3
Echinodermata	*Holothuria whitmaei*	Sea Cucumber	--		BS 3	3
Echinodermata	*Linckia diplax*				O	2
Echinodermata	*Linckia multiflora*	Sea star	--		BS 1, O	2, 3
Echinodermata	*Tripneustes gratilla*	Sea urchin	--		BS 1, BS 2, O	2, 3, 5
Holocentridae	*Myriprises amaena*	menpachi*	--		BS 1	2, 3
Holocentridae	*Myripristis amanea*	Brick soldierfish	ʻUʻu		BS 2	2, 3
Holocentridae	*Myripristis berndti*				BS 1, BS 2	5
Holocentridae	*Myripristis sp.*				BS 1, BS 2	5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Holocentridae	*Sargocentron diadema*	Crown squirrelfish	Alaihi		BS 1	2, 3
Holocentridae	*Sargocentron punctatissimum*	Peppered squirrelfish	ʻAlaiʻihi		BS 1, BS 3	2, 3,
Holocentridae	*Sargocentron xantherythrum*	Hawaiian squirrelfish	ʻAlaiʻihi		BS 1	2, 3
Holocentridae	*Sargocentron sp.*				BS 1	5
Kyphosidae	*Kyphosus bigibbus*	Gray chub, rudderfish	Nenue		BS 1, BS 2	2, 3
Kyphosidae	*Kyphosus sp.*				BS 1	5
Labridae	*Anampses chrysocephalus*	Psychedelic wrasse	Hi nalea	Endemic	K	1
Labridae	*Anampses cuvier*	Pearl wrasse	Opule		BS 1, BS 2	2
Labridae	*Bodianus albotaeniatus*				BS 1, BS 2	5
Labridae	*Bodianus bilunulatus*	Hawaiian dogfish	ʻAʻawa		BS 1, BS 2, BS 3, O	2, 3
Labridae	*Cheilinus rhodochrous*				O	2
Labridae	*Cheilio ineris*	Cigar wrasse	Kupoupou		BS 3	3
Labridae	*Coris flavovittata*	Yellowstripe coris	Hilu		BS 1, O	2, 3
Labridae	*Coris gaimard*	Yellowtail coris	Hinalea ʻakilolo		BS 1, BS 2, O	2, 3, 5
Labridae	*Coris venusta*	Wrasse	Hinalea		BS 1, BS 2, BS 3	2, 3, 5
Labridae	*Gomphosus varius*	Bird wrasse	Hinalea ʻiʻiwi		BS 1, BS 2	2, 3, 5
Labridae	*Halichoeres ornatissimus*	Ornate Wrasse	ʻOhua		BS 1, BS 2, O	2, 3, 5
Labridae	*Labroides phthirophagus*	Hawaiian cleaner wrasse	--		BS 1, BS 2, BS 3, O	2, 3, 5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Labridae	*Macropharyngodon geoffroy*	Shortnose wrasse	Hi nalea	Endemic	K	1
Labridae	*Novaculichthys taeniourus*				BS 1, BS 3	5
Labridae	*Pseudocheilinus octotaenia*	Eightstripe wrasse	--		K, BS 1, BS 2	1, 3, 5
Labridae	*Pseudocheilinus tetrataenia*				O	2
Labridae	*Pseudojuloides cerasinus*	Smalltail wrasse	--		O	2, 3
Labridae	*Stethojulis balteata*	Belted wrasse	Omaka	Endemic	K, BS 1	1, 2
Labridae	*Thalassoma ballieui*	Blacktail wrasse	Hinalea luahine	Endemic	K, BS 1, BS 3	1, 2
Labridae	*Thalassoma duperrey*	Saddleback wrasse	Hinalea lauwili		BS 1, BS 2, BS 3, O	2, 3, 5
Labridae	*Thalassoma purpureum*	Rainbow or surge wrasse	Hou		BS 1	3
Labridae	*Thalassoma quinquevittatum*	Fivestripe wrasse	Hi nalea	Endemic	K	1
Labridae	*Thalassoma trilobatum*	Christmas wrasse	Awela		BS 1, BS 2	2
Labridae	*Xyrichtys pavo*	Peacock razorfish	Laenihi		BS 3	3
Lethrinidae	*Monotaxis grandoculis*	Bigeye emperor	Mu		BS 1, BS 2, O	2, 3, 5
Lutjanidae	*Aprion virescens*	Gray snapper / green jobfish	Uku		BS 1, BS 3, O	2, 3
Lutjanidae	*Lutjanus fulvus*	Blacktail snapper	To‘au		BS 1, BS 2, BS 3, O	2, 3, 5
Lutjanidae	*Lutjanus kasmira*	Bluestripe snapper	Ta‘ape		BS 1, BS 2, BS 3, O	2, 3, 5
Malacanthidea	*Malacanthus brevirostris*	Flagtail tilefish	Maka‘a		BS 3, O	3
Microdesmidae	*Novaculichthys taeniourus*	Wormfish	--		BS 1	5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Microdesmidae	*Gunnellichthys curiosus*				BS 2	5
Microdismidae	*Ptereleotris heteroptera*	Dartfish	--		BS 1, BS 2	5
Mobulidae	*Manta birostris*	Giant manta ray	--	ST	BS	4
Mollusca	*Bivalve sp.*	Bivalve	--		BS 1	5
Mollusca	*Conus distans*	Cone shells	--		O	2, 3
Mollusca	*Conus ebreus*	Cone shells	--		BS 1	2, 3
Mollusca	*Conus imperaialis*	Cone shells	--		O	2
Mollusca	*Conus leopardus*	Cone shells	--		BS 1, O	2, 3
Mollusca	*Conus lividus*	Cone shells	--		BS 1, BS 2, O	2, 3
Mollusca	*Conus miles*	Cone shells	--		O	2, 3
Mollusca	*Conus miliaris*	Cone shells	--		O	2
Mollusca	*Cypraea tigris*	Tiger cowry snail	Leho-kiko		BS 1, BS 2,	3, 5
Mollusca	*Cypraea sp.*	Cowry shell	--		BS 1	5
Mollusca	*Halgerda terramtuentis*				BS 2	5
Mollusca	*Lyncina leviathan*				BS 2	5
Mollusca	*Octopus cyanea*	Octopus	He‘e		BS 1, BS 2, O	2, 3, 5
Mollusca	*Pinctada margaritifera*	Black-lipped oyster	Pa		BS 1	3
Mollusca	*Phyllidiella pustulosa*				BS 1, BS 2	5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Mollusca	*Spondylus tenebrosus*	Rock oyster	--		BS 1, O	2, 3
Mollusca	*Turbo sandwicensis*				BS 1	5
Mollusca		Snail, Cone	--		BS 1, BS 2	5
Mollusca		Snail, Horn	--		BS 1, BS 2, BS 3	5
Mollusca		Snail, Drupe	--		BS 1, BS 2	5
Mullidae	*Mulloidichthys flavolineatus*	Yellowstripe goatfish	Weke'a		K, BS 1, BS 2, BS 3, O	1, 2, 3, 5
Mullidae	*Mulloidichthys vanicolensis*	Yellowfin goatfish	Weke'ula		BS 1, BS 2, O	2, 3
Mullidae	*Parupeneus bifasciatus*	Doublebar goatfish	Munu		BS 1, BS 2, O	2, 3
Mullidae	*Parupeneus cyclostomus*	Blue goatfish	Moano kea		BS 1, O	2, 3, 5
Mullidae	*Parupeneus multifasciatus*	Manybar goatfish	Moano		BS 1, BS 2, BS 3, O	2, 3, 5
Mullidae	*Parupeneus pleurostigma*	Sidespot goatfish	Malu		BS 1, BS 2, BS 3, O	2, 3
Mullidae	*Parupeneus porphyreus*	Whitesaddle goatfish	Kumu		BS 3	3
Muraenidae	*Conger cinerus*				BS 1	2
Muraenidae	*Gymnothorax flavimarginatus*				BS 1, O	2
Muraenidae	*Gymnothorax meleagris*				BS 1	2
Muraenidae	*Gymnothorax steindachneri*				BS 3	3
Muraenidae	*Gymnothorax undulatas*	--	Puhi laumilo		BS 1, BS 3, O	2, 3
Myliobatidae	*Aetobatis narninari*				BS 3	3

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Oplegnathidae	*Oplegnathus punctatus*	Spotted knifejaw	--		BS 1, BS 3	3
Platyheminthes	*Pseudobiceros cf. dimidiatus*	Flatworm	--		BS 1, BS 2	5
Pocilloporidae	*Pocillopora damicornis*				BS 1, BS 2	5
Pocilloporidae	*Pocillopora eydouxi*	Antler coral	--		BS 1, BS 2, BS3, O	3
Pocilloporidae	*Pocillopora grandis*				BS 1, BS 2, BS 3	5
Pocilloporidae	*Pocillopora meandrina*	Cauliflower coral	kKo'a	ESA candidate	BS 1, BS 2, BS3, O	3, 5
Pomacanthidae	*Centropyge fisheri*		--		O	2
Pomacanthidae	*Centropyge loriculus*	Flame angelfish	Wekea		K	1
Pomacanthidae	*Centropyge potteri*	Potter's angelfish	--		O	2, 3
Pomacanthidae	*Holocanthus arcuatus*	Bandit angelfish	--		O	2, 3
Pomacentridae	*Abudefduf abdominalis*	Hawaiian sergeant major	Mamo	Endemic	K, BS 1, BS 2, BS 3	1, 2, 3, 5
Pomacentridae	*Abudefduf sordidus*	--	--		BS 2	3
Pomacentridae	*Chromis agilis*	Agile chromis	--		BS 1, O	2, 3, 5
Pomacentridae	*Chromis hanui*	Hawaiian bicolor chromis	--		BS 1, O	2, 3, 5
Pomacentridae	*Chromis ovalis*	Oval chromis	--	Endemic	K, BS 1, BS 2, BS 3	1, 2, 5
Pomacentridae	*Chromis vanderbiliti*	Blackfin chromis	--		BS 1, BS 2, BS 3, O	2, 3
Pomacentridae	*Chromis verator*	Threespot chromis	--		O	2, 3
Pomacentridae	*Dascyllus albisella*	Hawaiian damsel	ʻAloʻiloi		BS 1, BS 2, BS 3, O	2, 3

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Pomacentridae	*Plectroglyphidodon imparipennis*	Damselfish	--		BS 1, BS 2, BS 3	2, 3, 5
Pomacentridae	*Plectroglyphidodon johnstonianus*	Blue-eye damselfish	--		BS 1, BS 2, BS 3, O	2, 3, 5
Pomacentridae	*Plectroglyphidodon marginatus*				BS 1, BS 2	5
Pomacentridae	*Pycnochromis vanderbilti*				BS 1, BS 2, BS 3	5
Pomacentridae	*Stegastes fasciolatus*	Pacific gregory	--	Endemic	K, BS 1	1, 2, 3
Porifera	*Chondrosia chucalla*				BS 3	3
Porifera	*Dactylospongia sp.*				BS 3	3
Porifera	*Spirastrella vagabunda*				BS 1, BS 2, BS 3	5
Porifera	*Porifera sp.*				BS 1, BS 2, BS 3	5
Poritidae	*Porites brighami*				BS 1	5
Poritidae	*Porites compressa*				BS 1, BS 2, BS3, O	3, 5
Poritidae	*Porites evermanni*				BS 1, BS 2, BS3, O	3, 5
Poritidae	*Porites lobata*	Lobe coral	Pōhaku puna		BS 1, BS 2, BS3, O	3, 5
Poritidae	*Porites solida*				BS 1	5
Priacanthidae	*Heteropriacanthus cruentatus*	Glasseye	Aweoweo		BS 1	3
Scaridae	*Chlorurus perspicillatus*				BS 2	5
Scaridae	*Chlorurus spilurus*				BS 1,	5
Scaridae	*Calotomus carolinus*	Stareye parrotfish	Ponuhunuhu		BS 1, BS 3	2, 3

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Scaridae	*Scarus perspicillatus*	Spectacled parrotfish	Uhu uli uli, Ulu ʻahuʻula		BS 1, O	2, 3
Scaridae	*Scarus psittacus*	Palenose parrotfish	Uhu		BS 1, BS 2	2, 3, 5
Scaridae	*Scarus rubroviolaceus*	Redlip parrotfish	Palukaluka		BS 1, BS 2, O	2, 3, 5
Scaridae	*Scarus sordidus*	Bullethead parrotfish	Uhu		BS 1, BS 3	2, 3
Scleractinia incertae sedis	*Leptastrea bewickensis*				BS 1, BS 2	5
Scleractinia incertae sedis	*Leptastrea purpurea*				BS 1, BS 2, BS3, O	3, 5
Scleractinia incertae sedis	*Leptastrea transversa*				BS 1, BS 2	5
Scorpaenidae	*Scorpaenopsis cacopsis*	Jenkin's scorpionfish	Nohu		BS 1	3
Scorpaenidae	*Scorpaenopsis dibolus*	Devil scorpionfish	Nohu ʻo mākaha		BS 1, BS 2	2, 3
Serranidae	*Cephalopholis argus*	Peacock grouper	Roi		BS 1, BS 2, B 3	2, 3, 5
Serranidae	*Pseudanthis thompsoni*				O	2, 3
Sphenopidae	*Palythoa tuberculosa*				BS 1, BS 2	5
Synodontidae	*Synodus gracilis*				BS 3	3
Synodontidae	*Synodus varegatus*	Reef lizardfish	ʻUlae		BS 1, O	2, 3
Tetraodontidae	*Arothron meleagris*	Spotted puffer	Moa		K	1
Tetraodontidae	Canthigaster amboinensis				BS 1, BS 2	5
Tetraodontidae	Canthigaster jacator				BS 1, BS 2	5

Family/Phylum	Scientific Name	Common Name	Hawaiian Name	Special Status	Location	Reference
Zanclidae	*Zanclus cornutus*	Moorish idol	Kihikihi		BS 1, BS 2, O	2, 3, 5

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2. Dollar, S. and R. Brock. 2000. Survey of Marine and Fishery Resources for an Integrated Natural Resources Management Plan (INRMP) for the Pacific Missile Range Facility. PMRF. Barking Sands, Kauai, Hawaii.
3. Dollar, S. and R. Brock. 2006. Survey of Marine and Fishery Resources for an Integrated Natural Resources Management Plan (INRMP) for the Pacific Missile Range Facility (PMRF), Barking Sands, Kauai, Hawaii.
4. Incidental Observation by Natural Resources Program biologists
5. Miller, J., Dollar, S., Millan, A., Ericksen, M., Conger, C., Tumino, G. 2022. Biological and Benthic Habitat Surveys in Support of the Pacific Missile Range Facility (PMRF), Barking Sands Integrated Natural Resource Management Plan (INRMP). Kauai, Hawaii.

Key:
K= Ka'ula Island
BS 1= Nohili
BS 2= Mana
BS 3= Majors
O= Offshore

APPENDIX D – INRMP PROJECT, SCHEDULE, AND IMPLEMENTATION

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OJECTIVE	ACTION / STRATEGY	KEY DRIVER	YEAR	EPR#
General Habitat Management (Multiple Sites)				
Erosion Management				
Monitor, minimize, and restore erosion and soil compaction sites.	Conduct general surveys for erosion and soil compaction issues annually to prioritize restoration sites.	ESA, SA	annual	610642N002
Monitor, minimize, and restore erosion and soil compaction sites.	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.	ESA, SA	annual	610641N001
Monitor, minimize, and restore erosion and soil compaction sites.	Implement additional security measures such as increased signage and roping off certain areas to reduce off-road vehicle presence in the Nohili Dunes area.	ESA, BO, CH, SA	annual	610641N001
Monitor, minimize, and restore erosion and soil compaction sites.	Participate in future cooperative studies assessing potential shoreline loss that threatens base infrastructure or sensitive habitats.	Infrastructure, CH, ESA, SA	annual	(program labor)
Monitor, minimize, and restore erosion and soil compaction sites.	Monitor ungulate exclusion fence for areas vulnerable to ingress monthly and regularly monitor site for ungulate presence. Remove ungulates when identified within the fenced area.	Infrastructure, ESA, SA	annual	6106411R20
Monitor, minimize, and restore erosion and soil compaction sites.	Maintain Mākaha Ridge ungulate exclusion fencing for erosion control.	Infrastructure, ESA, SA	annual	6106411R20
Monitor, minimize, and restore erosion and soil compaction sites.	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 is in place until plants are well established.	Infrastructure, ESA	annual	6106411R08 6106411R19 6106411R22 610641N001

Invasive Plant Management				
Minimize and prevent encroachment of invasive species into protected species habitats and other priority native vegetation communities to the greatest extent practicable.	Include biosecurity requirements and provisions in Base Operating Support and construction contracts to reduce the risk of introduction of invasive species and plant diseases.	EO 13751, ESA, CH, SA, Infrastructure	annual	6106411R06
Minimize and prevent encroachment of invasive species into protected species habitats and other priority native vegetation communities to the greatest extent practicable.	Ensure that species identified as invasive in Hawai‘i 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.	EO 13751, ESA, CH, SA, Infrastructure	annual	6106411R06
Minimize and prevent encroachment of invasive species into protected species habitats and other priority native vegetation communities to the greatest extent practicable.	Ensure early detection and a rapid response to invasive plant species in sensitive areas.	EO 13751, ESA, CH, SA, Infrastructure	annual	6106411R08 6106411R19 6106411R22 610641N001
Minimize and prevent encroachment of invasive species into protected species habitats and other priority native vegetation communities to the greatest extent practicable.	Conduct removal of invasive plant species in sensitive areas and monitor for re-growth, and restore without-plantings if necessary, with a target of 80% reduction in invasive species within the areas of concern.	EO 13751, ESA, CH, SA, Infrastructure	annual	6106411R08 6106411R19 6106411R22 610641N001
Minimize and prevent encroachment of invasive species into protected species habitats and other priority native vegetation communities to the greatest extent practicable.	Decrease driving on dune vegetation, which can further increase the spread of invasive species into native habitats.	EO 13751, ESA, CH, SA, Infrastructure	annual	(program labor)
Native Plant Management				
Conserve and enhance native plant communities to the greatest extent practicable in a manner consistent with BASH requirements.	Update baseline floral surveys to improve understanding of plant community at PMRF.	ESA, CH, SA	annual	6106411R12

Conserve and enhance native plant communities to the greatest extent practicable in a manner consistent with BASH requirements.	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.	ESA, CH, SA, Infrastructure	annual	6106411R06
Conserve and enhance native plant communities to the greatest extent practicable in a manner consistent with BASH requirements.	Ensure that post planting care, including irrigation, invasive plant/weed control, and long-term monitoring and maintenance is implemented for all native plan restoration projects.	ESA, CH, SA, Infrastructure	annual	6106411R08 6106411R19 6106411R22 610641N001
Conserve and enhance native plant communities to the greatest extent practicable in a manner consistent with BASH requirements.	Identify suitable locations for planting native Hawaiian plants, particularly those that benefit native pollinators in support of national pollinator objectives.	SA	annual	6106411R08 6106411R19 6106411R22 610641N001
Conserve and enhance native plant communities to the greatest extent practicable in a manner consistent with BASH requirements.	Strive to find new opportunities to collaborate with partners on removing invasive and exotic vegetation and planting opportunities.	ESA, CH, SA, Infrastructure	annual	(program labor)
Wildland Fire Management				
Provide technical support to tenant commands and base planners to help identify and mitigate wildland fire issues.	Coordinate with the PMRF Fire Department on developing updates to the existing Fire Management Plan.	Infrastructure, SA	annual	(program labor)
Provide technical support to tenant commands and base planners to help identify and mitigate wildland fire issues.	Remove deadfall in high-risk areas including near the Barking Sands missile launch site and the Kamokala Magazines.	Infrastructure, SA	annual	(program labor)
Invasive Animal Management				
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.	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).	BO, ESA, EO 13751, SA, Infrastructure	annual	6106412036

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.	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.	ESA, EO 13751, SA, Infrastructure	annual	6106411R06
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.	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.	ESA, EO 13751, SA	annual	6106411R06 (program labor)
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.	Conduct surveys to improve baseline knowledge of populations of invasive animals at PMRF.	BO, EO 13751, ESA, SA, Infrastructure	annual	6106411R20 6106412003 6106412036
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.	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.	BO, EO 13751, ESA, SA	annual	6106412036 (program labor)
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.	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.	BO, EO 13751, ESA, SA	annual	6106412036 (program labor)
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.	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.	MBTA, EO 13751, SA, Infrastructure	annual	6106412036 6106411R04

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.	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.	BO, ESA, EO 13751, SA, Infrastructure	annual	6106412036 (program labor)
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.	Continue to partner with the Hawai‘i Department of Agriculture to ensure Coconut Rhinocerus Beetle traps are checked and maintained at PMRF.	EO 13751, SA	annual	6106411R06 (program labor)
Special Status Species Management				
Endangered Seabird Management				
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	Continue to promote base-wide awareness and implementation of the PMRF Dark Skies Program (PMRF Biological Opinion, 2018) through early annual trainings.	BO, ESA, SA	annual	6106410R01 610642N002 (program labor)
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	Continue to improve the Dark Skies Program lighting waiver system and grant standing waivers where applicable to stream-line the waiver process.	BO, ESA, SA	annual	6106410R01 610642N002 (program labor)
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	Continue Dark Skies implementation in areas adjacent to colonial nesting grounds at high elevation nesting sites during critical fledging timeframes.	BO, ESA, SA	annual	6106410R01 610642N002 (program labor)
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while	Conduct systematic ground searches for fallen out seabirds after high risk night operations.	BO, ESA, SA	annual	6106410R01 610642N002

providing maximum flexibility for training and operations.				
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	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).	BO, ESA, SA	annual	6106410R01 610642N002
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	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.	BO, ESA, SA	annual	6106410R01 610642N002
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	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).	BO, ESA, SA	annual	6106410R01 610642N002
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	Incorporate results of radar studies into future programs. Consider conducting additional radar studies at the Mākaha Ridge and Kōkeʻe sites.	BO, ESA, SA	annual	6106410R01 610642N002
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	Pursue avenues to provide funding to SOS to assist with seabird rehabilitation costs.	BO, ESA, SA	annual	6106410R01
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	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).	BO, ESA, SA	annual	(program labor)

Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	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).	BO, ESA, SA	annual	6106410R01 610642N002 (program labor)
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	Provide a 10-year calendar to mission planners with high-risk dates for endangered seabird fall out clearly depicted.	BO, ESA, SA	annual	6106410R01 610642N002 (program labor)
Nēnē Management				
Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.	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.	ESA, BASH, SA	annual	610642N002 (program labor)
Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.	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).	BO, ESA, BASH, SA	annual	610642N002 (program labor)
Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.	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.	BO, ESA, BASH, SA	annual	610642N002 (program labor)
Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.	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).	BO, ESA, BASH, SA	annual	610642N002 (program labor)
Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.	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	BO, ESA, SA	annual	610642N002 (program labor)

	other persistent disturbances occur within 100 ft. of nest sites and goslings to reduce risk of take.			
Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.	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.	BO, ESA, BASH, SA	annual	610642N002 (program labor)
Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.	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).	BO, ESA, BASH, SA	annual	(program labor)
Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.	Fund habitat modification that discourages nene presence near roadways, the airfield, and construction sites at Barking Sands.	BO, ESA, BASH, SA	annual	610642N002 (program labor)
Reduce impacts to the federally endangered Nēnē while providing maximum flexibility for testing and training.	Supplement ongoing water quality testing to detect particulates and soluble chemicals in waters at PMRF. Testing should be conducted at least quarterly.	ESA, SA	annual	610642N002 (program labor)
Obtain life history information to inform adaptive management strategies that will provide a conservation benefit to federally endangered Nēnē.	Continue to communicate and share data with USDA-WS and DOFAW regularly.	SA	annual	610642N002 (program labor)
Obtain life history information to inform adaptive management strategies that will provide a conservation benefit to federally endangered Nēnē.	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.	BASH, ESA, SA	annual	610642N002 (program labor)
Obtain life history information to inform adaptive management strategies that will provide a	Implement priority management actions identified in the PMRF Nēnē Management Plan. Work with partners to identify potential opportunities to	ESA, BASH, SA	annual	610642N002 (program labor)

conservation benefit to federally endangered Nēnē.	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).			
Hawaiian Hoary Bat Management				
Reduce impacts to the federally endangered Hawaiian hoary bat while providing maximum flexibility for training and operations.	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.	BO, ESA, Bat MOU, SA	annual	610642N002 (program labor)
Reduce impacts to the federally endangered Hawaiian hoary bat while providing maximum flexibility for training and operations.	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.	BO, ESA, Bat MOU, SA	annual	610642N002 (program labor)
Reduce impacts to the federally endangered Hawaiian hoary bat while providing maximum flexibility for training and operations.	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.	ESA, SA, BAT MOU, Infrastructure	annual	610642N002 (program labor)
Migratory Bird Management				
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.	Continue to incorporate monitoring of shorebirds, Cattle Egrets, and Black-crowned Night Herons at wetland sites and Barn Owls and pueo at all other areas of base into twice weekly surveys to inform control measures for non-native species and protective measures for native species.	MBTA, SA, ESA, Infrastructure	annual	6106411R04 6106419R01
Maintain and protect nesting and foraging habitats of native bird species protected by the MBTA at	Keep track of any newly established non-native songbird species at PMRF and their numbers by	MBTA, BASH, SA	annual	6106411R04

PMRF when consistent with BASH and other mission constraints and discourage non-native MBTA species presence at PMRF.	participating in the annual Audubon Christmas Bird Count.			
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.	Continue to advise development projects at PMRF that have potential to negatively impact native MBTA species habitat on how to avoid impacts.	MBTA, SA	annual	6106411R04 (program labor)
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.	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.	BASH	annual	(program labor)
Terrestrial Invertebrate and Pollinator Management				
Monitor and maintain biodiversity of native terrestrial invertebrate and pollinator populations at PMRF.	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.	SA, ESA, Pollinator MOU, CHE	Every 5 years	6106411R21 6106412003
Monitor and maintain biodiversity of native terrestrial invertebrate and pollinator populations at PMRF.	Coordinate all use of pesticides by natural resources staff with the NAVFAC PAC PMC and ensure that all applicators have received appropriate certifications.	State and Federal Laws and Requirements, Pollinator MOU	annual	(program labor)
Monitor and maintain biodiversity of native terrestrial invertebrate and pollinator populations at PMRF.	Ensure that treatments will not have negative effects on protected species.	SA, ESA, Pollinator MOU	annual	6106411R21 (program labor)

Monitor and maintain biodiversity of native terrestrial invertebrate and pollinator populations at PMRF.	Prohibit the use of neonicotinoids at PMRF sites.	SA, ESA, Pollinator MOU	annual	6106411R21 (program labor)
Monitor and maintain biodiversity of native terrestrial invertebrate and pollinator populations at PMRF.	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.	SA, Pollinator MOU, ESA	annual	6106411R08 610641N00161 06411R22 (program labor)
Data Collection and Database and Records Management				
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 inputting methods with the goal of decreasing errors and increasing efficiency.	Ensure that natural resources staff follow established standardized monitoring and surveying procedures.	BO, ESA, SA, BASH, MBTA	annual	all
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 inputting methods with the goal of decreasing errors and increasing efficiency.	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.	BO, ESA, SA, BASH, MBTA	annual	all
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 inputting methods with the goal of decreasing errors and increasing efficiency.	Consider acquiring tablets or Trimble units with excel/GIS uploading capabilities that natural resources staff can utilize for data collection in the field.	BO, ESA, SA, BASH, MBTA	annual	610642N00261 06419R01

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 inputting methods with the goal of decreasing errors and increasing efficiency.	Acquire the ability to upload GPS data directly to government computers.	BO, ESA, SA, BASH, MBTA	annual	(program labor)
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 inputting methods with the goal of decreasing errors and increasing efficiency.	Coordinate data sharing with natural resources partner agencies USFWS, DLNR and NOAA; coordinate common data collection formatting as possible.	SA	annual	(program labor)
Outdoor Recreation				
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.	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.	SA, ESA	annual	(program labor)
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.	Ensure that the degree of access allowed for outdoor recreation is consistent with conservation of natural resources.	SA, ESA	annual	(program labor)

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.	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.	SA	annual	(program labor)
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.	Provide PMRF Recreation Pass Program applicants with information on pertinent natural resources information as part of the application process.	SA	annual	(program labor)
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.	Continue to restore and enhance natural and cultural resource assets at PMRF for public benefit and enjoyment.	SA	annual	(program labor)
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.	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	SA, ESA	annual	(program labor)

	environments and measures that can be taken to avoid such impacts.			
Natural Resources Awareness, Education, and Training				
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.	Continue to present natural resources concerns and activities at indoctrination presentations.	ESA, SA	quarterly	610642N002 (program labor)
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.	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.	ESA, CH, MBTA, SA	quarterly	610642N002 (program labor)
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.	Ensure that standard reporting and response protocols for wildlife related observations are included in all security personnel vehicles.	ESA, MBTA, SA	quarterly	610642N002 (program labor)
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.	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.	ESA, CH, MBTA, SA	bi-annual	610642N002 (program labor)
Promote natural resources, environmental, and cultural stewardship and awareness by providing all personnel on installation	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.	ESA, CH, MBTA, SA	quarterly	610642N002 (program labor)

training and education related to the PMRF natural resources program and related protocols, laws, and policies.				
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.	Include natural resources information in Welcome Aboard packages for incoming Navy personnel.	ESA, CH, MBTA, SA	annual	610642N002 (program labor)
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.	Coordinate and participate in volunteer events, educational programs, and natural resources related site visits from local schools.	SA	annual	610642N002 (program labor)
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.	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.	BO, ESA, MBTA, SA	annual	610642N002 (program labor)
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.	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.	BO, ESA, MBTA, SA	annual	610642N002 (program labor)
Barking Sands Natural Resources Management				

Laysan Albatross Management				
Minimize impacts to Laysan Albatross while providing maximum flexibility for testing and training at PMRF and supporting regional Laysan Albatross conservation measures.	Continue the PMRF Laysan Albatross Egg Swap program.	MBTA, BASH, SA	annual	6106411R04 (program labor)
Minimize impacts to Laysan Albatross while providing maximum flexibility for testing and training at PMRF and supporting regional Laysan Albatross conservation measures.	Work with partners to ensure that as many albatross eggs as possible stay on Kaua‘i and find new suitable egg relocation locations.	MBTA, BASH, SA	annual	6106411R04 (program labor)
Minimize impacts to Laysan Albatross while providing maximum flexibility for testing and training at PMRF and supporting regional Laysan Albatross conservation measures.	Continue to translocate albatross to the north shore of Kaua‘i from January-April.	MBTA, BASH, SA	annual	6106411R04 (program labor)
Minimize impacts to Laysan Albatross while providing maximum flexibility for testing and training at PMRF and supporting regional Laysan Albatross conservation measures.	Coordinate with DOFAW on potential new albatross release sites.	MBTA, BASH, SA	annual	6106411R04 (program labor)
Minimize impacts to Laysan Albatross while providing maximum flexibility for testing and training at PMRF and supporting regional Laysan Albatross conservation measures.	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.	MBTA, BASH, SA	annual	6106411R04 (program labor)
Minimize impacts to Laysan Albatross while providing maximum flexibility for testing and training at PMRF and supporting regional	Use data analysis to assess the effectiveness of albatross translocations based on location of translocation, time of year, and whether or not the	MBTA, BASH, SA	annual	6106411R04 (program labor)

Laysan Albatross conservation measures.	albatross is a known breeder, sub-adult, or new bird to PMRF.			
Minimize impacts to Laysan Albatross while providing maximum flexibility for testing and training at PMRF and supporting regional Laysan Albatross conservation measures.	Support research on the PMRF albatross populations that increases the understanding of their behavior as it relates to the PMRF airfield.	MBTA, BASH, SA	annual	6106411R04 (program labor)
Minimize impacts to Laysan Albatross while providing maximum flexibility for testing and training at PMRF and supporting regional Laysan Albatross conservation measures.	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.	MBTA, SA	annual	6106412036 (program labor)
Wedge-tailed Shearwater Management				
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.	Enhance Wedge-tailed Shearwater habitat in areas far from the PMRF airfield and human presence and develop deterrant measures for burrows in areas of human traffic and near the airfield.	MBTA, BASH, SA	annual	6106411R04 (program labor)
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.	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.	MBTA, BASH, SA	annual	6106411R04 (program labor)
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.	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).	MBTA, SA	annual	6106411R04 (program labor)

Improve understanding of Wedge-tailed Shearwater population dynamics at Barking Sands to guide future adaptive management decisions and support regional conservation of shearwaters species.	Conduct annual Wedge-tailed Shearwater population surveys in the Kinikini Ditch, beach cottages, and Nohili Dune areas.	MBTA, BASH, SA	annual	6106411R04 (program labor)
Improve understanding of Wedge-tailed Shearwater population dynamics at Barking Sands to guide future adaptive management decisions and support regional conservation of shearwaters species.	Work with partners to collect additional data that supports adaptive management on PMRF and regional conservation objectives for shearwater species.	MBTA, BASH, SA	annual	6106411R04 (program labor)
Wetland and Waterbird Management				
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.	Continue to coordinate closely with Facilities Maintenance regarding restrictions on vegetation removal practices within a 100-foot radius of nesting or un-flighted young.	ESA, SA	annual	610642N002 6106411R09 (program labor)
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.	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.	ESA, SA	annual	610642N002 6106411R09 (program labor)
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.	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.	ESA, SA	annual	610642N002 6106411R09 (program labor)
Decrease negative interactions between Hawaiian waterbirds and PMRF operations by managing wetlands and waterbirds appropriately	Coordinate with Public Works to develop oxidation pond flushing protocols in response to avian botulism outbreaks or high-risk conditions.	ESA, SA	annual	610642N002 6106411R09 (program labor)

in order to minimize risks to waterbird and human safety.				
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.	Coordinate with Facilities Maintenance on all oxidation pond construction and restoration plans.	ESA, SA	annual	610642N002 6106411R09 (program labor)
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.	Supplement ongoing water quality testing to detect particulates and soluble chemicals in waters at PMRF. Testing should be conducted at least quarterly.	ESA, SA	annual	610642N002 6106411R09 (program labor)
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.	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.	BO, ESA, SA	annual	610642N002 6106411R09 (program labor)
Improve understanding of Hawaiian waterbird population dynamics at Barking Sands to guide future adaptive management decisions.	Continue to conduct regular monitoring for Hawaiian waterbird species at Barking Sands.	BO, ESA, SA	annual	610642N002 6106411R09 (program labor)
Improve understanding of Hawaiian waterbird population dynamics at Barking Sands to guide future adaptive management decisions.	Consider implementing a waterbird banding/telemetry program to track movement and monitor nest-site fidelity.	ESA, SA	annual	610642N002 6106411R09 (program labor)
Marine Mammal and Sea Turtle Management				
Hawaiian Monk Seal Management				

Maintain and enhance populations of Hawaiian monk seals to the greatest extent practicable.	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.	ESA, BO, MMPA, SA	annual	610642N002 (program labor)
Maintain and enhance populations of Hawaiian monk seals to the greatest extent practicable.	Continue to report observations of hauled-out Hawaiian monk seals to NOAA as soon as possible and provide high quality photos for identification purposes.	ESA, BO, MMPA, SA	annual	610642N002 (program labor)
Maintain and enhance populations of Hawaiian monk seals to the greatest extent practicable.	Collaborate with NOAA to enhance the regional population when feasible.	ESA, BO, MMPA, SA	annual	610642N002 (program labor)
Maintain and enhance populations of Hawaiian monk seals to the greatest extent practicable.	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.	ESA, BO, MMPA, SA	annual	610642N002 6106412036 (program labor)
Improve understanding of population dynamics to guide future adaptive management decisions	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.	ESA, BO, MMPA, SA	annual	610642N002 (program labor)
Improve understanding of population dynamics to guide future adaptive management decisions	Continue to conduct surveys through partnership with NOAA Fisheries for Hawaiian Monk Seals on Ni'ihau.	ESA, CH, MMPA, SA	bi-annual	6106414R50 (program labor)
Sea Turtle Management				
Maintain, enhance, and improve understanding of sea turtle populations at Barking Sands.	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.	ESA, BO, CH, SA	annual	610642N002 (program labor)
Maintain, enhance, and improve understanding of sea turtle populations at Barking Sands.	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.	ESA, BO, CH, SA	annual	610642N002 (program labor)

Maintain, enhance, and improve understanding of sea turtle populations at Barking Sands.	Continue to survey beaches for sea turtle nesting activity during the nesting season, enclose all nests observed with protective fencing and signage, mitigate light attraction issues on beaches, and coordinate with DAR to excavate nests.	ESA, BO, CH, SA	annual	610642N002 (program labor)
Maintain, enhance, and improve understanding of sea turtle populations at Barking Sands.	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.	ESA, BO, CH, SA	annual	610642N002 (program labor)
Maintain, enhance, and improve understanding of sea turtle populations at Barking Sands.	Develop and use USFWS-approved outreach, educational materials, and signage with the objective to educate and provide information to 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.	ESA, BO, CH, SA	annual	610642N002 (program labor)
Maintain, enhance, and improve understanding of sea turtle populations at Barking Sands.	Continue to implement surveys to ensure no sea turtles are in affected areas during training exercises or in-water work.	ESA, BO, CH, SA	annual	610642N002 (program labor)
Whale, Dolphin, and Porpoise Management				
Protect and monitor populations of whales, dolphins, and porpoises adjacent to Barking Sands.	Continue to report all observations of marine mammal strandings or deaths to NMFS and assist in response efforts.	ESA, MMPA, CH, SA	annual	610642N002 (program labor)
Protect and monitor populations of whales, dolphins, and porpoises adjacent to Barking Sands.	Improve coordination and communication regarding marine mammal strandings and other observations of note with NAVFAC PAC and CPF.	ESA, MMPA, CH, SA	annual	610642N002 (program labor)
Protect and monitor populations of whales, dolphins, and porpoises adjacent to Barking Sands.	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.	ESA, MMPA, CH, SA	annual	610642N002 6106412036 (program labor)

Protect and monitor populations of whales, dolphins, and porpoises adjacent to Barking Sands.	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.	ESA, MMPA, SA	annual	610642N003 (program labor)
Marine Nearshore Management				
Employ a systematic approach to managing coastal and near-shore resources, using a process that includes inventory, monitoring, modeling, management, assessment, and evaluation.	Establish a monitoring program for the nearshore environment of PMRF to inform future management decisions and monitor changes overtime.	SA, EO 13089, ESA	Every 5 years	610642N003 (program labor)
Employ a systematic approach to managing coastal and near-shore resources, using a process that includes inventory, monitoring, modeling, management, assessment, and evaluation.	Partner with DLNR DAR to incorporate regular monitoring site(s) in PMRF's nearshore waters into the state's regular monitoring schedule.	SA, EO 13089, ESA	annual	(program labor)
***Panicum niihauense* Critical Habitat Management**				
Provide conservation benefit to Ni'ihau panicgrass designated critical habitat area under Section 202(a)(3) of the Sikes Act.	Work toward removal of critical habitat designation for the Nohili Dunes area by demonstrating adequate protection as provided under Special Conservation Area designation and/or by the consideration of out planting Ni'ihau panicgrass.	CH, ESA, SA,	annual	6106411R08 610641N001 (program labor)
Provide conservation benefit to Ni'ihau panicgrass designated critical habitat area under Section 202(a)(3) of the Sikes Act.	Out-plant 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.	CH, EO 13751, ESA, SA	annual	6106411R08 610641N001
Provide conservation benefit to Ni'ihau panicgrass designated critical habitat area under Section 202(a)(3) of the Sikes Act.	Consider undergoing the approval process to out-plant the endangered Ni'ihau panicgrass in the effort to remove or reduce amount of PMRF property designated as critical habitat for the species.	CH, ESA, SA	annual	6106411R08 6106411R12 (program labor)

Mākaha Ridge Tracking Station Natural Resource Management				
Dwarf Ili'au and Hawai'i Scaleseed Management				
Assess current populations of dwarf ili'au and Hawai'i scaleseed to monitor population health.	Implement erosion control efforts that directly benefit areas where dwarf ili'au and Hawai'i scaleseed are present.	ESA, SA	annual	6106411R18 6106411R19
Assess current populations of dwarf ili'au and Hawai'i scaleseed to monitor population health.	Conduct a reassessment of the status and condition of listed plant species on the cliffsides of Mākaha Ridge Tracking Station populations every ten years and collaborate with partners to grant them access for further research and conservation efforts.	ESA, SA	Every ten years	6106411R18
Kōke'e Sites Natural Resource Management				
Hawaiian Picture-wing Fly				
Provide conservation benefits to federally endangered Hawaiian picture-wing flies and inform management decisions.	Conduct surveys every five years to assess presence/absence of endangered Hawaiian picture-wing fly species at and directly adjacent to PMRF Koke'e sites.	ESA, CH, SA	Every five years	6106411R21
Provide conservation benefits to federally endangered Hawaiian picture-wing flies and inform management decisions.	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.	ESA, SA, EO 13751	annual	6106411R22
Kamokala Ridge Natural Resources Management				
Invasive and Nuisance Animal Management				
Ensure sustainable use of Navy infrastructure at Kamokala Ridge.	Work with the PMRF Archery Club to control ungulate populations at the Kamokala Ridge site by implementing trapping and baiting stations if the	ESA, SA, EO 13751	annual	6106412036

	animals become a nuisance to Navy operations or pose a risk to protected wildlife.			
Ensure sustainable use of Navy infrastructure at Kamokala Ridge.	Conduct observations to identify feral cat use at Kamokala Ridge and consider expanding cat trapping if use is consistent or becomes a nuisance.	ESA, SA, EO 13751	annual	6106412036
Port Allen Natural Resource Management				
Endangered Seabird Management				
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	Coordinate with facilities owner and USFWS to address lighting issues	BO, ESA, MBTA, SA	annual	6106410R01 (program labor)
Minimize direct and indirect impacts to federally listed, endangered Hawaiian seabird species while providing maximum flexibility for training and operations.	Train staff to recognize, respond to, and report any circling or downed seabirds seen at the facility.	BO, ESA, MBTA, SA	annual	6106410R01 (program labor)
Kaʻula Island Natural Resource Management				
Special Status Species Management				
Maintain and enhance populations of special status species on Kaʻula Island.	Continue implementing all military training SOPS.	ESA, MBTA, MMPA, SA	annual	(program labor)
Improve understanding of special status species population dynamics to guide future adaptive management decisions.	Continue conducting aerial imagery surveys of Kaʻula Island to inform species presence, location, and numbers.	ESA, MBTA, MMPA, SA	annual	(program labor)
Improve understanding of special status species population dynamics to guide future adaptive management decisions.	Seek authorization to conduct land-based updates to floral and faunal surveys on Kaʻula Island.	ESA, MBTA, MMPA, SA	annual	(program labor)

Improve understanding of special status species population dynamics to guide future adaptive management decisions.	Partner with DOFAW and other partners to coordinate Barn Owl and other predator control efforts on Ka‘ula Island if access is allowed.	ESA, MBTA, MMPA, SA	annual	(program labor)
Mauna Kapu Site Natural Resource Management				
Protection of State and Federally Protected Species				
Assess the occurrence of wildlife populations utilizing the facility to better understand and manage for all wildlife species.	Conduct base-line flora and fauna surveys.	BO, ESA, MBTA, MMPA, SA	Every 5 years	6106412003
Ni‘ihau Natural Resource Management				
Disturbance of Protected Species due to Military Training Exercises				
Monitor protected species utlilizing Ni‘ihau 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.	Continue to conduct surveys through partnership with NOAA Fisheries for Hawaiian Monk Seals on Ni‘ihau.	BO, ESA, MMPA, SA	annual	6106414R50
Monitor protected species utlilizing Ni‘ihau 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.	If proposed Navy operations have the potential to impact sea turtles or habitat, conduct surveys for listed sea turtles and nesting activity on Ni‘ihau to understand habitat use and trends.	ESA, MMPA, SA	annual	6106414R50 6106411R09 610642N002
Monitor protected species utlilizing Ni‘ihau to help inform operations and management of wildlife and provide conservation benefits to the species	If proposed Navy operations have the potential to impact waterbirds at Ni‘ihau, conduct surveys to understand habitat use and trends.	ESA, MMPA, SA	annual	6106414R50 6106411R09 610642N002

and its habitat under Section 202(a)(3) of the Sikes Act.				

Key Drivers:

BASH –Bird/Wildlife Aircraft Strike Hazard

BO –Biological Opinion on Base-wide Infrastructure, Operations, and Maintenance

ESA – Endangered Species Act

CH – Critical Habitat

CHE – Critical Habitat Exemption

EO 13751 – Safeguarding the Nation from the Impacts of Invasive Species

EO 13089 – Coral Reef Protection

MBTA – Migratory Bird Treaty Act

MMPA – Marine Mammal Protection Act

Tripartite Agreement – MOU between DoD and USFWS and the Association of Fish and Wildlife Agencies for a Cooperative Integrated Natural Resources Management Program on Military Installations Pollinator MOU – MOU between DoD and the Pollinator Partnership

Bat MOU – MOU between DoD and Bat Conservation International

OPNAV M-5090.1 – Environmental Readiness Program Manual

SA – Sikes Act

APPENDIX E – PROTECTED SPECIES STANDARD OPERATING PROCEDURES

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DEPARTMENT OF THE NAVY

PACIFIC MISSILE RANGE FACILITY

P.O. Box 128

KEKAHA, HAWAII 96752-0128

From: Commanding Officer, Pacific Missile Range Facility

Subj: DARK SKIES PROGRAM DURING SHEARWATER FLEDGLING FALLOUT SEASON: 15 SEPTEMBER THROUGH 15 DECEMBER 2023

Encl: (1) 2023 Fledging Season AM Event and PM Event Calendars

(2) 2023 Dark Skies Night Operations Waiver Request

(3) PMRF Dark Skies Program Brochure

1. Purpose. To announce the arrival of Shearwater Fledgling Fallout Season at the Pacific Missile Range Facility (PMRF) and give guidance for measures to be implemented to reduce/eliminate risk to protected seabirds during this period.

2. Dates. Shearwater fledging season runs from 15 September through 15 December 2023. The most critical times to avoid use of exterior lights at PMRF are during the dark moon phases of the fledging season. In 2023, the highest risk periods occur 5-25 October and 2-21 November. Any nights with cloudy, misty conditions are also considered critical. Enclosure (1) may be used to inform planning for the 2023 shearwater fledging season.

3. Policy

a. All exterior lights will be turned off between 15 September and 15 December 2023 at PMRF (including Kokee, Makaha Ridge, Port Allen, and Kamokala facilities) unless required for safety or security. Any night lighting purported to be necessary to meet operational requirements during this period except as required by regulation, including motion sensing lighting, will require prior approval by the Natural Resources Manager/Installation Environmental Program Director, Public Works Officer, and Command on a case by case basis. Exceptions will require the activity to identify a Biological Monitor for the lighting event. Depending on the nature of the lighting, this

person may need to act as a monitor for seabird attraction for the duration of the event. If a protected seabird is attracted to the lights, the monitor will direct the lights to be turned off temporarily to allow the bird to fly safely away from the area. The activity will coordinate with Natural Resources ahead of time to ensure that appropriate training for biological monitors is completed prior to the event. Organizations may apply for a standing waiver if the activity is season-long and will continue to take place year after year. Project managers with standing waivers from prior years will annually verify with Natural Resources that personnel designated on the waiver and the nature of the operations covered by the waiver have remained unchanged. Updates to the standing waiver may need to be routed through the chain of command for approval.

b. All operations requiring night lighting at PMRF shall coordinate with the PMRF Natural Resources Manager, Brooke McFarland, by emailing brooke.a.mcfarland.civ@us.navy.mil or calling (808) 335-4017 to implement mitigation measures during the fledging season. The Installation Environmental Program Director, Jessica Hallman Behnke, is the designated secondary contact for coordination needs and can be reached by email at jessica.l.behnke.civ@us.navy.mil or by calling (808) 335-4064.

c. Requests to use exterior lighting at night during this period shall be made using enclosure (2), to be filled out completely by the Project Manager or other appropriate agent, and submitted to the Natural Resources Manager by email. All waiver requests will be approved/disapproved by the Executive Officer.

d. Portable light carts used for Force Protection should be equipped with two green and two white lights; due to their lower intensity; only the green lights are used during lower Force Protection Conditions (FPCON) status, while white lights are available for higher FPCON status. Lamps should be oriented in the full cut off position and facing directly downward.

e. Interior lighting that escapes from buildings through open bay doors will be considered the same as exterior lighting. Bay doors of buildings with bright interior lights such as the hangar will be kept closed at all times during the Dark Skies season except as approved by the command. When working in a building at night, please pull blinds and curtains to reduce the amount of light escaping into the outdoor environment and contributing to light pollution.

f. Waivers must be submitted for all motion sensor lights located on buildings and in parking lots. All motion sensors must have automatic timer mechanisms that turn off automatically after 120 seconds maximum. Motion sensor lights approved by the command through the waiver process must be inspected weekly by the designated Biological Monitor(s) to ensure lights are switching off in a timely manner.

g. Downed shearwaters should be immediately reported to the PMRF Natural Resources Hotline at (808) 208-4416. For more information refer to enclosure (3).

4. Safety. No measure taken during Dark Skies operations is worth serious injury to personnel on board PMRF. We will accept some risk for minor hazards like tripping in an unlit parking lot. We ask everyone to do their part to not only take action to mitigate risks (e.g., request waivers in critical areas, utilize head lamps, carry flashlights or use flashlight mode on cell phones as personal protective equipment), but also immediately bring an unmitigated serious hazard to the attention of Command Duty Officer (808) 651-3471. All government employees, contractors, and visitors to the base should plan their activities on the base with the Dark Skies Program requirements in mind and take any precautions that may be necessary to ensure safe passage to and from office buildings, work sites, and recreational areas. It is recommended that employees working during non-daylight hours during the Dark Skies season carry a working flash light or head lamp. PMRF Public Works Office will provide flashlights on a loaner basis for individuals who do not possess one. Should you have any question regarding this, please contact the Natural Resources Manager at (808) 335-4017.

5. Records Management. Records created as a result of this notice, regardless of media or format, must be managed per Secretary of the Navy Manual 5210.1 of September 2019.

6. Cancellation Contingency. This notice will be cancelled 31 December 2023 or upon completion of Dark Skies Program.

STEVENSON.BRETT.ASHLEY.1158727311 Digitally signed by STEVENSON.BRETT.ASHLEY.1158727311 Date: 2023.08.17 17:00:44 -10'00'

B. A. STEVENSON

PMRF Dark Skies Lighting Waiver Request

Organization seeking waiver:	
Supervisor/POC:	
Supervisor/POC phone:	
Supervisor/POC email:	
Designated Biological Monitor(s):	
Biological Monitor phone:	
Biological Monitor email:	
Date(s) and time period(s) for which waiver is requested:	
Describe proposed operation including start and stop times and details on requested lighting:	
Explain why this operation cannot be performed without the use of exterior lighting:	
Description of alternatives considered:	
ENVIRONMENTAL/ RAC COMMENTS:	
XO Approval:	

Enclosure 1

DARK SKIES PROGRAM- FIELD PROGRAM

The INRMP Implementation Field Biology Program is responsible for several components of the Dark Skies season to ensure safety of seabirds and the Navy's mission. There is some pre-season work that is described below. All team members, regardless of position, are expected to participate in all aspects of the Dark Skies Program. In addition, it is expected that everyone can accurately identify all three key seabird species (Newell's Shearwater, Hawaiian Petrel, and Band-rumped Storm Petrel).

Preseason activities:

-Assist the NR manager with Waivers, Department Heads Presentation, and comprehensive light list (by early September)

-Prepare lighting covers for the Major's Bay Bike Path, ensure they are approved by PWD. By Sept 15 all covers must be on.

-Communicate with Hunt housing and MWR regarding Dark Skies in early August.

-Purchase 36+ Bird Carriers (cardboard or plastic Flute Board), 50+ towels for bird carriers; Ziploc bags; 300 NESH stickers

-PRESEASON Lighting Survey. One-two weeks prior to Dark Skies to familiarize yourself and verify light numbers/ location/ description.

Shenanigans Downed Bird Walk Through

These walkthroughs need to happen Monday through Friday at least half an hour to an hour before dawn (refer to Sunset and Sunrise Calendar). We want to do this early before a bird could take off at dawn so that we aren't documenting missing any injuries, etc. They take approximately 20-30 minutes to do a walkthrough of the area. You will need to have a headlamp, bird box, towels, camera (cell phone works), field notebook, etc. You can do this in your personal car as long as you have all of the equipment, supplies.

For the walk through, walk the perimeter of the Shenanigans lawn, around the structures (Shenanigans, the dumpster, etc), and under any bushes need to be searched for downed birds. If one is found, call the SOS hotline, Call the NR manager, and text the PCSU/PMRF Project Coordinator. You need to make sure that you are adequately searching in and around the bushes in the area, under the building, etc. Birds tend to hide when they fall out.

The person who does the Shenanigans walkthrough is also responsible for checking the Save Our Shearwaters Aid station at Pass and ID and communicating to them if any birds were placed in the box. It is recommended to do this before doing the Shenanigans walkthrough so that you don't have to go in and out through the gate.

The PCSU Project Coordinator will do the Shenanigans walk through with you for a quick training.

Dark Skies Lighting Survey Overview

Surveys are performed once a week from September 15th to December 15th at Barking Sands, Kokee Site C and Makaha Ridge. During Dark Skies, there should be minimal lights on from dusk till dawn. The objective of the survey is to (1) look for any lights that are left on and do not have a waiver (2) make sure motion sensor lights are not on longer than 120 seconds and (3) look for any down seabirds.

Before starting these surveys, you must call Dispatch (808-335-4523) and let them know that you will be surveying the base for lights as well as what vehicle you are in. Before going North of the Hanagar you must call ICC (808-335-4258).

During these surveys, pay extra attention to nene resting in and around the roadways as to avoid injuring a nene.

<u>Kokee/Makaha</u>

If the Kokee and Makaha surveys are done in the morning, we are able to pair a downed seabird survey with the lighting surveys. It is preferred to do these surveys early in the morning. After the lighting surveys and downed bird survey at Kokee, a nene survey at both locations should be performed. The downed bird surveys will need to begin in October.

1. Surveys can be done 2 - 3 hours before sunrise or at night when it gets completely dark. You must ensure that you have plenty of time before sunrise if you choose an AM survey, including driving time.

2. Read over waivers and make note of what buildings have a waiver for lights and where the lights are located

3. Drive up/walk around buildings, making sure to set off motion lights.

4. Wait and see if motion lights turn off after 120 sec

5. Make sure to write down any violations (lights on, motion lights over 120 seconds, etc)

6. Look around buildings, towers, and guylines (kokee only) for down seabirds.

Barking Sands

1. Surveys can be performed in the morning (2 ½-3 hours before sunrise) or at night approximately an hour to an hour and half after sunset (when it is completely dark).

2. Make sure to read over waivers so you know what buildings can have lights on

3. Cover all base from SouthGate to North Launch, and especially housing and the rental cottages

4. Be sure to drive up to buildings and walk around to make sure all lights are in compliance or they have a waiver

5. Write down any findings that are in violation or you have a question about.

The Hangar doors are only permitted to be open for 5 minutes at a time. These lights in particular act as a giant beacon for seabirds. If we know that there are night operations, we will occasionally need to do a morning walkthrough of the Hanagar and Spotlight area (near the memorial) in addition to the daily Shenanigans walkthroughs.

Just be thorough with your surveys. The more you do, the smoother it will go and the quicker you will get.

AIRFIELD NĒNĒ NEST RESPONSE PROTOCOL PACIFIC MISSILE RANGE FACILITY

I. Overview

The Hawaiian Goose, or nēnē, (*Branta sandvicensis*) is federally protected under the Endangered Species Act and also presents a significant Bird Aircraft Strike Hazard (BASH) risk. Geese are of special safety concern to pilots as large birds with low, slow flight patterns, and are conversely at high risk themselves of being struck on an airfield. Additionally, females tend to return to their natal fledging ground to nest themselves, and so, if even one nest hatches from an area, more can follow in the area in future years. This makes preventing nēnē presence on the airfield of the highest priority. As per the 2014 Pacific Missile Range Facility (PMRF) Biological Opinion, PMRF's Bird Discovery and Dispersal Team (BDDT) is permitted to haze nēnē at the facility. However, despite best available hazing practices, USDA-Wildlife Services (WS) discovered an active nēnē nest in FY16 just south of the runway, and another nest in the area in FY17 by a different pair (Figure 1). The installation recognizes that the best strategy for preventing nesting within the PMRF airfield involves removing vegetation that provides nesting habitat and consistently hazing nēnē from the area. However, if a nēnē nest is discovered that poses a clear and present danger to human lives despite following best management practices, PMRF Natural Resources (NR), USDA Wildlife Services (WS), and PMRF Air Operations will comply with the following Nēnē Airfield Nesting Response Protocol. This protocol outlines a timeline for appropriate notification channels, instructions to document and destroy the nest, and guidance for discouraging re-nesting attempts.

II. Standard hazing protocol

Air Ops and USDA-WS staff currently haze nēnē using non-lethal techniques including vehicle horn blowing, human vocalizations, hand clapping, foot stomping, and/or use of flashing vehicle lights. The BDDT actively hazes during published hours of airfield operation: M-F 0700-1800, excluding federal holidays. On any given work day, USDA personnel drive a circuit covering the airfield and immediate surrounding area, hazing any nēnē observed. Each area on the circuit is visited approximately every 60-90 minutes during published airfield operational hours.

III. Nene Nest Exclusion Zone

A nest will be considered a clear and present danger to human lives when laid within the delineated Nene Nest Exclusion Zone to include the lateral clear zones (CZ's) of the taxiway and runway (Figure 2). An airfield's CZ is designated as that area where an aircraft accident is most likely to occur; as such, the area is maintained in a manner which provides the pilots with the safest possible conditions. At PMRF Barking Sands, the lateral CZ 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. Airfield Nēnē Nest Response Protocol Pacific Missile Range Facility

IV. Protocol upon seeing a nēnē pair for three consecutive days in the Nene Nest Exclusion Zone1

Protocol initiation will be considered prior to the three day bench mark if the weekend or holidays would factor into those initial three days, e.g., if a pair is repeatedly observed on Thursday and Friday, CDO's may monitor and haze the pair over the weekend if deemed necessary.

1) Notification of pair's presence on airfield and initiation of this protocol (within 24 hours)

a) Report pair to USDA-WS Kauai District Supervisor and PMRF NR Manager
b) NR Manager: Notify the following people of pair and initiation of this protocol
   i) USFWS: Lead for PMRF Base-wide Consultation
   ii) DOFAW: Kauai Wildlife Manager and Nēnē Biologist
   iii) PMRF Executive Officer
   iv) PMRF Public Works Officer
   v) PMRF Field Biologists
c) USDA-WS Kauai District Supervisor: Notify the following people
   i) PMRF Airfield Manager
   ii) PMRF Airfield Operations Officer
   iii) USDA-WS PMRF Biologist
   iv) USDA-WS PMRF Technicians

2) COA (Course of Action)

a) USDA-WS: Organize site meeting within 48 hours
   i) Include USDA and NR personnel, and Airfield Manager
   ii) Identify potential nesting areas in proximity to observations of the pair
   iii) Produce and implement an action plan to remove all proximate nesting vegetation or erect a physical barrier ASAP
      (1) Action plan should include coordination with Airfield Manager and Public Works
      (2) Preferred option is vegetation removal. If vegetation cannot be removed immediately, temporary fencing may act as a deterrent, preventing them from walking into nesting vegetation from the airfield.
      (3) Prior to any vegetation removal, thoroughly search the area for active nests
b) Airfield Operations Officer
   i) Notify Command Duty Officers to enact hazing protocol in area of concern
      (1) M-F: Haze at Dusk
      (2) Sa-Su, Holidays: Haze over weekends every 1.5-2 hours

V. Protocol upon finding a nest within the Nene Nest Exclusion Zone

1) Immediate Notification of nest discovery and initiation of this protocol (within 2 hours)

a) Report nest to USDA-WS Kauai District Supervisor and PMRF NR Manager
b) NR Manager: Notify the following people
   i) USFWS: Lead for PMRF Base-wide Consultation
   ii) DOFAW: Kauai Wildlife Manager and Nēnē Biologist
   iii) PMRF Public Works Officer
   iv) Navy Region Hawaii Natural Resources Manager
   v) PMRF Field Biologists
c) USDA-WS Kauai District Supervisor: Notify the following people

i) PMRF Airfield Manager
ii) PMRF Airfield Operations Officer
iii) USDA-WS Hawaii State Director
iv) USDA-WS PMRF Biologist
v) USDA-WS PMRF Technicians

d) Airfield Operations Officer: Notify the following people
i) PMRF Executive Officer (XO)
ii) PMRF Command Duty Officer (CDO)

2) Course of Action (COA)

a) NR: Initiate conversations with USFWS and DOFAW to first determine if the eggs will be translocated or destroyed, and second to identify potential foster nests
b) USDA-WS: Continue to actively haze adults away from airfield
i) Check area during routine wildlife checks approximately every 60-90 minutes
ii) Ensure neither parent is attending and that the female is not incubating the nest
iii) Record each time adults are observed and their behavior
iv) Ensure CDO's continue hazing efforts
(1) M-F: Haze at Dusk
(2) Sa-Su, Holidays: During daylight, haze every 1.5-2 hours
c) USDA-WS: Identify an action plan to remove all proximate vegetation if it has not yet been removed. Vegetation up to 1m of the nest should be removed if possible.
i) Action plan should include coordination with Airfield Manager and Public Works
ii) Document date and time of vegetation removal and take before and after photos
d) USDA-WS: If fencing was erected, remove the barrier; it could be an entanglement risk or prevent nesting adults from escaping predators.
i) Coordinate removal with Airfield Manager.
e) USDA-WS: Hang mylar deterrent tape over nest to discourage nēnē from accessing nest within 8 hours of initial nest observation
i) Document mylar placement with photographs, time, and personnel involved.
f) USDA-WS: Determine if the nesting pair has finished laying eggs
i) Geese often immediately re-nest if a nest is destroyed before the female is finished laying eggs
ii) A nesting pair will generally lay one egg every 24 hours until finished
iii) If the number of eggs has been constant for more than 24 hours, it is assumed that the female is done laying
iv) Nēnē clutch size range: 1-6 eggs; Mean: 3 eggs
g) NR: Remove eggs and destroy nest once the female has finished laying within 24 hours
i) NR Manager: Notify DOFAW, USFWS, USDA-WS, and Airfield Manager prior to nest destruction
ii) Photograph and GPS the nest if it has not already been done
iii) Collect eggs
iv) Destroy nest in a way that looks as if the eggs were scavenged

v) If available and permitted by USFWS and DOFAW, translocate eggs
vi) If no secondary location for egg placement is available, bury the eggs at least 200m away from the nest; hole should be at least 18 in. deep
vii) Document nest destruction process with times, personnel involved, and photographs
viii) NR Manager: Confirm nest destruction within 24 hours
(1) USFWS: Lead for PMRF Base-wide Consultation
(2) DOFAW: Kauai Wildlife Manager and Nēnē Biologist
(3) USDA-WS: Kauai District Supervisor
(4) Airfield Manager
(5) Airfield Operations Officer
(6) Public Works Officer
(7) Navy Region Hawaii Natural Resources Manager

h) NR and USDA-WS: Nest destruction follow-up actions
i) NR: Coordinate with Public Works to remove nesting vegetation in area if it has not already been completed
(1) Wait 48 hours after nest destruction to allow parents to see depredated nest
(2) Coordinate vegetation removal with Airfield Manager and USDA-WS
ii) USDA-WS: Remove all deterrent barriers from airfield
(1) Remove all mylar tape after the pair has been absent from the area for seven consecutive days
(2) If fencing is erected, take down once the vegetation has been removed or after the pair has been absent from the area for seven consecutive days if it has not already been deconstructed
(3) Coordinate removal with Airfield Manager
iii) USDA-WS: Continue to actively haze adults away from airfield to prevent re-nesting attempts
(1) USDA-WS: Check area during routine wildlife checks approximately every 60-90 minutes during published hours of airfield operation
(2) Ensure CDO's continue hazing efforts when airfield is closed
(a) M-F: Haze at Dusk
(b) Sa-Su, Holidays: During daylight, haze every 1.5-2 hours
(3) Record each time adults are observed and their behavior

3) Prepare formal report within thirty days for partners

a) NR: Collaborate with USDA to assemble the below information and write formal report
i) Parent band information
ii) First observation of the pair in the area
iii) Hazing efforts prior to nesting
iv) First observation of nest
v) Notification dates/times of all appropriate partner agencies
vi) Date/time fence erected (include photo documentation)
vii) Date/time mylar deterrent tape hung (include photo documentation)

viii) Last egg lay date
ix) Clutch size at time of egg removal
x) Date, time, and description of nest destruction (include photo documentation)
xi) Hazing efforts following nesting attempt
xii) All documented sightings of the pair prior to and post nest destruction
xiii) Strategies to discourage the nēnē pair from re-nesting in the area during the current season and in future years

b) NR: Submit formal report for internal review to following personnel
   i) NR Field Biologists
   ii) NR Manager
   iii) USDA-WS Biologist
   iv) USDA-WS Kauai District Supervisor
c) NR Manager: Send formal, final report to the following personnel within 30 days of nest destruction
   i) USFWS: Lead for PMRF Base-wide Consultation
   ii) DOFAW: Kauai Wildlife Manager and Nēnē Biologist
   iii) USDA-WS: Kauai District Supervisor
   iv) Airfield Manager
   v) Airfield Operations Officer
   vi) Public Works Officer
   vii) Navy Region Hawaii Natural Resources Manager
d) USDA-WS Kauai District Supervisor: Send formal report to following personnel within 30 days of nest destruction
   i) USDA-WS Hawaii State Director

Figure 1. Nēnē nest locations along Kini Kini Ditch in FY16 and 17. Airfield Nēnē Nest Response Protocol

Figure 2. Nene Nest Exclusion Zone. Area of PMRF to exclude all nene nesting, generated from the lateral clear zones for the runway and taxiway.

Pacific Missile Range Facility

Hawaiian Geese Family Hazing

Standard Operating Procedures

Background

There has been an increase in the population of Hawaiian Geese (nēnē) on Barking Sands Pacific Missile Range Facility which increases the BASH concerns for our Navy pilots. To avoid these hazards, both the PMRF Environmental Department and USDA requests the ability to haze nēnē adults and their goslings from roads and the Barking Sands Airfield.

Nēnē goslings are flightless for about 10 to 14 weeks after hatching (FWS Pacific). This limits the methods that are used for hazing. Hazing in this SOP will be defined as (gentle walking). from now on.

Procedure

The attached map is the nēnē exclusion zone shown in Figure 2. Hazing of nēnē with goslings will be only allowed on the airfield or where there is hazard to the wildlife (i.e. roads). Any nēnē family with goslings on the airfield will be reported to USDA biologist and/or USDA technician. No other personnel should try to haze, approach, and/or assess the situation without consulting USDA. The exception being PMRF Environmental Staff (EV), EV will inform USDA prior to hazing only on the airfield so documentation on USDA databases can be inputted. If hazing occurs in other areas besides the airfield, USDA does not need to be informed immediately; data collected will be inputted to the hazing databases at the beginning of each month.

USDA/EV will notify tower of the hazing operations, number of individuals, and area of airfield the family is located. USDA/EV will stay 25ft away when observing them in a vehicle prior to hazing. No hazing of adults and goslings should be done in a vehicle to avoid any injury to wildlife. Personnel will step out of the vehicle and walk the family off the airfield or area of hazard. No aggressive chasing of adults with goslings will be allowed. Slowly walking towards the family will be the method used. This will try to discourage separation of adults from goslings, as well as any confusion that might cause injury to the birds.

If a gosling is lagging behind, cease walking and do not continue until the family is reunited. If needed, take steps back to encourage the family to reunite. If a gosling does get separated, USDA/EV will keep an eye on the gosling as well as the family as best they can and call for back up. If needed, EV staff will notify their supervisor, USFWS and the state nēnē biologist about a separation or abandonment event.

Attached is a reference guide to ageing plumage. Please reference the guide if there are questions on the age of individuals to be hazed.

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References

Hunter J. M 1995. A key to ageing goslings of the Hawaiian Goose *Branta sandvicensis*. Wildfowl 46:55-58. www.theFWS.gov.

Figure 1. Key for ageing Nene goslings in the wild

	Stage	Age (weeks) Slimbridge	Age (weeks) Hawaii	
	1	0–1	0–1	Small, round and downy, short legs. Breast and belly held almost parallel with ground.
	2	1–3	1–4	Downy. No contour feathering. Upright posture: breast and belly held at about 45° to ground.
	3	3–5	4–6	Downy. Beginning to feather on belly and wing coverts.
	4	5–7	6–8	Feathering on belly, flanks and wing coverts. Tail feathers just showing. Beginning to darken on face between eye and chin.
	5	7–8	8–10	Well feathered on belly, flanks and wing coverts. Tail 2.5 – 5.0 cm long. Head and neck darkening and losing down.' Some down on back of neck and rump.
	6	8-11	10-12	Pre-fledging. Appearance of grey adult. Little or no down. Dark head and cheek becoming defined. Primary feathers almost reaching base of tail.
	7	9–16	11–18	Fledged. Primaries at full length. Well defined dark head and cheek. Neck dull grey.
	8	17–20+	19–23+	Looks almost identical to adult. Neck turning buff/gold, distinctive black ring forming between buff of neck and grey of chest.

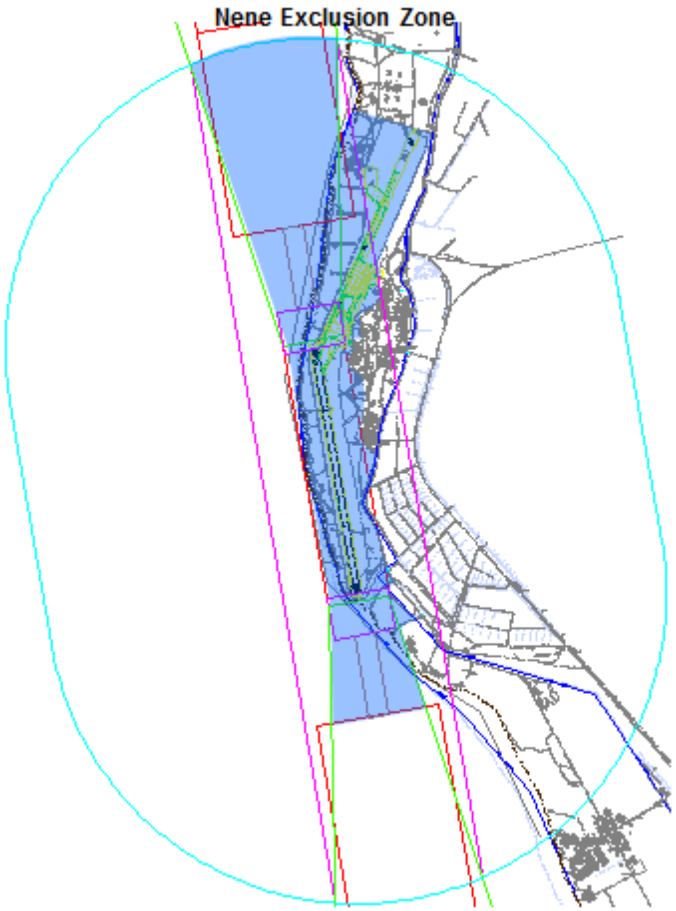

Figure 2

PMRF OXIDATION POND VEGETATION REMOVAL GUIDELINES

PMRF Natural Resources

1.0 Overview

The following guidelines were developed by PMRF biologists after consideration of the Endangered Species Act (, known breeding biology, observations collected from standardized monitoring, and informal consultation with the US Fish and Wildlife Service (USFWS) regarding species of concern. Compliance with restrictions below is required for compliance with the Endangered Species Act. The measures below are meant to avoid take under the Endangered Species Act. Oxidation pond maintenance is not currently covered by the incidental take license. Any take is a violation of the Endangered Species Act and can result in the USFWS initiating enforcement action for unauthorized take. Responsibility for compliance ultimately resides with the PMRF Commanding Officer.

Consult PMRF biologists before all vegetation removal at the Oxidation Pond compound at least one week prior. PMRF biologists will search for nests and flag nests and buffer areas to be avoided within two days. Each vegetation removal even will be taken on a case by case basis and can be affected by the breeding behavior of species of concern. Coordinate with the biologists to be on site immediately prior to actual removal of vegetation. Biologists will search for new nests and flush birds from brush. Additional maintenance of vegetation may be necessary and allowable contingent on nesting species of concern.

All observations of endangered species nests and chicks should be reported to PMRF biologists as soon as possible. All observations are reported to USFWS within 24 hours as per the 2014 PMRF Biological Opinion.

2.0 Oxidation Pond Vegetation Clearing Timeline

Early March: Perimeter of oxidation pond.

April/May: Entire Compound.

Early August: Entire compound, including perimeter pond vegetation.

3.0 Vegetation Clearing Guidelines

3.1 Hawaiian Coot and Hawaiian Stilt

Nest: No vegetation clearing withing a **100 foot buffer** of any nest until chicks have reached fledging age = **3 months after laying of egg** or **2 months after eggs have hatched.**

Chicks: If coot or stilt chicks are observed, a 100 foot buffer will be allotted around the area they are known to congregate and remain until the chicks fledge.

Hawaiian Monk Seal and Sea Turtle General Monitoring SOP

Natural Resources Program

Pacific Missile Range Facility

Kaua‘i Monk Seal Hotline: (808) 651-7668, kauaiseals@gmail.com

National Marine Fisheries Service (NMFS): (808) 938-5730

Species Overview

Hawaiian Monk Seal, *Neomonachus schauinslandi,* Ilio-holo-i-ka-uaua

- **Pupping Season:** Can pup year-round but primarily February-July, peak occurs April-June. Females nurse for 5-6 weeks. For females that give birth consecutively year after year, they pup a little later each year.
- **Lifespan:** 25-30 years
- **Male vs. Female:** females have 4 nipples on belly, males have penile opening and groove
- **Diet:** small, bottom dwelling fish, squid, octopus, eels, and crustaceans
- **Identifying Marks:** Biologists place flipper tags and/or dorsal bleach marks to mark individuals. Bleach marks are only temporary as monk seals molt their fur each year. However, many monk seals have marks such as line scars, small circle-shaped scars from cookie cutter sharks, or larger scars that can be caused by shark attacks, boat propellers or entanglement. These scars are useful for identifying individual monk seals.
- **Species Status:** Endangered, 1,400 individuals. Federally protected under the Endangered Species Act and the Marine Mammal Protection Act.

Green Sea Turtle,* *Chelonia mydas,* honu

- **Description:** Olive brown to black on top with light yellow underside; rounder head than hawksbill; non-overlapping scutes on carapace; 1 pair of prefrontal scales between eyes
- **Adult Size:** Carapace length: up to 40 inches; Weight: 200-500 lbs.
- **Identifying Marks:** Some turtles may be marked on their shell with a unique number combination or tagged on a flipper.
- **Species Status:** Central North Pacific distinct population unit listed as threatened and protected under the Endangered Species Act**.**

Hawksbill Sea Turtle,* *Eretmochelys imbricata,* honu’ea

- **Description:** Dark to golden brown, with streaks of orange, red, and/or black on top with lighter, yellow underside; head elongated with beak-like mouth; overlapping scutes on carapace; 2 pairs of prefrontal scales between eyes.
- **Adult Size:** 100-150 lbs.
- **Identifying Marks:** Some turtles may be marked on their shell with a unique number combination or tagged on a flipper.
- **Species Status:** Endangered**.** Federally protected under the Endangered Species Act.

**For more information see “Sea Turtle Nesting SOP”*

Hawaiian Monk Seal and Sea Turtle General Monitoring SOP

Natural Resources Program

Pacific Missile Range Facility

Introduction

Hawaiian monk seals and green sea turtles frequently use Pacific Missile Range Facility's (PMRF) beaches for resting or "hauling out." As federally protected species, this presents a valuable opportunity for biological monitors to inspect these hauled out individuals, checking for injuries or ailments that should be treated, or identifying a specific individual in the population.

Green sea turtles are commonly found hauled out at Turtle Cove (AKA Nohili Ditch Outfall). Favorable sea turtle foraging habitat in this area was identified by the 2010 PMRF INRMP marine nearshore surveys and the cove provides a safe place for turtles and monk seals to rest.

Adult sea turtles are most often injured by boat propeller collisions or entanglement issues. Although less common around Kaua'i, sea turtles may also be afflicted with life-threatening, tumor-like growths. These tumors, caused by the disease fibropapillomatosis, can grow over the eyes and nose obstructing vision and ability to breathe, or grow so large that they become an impediment to movement. There are two known instances of observed sea turtle injuries or strandings at PMRF. In 2009, a green sea turtle was observed by USDA at Turtle Cove with a boat propeller injury. The turtle was medivaced to Oahu for treatment, then showed up two months later in the same spot, healthy and healed. There are a few documented instances of a turtle strandings at the cove –The turtles can be found crawling along the wall and unable to find their way back to the ocean.

Hawaiian monk seals can become injured by collisions with boats, sharks, and entanglement with marine debris – especially swallowing fishing hooks and line. No major Hawaiian monk seal injuries or entanglements have been observed at PMRF, though a fish hook was removed once from the lip of a monk seal basking at Majors Bay. PMRF documented a pupping event in 1999 "beach side" of the runway across from the 2,000 ft. marker at the south end. Reporting Hawaiian monk seal sightings to the Kaua'i NOAA Fisheries monk seal hotline provides valuable information to biologists working for the recovery of the species. In some instances, biologists may want to tag or apply a bleach mark to a seal or even attach a "critter cam" to the animal to see where it goes. In addition, taking photos of the animal from all angles and observing it closely can inform if the seal is healthy and help NOAA biologists identify the individual.

NR Biologist: Turtle Cove and Diver's Landing Monitoring

1) **Frequency:** Daily as PMRF activity allows. Keep a log of days you are unable to survey in your field notebook. Keep PCSU/Program Coordinator and the Natural Resources Manager informed if you are not able to get into an area for more than 2 days in a row.
2) **Survey Method:**
   a) **Turtle Cove:**
      i) **Safety Protocol:** Call Security Dispatch and the ICC before heading out to the launch area and turtle cove to ensure that no operations are occurring in the area and that ARDEL is not radiating anywhere other than zones 1 and 2 (5 degrees above horizon is safe). Do not go over the dune south of the turtle cove area as this is within ARDEL's daily radiation operations (zone 1). Refer to the "AN/SPY-6 Radiation Cut Out Zones" map for more information.
      ii) **Survey Protocol:** After ensuring the area is safe, park on north side of turtle cove and walk to the edge of dune.
         (1) Scan the cove area and water with binoculars for seals or turtles and tracks.

(2) If no animals are observed, record date, any tracks observed, and time and location of observation.
(3) If a turtle is observed, proceed down to the beach and follow the "Sea Turtle Sighting Protocol" outlined below. If a monk seal is observed follow the "Hawaiian Monk Seal Sighting Protocol" below.

b) Diver's Landing:
i) Safety Protocol: The ARDEL facility is north of this area, do not proceed past any large triangular signs as these mark the areas of hazards. If you have any concerns with safety due to signs or operations, call Security Dispatch and ICC to confirm safety of the area.
ii) Survey Protocol:
(1) Park at the top of the dune, step out of vehicle, and scan to the left and right carefully with binoculars for seals in the water or on the beach and tracks on the sand.
(2) If no animals are observed, record date, any tracks observed, and time and location of observation.
(3) If a monk seal is observed follow the "Hawaiian Monk Seal Sighting Protocol" below.

3) Data Management:
a) Input all monitoring data into PMRF NR database daily as able (at a minimum weekly).

<u>Hawaiian Monk Seal Sighting Protocol</u>

1) Patrols for Hawaiian Monk Seals:
a) Patrols are conducted daily by PMRF Security at the majority of PMRF beaches.
i) Security reports all monk seal sightings to the PMRF Natural Resources cell phone at (808) 208-4416 and erects "Do Not Disturb" signs within the seal's vicinity if seal is in a public area.
ii) PMRF Natural Resources (NR) Personnel respond to all sightings to take data M-F during work hours
b) Daily surveys of Turtle Cove and the Diver's Landing area are conducted by PMRF NR for monk seals as able (see above). If monk seals are observed in a public area, NR personnel will report to Security Dispatch so they can erect signage.

2) NR Biologist: Response to Hawaiian Monk Seal Sightings

- ***Note: All Hawaiian monk seal sightings should be reported to the Kaua`i Monk Seal Hotline ASAP and photos sent by email. See below for more information.***

a) Safety Protocol: Goals = ensure safety of observer from seal attacks and ensure the seal does not become distressed by observer and retreat into the ocean.
i) Before approaching seal, inspect from a distance to determine the seal's level of awareness. Always approach a seal quietly, preferably down-wind of the animal, while focusing on the eyes of the animals to continually determine awareness.
ii) If the seal is unmoving and eyes closed, you are likely able to get within a safe distance of 10 ft. if necessary to get good photos.
iii) If the seal is in any way moving or if the eyes are open, proceed with great caution, do not get within 30 ft. of the animal, and approach outside of the animal's field of view to get the best photos possible. If the seal does make eye contact, immediately stop moving and crouch down until the seal looks away. If the seal becomes noticeably distressed, abort the survey and quickly walk back to your vehicle.

b) Survey Protocol: Collect data on seal(s) when safely within range.
i) Look for any injuries, open wounds, entanglement, or fishing lines coming out of mouth.
ii) If seal's belly is visible, look for nipples or penile opening and groove to determine sex.
iii) Record any identifying characteristics such as bleach marks, tags on flippers, or scars such as circle-shaped cookie cutter shark bites, small line scars, or propeller scars and the corresponding area of the body the mark is observed.
iv) Record date, time, gps location, and general location of sighting.
v) Take close-up photos of the seal from all angles (face, both sides, and flippers), if possible

c) If seal is on a public access section of beach, such as Major's Bay, notify Security Dispatch who will post signage notifying public of seal's protected status and provide a barrier between public and the seal.

i) Security has signage to post, provided by NOAA.
ii) Give the animal a large enough barrier with the signage that the individual will not be disturbed. A 150 ft. buffer between the seal and the public is requested by NOAA.
iii) If present, educate monk seal viewers of the need to keep their distance and to keep pets leashed to avoid disturbing the seal's rest and putting themselves or their pets in danger.

3) Reporting Hawaiian Monk Seal Sightings:
a) NR Biologist: Call the Kauai Hawaiian Monk Seal Hotline at (808) 651-7668 ASAP and report all information on observation.
b) If the seal is injured or entangled, a NOAA/DAR biologist will direct the response effort; PMRF NR biologist to act as coordinator between responders and Navy.
c) All photos taken of monk seals will be emailed to NOAA/DAR at kauaiseals@gmail.com with accompanying observational information ideally the same day of observation. See Data Management.
d) All information regarding injured or dead monk seal sightings and responses will be compiled and a designated NR POC will report information to NMFS PSD, DAR and USFWS within 24 hours of incident. A call is sufficient within 24 hours, but a formal report will be prepared and sent ASAP.

4) Data Management:
a) Enter all data relating to monk seal observations into the Monk Seal or Turtle sighting spreadsheet and the "PMRF NR Reporting Log" daily. Each seal needs a new line within the database to better identify individuals. If no seals or turtles are observed, enter all fields with a "0" or "N/A" to show that the sites were checked and that no focal species were observed.
b) Photos should be uploaded to an RCUH computer and organized in a folder titled with the date and abbreviated location of the sighting (ex 14aAPR2020_MonkSeal_DL). These photos should then be uploaded to the PMRF Google Drive and stored in PMRF Photos > Monk Seals > folder titled with date and abbreviated location of sighting. The link to the folder can then be shared with NOAA/DAR. The folder may need to be cleared out regularly to avoid taking up too much space on the drive. If this is the case, a new google shared drive can be created by someone with a UH email. The drive will then need to be shared with the team and the Natural Resources Manager.

Sea Turtle Sighting Protocol

1) Patrols for Turtles:
a) Patrols are conducted daily by PMRF Security at the majority of PMRF beaches
i) Security reports all turtle sightings to the PMRF Natural Resources Duty Phone at (808) 208-4416
ii) PMRF Natural Resources (NR) Personnel responds to sightings, ensures turtle is healthy, and record date, time, GPS location, general location, species, approximate size of turtle, and any identifying marks or tags
b) Daily surveys of Turtle Cove are conducted by PMRF NR for sea turtles as able (see above).

2) NR Biologist: Response to Turtle Sightings
a) Inspect turtle from an unobtrusive distance but close enough to note any injuries, entanglements, tumors, or fishing line coming out of mouth
i) If any of the above are observed, report to the National Marine Fisheries Service (NMFS) Stranding Line at (808) 983-5730.
ii) If the turtle appears healthy, record all applicable information to sighting including if the turtle is tagged or marked in an easily visible way. If the turtle is tagged, call the Kaua'i Monk Seal Hotline to report the sighting and email the photos upon return to the office (listed under "Turtle Datasheet").
iii) If NR Biologist is not available, Security will report sighting
b) If turtle is in a place frequented by people, notify Security Dispatch. Security will erect signage providing at least a 10 foot buffer around the turtle. If present, educate those present of the need to keep their distance to avoid disturbing the turtle's rest.
c) Dead turtles will be immediately reported, and stored as directed by NMFS and DAR.

3) **Reporting Live or Dead Stranded Turtles:**
   - **a)** Collect and record detailed information of the response including date and time of all actions and personnel involved.
   - **b)** Call the Natural Resources Manager immediately. If the Natural Resources Manager is unavailable, call the PCSU/PMRF Project Coordinator.
   - **c)** Document specimen and response with photos.
   - **d)** All information will be compiled and the Natural Resources Manager will report information to NMFS PSD, DAR and USFWS within 24 hours of incident. A call is sufficient within 24 hours, but a formal report will be prepared and sent ASAP.
4) **Data Management:**
   - **a)** All data, including photos, relating to observations of healthy or injured turtles should be imputed into the PMRF NR database daily (at a minimum weekly). Include reportable incidents in the "PMRF NR Reporting Log."

Species Overview

Hawaiian Green Sea Turtle*, Chelona mydas*

- **Breeding Season:** May – September; adults lay nests May – July; nests hatch July – September.
- **Lifespan:** 60-70 years; sexual maturity at 25 - 35 years.
- **Reproductive cycle:** Every 2-3 years; females usually return to natal beach.
- **Clutches:** 3 – 6 clutches per season laid every 2-3 weeks; average clutch size = 100 eggs.
- **Incubation:** 60 days on average in Hawaii
- **Nesting Range:** 90% of Hawaiian sub-population nests on French Frigate Shoals. Almost yearly nesting has been observed at PMRF with a record 6 hatched nests in 2015.
- **Adult Size:** Carapace length: 40 in; Weight: 200-500 lbs.
- **Description:** Olive brown to black on top with light yellow underside; rounder head than hawksbill; non-overlapping scutes on carapace; 1 pair of prefrontal scales between eyes.

Hawksbill Sea Turtle, *Eretmochelys imbricata*

- **Breeding Season:** Likely same as above; more information needed.
- **Reproductive cycle:** same as above
- **Clutches:** same as above
- **Incubation:** unknown, likely similar to green sea turtle.
- **Adult Size:** 100-150 lbs.
- **Description:** Dark to golden brown, with streaks of orange, red, and/or black on top with lighter, yellow underside; head elongated with beak-like mouth; overlapping scutes on carapace; 2 pairs of prefrontal scales between eyes.

Introduction

Hawaiian green sea turtles are a distinct, threatened, population segment protected under the Endangered Species Act. Green sea turtles are known historically to extensively utilize PMRF's nearshore waters for foraging and beaches for nesting and hauling out. Observations of turtle activities at PMRF dating back to 2006 show evidence of extensive year-round use of the Nohili Ditch outflow, also called Turtle Cove, in particular. Due to lack of intensive monitoring in the past, it is unknown how long green sea turtles have been nesting at PMRF. However, potential turtle digs have been observed as far back as 2006 by USDA-WS personnel with the first confirmed and excavated nest occurring in 2010.

PMRF security forces patrol the beaches of Barking Sands by vehicle daily; therefore it is imperative that sea turtle nests be fenced as soon as possible after laying in order to prevent a nest being driven over and crushed. Educating security forces, staff, and guests as well as encouraging a consistent line of communication will assist the natural resources program in its goal to protect, conserve, and monitor sea turtle nesting events on PMRF beaches. Additionally, the presence of invasive predators at PMRF poses a threat to the survivability of sea turtle nests and hatchlings. Conducting consistent predator control, monitoring and demarcating all nests found at PMRF will help protect them, especially from vehicle and foot traffic.

NR Biologist: Pre-Nesting Season, Prior to May 1

1) Planning:

a) Check in with DLNR DAR and/or USFWS before nesting season. Ensure a permitted biologist will be available and willing to excavate nests for the season

2) Notifications and Training:

a) Ask watch commanders to give nesting season reminders during shift changes to brief staff. These occur daily at 0730, 1530, and 2330

b) Ensure binders in all security vehicles have a "Security Personnel Sea Turtle Nesting SOP"

3) Preparation:

a) Mapping Shoreline

i) Sand deposition along the shoreline varies greatly from year to year with seasonal shifts observed.

ii) From the beginning of the south boundary of the AOA to roughly the northern launch pad, map areas of sandy beaches observed along the coral embankment with GPS.

iii) This will inform what sections will need to be surveyed throughout nesting season in this area.

NR Biologist: Nesting Season Survey Methods, May 1 – July 31

1) Frequency:

a) South half: twice per week (south end of base and airfield).

b) North half: once per week (Diver's Landing, Turtle Cove, and Nohili Dunes)

2) Duration*:

a) South end (south end – Beach cottages): ~20 minutes when using the UTV,
- ~1.5 hours when walking (Fig. 1)

b) Runway and Kini Kini: 0.5 hours (Fig. 2)

c) Divers Landing, Turtle Cove (Fig. 3): ~15 Minutes

*Survey times and areas may change with shifts in sand deposition along shoreline. Conduct shoreline surveys as needed, i.e. after big swells, to re-assess potential nesting habitat.

d) Nohili (Fig. 3): You must access the north section from Red Gate. Call Security to open the gate for you at the north launch area if driving UTV. Most days, they cannot open the gate until 0900.

3) Time of Day:

It is best to conduct these surveys as close to sunrise as possible either walking or in the UTV. If the sand gets too hot, the UTV can get stuck. If walking, staff needs to survey in the morning before turtle tracks are washed or blown away by the wind as tracks going up to the high tide line are often indicative of a nest.

4) Personnel:

When driving in the UTV, it is ideal to have two people surveying to ensure safety. One person drives and the other person should be looking for turtle tracks and possible digs. If walking, just one surveyor is sufficient.

5) Materials:

a) Field notebook

b) GPS

c) Camera

d) Roll of flagging tape/pin flags

e) Binoculars

f) Plenty of water, sunscreen, hat, etc.

e) Radio if survey is within Airfield Operating Area (AOA)

g) UTV when possible and associated supplies

h) Cell Phone

6) Survey Methods:

a) Call dispatch before heading to survey start point.

i) You will need to tell them exactly what you are doing, where, and which vehicle you're driving. For example, for the South survey you would say: "Hi, this is 'name' with Natural Resources. I'm about to conduct a sea turtle nesting survey at the south end of base. I am parked by super stripey, will be starting

at the south end of the beach, walking to beach cottages, and then walking back along the road. I am driving a university truck OR I am driving "make, model, color." When driving on the beach, it is especially important to call dispatch before you do so.

ii) If the survey is within the AOA, you will also need to have constant communication with tower. After calling dispatch, park your vehicle outside of the AOA, call tower with your radio when you are at the boundary, and request permission to enter the AOA, e.g., "Tower, Environmental" (wait for response,). "Environmental requests permission to access mouth of Kinikini Ditch at south end of runway for 10 minutes" (wait for approval from tower) "Environmental Proceeding" Keep your radio on you at all times. When you are done in the area, notify tower: "Tower, Environmental" (Wait for response) "Environmental is off of the AOA." (Should hear a roger/copy in response). The airfield channel is Zone 2, Channel 1. The notch on the radio should be in position "B" for Zone 2 and the screen on the back will say "Air Ops" if radio is on correct channel.

iii) If surveying the north end, call dispatch and ICC before going north of the hangar. Notify dispatch of where you are going and what you are doing. Ask ICC if there are any operations occurring on the north end of base that may limit access.

b) Record start time and location

c) Drive the beach using the UTV or walk below the vegetation line. Pay special attention to the area mid-way between dune vegetation and high tide line looking to each side for turtle tracks as well large pits in sand. Sea turtles at PMRF have historically preferred nesting high up on the beach near the toe of dunes. When driving, avoid vegetation when possible and drive in previously established tire tracks

d) Record stop time and location

e) Enter data into the PMRF NR database, regardless of locatinga nest or not.

7) Upon Finding a Turtle Dig:

b) A female sea turtle may dig in several spots before finding an acceptable spot to deposit her eggs, meaning not all digs are true nests. It is difficult to determine whether a dig is a true nest or a false dig, however there are some clues to look for:

i) Analyze tracks left by the nesting turtle

(1) The marks left by the turtle's flippers will make an arrow in the direction she was moving (Fig. 4 and 5)

(2) If the same turtle tracks lead to multiple digs, it is likely that there are only eggs in the last dig area.

ii) A true green sea turtle nest will likely have a mound with a depression next to it and tracks leading out of the depression (Fig. 4). Do not walk within 1 meter (m) of nest site. This can compact sand and inhibit hatchlings from emerging properly.

iii) After analyzing tracks, assign I.D(s) for dig(s)

(1) When one nest is found: ID the first nest of the season as "Nest 1" and so on

(2) When multiple digs are found: I.D the first nest of the season as "Nest 1" and all of its associated digs as "Dig 1-a," "1-b," etc., beginning with the southernmost dig

c) Record date and time found, GPS coordinates of each individual dig, general location, description (i.e. false dig or probable nest), and photographs

d) Flag the dig(s) and create a temporary barrier to alert Security to steer clear of nest site

8) Reporting Turtle Dig:

a) NR Biologist to **call NR Manager and report nest ASAP**.

b) When back in office, **send email to NR manager with all applicable information*** about nest(s) and dig(s). Report time, date, location, GPS coordinates, description, and Nest I.Ds.

c) **NR Manager to forward email and report to USFWS, DLNR DAR, and NMFS within 24 hours*** of NR Biologist's initial observation.

* If for any reason an email is not able to be sent to these agencies a phone call within 24 hrs of the observation will suffice as the PMRF Biological Assessment (BA) does not specify that details of the dig need be reported within 24 hrs. See below for reporting requirements.

d) NR Biologist to **call Dispatch/Security and report nest.**

e) Enter data into PMRF sea turtle database.

9) Erect Temporary Exclusion around Nest Site ASAP:

a) Place 6 ft tall posts 3 m apart in a circle, with a 2 m radius from the mound and depression. Wrap rope around posts, tying them onto the posts to create a circular demarcation (Fig. 6). According to DAR, there have been no records of dogs disturbing turtle nests thus far, so an orange plastic mesh enclosure is unnecessary and an entanglement hazard (as of 2020).

b) Place signage indicating this is a federally protected, sensitive area, and disturbing it can lead to fines/imprisonment.

c) Document fencing effort with time, date, and photos and enter the data into the PMRF sea turtle database.

Monitoring Nests

1) Day 1-49: Check nest once a week, assuring fence is properly in place and nothing has disturbed nest.

2) Prior to Day 50: Check nest at night once to make sure no lights are visible from nest site. If problem lights are identified, arrange to have them turned off or create a lighting shield.

3) Day 50: Create a "causeway" between nest and ocean if found in area with vehicular traffic to prevent vehicles running over hatchlings and/or creating deep ruts that hatchlings could get stuck in (Fig. 7)

a) The hatchling causeway should start on either side of the nest and fan out, becoming wider closer to the water.

b) Use T-posts ~6m apart, and secure firmly in sand with a mallet.

c) Hang flagging on the t-posts to make them more visible. Place signage on the posts indicating no vehicles should pass through the "causeway". Signs can include large images of turtles to indicate from afar that there might be hatchlings making their way to the water.

d) Make the slopes of existing deep tire ruts in the causeway more gradual by either raking, or simply dragging your foot along the edge of the rut. PMRF had one hatchling in 2015 that became stuck in a tire rut and crawled down the beach, parallel to the ocean for quite a ways; it eventually had to be assisted to the water by Environmental.
e) Look for and remove potential hazards like LTK, etc

4) Day 50-75: Check nest daily, looking for signs of hatching. Hatchlings usually emerge during the night or early morning.

a) Signs of hatched nest:

i) Hatchling tracks leading away from the dig (Fig. 8).
ii) A pitted or dimpled surface covering one side of the dig
iii) An 8-12 inch diameter dimple in the mound of sand from which all the hatchlings emerged. This slight dimple is the only change to the shape of the dig.

b) Check nests in the morning when the sun is still low in the sky. If there are tracks in the sand, they will cast shadows and look more pronounced. Wind/rain can easily erase hatch signs.

c) There are often crab tracks in and around turtle digs which can look very similar to baby turtle tracks especially if wind or rain has obscured them, however, crab tracks are made up of more linear marks while baby turtles leave more rounded impressions

5) Hatch Day: Check for strayed hatchlings and tracks heading away from the water. Walk 50m in either direction of the nest looking for hatchlings.

a) Report and document hatch:

i) Field Biologist to **call NR Manager and report hatch date ASAP.**

ii) When back in office, **send email to NR manager with all applicable information*** about hatch observation. Report time, date, location, GPS coordinates, description, and Nest I.D(s).

iii) NR Manager to forward email to USFWS, DLNR DAR, and NMFS within 24 hours of hatch date.*

* If for any reason an email is not able to be sent to these agencies a phone call within 24 hrs of the observation will suffice as the BA does not specify that details of the dig need be reported within 24 hrs. See below for annual report reporting requirements.

iv) Enter data into PMRF sea turtle database.

<u>After Hatch Date</u>

1) Schedule Excavation:

a) Schedule excavation for no earlier than 72 hrs after observation of hatching. This will allow late hatchlings to properly complete the hatching and emerging process.

b) Coordinate with a permitted individual such as a DAR Sea Turtle Biologist to excavate the nest.

c) Digs are excavated to ensure no baby turtles are trapped under the surface of the sand and also to count egg shells or unhatched eggs and collect samples for DNA analysis.

2) Continue Monitoring: Monitor nest until excavation date, looking for more turtle tracks or strayed turtles.

3) Sea Turtle Nest Excavation SOP:

a) Locating eggs:

i) Look for 8-12 inch dimple in sand and carefully move the sand away with your hands. There may be turtles just under the surface, so it is important to start with hand digging.

ii) The sand should feel soft. If you are digging into packed sand it is not the correct place.

iii) The eggs will be about 3 feet below the surface and will be consolidated in a small area, no more than a foot in diameter.

b) Counting eggs:

i) Collect eggshells and unhatched eggs and put them in separate bags; the state conducts DNA analysis on unhatched eggs

ii) Count egg shells. Some may be small fragments – try to estimate how many fragments would constitute an entire shell.

c) If live hatchlings are found:

i) Set hatchlings down near the nest, facing the ocean to allow the hatchlings to make their way to the ocean unassisted. Observe their progress until they reach the water. The process of crawling on the beach to the water is an important aspect of sea turtle hatchling biology. During the crawl, turtles can essentially "warm up" before entering the ocean and imprint on their natal beach.

ii) If hatchlings crawl away from the ocean direct them as needed.

iii) If all else fails and the hatchlings are alive but do not actively crawl to ocean, bring the turtles closer and closer as needed or release directly into the water.

d) Report:

i) Field Biologist to **call NR Manager and report excavation ASAP. NR Manager to notify USFWS, DLNR DAR, and NMFS that an excavation has taken place.**

ii) When back in office, **send email to NR manager with all applicable information about excavation.** Report time, date, location, GPS coordinates, description, Nest I.D(s), and results of excavation.

iii) Enter data into PMRF sea turtle database.

Sea Turtle Nesting Data Management

1) Enter all data including survey efforts, found nests and digs, fencing efforts, monitoring efforts, and excavation results into PMRF sea turtle database on a weekly basis.

2) Name and file all sea turtle nesting related photos with appropriate nest/dig ID, date, and location code and file into PMRF sea turtle database.

BA Reporting Requirements for End of Year Annual Report

1) PMRF will submit information on all turtle response activity in their annual reports for the Biological Opinion.

The annual report will include:

a) The number of nests laid, their date and location.

b) The specific management measures implemented with respect to each nest.

c) The number of false crawls, their date and location.

d) Nest hatching success and emergence success.

e) The number of stranded turtles (alive and dead).

f) Any incidents of take (i.e., light disturbance, mortality, harassment, etc.).

g) Any other information regarding sea turtles at PMRF that may be relevant to evaluating the response of sea turtles to different management actions.

For general sea turtle monitoring, see "Hawaiian Monk Seal and Sea Turtle General Monitoring SOP."

Figure 1. Turtle Survey Routes – South

Figure 2. Turtle Survey Routes – Runway/Kinikini

Figure 3. Turtle Survey Routes – North

Figure 4. Sea turtle nest with body tracks leading out of dig. The eggs are under the mound (which is not always a pronounced mound but will be adjacent to the dig) and not under the body pit.

Figure 5. Sea turtle nesting tracks leading up to digs at high tide line (right) and then back down to ocean (left). The arrow imprints from the turtle's flippers indicate direction of travel.

Figure 6. Fenced off turtle nest at Nohili in 2020. Driftwood may be used if t-posts are unavailable. Rope is wrapped around poles demarcating the exclusion boundary and signs are erected to inform the public of the nest.

Figure 7. Example of causeway erected near hatching date to inhibit vehicle traffic from running over hatchlings that may be making their way to the ocean. This is an older example of a causeway with wire connecting the poles. Instead of stringing wire, simply attach flagging on each t-post to make them visible and erect signs.

Figure 8. Hatchling tracks leading away from nest.

Security Personnel Sea Turtle SOP

<u>Year-round Reporting Procedure for all Turtle Sightings, Tracks, and Digs/Nests:</u>

Call the **PMRF Natural Resources Duty Phone at (808) 208 - 4416** and leave a message with:

1. Your full name and phone number

2. The time, date, and location of the observation

3. Details about observation (e.g., if turtle appears injured or entangled in any way, number of turtle tracks, number of holes).

4. Please direct any onlookers to stay at least 10 ft. away from turtle to avoid disturbing it.

Sea Turtle Nesting Season SOP, May – August:

1) **Drive below the high tide line** avoiding sand dunes and beach vegetation whenever possible. Sea turtles prefer nesting at the toe of sand dunes near beach vegetation.

2) **Be alert for evidence of sea turtle nesting, especially during night patrols**

a) *How to Identify sea turtle tracks and digs:*

i) Sea turtles tracks are arrow shaped (see Figure 2)

ii) Sea turtle digs look like a crater-like hole in the sand (see Figure 1)

iii) If you observe sea turtle tracks leading up to a hole in the sand, you have likely found a turtle nest. Do not drive or walk within 10 ft. of nest site, doing so can cause the sand to cave in or compact.

b) *What to do if you find a live sea turtle at night:*

i) Stay at least 150 ft. away and slowly drive away from the area before reporting the observance. The turtle may abort her nesting attempts if disturbed.

DEPARTMENT OF THE NAVY

PACIFIC MISSILE RANGE FACILITY

P.O. Box 128

KEKAHA, HAWAII 96752-0128

PACMISRANFAC NOTICE 11015

From: Commanding Officer, Pacific Missile Range Facility

Subj: TREE CUTTING AND TRIMMING DURING ENDANGERED HAWAIIAN HOARY BAT PUPPING SEASON 1 JUNE - 15 SEPTEMBER

Encl: (1) PMRF Wildlife Seasons Chart

(2) Hawaiian Hoary Bat Fact Sheet

1. Purpose. To give guidance for allowable and prohibited vegetation maintenance activities during the endangered Hawaiian hoary bat pupping season to eliminate risk to bat pups before they are able to fly.

2. Policy. No part of any tree 15 feet or taller, with the below exceptions, is allowed to be trimmed, cut or removed during the period above, including for construction by or for tenant or customer Department of Defense commands or other federal agencies. For the purposes of this policy, trees are woody vegetation with a central trunk. Tree trimming that is routinely needed shall be scheduled to be completed outside of this period; trees that need to be trimmed for projects during the prohibited period should be maintained at a height less than 15 feet during the pupping season. This policy applies across the installation and leased properties, including Barking Sands, Makaha Ridge, Koke'e sites and Kamokala Ridge. Natural Resources must be notified of bats found on any part of the installation.

3. Dates. Hawaiian hoary bat pupping season lasts from 1 June - 15 September 2023 inclusive. Exceptions to the Policy:

a. Coconut palms. Leaves and coconuts may be removed from coconut palms 15' or taller if a visual inspection is conducted prior to trimming and there are no bats present. Coconut palms may not be cut down during the period.

b. Emergency need. In the event of an unforeseeable event leading to the immediate need for tree/tree branch removal, Natural Resources must be contacted and allowed to conduct a pre-dawn bat survey of the vegetation, as safety allows. Any trimming that

must be done without delay and without the necessary notification for a survey will be documented and reported to the Natural Resources Manager, Brooke McFarland at brooke.a.mcfarland.civ@us.navy.mil or (808) 335- 4017. All felled vegetation will remain on site until inspected by a biologist.

Subj: TREE CUTTING AND TRIMMING DURING ENDANGERED HAWAIIAN HOARY BAT PUPPING SEASON 1 JUNE - 15 SEPTEMBER

4. Safety. No measures taken during this period should result in unsafe situations for human health or property. All reasonable measures should be taken to identify trees that could become a safety hazard within the prohibited period.

5. Cancellation Contingency. This notice will be cancelled 31 December 2023 or upon completion of the Hawaiian hoary bat pupping season.

6. Records Management. Records created as a result of this notice, regardless of media or format, must be managed per Secretary of the Navy Manual 5210.1 of September 2019.

STEVENSON.BRETT.ASHLEY.1158727311 Digitally signed by STEVENSON.BRETT.ASHLEY.1158727311 Date: 2023.04.25 16:12:45 -10'00'

B. A. STEVENSON

APPENDIX F – PROTECTED SPECIES MANAGEMENT PLANS

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Nēnē Management Plan: Pacific Missile Range Facility, Barking Sands

Kauai, Hawaii

TABLE OF CONTENTS

LIST OF ACRONYMS & ABBREVIATIONS

ac	Acre(s)
AOA	Airfield Operations Area
Admin	Administration
BASH	Bird Aircraft Strike Hazard
BO	Biological Opinion
cm	Centimeter(s)
CNIC	Commander Navy Installation Command
CNRH	Commander Navy Region Hawaii
CNO	Chief of Naval Operations
DLNR	Hawaii Department of Land and Natural Resources
DoD	Department of Defense
DOFAW	Hawaii Division of Forestry and Wildlife
DoN	Department of the Navy
ESA	Endangered Species Act
etc	Et cetera (examples)
e.g.	Exemplia gratia (for example)
ft	Feet
FAA	Federal Aviation Administration
Fig(s)	Figure(s)
g	Gram(s)
GIS	Geographic Information Systems
GPS	Global Positioning System
ha	Hectare(s)
hr	Hour
HIANG	Hawaii Air National Guard
in	Inch(es)
INRMP	Integrated Natural Resources Management Plan
INST	Instruction
IR	Infrared
KISC	Kauai Invasive Species Council
km	Kilometer(s)
KPNWR	Kilauea Point National Wildlife Refuge
lbs	Pound(s)
LCDR	Lieutenant Commander
LT	Long-Term
m	Meter(s)
MBTA	Migratory Bird Treaty Act
mi	Mile(s)
mph	Miles Per Hour
NEPA	National Environmental Policy Act
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge
NWRC	USDA WS National Wildlife Research Center

OANRP	Oahu Army Natural Resources Program
Oz	Ounce(s)
PMRF	Pacific Missile Range Facility
PWO	Public Works Office
SOH	State of Hawaii
Spp	Species (plural)
ST	Short-Term
TNR	Trap Neuter Release
UAV	Unmanned Aerial Vehicle
US	United States
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WHA	Wildlife Hazard Assessment
WHMP	Wildlife Hazard Management Plan
WS	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services
WVC	Wildlife Vehicular Collision
ZSSD	Zoological Society of San Diego

LIST OF TABLES & FIGURES

COVER PHOTO: NORMA CREPS

EXECUTIVE SUMMARY

This Nēnē Management Plan (NMP) has been developed for the United States (US) Department of the Navy (DON), Commander Navy Region Hawaii (CNRH) for its Pacific Missile Range Facility (PMRF) to assist in the management of the endangered Hawaiian Goose or nēnē (Branta sandvicensis). This plan is in accordance with the DON PMRF Integrated Natural Resources Management Plan (INRMP) (Section 3.4.1.1) (CNRH, 2010) and in partial fulfillment of the US Fish and Wildlife Service (USFWS) 2014 Biological Opinion (BO) for PMRF Base-wide Infrastructure, Operations and Maintenance, Kauai.

The nēnē, as a federally endangered species as well as a Bird Aircraft Strike Hazard (BASH) risk, requires proactive management and specific conservation measures. The following management plan details species biology, threats to species conservation, species history at PMRF, and best management strategies for the species across all PMRF's sites to support mission capability as well as species recovery.

The management and monitoring actions detailed in this plan will be incorporated into the facility's INRMP, stressing the need for adaptive management based on best information available. These actions include but are not limited to the following: predator population monitoring and control, standardized nēnē population surveys, education and outreach efforts, and habitat management. The recommended management and monitoring actions are presented such that they may be implemented individually or in combination. By continuing to monitor nēnē populations, these management actions may be evaluated by their apparent effects – intended and otherwise – and can inform adaptive management strategies. This management plan is a living document that can, and should, be revised at any time as new information becomes available.

1. INTRODUCTION

PURPOSE

This NMP has been developed for the US DON, CNRH for the PMRF to assist in the management of the endangered Hawaiian Goose or nēnē (*Branta sandvicensis*). A single adult nēnē was first observed at Barking Sands by DOFAW Wildlife Manager Tom Telfer in 1987 (Banko & Elder, 1990). Observations of nēnē at PMRF have since become regular in conjunction with the species' overall population growth on Kauai.

This NMP serves two main functions: (1) it serves as a central source of nēnē natural history for the DON, specifically in relation to PMRF; 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.

This plan is meant to be an internal guidance document, and was prepared in partial fulfillment of the US Fish and Wildlife Service (USFWS) 2014 BO for PMRF Base-wide Infrastructure, Operations and Maintenance, Kauai. Compliance with the provisions of National Environmental Policy Act (NEPA) and other applicable laws, regulations, and policies is required prior to implementation of management strategies. The management actions proposed herein will be incorporated into the PMRF INRMP that is implemented under the guidance of the PMRF Natural Resources (NR) Manager. Regular monitoring and documentation will be completed concurrently with implementation of all nēnē management strategies at PMRF to evaluate effectiveness.

This NMP is to be reviewed annually by PMRF stakeholders, USFWS, and Department of Land and Natural Resources (DLNR)-Department of Fish and Wildlife (DOFAW). At that time parties will review most recent nesting and population data for PMRF, the apparent effects of implemented management strategies, and novel relevant information on nēnē biology or demography; taking all this information into account, managers will collaborate and amend the proposed strategies as needed throughout the adaptive management process.

INSTALLATION BACKGROUND

Mission & Vision

The mission and vision of PMRF, Barking Sands, Kauai is to provide integrated range service in a modern, multi- threat, multi-dimensional environment that ensures the safe conduct and evaluation of training and Test & Evaluation missions, in addition to delivering products to improve the customer's ability to achieve readiness and other national defense objectives (CNIC, 2016).

Location & Facilities

Located on the western coast of the island of Kauai, PMRF encompasses approximately 3,700 ac (1,497 ha). It is the largest multi-environment test range in the world and contains land, sea, and air zones. PMRF's Main Base is located at Barking Sands, Kauai and supports training, tactics development, and evaluation of air, surface and subsurface weapons systems for the Navy and other Department of Defense (DoD) agencies, foreign military forces, and private industry (Figure 1).

The Mana Plain, where PMRF, Barking Sands is located, was historically associated with extensive wetlands separated from the coastal beach area by a system of high sand dunes. Currently, a man-made oxidation pond, used for sewage treatment, and several irrigation ditches at Barking Sands support protected bird species, however these areas have not been delineated by the US Army Corps of

Engineers and are not listed in the USFWS's wetland inventory. Kini Kini Ditch runs east to west directly south of the PMRF airfield (Figure 2), while the Oxidation Pond is located 2 miles south of the airfield. Nēnē are most often observed at the Barking Sands facility around these manmade water sources or loafing and foraging on mowed lawns.

In addition to the Barking Sands main base, there are numerous support facilities located both on and off Kauai including those at Makaha Ridge (secondary range), Kokee (tracking radars, telemetry, communications, command and control), Kamokala Ridge (explosive storage), Milolii Ridge (reflectors), Niihau Island (radar, optics, and electronic warfare), and Kaula Island (aircraft gunnery and inert ordnance target practice) (CNRH, 2010). Of these support facilities, the Makaha Ridge Tracking Station and Kokee Sites are known to harbor nēnē and are included in this plan.

The Makaha Ridge Tracking Station sits on a Na Pali finger ridge to the north of Barking Sands, overlooking the Mana Plain. The station has a maximum elevation of about 1,850 ft (564 m), with steep slopes that surround it on the south, west, and north. Nēnē often forage and loaf in the mowed lawns around the most distal group of buildings at the station near the bottom of the ridge.

East of Makaha Ridge and higher in elevation (3,710 ft), PMRF leases five small parcels of land within the boundaries of Kokee State Park collectively referred to as the Kokee sites. The Kokee sites are fenced, and open areas within the fence line consist mainly of mowed lawns. Nēnē are not often observed at Kokee, however, the open green lawn will be a continued attractant as Kauai's nēnē population increases in size.

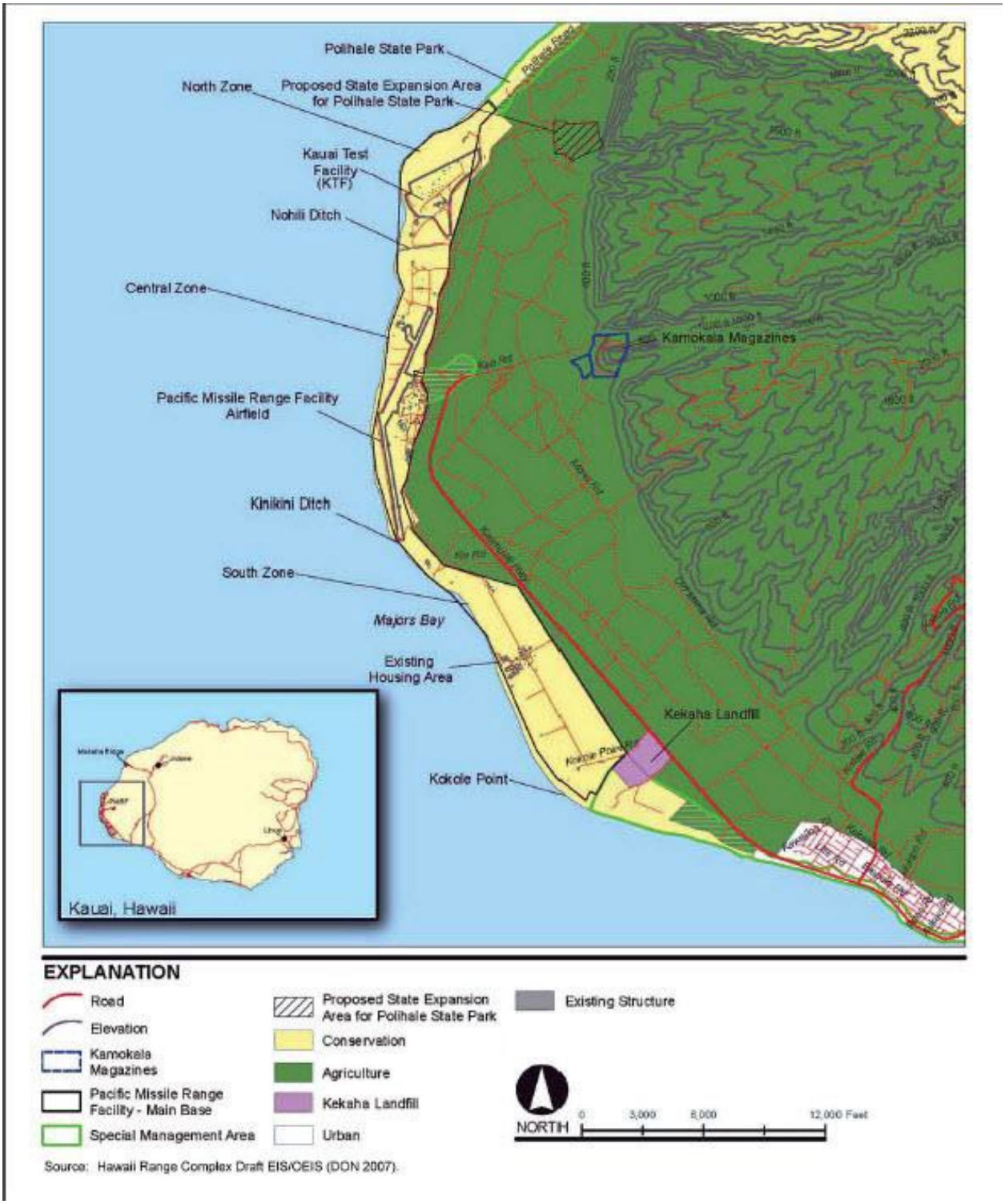

Figure 1. PMRF, Barking Sands, island of Kauai map

Figure 2. Aerial views of airfield area of PMRF with Kini Kini and Kawaiole Ditches (bottom) and agricultural lands visible (right)

2. NĒNĒ BIOLOGY AND ECOLOGY

FORAGING

Historically, seasonal changes in food availability led nēnē to migrate between the uplands in summer to forage on berries and lowlands during the winter to forage on new growth of greens (Baldwin, 1947). Browsers and grazers, nēnē today forage on the leaves, seeds, flowers and fruits of over 50 native and non-native grasses, sedges, composites, and shrubs (Banko, Black & Banko, 1999; DOFAW 2005). As opportunistic generalists, their diet is largely dependent on their surrounding habitat (Black et al, 1994; Banko et al, 1999; Woog, 2000). This adaptability has allowed nēnē to survive in marginal environments and thrive in highly altered landscapes (Black et al, 1994 & Banko et al, 1999). Nēnē are readily attracted to short growing exotic grasses and herbs found in pastures, golf courses, roadsides, and lawns (Black et al, 1994; Loepold & Hess, 2013; Baldwin, 1947; Woog & Black, 2001). These cultivated grasses when mowed, grazed, fertilized, and irrigated, provide nēnē with much needed high-protein forage – higher than that in either than berries or grass seeds.

REPRODUCTION

The vast majority of wild nēnē nest between October and March, with the production of clutches peaking between October and December; however, nēnē nesting has been documented anytime from August – April (Banko, Black & Banko, 1999; Kear & Berger, 2010). Directly prior to nesting, nēnē tend to pair off, separating from flocks and family groups. Males become aggressive toward other geese, people, and even, at times, cars that approach the pair. Nēnē mate for life and remain in close proximity to each other throughout the year, generally finding a new mate only if their current mate perishes.

Nēnē usually build nests along "veg lines" – a line of taller vegetation (herbaceous or woody) that borders an open area. Nest locations can be identified by a solitary male acting defensively near one of these veg lines; the female, along with the nest, is generally well-hidden in the taller vegetation. Additionally, a pair will regularly attend an area for 2-3 weeks prior to nesting. A nēnē clutch contains an average of 3 (1-6) large eggs laid every 24-48 hours
(Banko, Black & Banko, 1999). Female nēnē incubate their eggs for 29- 31 days and are known to re-nest within 14-60 days should their first clutch fail (USFWS, 2004). Typically, all eggs in a clutch hatch within the same 24-hr period (Banko et al, 1999). Female nēnē will often return to their natal fledging sites for nesting, and commonly nest within the previous year's nest cup or in close proximity to it (Banko, 1980; Banko & Manuwal, 1982; Woog, 2000).

Nēnē incubate eggs for 30 days, and goslings remain in the nest for only 1-2 days after which broods become mobile (Banko, 1992). Until their first pre-basic molt, which occurs 11-14 weeks post-hatching, juvenile nēnē are flightless and duller in color than adults (USFWS, 2004); by 5 months of age juveniles are nearly indistinguishable from their parents with whom they will remain for about a year (Banko, Black & Banko, 1999).

MOLTING AND FLOCKING

Like most waterfowl, nēnē undergo a complete molt each year between March and June. When molting, nēnē lose and regrow all body, wing, and tail feathers. Nēnē are flightless during the 4-6 week molting period, and therefore highly vulnerable to predation; birds are accordingly extremely cautious and spend the majority of their time in thick brush or by water sources which both provide escape avenues (Leopold & Hess, 2013). Post-breeding and molting (May – August), nēnē family units will flock together and move locally within a 6 mile radius (10 km) in large groups.

DISTRIBUTION

Prior to western colonization of the Hawaiian Islands in the early 1700's, the nēnē population was approximately 25,000 birds (Baldwin, 1945). In 1949, the wild nēnē population was less than 50 individuals (Banko, 1978), when a second captive breeding program was organized for the protection of the species. Today, over 2,600 captive-bred birds have been released on Hawaii, Maui, Molokai, and Kauai (DOFAW, 2012; USFWS, 2004).

The 2015 statewide nēnē population estimate is 3,039 birds with 1,319 on the island of Kauai (Nēnē Recovery Action Group, 2016). While survival and breeding success in the wild remains low for some nēnē populations on other islands, the Kauai population nearly tripled in just over a decade: the population was estimated at only 525 birds in 2002 (USFWS, 2002). This growth has been largely attributed to the lack of an established mongoose population on Kauai, and the presence of large tracts of undeveloped low elevation grasslands throughout the island. Kauai's 2015 west-side population was estimated to be 60 individuals (DOFAW Kauai Nēnē Biologist J. Olbert, personal communication).

THREATS

Nēnē evolved with no native predators excepting perhaps the Hawaiian Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) and Black–crowned Night Heron ('Auku'u, *Nycticorax nycticorax*) on goslings. The geese have very limited evolutionary adaptations – behavioral or physical – to protect against the introduced mammalian predators of the Hawaiian Islands. Predators include feral and free-ranging cats, feral and free-ranging dogs, rats, mongoose, pigs, and even humans historically. In addition to directly consuming or attacking nests, goslings, and/or adults, many of these mammals can also be disease vectors.

One of the growing threats to adult nēnē on Kauai is vehicle collisions: Over 50 adults between 2015 and 2017 were killed by vehicle collisions on the island (DOFAW, 2016). Mowed grassy areas along roadsides are often the first place to green on the west side after rains, since these grassy areas collect the water runoff from the roads. This makes these green grassy areas highly attractive to nēnē for foraging opportunities, and the birds' low slow flight patterns make them especially vulnerable to passing vehicles (DOFAW, 2016).

Nēnē may also be attracted to roadways by well-meaning people who feed the birds. However, feeding nēnē creates a serious risk for individuals: "A fed Nēnē is a dead Nēnē" as Volcano National Park on the island of Hawaii advertises to visitors. Nēnē that have been fed have a higher incidence of vehicular collision, returning to roadways and parking lots in search of food handouts (Huijser, et al., 2008).

Other anthropogenic threats include land use conflicts such as nēnē foraging around farms, golf courses, and airfields. On farms, nēnē forage on young seedlings and farmers are increasingly concerned about theeconomic impact the geese may have on their crops and their inability to haze the geese from the field due to their endangered status. Geese on golf courses are at risk of being hit by golf balls, and can be attracted to major population centers by the lush green fields. Geese in the vicinity of airports present a BASH, dangerous for birds and pilots alike.

3. NĒNĒ AT PMRF

DEMOGRAPHY

Standardized surveys have been completed at PMRF Barking Sands since July 2016 (Table 1). In eight months of data collected between July 2016 and February 2017, the average nēnē

population on base was 26 individuals, with slightly more during flocking season and significantly less during molting season (Figure 3). The most variable month, by far, was July during the height of flocking season with a high of 79 individuals and a low of 0 individuals observed during a single survey. The least variable month was December during the height of breeding season (21-30 individuals).

Similar to population count, popular areas at Barking Sands also varied depending on the season. During flocking season, nēnē were most often observed in the Kini Kini Ditch area east of Nohili Rd (technically outside the property lines of Barking Sands), at Shenanigans All-Hands Club, and near Subway (Figure 4, Figure **5**). However, during nesting season, nēnē were most regularly observed at the Oxidation Pond and Hawaii Air National Guard (HIANG), both of which are common nesting locations (Figure 4, Figure **5**). From April 2016 through March 2017, 123 banded individuals were recorded at Barking Sands.

Seven surveys were completed at Makaha Ridge and Kokee Sites from July 2016 through February 2017 by PMRF staff. During these surveys, between 11 and 12 nēnē were observed on average at Makaha Ridge. DOFAW conducted 25 surveys at Makaha Ridge between January 2014 and February 2017, and similarly observed 11 birds on average at the facility (J. Olbert, 2017 personal communication). No nēnē were observed at the Kokee sites by PMRF staff.

Table 1. Number of basewide nēnē surveys completed at Barking Sands, Pacific Missile Range Facility, HI between July 2016 and February 2017

Month	# of Surveys
2016	
July	6
August	6
September	6
October	7
November	9
December	6
2017	
January	7
February	7

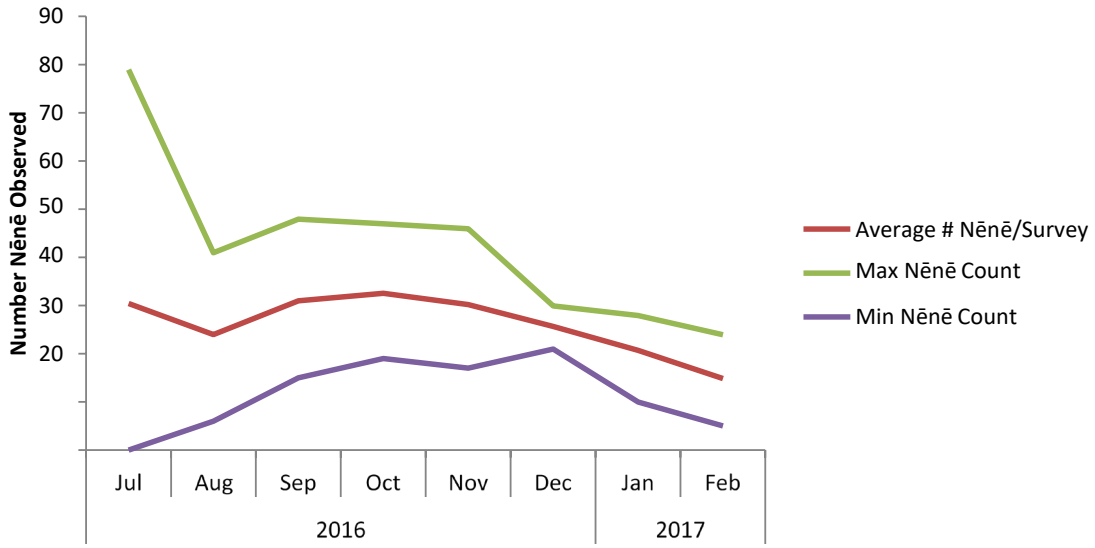

Figure 3. Number of nēnē observed at PMRF Barking Sands during basewide surveys, per month (July 2016 – February 2017)

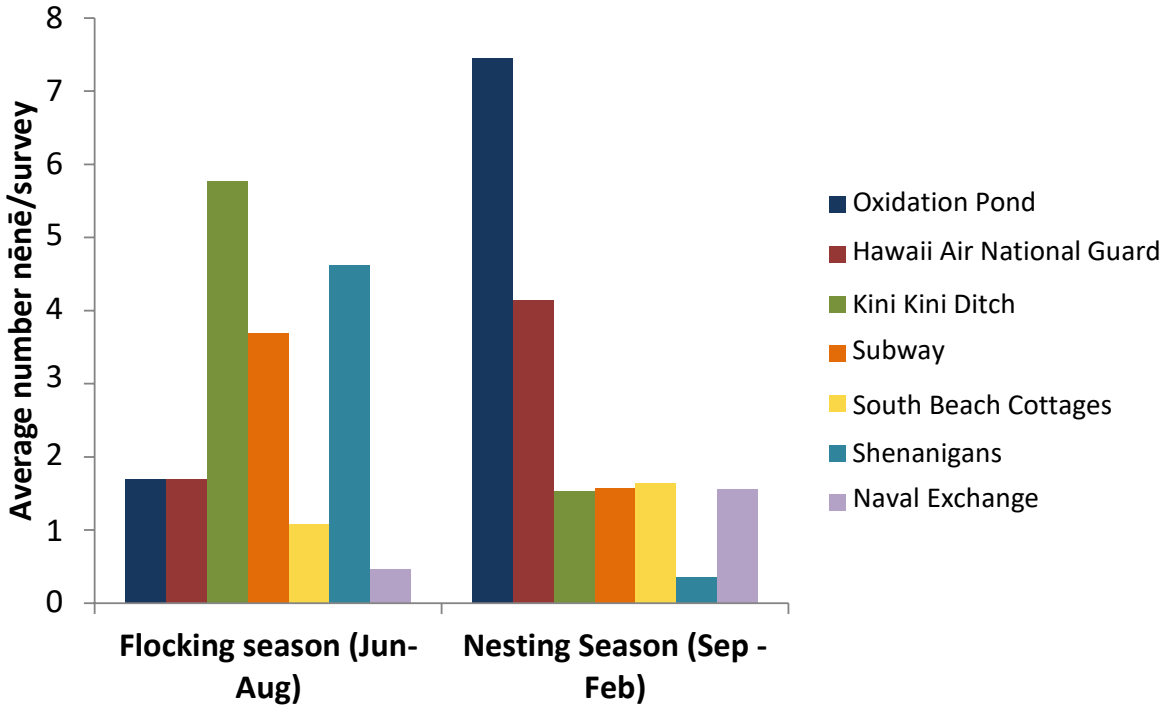

Figure 4. Average number of nēnē in the most frequented areas of PMRF Barking Sands, July 2016 – Feb 2017

Figure 5. Most frequented areas by nēnē at PMRF Barking Sands, July 2016 – Feb 2017

NESTING

The first documented nest on Barking Sands was observed in fall 2010 near the Nohili Road Curve. Since that time, 31 nests have been established at Barking Sands and at least 36 geese have fledged (Figure 6. Nēnē nests laid at PMRF Barking Sands. Information includes total number of nests documented in an area (yellow circle), fiscal years during which at least one nest was documented in an area, and number of pairs which have nested in the area. The two most popular nesting areas are in the vicinity of South Site (six nests between 2010 and 2017) and the Oxidation Pond (18 nests between 2012 and 2017). Of highest threat to base operations were the two nests laid at the south end of the runway in FY16 and FY17. The nest in FY16 was predated soon after discovery and the parents abandoned the area directly after. However, the FY17 pair laid their nest less than 75m from the end of the runway, and through emergency consultation with USFWS and DOFAW, all agencies agreed the best mitigation of risk to human and nēnē lives at the time was to destroy the nest.

Makaha Ridge had six active nests in FY17, and DOFAW documented 24 nests between FY07 and FY16 at the site. All nests have been in the western most cleared area near the end of the ridge (Figure 7). No active nests have been observed at the Kokee sites.

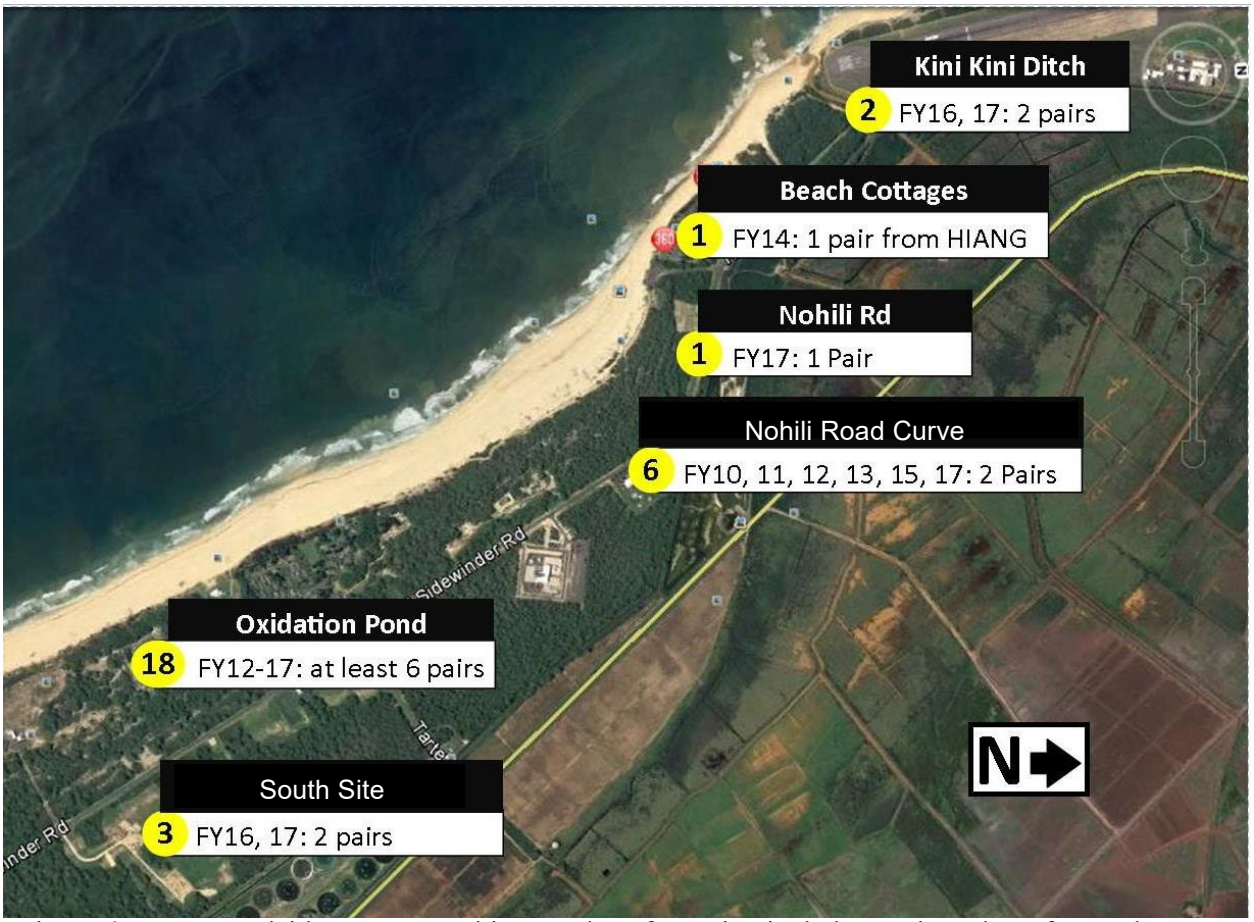

Figure 6. Nēnē nests laid at PMRF Barking Sands. Information includes total number of nests documented in an area (yellow circle), fiscal years during which at least one nest was documented in an area, and number of pairs which have nested in the area

Figure 7. Nēnē nesting area at Makaha Ridge, delineated by red circle

HAZING

United States Department of Agriculture Wildlife Services (USDA-WS) currently hazes nēnē only by foot and/or vehicle horns. The Bird Discovery and Dispersal Team (BDDT) actively hazes during published hours of airfield operations: M-F 0700-1800, excluding federal holidays. On any given day, USDA-WS personnel drive a circuit covering the airfield and immediate surrounding area, hazing any wildlife posing a danger to aircraft. Each area on base is visited approximately every 60-90 minutes during airfield operational hours.

Nēnē are most often seen on the Barking Sands airfield outside breeding season, when large groups flock together overnight (Figure 8). Monthly highs fluctuate significantly from year to year, and the most populous month on the airfield for nēnē occurred anywhere between May and October. September 2016 had a record high of 504 nēnē hazing events on the airfield – more than double the number of hazing events from any other month. A "hazing event" refers to a single individual being hazed: If a flock of 20 birds was hazed once or the same five-member family unit was hazed four times, both would qualify as 20 hazing events. Airfield population trends could be correlated with weather conditions, breeding season, and/or other variables.

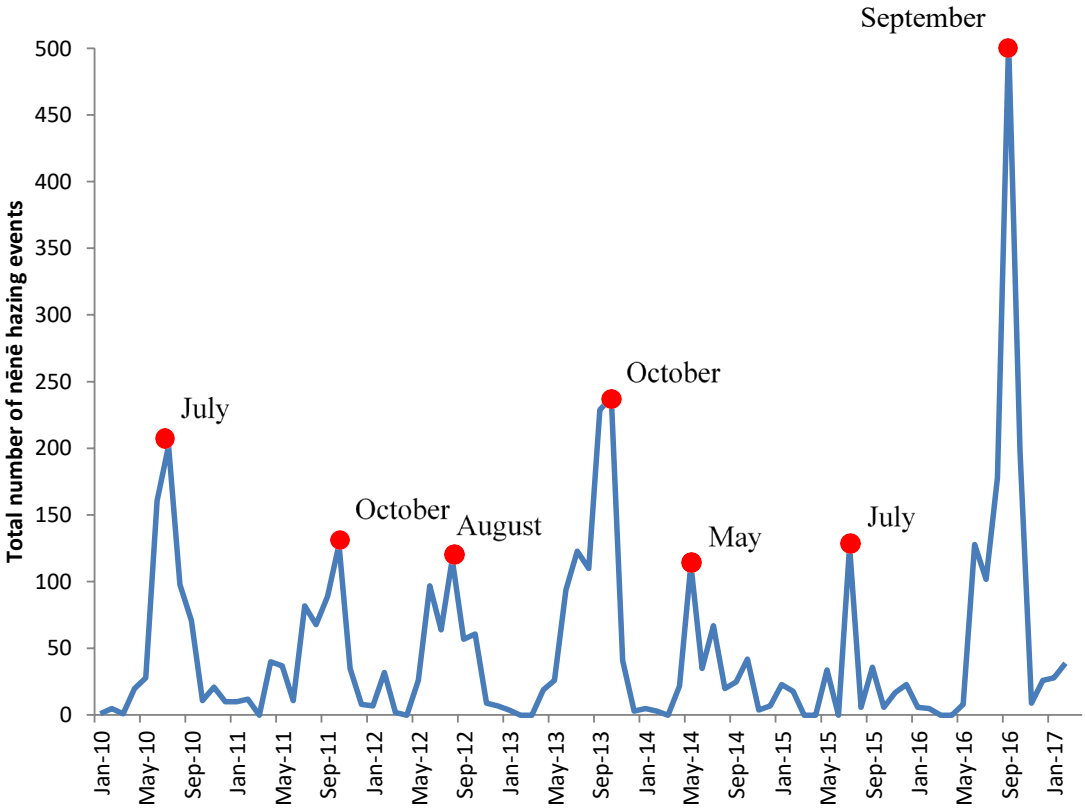

Figure 8. Total number of nēnē hazing events on the Barking Sands Airfield from January 2010 - March 2017 by USDA-WS. Red dots and corresponding labels indicate annual highs and their corresponding months.

MORTALITY INCIDENTS

Six nēnē mortality events occurred between March 2015 and March 2017 at Barking Sands: five due to vehicle collisions and one due to an enlarged liver (Figure 9). All vehicle collisions occurred on Nohili Drive in 45mph speed limit sections. Of special concern is the Nohili Road Curve area where four mortality events occurred within three months. Geese are attracted to this area to forage along the roadside, especially during drought events (See Nēnē Biology and Ecology: Threats section). The 2016- 17 events also coincided with breeding season when geese are especially territorial and less prone to flee from human activity. Additionally, one mortality occurred at Makaha Ridge in 2010 when a goose was struck by a truck in the same area as the nesting region (Figure 7).

Figure 9. Documented nēnē mortality events at Barking Sands, Pacific Missile Range Facility. Red icons indicate vehicle strikes along Nohili Road, and the blue icon represents the location where the adult male carcass was found with an enlarged liver.

4. NĒNĒ MANAGEMENT AT PMRF: GOALS, OBJECTIVES, AND STRATEGIES

The goals for the Navy's Installation NR Program are:

1. Integrate natural resource conservation responsibilities with military activities, installation planning and programming, and other activities as appropriate to ensure no net loss to the Navy mission.
2. Ensure sustainable multipurpose use of the resources and public access when consistent with the mission, and safety and security requirements; and
3. Interact with the surrounding community to develop positive and productive community involvement, participation, and educational opportunities.

A summary of the objectives and strategies to achieve these program goals with respect to nēnē are presented below. Target timeline for implementation is classified as either short-term (ST), starting within the next 2 years, or long-term (LT), starting up to 5 years from now. The final implementation of the strategies described is contingent upon adequate staffing and funding. Additional details explaining rationale and suggested implementation of strategies follow after the summary table.

OBJECTIVE 1 – MINIMIZE NĒNĒ BASH RISK AT PMRF VIA HABITAT MODIFICATION, HAZING, AND OTHER ACTIVE MANAGEMENT MEASURES

STRATEGY 1-1. Maintain the grass at 7-14 inches in areas under mandate of Air Traffic Control (ST & LT)

STRATEGY 1-2. Manage landscaping (off the airfield) to minimize attractiveness to nēnē. (LT)

STRATEGY 1-3. Maintain vegetation adjacent to drainage ditches near the airfield to discourage nēnē presence. (ST)

STRATEGY 1-4. Expand the current hazing toolkit to make hazing operations more effective. (ST & LT)

STRATEGY 1-5. Increase hazing efforts for nēnē to preclude them from breeding in areas adjacent to the airfield. (ST)

STRATEGY 1-6. Review and revise current Wildlife Hazard Assessment and Wildlife Hazard Management Plans in respect to nēnē. (ST)

OBJECTIVE 2 – REDUCE NĒNĒ INJURY/MORTALITY AT PMRF ASSOCIATED WITH MILITARY PRESENCE (EXCEPT AS RELATED TO BASH) TO A MAXIMUM OF TWO INCIDENTS PER YEAR BY 2020

STRATEGY 2-1. Standardize SOPs for notification and response actions when nēnē nests are observed (ST)

STRATEGY 2-2. Improve preventative measures along roads where nēnē are frequently observed, such as road signage, rumble strips, or speed bumps (ST & LT

STRATEGY 2-3. Implement training to increase awareness of presence of nēnē on base, guidelines for notification and response, rules for pets on base, nēnē biology and protected status. (ST)

OBJECTIVE 3 – DEVELOP A COMPREHENSIVE PREDATOR CONTROL PLAN TO REDUCE NĒNĒ INJURY AND MORTALITY FROM PREDATORS

STRATEGY 3-1. Identify predator population on base and prioritize areas for predator control actions. Target species include feral cats, dogs, pigs, barn owls, rats, and mongoose should they become established on the island. (ST)

STRATEGY 3-2. Integrate monitoring for predators to support evaluation of effectiveness of predator control actions (ST)

STRATEGY 3-3. Increase awareness and enforcement of Navy policy regarding feral cats through improved training and outreach (ST)

OBJECTIVE 4 – REVIEW THE NĒNĒ MANAGEMENT PLAN ANNUALLY AND IDENTIFY OPPORTUNITIES FOR IMPROVEMENT

STRATEGY 4-1. Implement standardized monitoring to track the baseline nēnē population.

(ST)

STRATEGY 4-2. Review new information obtained through implementation of the management plan annually, and evaluate for overall effectiveness and efficiency of meeting stated objectives. (ST)

STRATEGY 4-3. Establish a working group with the NR staff and key stakeholders with responsibilities in the implementation of this management plan. Meet annually to review changes to mission needs, population update as identified in Strategies 4-1 and 4-2 above, and recommend changes to the plan. (ST)

OBJECTIVE 5 – IDENTIFY OPPORTUNITIES FOR MULTIPURPOSE USE AT PMRF TO PROVIDE CONSERVATION BENEFIT TO NĒNĒ

STRATEGY 5-1. Conduct studies to improve understanding of nēnē population dynamics at PMRF. Studies to start with surveys that can be implemented within the next year with existing funding. (ST)

STRATEGY 5-2. Identify additional research objectives that could be of value to nēnē management at Barking Sands, justify the expenditure within the scope of the PMRF NR program, and request funding to implement these additional studies. (LT)

OBJECTIVE 6. IMPROVE UNDERSTANDING OF HOW NĒNĒ AT PMRF INCORPORATE INTO THE REGIONAL NĒNĒ POPULATION AND IDENTIFY OPPORTUNITIES TO SUPPORT CONSERVATION OF NĒNĒ AS A SPECIES

STRATEGY 6-1. Maintain close coordination with Sikes Act Partners with nēnē programs to share data and identify opportunities to integrate the PMRF nēnē management with other nēnē conservation programs (ST)

STRATEGY 6-2. Establish and maintain partnership and open communication lines with private and public landowners surrounding PMRF (LT)

OBJECTIVE 1 – MINIMIZE NĒNĒ BASH RISK AT PMRF VIA HABITAT MODIFICATION, HAZING, AND OTHER ACTIVE MANAGEMENT MEASURES.

Birds and other wildlife in proximity to airfields are a serious threat to aviation safety. A record 13,668 wildlife strikes were reported to the Federal Aviation Administration (FAA) in 2014 alone (FAA, 2014). Naval aviators specifically have experienced over 16,550 bird strikes, which resulted in over 440 aircraft mishaps, 250 foreign object damaged engines, $372 million in damage related costs, 10 destroyed aircraft, and one fatality since 1981 (CNIC, 2011).

The 2007 Wildlife Hazard Assessment (WHA) for PMRF identified the nēnē and Laysan Albatross as special threats to aviators at the facility. Nēnē in the Aircraft Operations Area (AOA) pose a significant threat to human safety and Navy equipment due to their low and slow flight patterns, large body size, and flocking behavior. The following strategies have been developed to mitigate this risk. USDA-WS is currently working on a revised WHA; tentatively scheduled for completion in 2018. This will be a key resource for the Bash Working Group (BWG) in the preparation of the revised Wildlife Hazard Management Plan (WHMP) which describes management actions to be implemented at PMRF to minimize BASH hazards. The BWG is comprised of representatives from airfield operations, USDA- WS, public works, natural resources, public affairs, security, and mission-related operations. The PMRF NR Manager is responsible for ensuring that management actions identified in the WHMP are consistent with all applicable laws relating to natural resources, in line with the INRMP, and to initiate consultation with the USFWS through the Section 7 consultation process as needed.

One of the most permanent methods of discouraging birds and other wildlife from visiting or utilizing airfields is modifying or removing attractive habitat features (CNIC, 2010 & Washburn & Seamans, 2004). The PMRF BASH Instruction 5090.7B (2012) identifies numerous land management procedures for discouraging wildlife from using the airfield at PMRF.

STRATEGY 1-1. Maintain the grass at 7-14 inches in areas under mandate of Air Traffic Control. (ST & LT)

Grasses are highly attractive to a variety of hazardous wildlife species, and no one grass management regime will deter all species of hazardous wildlife in all situations. The 2014 BO and PMRFINST 5090.7C stipulate a 7-14” grass regime on the airfield which would likely discourage casual loafing by large flocks of nēnē. All areas of the airfield which require contact with Air Traffic Control should be maintained according to this guidance (Figure 10).

While this target grass height is less attractive to nēnē for loafing and feeding, provided it does not seed at this height, the altered landscape could attract more nesting nēnē to the area. Of 142 nests island-wide in FY17 monitored by DOFAW, 44 percent were located in grasses: buffelgrass (6-84”), California grass (12-40”), crabgrass (12”) and guinea grass (12-72”) (J. Olbert, personal communication 2017). One 2016 nēnē pair was observed nesting in just 8” buffelgrass at the Oxidation Pond. Increased hazing effort may be necessary to counteract the expansion of potential nesting habitat (discussed in further detail under Strategy 1-4). Taller grasses could also attract gamebirds who favor hiding in these taller grasses and flush when startled.

Alternative vegetation to replace grass on the airfield has been considered in the past, but no workable replacement has been identified. Per the BO recommendation, test plots of native beach morning glory (*Ipomoea pes-caprae*) and akiaki grass (*Sporobolus virginicus)* were established at the north end of the base in 2012. Without irrigation, invasive grasses and shrubs moved into the area, and the native

vegetation began to die back. This trial indicates that maintaining monoculture carpets of native vegetation could be unmanageable without irrigation or intensive landscaping.

In evaluating potential alternatives, a foraging preference study similar to the one conducted by Washburn & Seamans (2012) could be valuable. Such a study would help to determine which turf grass species are the least likely to attract nēnē, and hence are best suited for use within the AOA. Captive nēnē, such as those currently at the Honolulu Zoo, could provide an alternative to the use of wild nēnē in the execution of the study. In addition to considering attractiveness to nēnē, all vegetation would be selected with the following in mind: effects on non-target species, and adaptability to the dry, hot environment of Kauai's west-side. USDA-WS is currently working on revising the WHA and WHMP which should provide additional suggestions for potential alternatives.

Management Actions:

1. Implement grass maintenance at 7-14" on the airfield.
2. Assure mowing and landscaping efforts are coordinated with the airfield manager for minimal impact to air operations.
3. Identify and evaluate potential alternatives for vegetation on the airfield.

Figure 10. Designated areas of the airfield which require contact with Air Traffic Control. Currently mowed lawns will be maintained at 7-14 inches within the next two years. In the long-term, all trees and shrubbery in the designated area will be cleared and these areas will also be maintained at 7-14 inches.

STRATEGY 1-2. Manage landscaping (off the airfield) to minimize attractiveness to nēnē. (LT)

Per the 2014 BO the watering of lawns on the Barking Sands airfield ceased entirely in 2015, as well as the area near Nohili Road Curve. However, certain high visibility areas in direct proximity to the airfield continue to be watered for aesthetic and financial purposes: the area around Subway, the field around the flagpole, the memorial area, the Public Works Office, and the north PMRF gate entrance. During dry times of the year, nēnē are regularly observed loafing and feeding in these areas. Again, during flocking season 2016, the

area around Subway and the flagpole, less than 500 meters from the airfield, was the second most popular spot to observe nēnē at Barking Sands (Figure 4).

Public Works (PW) will aim to modify these areas by 2025, eliminating all lawn irrigation within 5000 ft of the airfield. PW may look into xeriscaping, artificial turf grasses, or simply discontinuing watering.

Management Actions:

1. PW – develop landscaping plans eliminating the use of irrigation to maintain lawns within 5000 ft of the airfield by end of 2018, with input from BWG.
2. Eliminate all irrigation within 5000 ft of the airfield by 2025.

STRATEGY 1-3. Maintain vegetation adjacent to drainage ditches near the airfield to discourage nēnē presence. (ST)

Standing water or water flowing through drainage ditches creates habitat that provides food, cover, potential nesting areas, loafing areas and water resources for wildlife (CNIC, 2010). Nēnē, which readily utilize standing water for bathing, drinking, and predator avoidance (USFWS, 2004 & Loepold & Hess, 2013), have been observed most often within the AOA in the Kini Kini Ditch vicinity. Reducing the attractive habitat features of Kini Kini and Kawaiole Ditches will help to reduce nēnē BASH risk. The ditches are state-owned, but maintained by Agribusiness Development Corporation (ADC). The ADC is responsible for water quality from source to sea including water flowing through the installation, as well as ditch maintenance off installation. The Navy has been responsible for ditch maintenance on the installation since 2010. Coordination for real estate actions or other work pertaining to the ditches near the airfield will be reviewed to ensure consistency with base instructions and coordinated through the BASH working group to minimize BASH hazards. PMRF Instruction 5090.7B (2012) outlines that drainage ditches should be kept clear and built as steeply as possible. A minimum slope ratio of 5 to 1 should be established within both ditches and all vegetation should be cleared, and regularly maintained.

If monitoring indicates that clearing the ditches does not sufficiently minimize BASH risk, other actions may need to be considered such as netting to prevent access or construction modifications to the ditch. Any proposed changes would be coordinated with the ADC through PW to evaluate potential impacts to other environmental media and all real estate commitments are fulfilled.

Management Actions:

1. Remove vegetation from ditches near the airfield.
2. Ensure the real estate agreements identify restrictions for vegetation in the ditches.
3. Develop long term plan for ditch maintenance through airfield manager and PW.

STRATEGY 1-4. Expand the current hazing toolkit to make hazing operations at the airfield more effective. (ST & LT)

Air Ops and USDA-WS staff currently haze nēnē using non-lethal techniques including vehicle horn blowing, human vocalizations, hand clapping, foot stomping, and/or use of flashing vehicle lights. Though these techniques are immediately effective in dispersing flocks, they often return to the PMRF airfield throughout the day or in the evenings when no hazing occurs (Williamson & Ohashi, 2013). Noise-producing pyrotechnics have not been used at PMRF due to restrictions on their storage at the facility;

however, approval for storage is expected in the near future (LCDR J. Bartholomew, 2016 personal communication). As previously mentioned, the revised WHMP will describe any changes to nēnē hazing practices and will include coordination with the USFWS through the Section 7 consultation process.

Hazing effectiveness could be improved with implementation of additional hazing techniques such as auditory, visual and physical deterrents. Pyrotechnics would allow for aggressive dissuasion and, when combined with different noises and varying visual effects, could prove particularly effective in hazing nēnē and other wildlife at PMRF. Other auditory deterrents being considered include fog horns, cattle flags, and biosonic devices that produce predator calls. Visual deterrents such as high intensity lasers have successfully been used to haze geese on the mainland in conjunction with other hazing techniques (Portland International Airport, 2009). Lasers are considered humane and eco-friendly and can be deployed as automated systems or as hand-held portable devices; they are most effective in low-light conditions such as dawn or twilight (Portland International Airport, 2009). Finally, many airports around the country have had tremendous success using trained and certified dogs to haze wildlife, including geese. The most effective BASH programs use a combination of these techniques, to prevent wildlife from becoming habituated to any one method. The BASH working group will work together to identify and implement most effective practices in an adaptive fashion.

Management Actions:

1. Continue pursuing approval for use of novel auditory, visual, and physical deterrents to effectively haze nēnē.

STRATEGY 1-5. Increase hazing efforts for nēnē to preclude them from breeding in areas adjacent to the airfield. (ST)

Most current hazing efforts at PMRF are aimed at preventing nēnē presence in the AOA. USDA-WS currently hazes from the Nohili Road Curve to north of Nohili Ditch (Figure 12), and does not discourage nēnē nesting elsewhere at Barking Sands.

Increasing the hazing effort prior to, and during the nēnē breeding season so as to preclude nēnē from nesting in areas on the airfield is critical. Nest-preventative hazing is more involved than hazing loafing flocks, which once scared, generally disperse for the day. Once a nēnē pair has chosen an area for nesting they are difficult to effectively haze from the area before a nesting attempt is made. Pre-nesting adults must be hazed intensively multiple times a day. Any nesting pairs spotted repeatedly within 5000 ft of the airfield will be hazed intensively until the pair abandons the area or evidence of nesting is found.

In response to a 2017 pair that nested 75m from the approach end of Runway 34 despite dedicated hazing during airfield operational hours, the PMRF BASH Working Group is working to develop a protocol to better prevent nēnē from nesting near the airfield. One strategy is to clear all nesting vegetation from Kini Kini Ditch, and another is to expand hours of hazing coverage. If a pair is observed on three consecutive days exhibiting nesting behavior within the Nēnē Nest Exclusion Zone, hazing coverage will be expanded to include weekends and evenings to prevent nesting attempts, provided by the Command Duty Officer. Expanded hazing will be considered prior to the three day bench mark if the weekend or holidays would factor into those initial three days, e.g., if a pair is repeatedly observed on Thursday and Friday Command Duty Officer's (CDO) may monitor and haze the pair over the weekend if deemed necessary.

All nesting within the lateral clear zones (CZ's) of the taxiway and runway will be disallowed to protect adult nēnē as well as human health and safety. If a nēnē pair nests within the exclusion zone despite best hazing practices, the nest should be removed for human and nēnē safety. The 2014 BO mandates coordination with USFWS prior to

implementation of any actions affecting a nēnē nest. In order to expedite coordination and implementation, the afore-mentioned protocol will also cover nest removal and destruction. PMRF will continue to pursue options to translocate eggs into available nests.

Management Actions:

1. Plan for expanded hazing coverage in response to nesting behavior on the airfield. Offer hazing training for all CDOs by August 2017.
2. Finalize SOP for emergency action to remove nēnē nests within the Nēnē Nest Exclusion Zone, with USFWS and DOFAW coordination by July 2017.
3. Pursue an option to translocate eggs into foster nests, if available, with USFWS and DOFAW.

Figure 11. Nēnē Nest Exclusion Zone. Area of PMRF to exclude all nēnē nesting, generated from the lateral clear zones for the runway and taxiway.

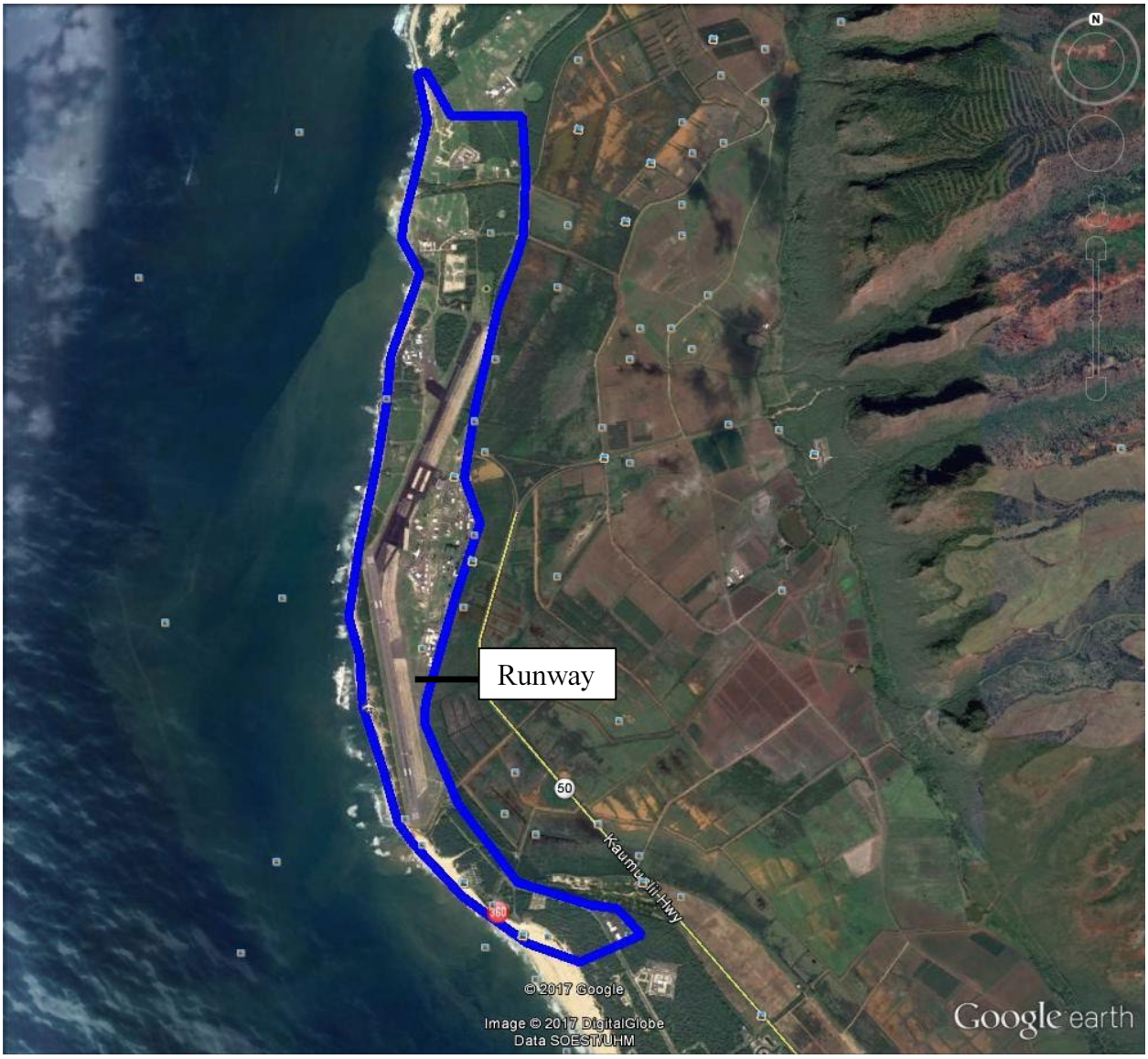

Figure 12. Area of coverage by USDA-WS for nēnē hazing at PMRF, July 2017

STRATEGY 1-6. Review and revise current Wildlife Hazard Assessment and Wildlife Hazard Management Plans in respect to nēnē. (ST)

USDA-WS prepared a WHA for the PMRF airfield in 2013, and a draft WHMP in 2016. This plan was never finalized; however, some of the actions recommended in the plan have been implemented. The management actions described under Objective 1 are meant to support BASH program goals with respect to nēnē as described in that draft. USDA-WS is currently collecting data to support informed revisions to the WHA. A revised WHA and WHMP will likely provide additional insight and actions that will modify the actions currently described above in Objective 1.

NR management is dynamic and the WHA, WHMP, and this NMP should be reviewed annually.

OBJECTIVE 2 – REDUCE NĒNĒ INJURY/MORTALITY AT PMRF ASSOCIATED WITH MILITARY PRESENCE (EXCEPT AS RELATED TO BASH) TO A MAXIMUM OF TWO INCIDENTS PER YEAR BY 2020

STRATEGY 2-1. Standardize SOPs for notification and response actions when nēnē nests are observed (ST).

The NR program established standard protocols for nest response in FY17: flag the nest, record parent bands and the date the nest was first observed, notify Facilities Manager who will then notify landscaping contractors to avoid disrupting the nesters, notify NR Manager, USFWS, and DOFAW within one business day, and set up a 25 mph zone if the nest is less than 50 m from a main road. A 25 mph zone will also be established for any areas where families are repeatedly observed. Field biologists will prepare a nesting summary notifying agency partners of all nest fates, to be included in the PMRF nēnē summary submitted by June. See Strategy 4-2.

NR Biologists will continue to train PMRF personnel to recognize nesting behavior and to notify the NR program of any perceived nesting attempts.

Management Actions:

1. Increase awareness of nēnē nesting behaviors and notification channels at PMRF, through training and outreach.

STRATEGY 2-2. Improve preventative measures along roads where nēnē are frequently observed, such as road signage, rumble strips, or speed bumps. (ST & LT)

There are currently several permanent signs at PMRF Barking Sands installed to minimize vehicular collisions with nēnē in areas where vehicle strikes have occurred (Figure 13a). However, despite signs posted in the Nohili Road Curve area, two adults and two goslings were struck in a three-month period in FY17.

The NR program will pursue other more effective preventative measures in this area as well as other problem areas that arise in the future: temporarily or permanently decreasing the speed limit; attach flags or lights to existing signage to increase visibility (Figure 13b); changing signage strategy as Yosemite National Park did in 2005, posting signs where wildlife strikes occurred to increase visitor awareness (Figure 13c); or even constructing speed bumps or rumble strips to attract driver attention and slow down traffic.

Additionally, if a nēnē family with young goslings is routinely observed along a specific section of road, fencing might be used to good effect to prevent the family from accessing the roadway. NR personnel would consult with PW, USDA-WS, USFWS, and DOFAW as needed to implement a strategy such as this.

Management Actions:

1. Increase visibility of permanent signage.
2. Pursue more permanent options to decrease speed of traffic if signage is not effective.
3. Consider temporary barriers in response to young goslings frequenting roadsides.

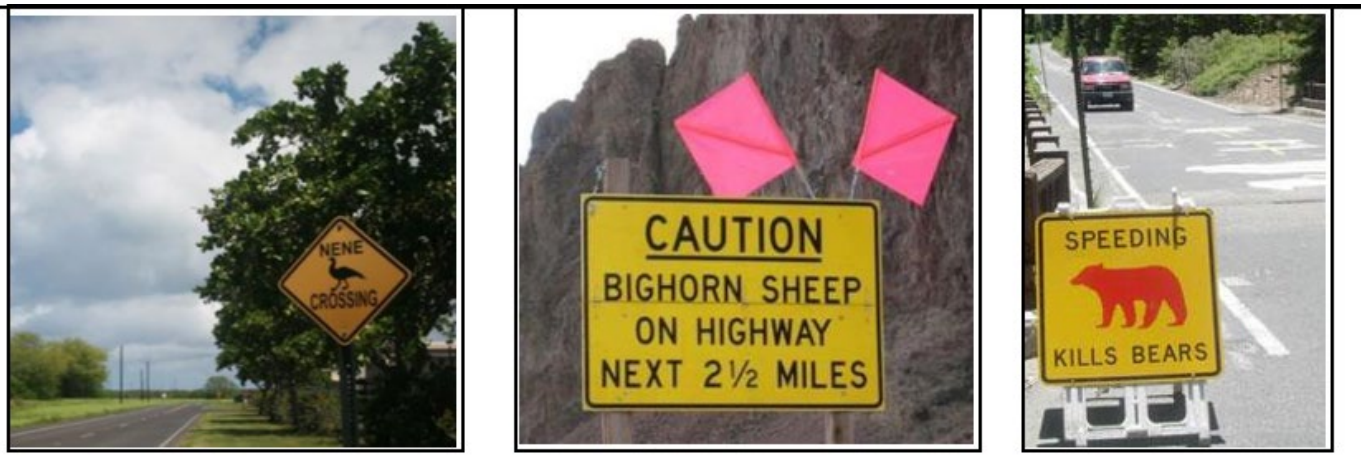

Figure 13. a) PMRF nēnē crossing sign fronting Nohili Road Curve area; b) Enhanced wildlife vehicle collision sign with flagging; c) "Red Bear, Dead Bear" sign posted at Yosemite National Park marking areas where wildlife strikes occurred along the highway

STRATEGY 2-3. Implement training to increase awareness of presence of nēnē on base, guidelines for notification and response, rules for pets on base, nēnē biology and protected status. (ST)

By growing awareness of nēnē at PMRF, many of the human-nēnē conflicts at the facility could be avoided. Additionally, by offering notification channels for nesting, injured, or dead nēnē, management will be more effective at the institution.

NR Program will prepare outreach materials aimed at distributing information to all personnel at PMRF. The NR program developed basic informational sheets to be distributed to Beach Cottage visitors in FY17. The program will also develop additional programs to educate PMRF residents and employees on species biology, various nēnē behaviors, threats to species recovery (e.g., loose dogs, feeding, vehicles), and current recovery efforts.

Management Actions:

1. Develop printed materials such as printed brochures, fact sheets, or signs for widespread distribution and education.
2. Increase awareness by distributing magnets or stickers to spread a program message.
3. Develop an internet-based education approach, to include utilizing social media in cooperation with public affairs and creating a PMRF NR web page.

OBJECTIVE 3 – CONTINUE TO DEVELOP A COMPREHENSIVE PREDATOR CONTROL PLAN TO REDUCE NĒNĒ INJURY AND MORTALITY DUE RESULTING FROM PREDATORS.

STRATEGY 3-1. Identify predator population on base and prioritize areas for predator control actions. Target species include feral cats, dogs, pigs, barn owls, rats, and mongoose should they become established on the island.

(ST)

The predator control (PC) program has identified predator populations at Barking Sands, Makaha Ridge, and Kokee Sites. PC efforts are focused in areas around Migratory Bird Treaty Act (MBTA) and Endangered Species Act (ESA) species' flocking and nesting sites, including those areas that regularly harbor nēnē. Potential predators include feral and free-ranging dogs (*Canis lupus familiaris*), feral and free-ranging cats (*Felis silvestris catus*), rats (*Rattus* spp.), and feral pigs (*Sus scrofa*). Additionally, the introduced Barn Owl (*Tyto alba*) may prey upon nēnē goslings and should be included in predator surveys. Should mongoose (*Herpestes javanicus*) be sighted or captured during predator control measures, Kauai Invasive Species Committee (KISC) will be immediately notified.

Drafted management plans pertaining to predator control at PRMF facilities will be specific, adaptive, and provide detailed protocols to ensure continuity, repeatability, and accountability.

Management Actions:

1) High priority areas have been identified for predator control where large predator populations and frequently used areas by nēnē overlap.
2) Protocols will continue to be developed to address all predator species across all PMRF sites.

STRATEGY 3-2. Integrate monitoring for predators to support evaluation of effectiveness of predator control actions. (ST)

Standardized predator population monitoring will be incorporated into the PC program. Monitoring tools may include wax bait blocks, trail cameras, chew cards, and/or tracking tunnels. Quarterly summaries will be prepared reporting population updates, trapping effort, and program plans/goals for the following quarter. This will ensure an adaptive program, consistently identifying and responding to immediate program needs.

Management Actions:

1) Use peer-reviewed methods to monitor predator populations across PMRF Barking Sands, Makaha Ridge Tracking Station, and Kokee sites.

STRATEGY 3-3. Increase awareness and enforcement of Navy policy regarding feral cats and loose dogs through improved training and outreach. (ST)

Navy policy prohibits feeding of feral cats on all Navy installations (CNO Policy Letter dated 10 JAN 2002, OPNAV M-5090.1). Feral cats pose a significant threat to nēnē and other listed species found at Barking Sands. Recent trapping efforts at PMRF have identified a large feral cat population at Barking Sands that may be in part sustained by well-meaning, yet uninformed individuals. NR and PC programs will increase outreach and education efforts to improve awareness of the CNO policy on feral animal feeding, and the impacts that such feeding has on protected species. Additionally, NR personnel will increase efforts to educate people of the danger unleashed dogs pose to native and protected wildlife. Awareness training will be targeted at military personnel, civilian employees, resident families, TDY personnel, and visitors at PMRF. Media for improving awareness may include printed brochures, fact sheets, posted signs, base newspapers, trainings, and internet notification.

NR works closely with Security Forces to train personnel on the above risks, and has developed protocols for improving reporting and enforcement efforts concerning the no feeding directive, in conjunction with Conservation Law Enforcement Program requirements for the base.

Management Actions:Explain need for Conservation Law Enforcement, and continue to secure support of

Command and Security personnel at PMRF in light of continuous personnel changeover.

1) Develop educational materials and media targeted toward ill effects on wildlife as a result of feeding feral animals and failing to keep dogs on leashes.
2) Enact the established reprimand and educational protocol for individuals found feeding feral or wild animals, as well as those who let dogs run loose.

OBJECTIVE 4 – REVIEW THE NĒNĒ MANGEMENT PLAN ANNUALLY AND IDENTIFY OPPORTUNITIES FOR IMPROVEMENT.

STRATEGY 4-1. Implement standardized monitoring to track the baseline nēnē population. (ST)

Standardized basewide nēnē surveys have been conducted approximately twice a week at PMRF since July 2016. These surveys over time will allow the NR program to track individuals on base as well as seasonal and annual population fluctuations. Monitoring will also provide documented population and individual response to implemented strategies.

Management Actions:

1) Continue performing standardized basewide nēnē surveys at PMRF.
2) Compile annual reports on nesting activity and population demographics.

STRATEGY 4-2. Review new information obtained through implementation of the management plan annually, and evaluate for overall effectiveness and efficiency of meeting stated objectives. (ST)

NR will draft a report to be completed by the beginning of June each year, addressing progress in meeting each of the objectives outlined in the PMRF Nēnē Management Plan. At this time, each management strategy will be addressed as completed, in progress, or no longer the best management strategy with current data. This plan will also provide a PMRF nēnē population summary to include prior year's nesting information, as well as predator control efforts targeted at protecting nēnē. This report will be dispersed to the BASH working group as well as state and federal partner agencies.

Management Actions:

1) Compile annual report on nesting activity and population demographics in June.
2) Address status of each objective of NMP in annual report.
3) Send report to all stakeholders and schedule meeting reviewing NMP.

STRATEGY 4-3. Establish a working group with the NR staff and key stakeholders with responsibilities in the implementation of this management plan. Meet annually to review changes to mission needs, population update as identified in Strategies 4-1 and 4-2 above, and recommend changes to the plan. (ST)

After reviewing the report as outlined in Strategy 4-2, the NR program will arrange one or several working groups addressing nēnē annually to include the BASH working group and state partners. The BASH working group includes airfield, USDA-WS, NR, executive officer, and public works personnel. Suggested time for this review and editing of the plan is June/July between nesting seasons.Concerns/suggestions aired at these meetings should be documented, to be referred to in the future if needed.

If all parties agree on strategy or objective modifications, edits to the NMP will be documented and made following this meeting. Each version of the plan will be saved and archived with a date and version number attached. The most current version of the NMP will be dispersed to all stakeholders.

USFWS will submit an independent recommendation pertaining to the Navy's effectiveness in implementing the strategies outlined in this plan and compliance with BO requirements.

Management Actions:

1) Compile annual report on nesting activity and population demographics in June.
2) Address status of each strategy of NMP in annual report.
3) Send report to all stakeholders and schedule meeting reviewing NMP.

OBJECTIVE 5 – IDENTIFY OPPORTUNITIES FOR MULTIPURPOSE USE AT PMRF TO PROVIDE CONSERVATION BENEFIT TO NĒNĒ.

STRATEGY 5-1. Conduct studies to improve understanding of nēnē population dynamics at PMRF. Studies to start with surveys that can be implemented within the next two years with existing funding. (ST)

Field biologists will incorporate recording behavior into standardized surveys. For each group of nēnē, foraging, loafing, or breeding behavior will be recorded. All incidences of molting are to be noted as well.

Additionally, biologists will establish a protocol to collect data on vegetation type/structure in areas where nēnē frequent. This may be documented during the biweekly nēnē surveys, or through a separate vegetation monitoring strategy.

Finally, placing game cameras on active nests would be valuable in documenting potential nest depredation events and informing management strategies.

STRATEGY 5-2. Identify additional research objectives that could be of value to nēnē management at Barking Sands, justify the expenditure within the scope of the PMRF NR program, and request funding to implement these additional studies. (LT)

Various other studies may be of value to nēnē management at Barking Sands. These long term additional research objectives will be discussed each year at the NMP meeting. For this strategy,

objectives should directly address nēnē management at PMRF and should be implemented on property. A "wish list" will be established among all stakeholders and as funding is available, NR will conduct projects addressing these research objectives.

Management Actions:

1) Schedule NMP Stakeholder meeting.
2) Compile a research objective list with input from all parties on ranking of objective priority – protection of human life and mission capability will be of highest priority to PMRF. Program funding for established future research objectives.

OBJECTIVE 6 – IMPROVE UNDERSTANDING OF HOW NĒNĒ AT PMRF INCORPORATE INTO THE REGIONAL NĒNĒ POPULATION AND IDENTIFY PARTNERING OPPORTUNITIES TO SUPPORT CONSERVATION OF NĒNĒ AS A SPECIES

STRATEGY 6-1. Maintain close coordination with Sikes Act Partners with nēnē programs to share data and identify opportunities to integrate the PMRF nēnē management with other nēnē conservation programs. (ST)

NR program will continue to notify Sikes Act Partners of any nēnē nesting or mortality incidents at Barking Sands immediately, and meet quarterly to discuss NR Program updates and status. These quarterly meetings can serve as an opportunity to update one another of research or conservation initiatives each agency is currently implementing or planning.

PMRF will contribute to regional nēnē projects as funding is available, especially those with direct implications for informed management on installation. Potential projects include, but are not limited to, tracking nēnē families with satellite tags or telemetry, contributing to an interagency diet study, and improving rehabilitation facilities.

Management Actions:

1) Continue reporting all nesting, injury, and mortality events.
2) Continue collaborating with DOFAW for standardized nēnē monitoring and banding efforts.
3) Discuss nēnē update in quarterly NR meetings, and maintain communication on upcoming island- wide or regional projects to which the Navy could contribute.

STRATEGY 6-2. Establish and maintain partnership and open communication lines with private and public landowners surrounding PMRF. (LT)

As the nēnē population grows, and surrounding land use changes, integrated landscape management will be important for protection of mission capability at PMRF. NR program should work with various agriculture and state agencies that own proximate land to the facility, in the efforts of long term and comprehensive monitoring and conservation of the population.

Management Actions:

1) Work with Community Planning Liaison Officer (CPLO) and Public Affairs Officer (PAO), with command approval, to establish a community working group. Members will discuss

regional nēnē management objectives and concerns.

2) Attempt to gain access to surrounding lands to monitor region population or regional nesting data, with landowner approval, through physical access or aerial surveys with drone technology.

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APPENDIX G – PROTECTED SPECIES OUTREACH MATERIALS

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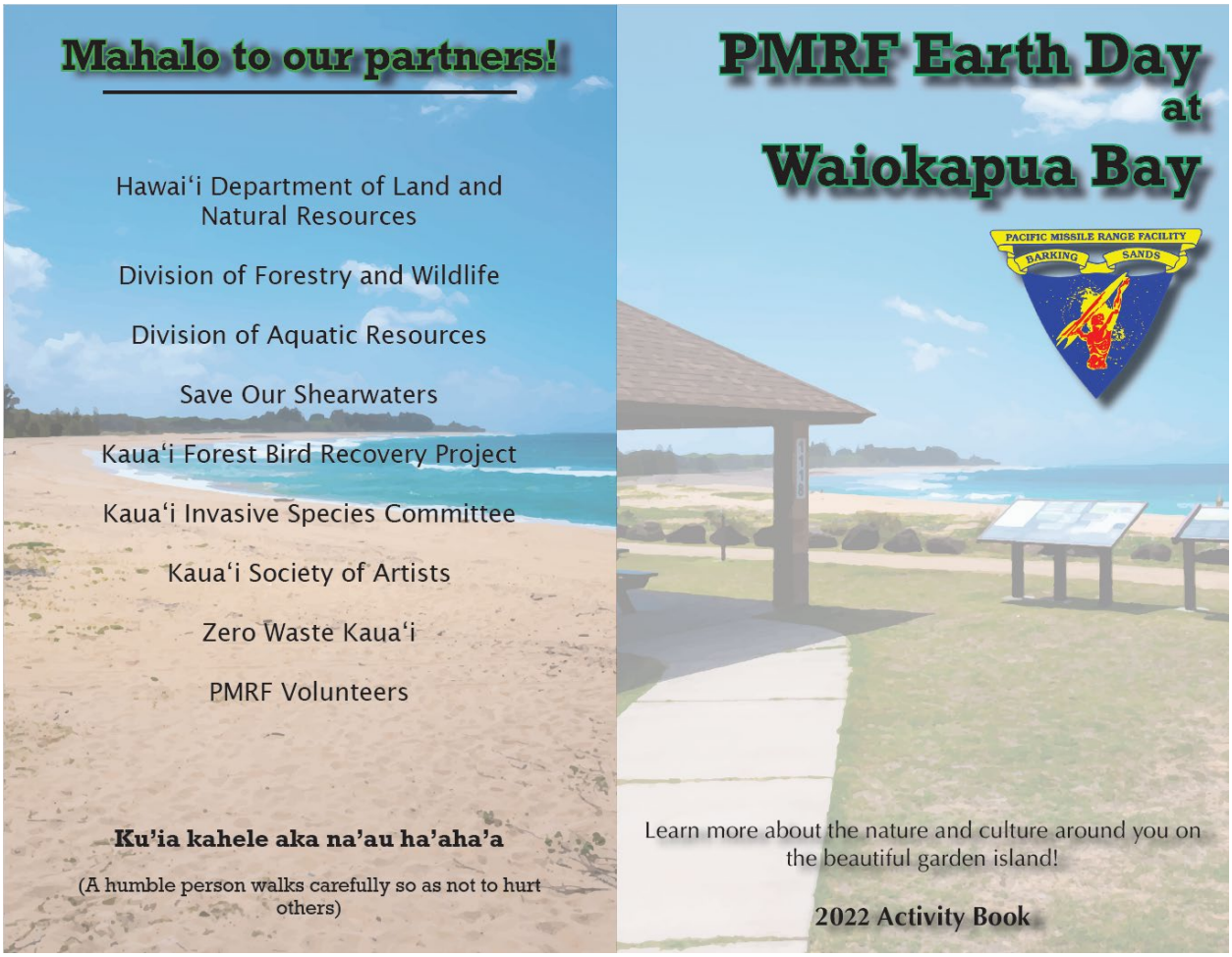
PMRF Earth Day at Waiokapua Bay 2022 Activity Book



Take a look around you!

Use this list to notice the beautiful nā mea kanu (plants) and holoholona (animals) around you! Mark a tally for each time you see nā mea kanu or holoholona listed below.

Hala - *Pandanus Tectorius* _____ Sightings

Ulu - *Artocarpus altilis* _____ Sightings

A`ali`i - *Dodonaea viscosa* _____ Sightings

Naupaka kahakai - *Scaevola taccada* _____ Sightings

`alae ke`oke`o - *Fulica alai* _____ Sightings

ae`o - *Himantopus mexicanus knudseni* _____ Sightings

nēnē - *Branta sandvicensis* _____ Sightings

`ua`u kani - *Puffinus Pacificus* _____ Sightings

Add your own list here:

_____ _____ Sightings

_____ _____ Sightings

_____ _____ Sightings

_____ _____ Sightings

_____ _____ Sightings

How can you help protect this beautiful island?

Here are some tips to help you and your 'Ohana be mindful every day.

Don't feed wildlife

Keep your pets on a leash

Don't step on vegetation, you never know if it's important

Don't leave trash behind at the beach

Plant indigenous species, not invasive species

Use less plastic

Use reef safe sunblock at the beach

Look for re-usable products like bags, bottles, straws

Can you think of any more tips?:

_____

_____

_____

_____

_____

_____

Holoholona hiding in plain sight!

Use these photos and facts to learn about the holoholona (animals) hiding in plain sight!

Name: `Alae ke`oke`o - Hawaiian Coot - *Fulica alai*

Did you know?: The white growth on the forehead is called a "frontal shield." Some individuals of this species can have dark red coloration at the base of their frontal shield. Have you seen one of these unique coots?

Name: Ae`o - Hawaiian Stilt - *Himantopus mexicanus knudseni*

Did you know?: Younger ae`o who are not quite ready to have a family of their own have more white feathers on their cheeks and necks than adults. Their legs are also a lighter pink color. Can you find a young ae'o or an adult with bright pink legs?

Nā mea kanu and you!

Use these photos and facts to learn about nā mea kanu (plants) in your own back yard!

Name: Hala - *Pandanus Tectorius*

Uses: Woven mats, dried seeds were used as paintbrushes

Location on base: South-west corner of Pass & ID Gate Parking Lot

Name: Ulu (Breadfruit) - *Artocarpus altilis*

Uses: Food

Location on base: Waiokapua Bay

Nā mea kanu and you!

Use these photos and facts to learn about the nā mea kanu (plants) in your own back yard!

Name: A`ali`i - *Dodonaea viscosa*

Uses: Lei making

Location on base: Kawai`ele Water Bird Sanctuary, and on base

Name: Naupaka Kahakai - *Scaevola taccada*

Uses: Erosion control, provides shade

Location on base: Kawai`ele Water Bird Sanctuary, and on base

Holoholona hiding in plain sight!

Use these photos and facts to learn about the holoholona (animals) hiding in plain sight!

Name: Nēnē - Hawaiian Goose - *Branta sandvicensis*

Did you know?: Fossil remains of 7 duck and geese-like species have been discovered in Hawai'i. Evidence suggests some of these birds were giant compared to our present day nene.

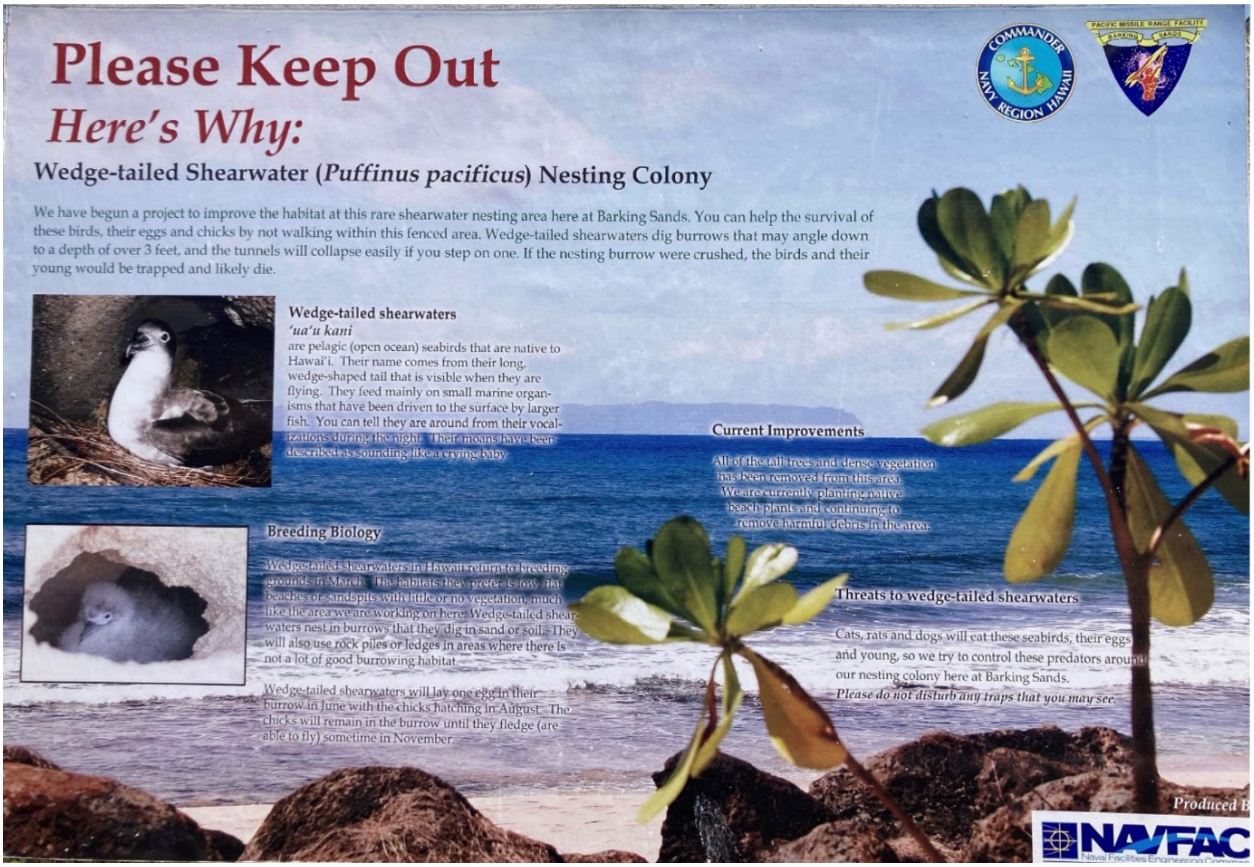
Name: `Ua`u kani - Wedge-tailed Shearwater - *Puffinus Pacificus*

Did you know?: The `ua`u kani's name sounds a lot like the sound they make in their burrows at night, a spooky oooaaaHHHHoooo call. You can even hear babies calling to their parents in a higher pitched tone between August-November!

Wedge-tailed Shearwater Colony Signs

Wedge-tailed Shearwater Colony Signs

Wedge-tailed Shearwater Colony Informational Sign



Endangered Seabird Lighting Restrictions Sign at Majors Bay

Endangered Seabird Lighting, Dark Skies Brochure

Shearwater Fledging Season at PMRF

In the mountains of Kauai, during **September - December**, young endangered seabirds leave their nests for the first time and journey out to the ocean. This process is called "fledging" with many seabirds **taking their first flight near PMRF at night** and using the moon and starlight to navigate to sea to hunt for the first time.

Artificial light can disorient these young birds and cause them to circle lights in confusion. Eventually, they **may "fallout" in exhaustion and are typically unable to take flight again without help**. These birds are in need of immediate assistance due to their vulnerability to predators, vehicle strikes, and dehydration.

As these birds are a **federally protected endangered species**, seabird fallout can cause disruptions in PMRF operations. **To support the PMRF Dark Skies Program and protect these rare Hawaiian birds please refer to the information in this pamphlet.**

Photo Credit: "Save Our Shearwaters"

Learn More

PMRF, Natural Resources Webpage:
http://www.cnic.navy.mil/regions/cnrh/installations/pacific_missile_range_facility_barking_sands/about/resources.html

Save Our Shearwaters Project, *Kaua'i Humane Society*:
http://kauaihumane.org/programs-services/save-our-shearwaters

Kaua'i Endangered Seabird Recovery Project:
http://kauaiseabirdproject.org

PMRF Contacts

PMRF Natural Resources Hotline
(808) 208-4416

PMRF Natural Resources Manager
Office: (808) 335-7507

Installation Environmental Program Director
Office: (808) 335-4064

PMRF Dark Skies Program

Protecting PMRF Mission and Endangered Seabirds

Shearwater Fledging Season (September 15 — December 15)

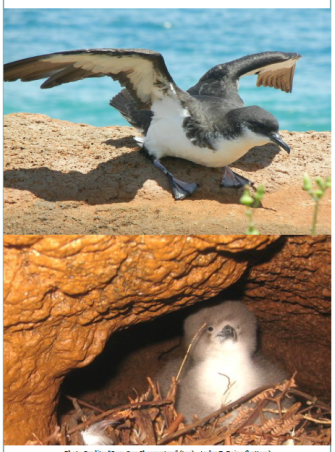


Photo Credits: "Save Our Shearwaters" (top), Andre F. Raine (bottom)

PACIFIC MISSILE RANGE FACILITY (PMRF)
KAUA'I, HI

How you can protect PMRF Mission and Endangered Seabirds:

1. SUPPORT THE PMRF DARK SKIES PROGRAM

During the hours of 1800 - 0600:

- Turn off all unnecessary outdoor lighting
- Draw curtains and blinds

2. CONTROL YOUR PETS

- It is an official PMRF Base Policy to have pets leashed and supervised at all times
- Please do not feed any wildlife or feral animals

3. BE AWARE

If you find a seabird, please refer to the enclosed guide for species of concern. Note time, location, and condition of the seabird and call the:

PMRF Natural Resources Hotline (808) 208-4416

DO NOT give food or water to the seabird and stay 20 ft. away

Seabird I.D guide
SPECIES OF CONCERN FOR FALLOUT

Newell's Shearwater / ʻAʻo

Description: Dark black back and white underneath. No white on forehead.

Hawaiian Petrel / ʻUaʻu

Description: Dark grey back and white underneath. Distinguished from the Newell's Shearwater by the white above its beak and lighter grey color.

IMPORTANT NOTE:
The above species nest in burrows in the mountains and fledglings over PMRF to the ocean. If either of these birds are seen at PMRF they are in need of immediate assistance. These birds are federally protected by the Endangered Species Act.

Photo Credits (front page and above): Jim Denny

Seabird I.D guide
Similar Looking Species found at PMRF

Wedge-tailed Shearwater / ʻUaʻu kani

Description: Grey or dark brown back gradually fading into light grey underneath.

IMPORTANT NOTE:
This species nests in burrows near the coast and is not as vulnerable to fallout. These birds are commonly seen around the PMRF Beach Cottages and Major's Bay.

Please only report this species if it appears injured or sick. This species is more common than the Newell's Shearwater and Hawaiian Petrel, however, it is federally protected by the Migratory Bird Treaty Act.

Photo Credits: The United States Fish and Wildlife Service

Nene sign

PMRF Native Bird Guide

Native Birds at PMRF

Hawaiian Goose

Nēnē

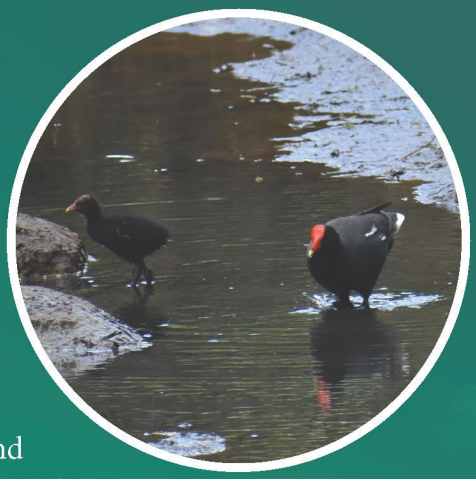
Nēnē are listed as threatened under the Endangered Species Act. They are endemic to Hawai'i, meaning they are not found anywhere else in the world. They are adapted to walking on Hawai'i's rocky lava flows by having claw like feet and less webbing than other geese. On Kaua'i, they are mainly seen on grasslands, agricultural pastures, and human modified habitat such as golf courses. They graze on grass, seeds, berries, flowers, and occasionally insects. Nēnē are the state bird of Hawai'i. Current threats to the Nēnē include introduced predators including feral cats and dogs, human disturbance (such as getting hit by cars), and habitat loss.

Hawaiian Coot

'Alae ke'oke'o

The Hawaiian Coot is endangered and is endemic to Hawai'i. It has a black head, grey body, and white shield on its face. Its legs and feet are greenish grey and its feet are lobed instead of webbed. They are found in wetlands where they eat seeds, leaves, insects, small crustaceans and fish. The Hawaiian Coot nests year round and constructs its nest on or near water. The Hawaiian Coot is one of the five native and endangered waterbirds in Hawai'i, all of which are facing similar threats. Habitat loss, introduced predators such as feral cats, and disease are among those threats.

Hawaiian Gallinule
ʻAlae ʻula



The Hawaiian Gallinule is endangered and is endemic to Hawaiʻi. It is similar in appearance to the Hawaiian Coot. However, Hawaiian Gallinules can be identified by their red shield and yellow legs in comparison to the Hawaiian Coot's white shield and dark colored legs. They can be found in freshwater habitats such as ponds and wetlands. Their variable diet includes insects, snails, vegetation, seeds, and algae. Nesting year-round, nests are constructed in secretive spots on water hidden in vegetation. Like the other native waterbirds, the Hawaiian Gallinule is threatened by habitat loss, introduced predators such as feral cats, and disease.

Hawaiian Duck
Koloa maoli

The Hawaiian Duck is endangered and is endemic to Hawaiʻi. This species is very secretive and easily spooked by people. They are found in wetland habitats and nest year-round. Like many ducks, they have a varied diet that includes insects, worms, algae, and seeds and leaves. Today, Kaua'i is the only island where pure forms of the Hawaiian Duck still exist. On the other Hawaiian Islands, interbreeding with introduced Mallard ducks have resulted in hybrid individuals. Other threats to the Hawaiian Duck include habitat loss, introduced predators such as feral cats, and disease.

Hawaiian Stilt
Ae'o

The Hawaiian Stilt is endangered and is endemic to Hawai'i. It is a slender waterbird with tall pink legs, white belly, and black head and back. It has a long and thin black bill, which it uses to prey on insects, worms, small crustaceans and fish. It is found in wetlands with shallow water or mudflats. Hawaiian Stilts nest between March and August in mudflats with low vegetation or in ponds. Threats to these elegant waterbirds include habitat loss, introduced predators such as feral cats, and disease.

Pacific Golden-Plover
Kōlea

The Pacific Golden-Plover breeds on tundra in western Alaska and Russia during the summer months. Many individuals spend their winters on the Hawaiian Islands where they are often seen on grasslands, tidal flats, or agricultural fields. Their diet includes mainly insects and occasionally seeds and berries. Pacific Golden-Plovers shed their feathers and grow new ones for the summer breeding season through a process called molting. They molt their feathers once again after nesting.

Hawaiian Short-eared Owl
Pueo

The Hawaiian Short-eared Owl is an endemic subspecies. These charismatic owls can be seen soaring over open fields where they hunt for small mammals and birds during the day. Little information is known about this subspecies of Short-eared Owl as they can be quite secretive in their breeding habits and difficult to observe for long periods of time. These birds are likely relatively new arrivals to the islands, appearing after Polynesian settlement.

Black-crowned Night Heron
ʻAukuʻu

Adult Black-crowned Night Herons have a black back and cap on their heads with grey wings and whiteish bellies. Juveniles are brown overall with white streaks or spots. They are common in waterways and wetlands where they forage for insects, fish, frogs, and other young waterbirds. Unlike the Black-crowned Night Herons on mainland North America, the individuals in Hawaii primarily hunt during the day instead of night. They breed between December and August, constructing large nests made of twigs in vegetation low to the ground.

Laysan Albatross

Mōlī

The Laysan Albatross is a large seabird that returns to land only to breed. It travels great distances across the ocean and breeds mainly in the Hawaiian Islands. Like many other seabirds, the Laysan Albatross returns to the same location it was born in order to breed and it lays only one egg. Eggs are laid between November and December, and chicks fledge in July. It is mostly white with black wings and tail. The oldest known Laysan Albatross is named Wisdom and she is at least 69 years old. Wisdom breeds on Midway Atoll National Wildlife Refuge in the Northwestern Hawaiian Islands.

dark morph (left), pale morph (right)

Wedge-tailed Shearwater
ʻUaʻu kani

The Wedge-tailed Shearwater is a nocturnal seabird that digs underground burrows or nests in rock crevices. Its call sounds like a series of wails and moans. This shearwater is commonly seen breeding in colonies along coastlines. Starting in March, they return to the same location they were born to breed. They lay only one egg per season, and the chicks fledge in November-December. These shearwaters fly out to sea during the day to fish and return to their burrows at night. Wedge-tailed Shearwaters have two color morphs: pale and dark. Some individuals have a lighter grey belly (pale morph) and some have a darker grey belly (dark morph).

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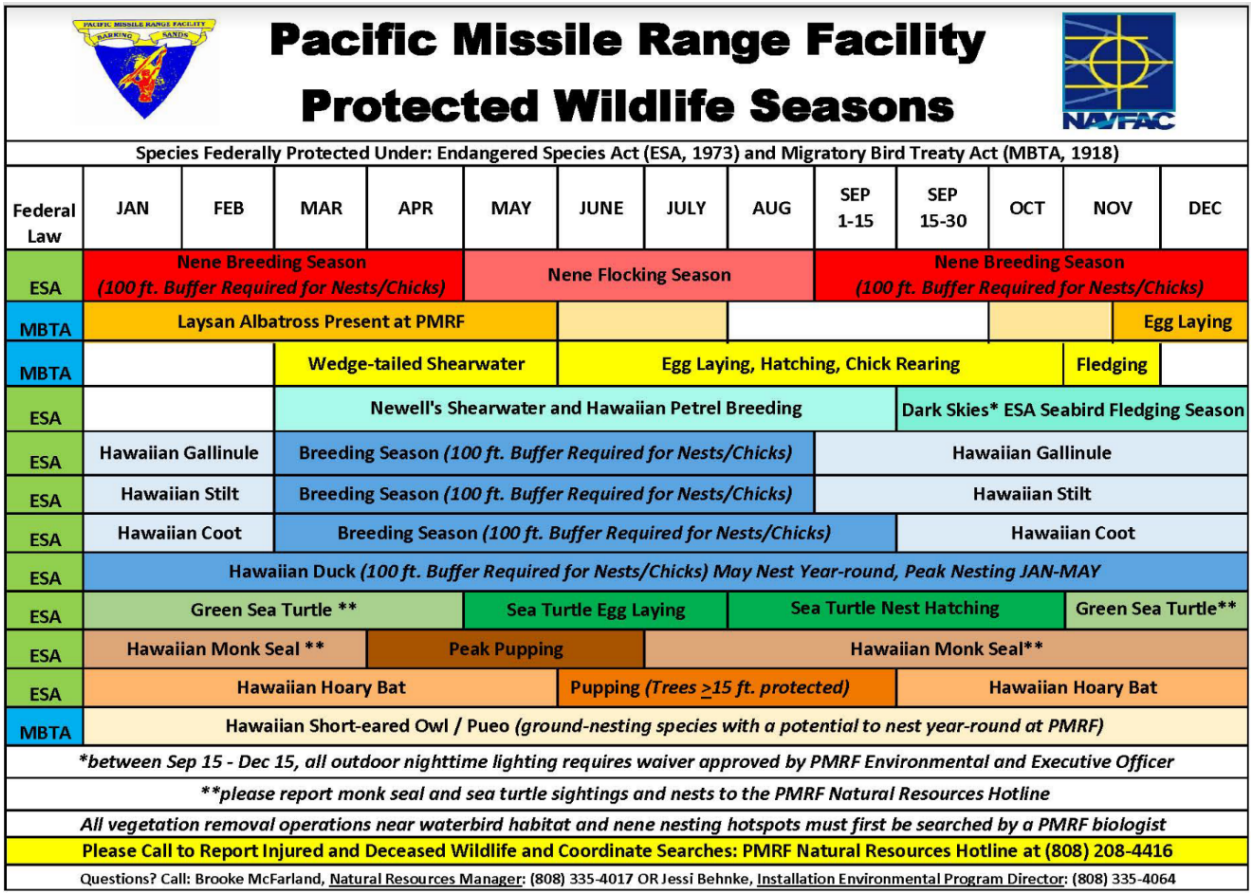
PMRF Protected Wildlife Seasons Chart



Pacific Missile Range Facility

Protected Wildlife Seasons

Species Federally Protected Under: Endangered Species Act (ESA, 1973) and Migratory Bird Treaty Act (MBTA, 1918)

Federal Law	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP 1-15	SEP 15-30	OCT	NOV	DEC
ESA	Nene Breeding Season *(100 ft. Buffer Required for Nests/Chicks)*				Nene Flocking Season				Nene Breeding Season *(100 ft. Buffer Required for Nests/Chicks)*				
MBTA	Laysan Albatross Present at PMRF												Egg Laying
MBTA			Wedge-tailed Shearwater			Egg Laying, Hatching, Chick Rearing						Fledging	
ESA			Newell's Shearwater and Hawaiian Petrel Breeding							Dark Skies* ESA Seabird Fledging Season			
ESA	Hawaiian Gallinule		Breeding Season *(100 ft. Buffer Required for Nests/Chicks)*						Hawaiian Gallinule				
ESA	Hawaiian Stilt		Breeding Season *(100 ft. Buffer Required for Nests/Chicks)*						Hawaiian Stilt				
ESA	Hawaiian Coot		Breeding Season *(100 ft. Buffer Required for Nests/Chicks)*							Hawaiian Coot			
ESA	Hawaiian Duck *(100 ft. Buffer Required for Nests/Chicks) May Nest Year-round, Peak Nesting JAN-MAY*												
ESA	Green Sea Turtle **				Sea Turtle Egg Laying			Sea Turtle Nest Hatching				Green Sea Turtle**	
ESA	Hawaiian Monk Seal **			Peak Pupping			Hawaiian Monk Seal**						
ESA	Hawaiian Hoary Bat					Pupping *(Trees >15 ft. protected)*				Hawaiian Hoary Bat			
MBTA	Hawaiian Short-eared Owl / Pueo *(ground-nesting species with a potential to nest year-round at PMRF)*												

**between Sep 15 - Dec 15, all outdoor nighttime lighting requires waiver approved by PMRF Environmental and Executive Officer*

***please report monk seal and sea turtle sightings and nests to the PMRF Natural Resources Hotline*

All vegetation removal operations near waterbird habitat and nene nesting hotspots must first be searched by a PMRF biologist

Please Call to Report Injured and Deceased Wildlife and Coordinate Searches: PMRF Natural Resources Hotline at (808) 208-4416

Questions? Call: Brooke McFarland, Natural Resources Manager: (808) 335-4017 OR Jessi Behnke, Installation Environmental Program Director: (808) 335-4064

APPENDIX H – ENVIRONMENTAL ASSESSMENT FOR PMRF INRMP

Following review and approval, the Environmental Assessment will be appended here.

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