

Draft

Integrated Natural
Resources Management
Plan for

Joint Base Pearl Harbor-
Hickam, O'ahu
September 2022

Appendices

Prepared for:
Naval Facilities
Engineering Systems
Command, Hawaii



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Appendix A

Acronyms and Abbreviations

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APPENDIX A

ACRONYMS AND ABBREVIATIONS

%	Percent
°	degree
°C	degrees Celsius
°F	degrees Fahrenheit
AFB	Air Force Base
AIS	Aquatic Invasive Species
AT/FP	Anti-Terrorism/Force Protection
BASH	Bird/Wildlife Aircraft Strike Hazard
BMP	Best Management Practice
BO	Biological Opinion
BRAC	Base Realignment and Closure
C5ISR	Command, Control, Communications, Computers, Combat Systems, Intelligence, Surveillance, and Reconnaissance
cal.	Caliber
CCH	City and County of Honolulu
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESU	Cooperative Ecosystem Studies Units
CFR	Code of Federal Regulations
Cl ⁻	chlorides
cm	centimeter
cm/sec	Centimeter per second
CNIC	Commander, Navy Installations Command
CNO	Chief of Naval Operations
CNRH	Commander, Navy Region Hawaii
COMNAVREGHIINST	Commander, Navy Region Hawaii Instruction
COMPACFLT	Commander U.S. Pacific Fleet
CWA	Clean Water Act
CWB	Clean Water Branch
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DAR	Division of Aquatic Resources
DLA	Defense Logistics Agency
DLNR	Department of Land and Natural Resources
DoD	Department of Defense
DoDI	Department of Defense Instruction
DoDM	Department of Defense Manual
DOFAW	Division of Forestry and Wildlife
DON	Department of the Navy
DOT	Department of Transportation
DPS	Distinct Population Segment
DRMO	Defense Reutilization Marketing Office
DRSL	DoD Regional Sea Level
EA	Environmental Assessment
ECS	Ecosystem Component Species

EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EMS	Environmental Management System
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPA	United States Environmental Protection Agency
EPR-Web	Environmental Program Requirement Web
ERL	Environmental Readiness Level
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
FEMA	Federal Emergency Management Agency
FFD	Federal Fire Department
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
FY	Fiscal Year
GIS	Geographic Information System
HAPC	Habitat Area of Particular Concern
HDOH	State of Hawai'i Department of Health
HERO	Hazards of Electromagnetic Radiation to Ordnance
HERP	Hazards of Electromagnetic Radiation to Personnel
HFD	Honolulu Fire Department
HNHP	Hawai'i Natural Heritage Program
IEPD	Installation Environmental Program Director
IHA	Incidental Harassment Authorization
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
IS	Invasive Species
JBPHH	Joint Base Pearl Harbor-Hickam
JBPHHINST	Joint Base Pearl Harbor-Hickam Instruction
km	kilometer
LOA	Letter of Authorization
LUC	Land Use Commission
m/s	meter per second
MBTA	Migratory Bird Treaty Act
MCAS	Marine Corps Air Station
mg/L	milligram per liter
mgd	million gallons per day
MHHW	Mean Higher High Water
MILCON	Military Construction
mld	million liters per day
mm	millimeter
MMPA	Marine Mammal Protection Act
MOU	Memorandum of Understanding
MPRSA	Marine Protection, Research, and Sanctuaries Act
MSC	Military Sealift Command
MSF	Magnetic Silencing Facility
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level

MU	Management Unit
MUS	Management Unit Species
MWR	Morale, Welfare, and Recreation
NAS	Naval Air Station
NASBP	Naval Air Station Barbers Point
NAVCOMSTA	Naval Communications Station
NAVFAC	Naval Facilities Engineering Systems Command
NAVFAC HI	Naval Facilities Engineering Systems Command Hawaii
NAVFAC PAC	Naval Facilities Engineering Systems Command Pacific
NAVMAG PH	Naval Magazine Pearl Harbor
NAVSUP FLC	Naval Supply Systems Command Fleet Logistics Center
NCTAMS EASTPAC	Naval Communications Area Master Station, Eastern Pacific
NCTAMS PAC	Naval Computer and Telecommunications Area Master Station Pacific
NDSA	Navy Defensive Sea Area
NEPA	National Environmental Policy Act
NEX	Navy Exchange
NHL	National Historic Landmark
NISMO	Naval Inactive Ship Maintenance Office
NMC EAD DET PH	Naval Munitions Command Pacific East Asia Division, Detachment Pearl Harbor
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRH	Navy Region Hawaii
NRHP	National Register of Historic Places
NRTF	Naval Radio Transmitter Facility
NSW	Naval Special Warfare
NTU	Nephelometric Turbidity Unit
NUWC	Naval Undersea Warfare Center
NWI	National Wetland Inventory
NWP	Nation Wide Permits
OANRP	O'ahu Army Natural Resources Program
OISC	O'ahu Invasive Species Committee
OPNAV M	Office of the Chief of Naval Operations Manual
OPNAV	Office of the Chief of Naval Operations
OPNAVINST	Office of the Chief of Naval Operations Instruction
OSD	Office of the Secretary of Defense
PHNC	Pearl Naval Harbor Complex
PHNSY & IMF	Pearl harbor Naval Shipyard and Intermediate Maintenance Facility
PHNWR	Pearl Harbor National Wildlife Refuge
PICHTR	Pacific International Center for High Technology Research
PIFSC	Pacific Islands Fisheries Science Center
PL	Public Law
PMUS	Pelagic Management Unit Species
ppt	parts per thousand
RCUH	Research Corporation of the University of Hawaii
RFI	Radio Frequency Interference
RI	Remedial Investigation

RSL	Relative Sea Level
SECNAV	Secretary of the Navy
SECNAVINST	Secretary of the Navy Instructions
SEPP	Snail Extinction Prevention Program
SERDP	Strategic Environmental Research and Development Program
SESEF	Shipboard Electronics Systems Evaluation Facility
SGCN	Species of Greatest Conservation Need
SIMA	Shore Intermediate Maintenance Activities
SIOP	Shipyard Infrastructure Optimization Program
SLR	Sea Level Rise
SME	Subject Matter Expert
SOH	State of Hawai'i
SOP	Standard Operating Procedure
TWL	Total Water Level
U.S.	United States
U.S.C.	United States Code
UNDS	Uniform National Discharge Standards
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WFMP	Wildland Fire Management Plan
WMWP	Wai'anāe Mountains Watershed Partnership
WPRFMC	Western Pacific Regional Fishery Management Council
WQC	Water Quality Certification
WQMA	Water Quality Monitoring Assessment
WQS	Water Quality Standards
WWTP	Wastewater Treatment Plan

Appendix B
Relevant Environmental Laws, Regulations, Policies, Guidance,
Instructions, and Executive Orders

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APPENDIX B

Relevant Environmental Laws, Regulations, Policies, Guidance, Instructions, and Executive Orders

FEDERAL LAWS, REGULATIONS, AND EXECUTIVE ORDERS FOR NATURAL RESOURCES

- Animal Damage Control Act (Public Law [PL] 102-237)(7 United States Code [U.S.C.] 426 et seq.)
- Anti-Deficiency Act (31 U.S.C. 1341 et seq.)
- Archaeological Resources Protection Act (16 U.S.C. 470aa-470ll)(43 Code of Federal Regulations [CFR] Part 7)
- Brown Treesnake Control and Eradication Act (7 U.S.C. 8501 et seq.)
- Clean Air Act, as amended (42 U.S.C. 7401 et seq.)
- Clean Water Act (CWA) Sections 401 and 404 (33 U.S.C. 1251 et seq.)
- CWA Section 404(b)(1) Regulations (40 CFR 230)
- Coastal Barrier Resources Act of 1982 (16 U.S.C. 3501 et seq.)
- Coastal Zone Management Act (16 U.S.C. 1451-1465)
- Coastal Zone Management (Hawai'i Revised Statute [HRS] Chapter 205A)
- Consolidated Appropriations Act of 2005 (PL 108-447)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Superfund) of 1980, (42 U.S.C. 9601 et seq.)
- Conservation and Rehabilitation Program on Military and Public Lands, as amended (16 U.S.C. 670 et seq.)
- Conservation District Rules (Hawai'i Administrative Rules [HAR] Chapter 13-5)
- Conservation of Aquatic Life, Wildlife, and Land Plants (HRS 195D)
- Coral Reef Conservation Act of 2000 (16 U.S.C. 6401 et seq.)
- Council on Environmental Quality (CEQ) Regulations on Implementing National Environmental Policy Act (NEPA) Procedures (40 CFR 1500-1508)
- Defense Environmental Restoration Program (10 U.S.C. 2701)
- Department of Defense (DoD) Appropriation Act (PL 102-396)
- Designation of Federal Trustees (40 CFR 300.600)
- Disabled Sportman's Bill (1999)
- Dredge and Fill Nationwide Permit Program (33 CFR 330)
- Economy Act (31 U.S.C. 1535)
- Endangered and Threatened Wildlife and Plants; Regulations for Listing Endangered and Threatened Species and Designating Critical Habitat (50 CFR 424)
- Endangered Species Act (ESA), as amended (PL 93-205)(16 U.S.C. 1531 et seq.)
- Entering Military, Naval, or Coast Guard Property (18 U.S.C. 1382)
- Environmental Effects in the United States (U.S.) of DoD Actions (32 CFR 188)
- Erosion Protection Act (33 U.S.C. 426)
- Estuary Protection Act (16 U.S.C. 1226)
- Executive Order (EO) 11514, *Protection and Enhancement of Environmental Quality* (as amended by EOs 11541 and 11991)
- EO 11644, *Use of Off-Road Vehicles on the Public Lands*
- EO 11987, *Exotic Organisms*
- EO 11988, *Floodplain Management*
- EO 11989, *Off-Road Vehicles Use on Public Lands*

- EO 11990, *Protection of Wetlands*
- EO 12780, *Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy*
- EO 12902, *Energy Efficiency and Water Conservation at Federal Facilities*
- EO 12962, *Recreational Fisheries*
- EO 13089, *Coral Reef Protection*
- EO 13112, *Invasive Species*
- EO 13148, *Greening the Government through Leadership in Environmental Management*
- EO 13158, *Marine Protected Areas*
- EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*
- EO 13352, *Facilitation of Cooperative Conservation*
- EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*
- EO 13751, *Safeguarding the Nation from the Impacts of Invasive Species*
- Farmland Protection Policy Act (7 U.S.C. 4201 et seq.)(7 CFR 658)
- Federal Aid in Wildlife Restoration Act (16 U.S.C. 669-669i); also known as the “Pittman-Robertson Act”
- Federal Compliance with Pollution Control Standards (42 U.S.C. 4321)
- Federal Consistency with Approved Coastal Management Programs under Coastal Zone Management Act (CZMA) (15 CFR 930)
- Federal Environmental Pesticide Control Act (7 U.S.C. 2809)
- Federal Facilities Compliance Act (42 U.S.C. 6961)
- Federal Insecticide, Fungicide, and Rodenticide Act, as amended (PL 92-516)(7 U.S.C. 136 et seq.)
- Federal Land Policy and Management Act (43 U.S.C. 1701 et seq.)
- Federal Noxious Weed Act (PL 93-6290)(7 U.S.C. 2801 et seq.)
- Federal Plant Pest Act (7 U.S.C. 150aa et seq.)
- Federal Water Pollution Control Act, as amended by the CWA (PL 92-500)
- Fish and Wildlife Conservation Act (PL 96-366)(16 U.S.C. 2901-2911)
- Fish and Wildlife Conservation and Natural Resources Management Programs on Military Reservations (PL 96-561)
- Fish and Wildlife Coordination Act (PL 85-624)(16 U.S.C. 661-667e)
- Fish and Wildlife Improvement Act (16 U.S.C. 7421)
- Fishery Conservation and Management (16 CFR 1801 et seq.)
- Forest Resources Conservation and Shortage Relief Act (16 U.S.C. 620 et seq.)
- Hunting and Fishing on Federal Lands (10 U.S.C. 2671 et seq.)
- Interagency Cooperation, ESA of 1973, as amended (50 CFR 402)
- Introduction of Non-native Species (HRS Chapters 150A, 152, 149A, HAR Title 4, Subtitle)
- Lacey Act of 1900 (16 U.S.C. 701), and Lacey Act Amendments (16 U.S.C. 3371-3378)
- Land and Water Conservation Act (16 U.S.C. 4601 et seq.)
- Legacy Resource Protection Program Act (PL 101-511)
- List of Migratory Birds (50 CFR 10.13)
- Magnuson Stevens Fishery Conservation and Management Act of 1976, as amended (PL 94-265)(16 U.S.C. 1801 et seq.)
- Marine Mammal Protection Act (MMPA), as amended (PL 92-522)(16 U.S.C. 1361 et seq.)
- Marine Protection, Research, and Sanctuaries Act (also referred to as the Ocean Dumping Act) (PL 92-532)(16 U.S.C. 1431 et seq. and 33 U.S.C. 1401 et seq.)
- Migratory Bird Conservation Act (16 U.S.C. 715 et seq.)

- Migratory Bird Permits; Take of Migratory Birds by the Armed Forces, U.S. Fish and Wildlife Service (USFWS) Final Rule (72 Federal Register 8931-8950 [February 28, 2007])
- Migratory Bird Treaty Act (MBTA) of 1918 (PL 65-186)(16 U.S.C. 703-712)
- Military Construction Authorization Act of 1956, Leases; Non-Excess Property (10 U.S.C. 2667)
- Military Construction Authorization Act of 1956, Military Reservations and Facilities and Hunting, Fishing, and Trapping (PL 85-337)(10 U.S.C. 2671)
- Military Construction Authorization Act of 1956, Sale of Certain Interests in Lands, Logs (10 U.S.C. 2665)
- Military Construction Authorization Act of 1975 (10 U.S.C. 2665)
- Military Readiness Rule (50 CFR Part 21.15)
- Military Reservation and Facilities: Hunting, Fishing, and Trapping (10 U.S.C. 2671)
- Multiple-Use Sustained Yield Act (16 U.S.C. 528)
- National Defense Authorization Act for Fiscal Year 2003
- National Defense Authorization Act for Fiscal Year 2015 (PL 113-291)
- National Defense Authorization Act for Fiscal Year 2016 (PL 114-92)
- National Defense Authorization Act for Fiscal Year 2017 (PL 114-328)
- National Defense Exemption to MMPA (January 23, 2007)
- NEPA of 1969, as amended (42 U.S.C. 4321 et seq.)
- National Historic Preservation Act (NHPA) (PL 89-665) (54 U.S.C. 300101 et seq.)
- National Invasive Species Act of 1996 (Formerly, Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990), as amended (PL 104-332)(16 U.S.C. 4701 et seq.)
- National Oceanic and Atmospheric Administration (NOAA) Coastal Zone Management Program Development and Approval Regulation (15 CFR 923, Subparts A-K)
- National Wildlife Refuge (NWR) System Administration Act of 1996 (16 U.S.C. 668dd-668ee)
- Native American Graves Protection and Repatriation Act (43 CFR Part 10)
- Natural Resources Management Program (32 CFR 190)
- NOAA Fisheries Climate Science Strategy, NOAA Technical Memorandum NMFS-F/SPO-155 (August 2015)
- North American Wetlands Conservation Act (16 U.S.C. 4401-4414)
- Noxious Plant Control Act (43 U.S.C. 1241)
- Ocean Dumping Regulations and Criteria (40 CFR 220-229)
- Oil Pollution Act (PL 101-380)(33 U.S.C. 2701 et seq.)
- Outdoor Recreation, Federal/State Program Act (PL 88-29)(16 U.S.C. 4601 et seq.)
- Pacific Islands Regional Action Plan (December 2016)
- Partners for Fish and Wildlife Act (16 U.S.C. 3771 et seq.)
- Plant Quarantine Act (7 U.S.C. 151-167)
- Pollution Prevention Act (42 U.S.C. 13101 et seq.)
- President's Directive on Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds
- Regulations Concerning Marine Mammals (50 CFR 10, 18, 216, 228)
- Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.)
- Rivers and Harbors Act of 1889 (33 U.S.C. 403 et seq.)
- Safe Drinking Water Act (42 U.S.C. 300(f) et seq.)
- Sales of Forest Products on Federal Lands (10 U.S.C. 2665 et seq.)
- Sikes Act - Conservation Programs on Military Installations, as amended (16 U.S.C. 670a et seq.)
- Soil and Water Conservation Act (16 U.S.C. 2001-2009)

- Soil Conservation Act (16 U.S.C. 5901)
- Soil Conservation and Domestic Allotment Act of 1963 (16 U.S.C. 590A)
- State Species Protection (HRS 195D, HAR Chapters 13-107, 13-124)
- Sustainable Fisheries Act of 1996 (16 U.S.C. 1801)
- Territorial Submerged Lands Act (PL 93-435)
- USFWS Guidelines for Coordination on Integrated Natural Resources Management Plans (INRMPs)(June 2015)
- Water Pollution Prevention and Control (33 U.S.C. 1251 et seq.)
- Watershed and Floodplains Protection (16 U.S.C. 1001 et seq.)
- Wetland Resources (16 U.S.C. 3901)
- Wild and Scenic Rivers Act of 1968 (PL 90-542)(16 U.S.C. 1271-1287)

FEDERAL GUIDELINES FOR NATURAL RESOURCES

- Climate Adaptation for DoD Natural Resource Managers: A Guide to Incorporating Climate Considerations into INRMPs (April 2019)
- U.S. Army Corps of Engineers (USACE) 1987 Wetland Delineation Manual
- Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Hawaii and Pacific Islands Region (Version 2.0)
- USFWS Memo on Guidance for Coordination on DoD Sikes Act INRMPs (June 8, 2001)
- USFWS Reducing Bird Collisions with Buildings and Building Glass Best Practices (July 2016)

DEPARTMENT OF DEFENSE DIRECTIVES, INSTRUCTIONS, REGULATIONS, AND POLICIES FOR NATURAL RESOURCES

- Deputy Under Secretary of Defense for Installations and Environment (I&E) Memorandum, Implementation of Sikes Act Improvement Act: Updated Guidance with Attachment (October 10, 2002)
- Deputy Under Secretary of Defense Memorandum, INRMP Template
- DoD Directive 3200.15, *Sustaining Access to the Live Training and Test Domain*
- DoD Directive 4140.1, *DoD Supply Chain Material Management Policy*
- DOD Directive 4705.01E, *Management of Land-Based Water Resources in Support of Contingency Operations*
- DoD Directive 4710.1, *Archaeological and Historic Resources Management*
- DoD Directive 4715.21, *Climate Change Adaptation and Resilience*
- DoD Directive 4715.3, *Environmental Conservation Program*
- DoD Directive 5030.41, *Oil and Hazardous Substance Pollution Prevention and Contingency Program*
- DoD Directive 6050.1, *Environmental Effects in the U.S. of DoD Strategies*
- DoD Directive 6050.15, *Prevention of Oil Pollution from Ships Owned or Operated by the Department of Defense*
- DoD Directive 6050.2 (as amended), *Use of Off-Road Vehicles on DoD Lands*
- DoD Directive 6050.4, *Marine Sanitation Devices for Vessels Owned or Operated by DoD*
- DoD INRMP Handbook, *Resources for INRMP Implementation*
- DoD Instruction 4001.01, *Installation Support*
- DoD Instruction 4150.07, *DoD Pest Management Program*
- DoD Instruction 4165.57, *Air Installations Compatible Use Zones*
- DoD Instruction 4165.59, *DoD Implementation of the Coastal Zone Management Act*

- DoD Instruction 4700.2, *Secretary of Defense Award for Natural Resources and Environmental Management*
- DoD Instruction 4715.03, *Natural Resources Conservation Program*, Incorporating Change 2 (August 31, 2018)
- DoD Instruction 4715.4, *Pollution Prevention*
- DoD Instruction 4715.06, *Environmental Compliance in the United States*
- DoD Instruction 4715.07, *Environmental Restoration Program*
- DoD Instruction 4715.9, *Environmental Planning and Analysis*
- DoD Instruction 5000.13, *Natural Resources - The Secretary of Defense Natural Resource Conservation Award*
- DoD Instruction 6050.05, *DoD Hazard Communication Program*
- DoD Instruction 6055.06, *DoD Fire and Emergency Services Program*
- DoD Instruction 8130.01, *Installation Geospatial Information and Services (IGI&S)*
- DoD 2014 Climate Change Adaptation Roadmap (June 2014)
- DoD Environmental Management Systems Compliance Management Plan (November 2009)
- DoD Supplemental Guidance for Implementing and Operating a Joint Base, Office of the Under Secretary of Defense (April 15, 2008)
- Supplemental Guidance for Implementation of the Sikes Act Improvement Act, Office of the Secretary of Defense (November 1, 2004)
- Supplemental Guidance for Implementation of the Sikes Act Improvement Act, Office of the Secretary of Defense (September 5, 2005)
- Updated Guidance For Implementation of the Sikes Act Improvement Act, Office of the Under Secretary of Defense (October 10, 2002)
- Army Regulation 200-1, *Environmental Protection and Enhancement* (December 13, 2007)

U.S. DEPARTMENT OF THE NAVY DIRECTIVES, REGULATIONS, AND POLICIES FOR NATURAL RESOURCES

- Biosecurity Plan for Joint Base Pearl Harbor-Hickam (JBPHH) (June 2020)
- Characterization of Fish and Benthic Communities of Pearl Harbor and Pearl Harbor Entrance Channel, Draft Report (February 2006)
- Commander-in-Chief, U.S. Pacific Fleet Instruction 5090.1B, *Pacific Fleet Environmental Protection Program*
- U.S. Department of Navy (DON) Procedures for Implementing NEPA (32 CFR 775)
- Geodatabase Navy Data Model 4.0
- INRMP, Pearl Harbor, O'ahu, Hawai'i (October 2001)
- INRMP, JBPHH (September 2011)
- JBPHH Instruction 5510.3, *Pearl Harbor Naval Defensive Area Entry Regulations for Recreation* (July 2016)
- Naval Facilities Engineering Systems Command (NAVFAC) Instruction MO-100.3, *Fish and Wildlife Management*
- NAVFAC Instruction MO-100.4, *Outdoor Recreation Management*
- NAVFAC Instruction MO-110.1,
- NAVFAC Instruction 11010.45, *Regional Shore Infrastructure Planning*
- NAVFAC Instruction 11012.111A, *Land Use Conservation Planning*
- NAVFAC Instruction 11014.16B, *Procedures for Requesting and Processing Shore Infrastructure Requirements*
- NAVFAC Instruction 6250.3H, *Applied Biology Program Services and Training*

- NAVFAC Procedural Manual P-73, *Real Estate Operations & Natural Resources Management*
- Chief of Naval Operations Instruction (OPNAVINST) 11010.20F, *Facilities Projects Manual*
- OPNAVINST 5090.1E, *Environmental Readiness Program*
- OPNAVINST 6250.4C, *Pest Management Program*
- OPNAVINST 8000.16, *Environmental Security Management*
- OPNAVINST 8026.2C, *Navy Munitions Disposition Policy*
- Office of the Chief of Naval Operations (OPNAV) NEPA Template, Regional & Installation Matrices, and Navy Environmental Planning Document Preparation Guide
- Secretary of the Navy Instruction (SECNAVINST) 5090.6A, *Environmental Planning For Department of the Navy Actions*
- SECNAVINST 5090.8A, *Policy for Environmental Protection, Natural Resources, Cultural Resources Programs* (October 18, 2018)
- SECNAVINST 6240.6E, *Implementation of DoD Directives under DoD Instruction 4700.4*
- SER 818 JBPHH Greenwaste Policy (October 29, 2018)
- INRMP Guidance for Navy Installations (April 10, 2006)
- A Cooperative Strategy for 21st Century Seapower (March 2015)
- DON Environmental Strategy (April 2008)

U.S. DEPARTMENT OF THE AIR FORCE DIRECTIVES, REGULATIONS, AND POLICIES FOR NATURAL RESOURCES

- Air Force Instruction (AFI) 32-1053, *Pest Management Program*
- AFI 32-7024, *Integrated Natural Resources Management*
- AFI 32-7060, *Interagency and Intergovernmental Coordination for Environmental Planning*
- AFI 32-7061, *Environmental Impact Analysis Process (EIAP)*
- AFI 32-7064, *Integrated Natural Resources Management*
- AFI 32-7081, *Forest Management Manual*
- AFI 91-202, *U.S. Air Force Mishap Prevention Program*
- Policy Memo for Implementation of Sikes Act Improvement Amendments, U.S. Air Force (USAF) Environmental Office (HQ USAF/ILEV) on January 29, 1999
- Air Force Policy Directive 32-70, *Environmental Quality*
- *Environmental Protection, EIAP* (32 CFR 989)

MEMORANDUMS OF AGREEMENT, MEMORANDUMS OF UNDERSTANDING, AND COOPERATIVE AGREEMENTS REGARDING NATURAL RESOURCES

- DoD Memorandum on Implementation of Ecosystem Management in DoD
- Memorandum of Agreement (MOA) for Brown Treesnake Control among the U.S. Department of Interior, DoD, U.S. Department of Agriculture (USDA), U.S. Department of Commerce, U.S. Department of Transportation (USDOT), National Invasive Species Council, Government of Guam, the State of Hawai'i, and Commonwealth of the Northern Mariana Islands (1992, 1999, 2011)
- Memorandum of Understanding (MOU) between the DoD and the USFWS for the Ecosystem-based Management of Fish, Wildlife, and Plant Resources on Military Lands (May 17, 1999)
- MOU between the DoD and the USFWS to Promote the Conservation of Migratory Birds (September 5, 2014)

- MOA for Professional and Technical Assistance Conducting Biological Surveys, Research and Related Activities between the DoD and the National Biological Service of the Department of the Interior
- MOU between DoD, USFWS, and the Association of Fish and Wildlife Agencies for a Cooperative INRMP on Military Installations (July 29, 2013)
- MOU between the U.S. Environmental Protection Agency (USEPA) and the DoD with Respect to Integrated Pest Management (IPM)
- MOU for Watchable Wildlife Programs
- MOU to Foster the Ecosystem Approach between the CEQ, USDA, Department of the Army, Department of Commerce, DoD, Department of Energy, Department of Housing and Development, Department of the Interior, Department of Justice, Department of Labor, Department of State, USDOT, USEPA, and Office of Science and Technology Policy (December 15, 1995)
- Mutual DoD and USFWS Guidelines for Streamlined Review of INRMP Updates (July 20, 2015)
- Cooperative Agreement between the DoD and The Nature Conservancy for Assistance in Natural Resources Inventory
- Regional Biosecurity Plan (RBP) for Micronesia and Hawaii (formerly referred to as the Micronesia Biosecurity Plan) (University of Guam [UOG] and Secretariat of the Pacific Community 2014)

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Appendix C
Environmental Assessment of INRMP

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Appendix D
Blanket Section 401 Water Quality Certification

<https://health.hawaii.gov/cwb/permitting/section-401-wqc/blanket-section-401-wqc/>

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Appendix E
DON and U.S. Marine Corps De Minimis Activities
under the CZMA

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DEPARTMENT OF THE NAVY

COMMANDER
NAVY REGION HAWAII
850 TICONDEROGA ST STE 110
PEARL HARBOR, HAWAII 96860-51015090
Ser N4/ 04163
01 JUN 2009

CERTIFIED MAIL NO. 7007 2560 0002 0326 9580

Mr. Abbey Mayer
Office of Planning
Department of Business, Economic
Development and Tourism
P. O. Box 2359
Honolulu HI 96804

Dear Mr. Mayer:

SUBJECT: REQUEST FOR CONCURRENCE WITH MODIFICATIONS TO THE DEPARTMENT
OF THE NAVY DE MINIMIS ACTIVITIES UNDER THE COASTAL ZONE
MANAGEMENT ACT (CZMA)

This letter is to request your concurrence with the attached list of Navy/Marine Corps de minimis activities under the CZMA. The attached de minimis list will amend the current de minimis list which was established on April 2, 2007. The new de minimis list will include the Marine Corps, and will cover areas in the Pearl Harbor Naval complex, Naval Magazine Lualualei, Naval Communications and Telecommunications Area Master Station Pacific, Pacific Missile Range Facility on Kauai, Kaneohe Marine Corps Base Hawaii, Camp Smith and all associated installations/facilities/equipment located outside of those Navy/Marine Corps properties.

The Navy and Marine Corps have determined that the listed Proposed Actions have insignificant direct or indirect (cumulative and secondary) coastal effects and should therefore be categorized as de minimis in accordance with the Department of Commerce, National Oceanic and Atmospheric Administration, CZMA Federal Consistency Regulations 15 CFR part 930.33 (3). With the corresponding mitigation and conditions applied, these actions would be exempt from a negative determination or a consistency determination from the State of Hawaii.

Should you have any questions, please contact Mr. Brian Yamada at 472-1449, by facsimile transmission at 474-5419, or by email at brian.yamada@navy.mil.

Sincerely,

E. J. D'ANDREA
Lieutenant Commander, CEC, U. S. Navy
Assistant Regional Engineer
By direction of the
Commander

Enclosure: 1.Navy De minimis Activities Under CZMA

Navy/Marine Corps De Minimis Activities Under CZMA

*covering areas in Pearl Harbor Naval Complex, Naval Magazine Lualualei, Naval Communications and Telecommunications Area Master Station (NCTAMS) Pacific, Pacific Missile Range Facility (PMRF), Kaneohe Marine Corps Base Hawaii, Camp Smith, and all associated installations/facilities/equipment located outside of these Navy/Marine Corps properties

No.	Proposed Action	Description	Mitigation / Conditions
1	New Construction	Construction of new facilities and structures wholly within Navy/Marine Corps controlled areas (including land and water) that is similar to present use and, when completed, the use or operation of which complies with existing regulatory requirements.	1, 3, 6, 8, 9, 10, 11, 13, 14, 16
2	Utility Line Activities	Acquisition, installation, operation, construction, maintenance, or repair of utility or communication systems that use rights of way, easements, distribution systems, or facilities on Navy/Marine Corps controlled property. This also includes the associated excavation, backfill, or bedding for the utility lines, provided there is no change in preconstruction contours.	1, 10, 11, 12, 14, 16
3	Repair and Maintenance	Routine repair and maintenance of buildings, ancillary facilities, piers, wharves, dry docks, vessels, or equipment associated with existing operations and activities.	12, 14, 16
4	Aids to Navigation	Includes buoys, beacons, signs, etc. placed within Navy/Marine Corps controlled coasts and navigable waters as guides to mark safe water.	2, 5, 14, 16
5	Structures in Fleeting and Anchorage Areas	The installation of structures, buoys, floats and other devices placed within anchorage or fleeting areas to facilitate moorage of vessels within Navy/Marine Corps controlled property.	2, 5, 14, 16
6	Oil Spill and Hazardous Waste Cleanup	Activities required for the containment, stabilization, removal and cleanup of oil and hazardous or toxic waste materials on Navy/Marine Corps controlled property.	1, 8, 14, 16
7	Maintenance Dredging	Excavation and removal of accumulated sediment for maintenance to previously authorized depths.	2, 3, 4, 5, 7, 8, 9, 13, 14, 16
8	New Dredging	Excavation and removal of material from the ocean floor not to exceed 100 cubic yards below the plane of the ordinary high water mark or the mean high water mark from navigable waters of the US and; excavation and removal of material from the ocean floor within Navy/Marine Corps controlled property. This does not include dredging or degradation through coral reefs.	2, 3, 4, 5, 7, 8, 9, 13, 14, 16
9	Scientific Measuring Devices	The installation of devices which record scientific data (staff gages, tide gages, water recording devices, water quality testing and improvement devices and similar structures) on Navy/Marine Corps controlled property. Devices must not transmit acoustics (certain frequencies) that will adversely affect marine life.	1, 2, 14, 16
10	Studies and Data Collection and Survey Activities	Studies, data and information-gathering, and surveys that involve no permanent physical change to the environment. Includes topographic surveys, wetlands mapping, surveys for evaluating environmental damage, engineering efforts to support environmental analyses, core sampling, soil survey sampling, and historic resources surveys.	2, 3, 6, 8, 9, 11, 12, 13, 14, 16
11	Demolition	Demolition and disposal involving buildings or structures when done in accordance with applicable regulations and within Navy/Marine Corps controlled properties.	1, 11, 12, 14, 16
12	Military Testing and Training	Routine testing and evaluation of military equipment on or over military, or an established range, restricted area or operating area or training conducted on or over military land or water areas in which the impact is not significant.	9, 13, 14, 15, 16
13	Real Estate/Property Transfer	Real estate acquisitions or outleases of land involving new ingrats/outgrants and/or 50 acres or more where existing land use will change.	14, 16

ENCLOSURE(1)

14	Mission Changes	Mission changes, base closures/relocations/consolidations, and deployments that would cause long term population increases or decreases in affected areas.	14, 16
15	Limitation of Access to Property	Permanent closure or limitation of access to any areas that were open previously to public use, such as roads or recreational purposes (provided the access is not required by established agreements with State of Hawaii, private industry, etc.)	14, 16
16	Environmental Management Activities	Environmental management activities within Navy/Marine Corps controlled areas including, but not limited to, activities such as vegetation and mangrove removal, ditch clearing, sediment removal, invasive species removal, construction related to protecting endangered species and wildlife, and actions prescribed by the Integrated Natural Resources Management Plan (INRMP)	2, 13, 14, 16
17	Towers	Installation, operation, and maintenance of towers (such as communication towers, cellular phone antennas, wind-energy towers) within Navy/Marine Corps controlled areas.	1, 2, 6, 8, 9, 12, 13, 14, 16
18	Alternative Energy Research	Installation, operation, replacement, and removal of alternative energy research structures/equipment taking place within Navy/Marine Corps controlled areas.	1, 2, 3, 5, 6, 12, 13, 14, 16
19	Army Corps Nation Wide Permits	Work subject to an Army Corps of Engineers Nationwide permit (which are applicable to Hawaii)	16

Project Mitigation / General Conditions

- 1) Navy/Marine Corps controlled property refers to land areas, rights of way, easements, roads, safety zones, danger zones, ocean and naval defensive sea areas under active Navy/Marine Corps control.
- 2) If any listed species enters the area during conduct of construction activities, all activities should cease until the animal(s) voluntarily depart the area.
- 3) Turbidity and siltation from project related work shall be minimized and contained to within the vicinity of the site through appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.
- 4) Dredging/filling in the marine/aquatic environment shall be scheduled to avoid coral spawning and recruitment periods.
- 5) All project-related materials and equipment (dredges, barges, backhoes, etc.) to be placed in the water shall be cleaned of pollutants prior to use.
- 6) No project-related materials (fill, revetment rock, pipe, etc.) should be stockpiled in the water (intertidal zones, reef flats, stream channels, wetlands, etc.).
- 7) All debris removed from the marine/aquatic environment shall be disposed of at an upland site or EPA approved ocean disposal site, and Best Management Practices shall be followed.
- 8) No contamination (trash or debris disposal, alien species introductions, etc.) of adjacent marine/aquatic environments (reef flats, channels, open ocean, stream channels, wetlands, etc.) shall result from project-related activities.
- 9) Fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project shall be developed. Absorbent pads and containment booms shall be stored on-site, if appropriate, to facilitate clean-up of accidental petroleum releases.
- 10) Any under-layer fills used in the project shall be protected from erosion with stones (or core-loc units) as soon after placement as practicable.
- 11) Any soil exposed near water as part of the project shall be protected from erosion (with plastic sheeting, filter fabric, etc.) after exposure and stabilized as soon as practicable (with vegetation matting, hydroseeding, etc.).
- 12) Section 106, of the National Historic Preservation Act (NHPA), consultation requirements must be met. Also, follow guidelines in the area-specific Integrated Cultural Resources Management Plan (ICRMP) if applicable.
- 13) Navy/Marine Corps shall evaluate the possible impact of the action on species and habitats protected under the Endangered Species Act (ESA). If the Navy/Marine Corps determines that no such species or habitats will be affected by the action, neither U.S. Fish and Wildlife (FWS) Service nor National Oceanic and Atmospheric Administration (NOAA) concurrence is required. Should it be determined by the Navy/Marine Corps, FWS, or NOAA that the action may affect any such species or habitat, informal or formal consultation will be initiated by the Navy/Marine Corps as required by section 7 (Interagency Cooperation) of the ESA.
- 14) The National Environmental Policy Act (NEPA) review process will be completed.
- 15) The training, testing and evaluation will be conducted in accordance with applicable standard operating procedures protective of the environment.
- 16) Navy or Marine Corps staff shall notify State CZM of de minimis list usage for projects which require an Environmental Assessment (EA). Notification can be sent via email: to JNakagaw@dbedt.hawaii.gov



**DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT & TOURISM**

OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
MARK K. ANDERSON
DEPUTY DIRECTOR
ABBEY SETH MAYER
DIRECTOR
OFFICE OF PLANNING

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-12644

July 9, 2009

Lieutenant Commander E. J. D'Andrea
Assistant Regional Engineer
Department of the Navy
Commander
Navy Region Hawaii
850 Ticonderoga Street, Suite 110
Pearl Harbor, Hawaii 96860-5101

Attention: Mr. Brian Yamada

Dear Lt. Commander D'Andrea:

Subject: Hawaii Coastal Zone Management (CZM) Program Federal Consistency
Concurrence with Modifications to the Department of the Navy De Minimis
Activities in Hawaii under the Coastal Zone Management Act (CZMA)

The Hawaii CZM Program has completed the federal consistency review of the proposed modifications to the list of Department of the Navy de minimis activities under the CZMA, including changes to various activity categories, adding new activity categories, and expanding the coverage to Marine Corps Base Hawaii Kaneohe Bay and Camp Smith. The CZM Program conducted a thorough review of the request and a public notice of the CZM review was published in the State of Hawaii Office of Environmental Quality Control's publication, *The Environmental Notice*, on June 23, 2009. The public was provided an opportunity to participate in the review through July 7, 2009. There were no public comments received.

We concur that the activities identified on the modified list entitled, "Navy/Marine Corps De Minimis Activities Under CZMA" are expected to have insignificant direct or indirect (cumulative and secondary) coastal effects, and should not be subject to further review by the Hawaii CZM Program on the basis and condition that the listed activities are subject to and bound by full compliance with the corresponding "Project Mitigation / General Conditions."

The Hawaii CZM Program reserves the right to review, amend, suspend, and/or revoke the "Navy/Marine Corps De Minimis Activities Under CZMA" list whenever it finds that a listed activity or activities will have reasonably foreseeable coastal effects. CZM consistency

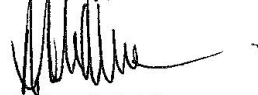
Lieutenant Commander E. J. D'Andrea
Page 2
July 9, 2009

concurrence does not convey approval with any other regulations administered by any State or County agency.

Modifying and expanding the list of Navy de minimis activities under the CZMA was a cooperative effort between our Office and Mr. Brian Yamada from the Department of the Navy, who interned with the Hawaii CZM Program in September 2008. We appreciate the efforts of Mr. Yamada in working with our CZM staff. The de minimis activities list will result in more efficient compliance with CZMA federal consistency requirements for both the Navy and the Hawaii CZM Program.

If you have any questions, please call John Nakagawa of our CZM Program at 587-2878.

Sincerely,



Abbey Seth Mayer
Director

c: U.S. Army Corps of Engineers, Regulatory Branch (w/ copy of de minimis list)
Ms. Rebecca Hommon, Region Counsel, Navy Region Hawaii

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Appendix F
Notice of Availability and Public Review Comments Received

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Appendix G

MOU Between Working Group Members for INRMP Implementation

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Appendix H

Stakeholder Names

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Internal Stakeholders	
Region	
CAPT Gordie Meyer	NAVFAC HI Regional Engineer / NAVFAC HI CO
CAPT Kent Hendricks	NAVFAC HI Deputy Regional Engineer / NAVFAC HI XO
Sherrie Eng	EVBL
Curtis Wong	AMBL - master plans
Aaron Darley	Capital Improvements/Public works
Dan Fujii	Public Works
Sofie Loomis	NAVFAC HI AM5 - PPV Business Agreements Manager (BAM)
CDR Dasher	NFH Operations Officer
CDR Samuel Johnson	CNRH N4/ARE
Clyde Haruno	CNRH N4/DARE
Janice Fukawa	CNRH N4/RCPLO
Randy Young	Region General Counsel
Robert Rowland	Region, N00 Assistant Counsel/ RE/ EV
Claude Shaw	Region, N3 - Operations Director
JBPHH Leadership	
CAPT Spitzer	JBPHH Joint Base CO
CAPT Pecoraro	JBPHH CSO/ XO
CAPT Randall Harmeyer	JBPHH Facilities and Environmental/ JB4
Lt COL Manegdeg	JBPHH PW Deputy PWO
Reid Matsuda	JBPHH PW Deputy FMD/ AM Branch Head (temp)
Jordan Garrett	ED, 647th Air Base Group
COL Melissa Hull	JB2
CDR Blaine Pitkin	Operations Officer/ JB3
Joe Krakowiak	JB5
CAPT Madelen Means	NIOC CO
CAPT Greg Burton	Shipyard CO
CAPT Kalp	NAVSUP FLC PH CO
Planning	
CDR Brown	JBPHH PW FMD Director
Reid Matsuda	JBPHH PW Deputy FMD
Ms. Niru Santos, JD	Senior Realty Specialist/ Real Estate Contracting Officer
Amanda Maeda	JBPHH FMD AM PRJ12B
Gary Tasato	Planner
Duane Tsuruda	Planner (Functional)
Wes Choy	Planner
Karen Wong	Planner (Outlying)
Tyler Tsubota	Functional Planner
Shaun Kagawa	Planner
Sandra Tanoue	Director, PPV
Larry Smith	15 OSS/OSA. Chief Airfield Ops
Vilachack Ladara	PACAF Encroachment Manager
Michael Catalano	Airspace Liaison
LT Michael Yoshihara	Functional APWO
Maj John Nussbaum	Airfield APWO
LT Keji Aderibeigbe	Outlying Deputy APWO
LCDR Henry Pollock	Waterfront Team APWO
LCDR Trevor Bingham	IMF/PHNSY Team (Shipyard) APWO

Environmental	
David Sullivan	JBPHH PRJ42, EV Compliance Branch Head
Dayna Fujimoto	EV Compliance
Jan Kotoshirodo	Acting EV3
Jeff Pantaleo	NFH, CRM
Arthur Yatsuoka	EV Res & Assessment
Terence Tengan	JBPHH PRJ42, EV Compliance
Robert Young	JBPHH PRJ42, EV Compliance
Haley Miranda	JBPHH PRJ42, Waterfront EC
Jeffrey Hattemer	JBPHH PRJ42, Waterfront EC
Kyna Borel	JBPHH PRJ42, Waterfront EC
Ginger Nakamoto	JBPHH PRJ42, PHNSY & IMF EC
Henry Rimas	JBPHH PRJ42, Hickam Airfield EC
Frans Joula	NAVFAC PAC EV Environmental Planning & Conservation Division Manager (EV2)
Janice Fukumoto	NAVFAC PAC Environmental Restoration (EV3)
Steven Christiansen	JBPHH Environmental Program Director
Safety / Security	
Lori Katahira	Safety Director - NAVFAC HI
Training/Range/Munitions	
CAPT Buckles	Deputy Director, Plans and Policy
Bryan McCorkell	NMCPAC EAD Unit PH, Ordnance Manager
Tresa Bell	CNRH/JBPHH Explosive Safety Officer
EODC Jordan Bethke	EOD
EODC Tyler Dunbar	EOD
LT Joseph Grim	EOD
Public Affairs/Legal	
Charles Anthony	JBPHH PAO
Denise Emsley	NFH PAO
Susie Kim	CPLO, NAVFAC HI
Victor Flint	CPLO, NAVFAC HI
David Hodge	Community Relations
Kathy Isobe	RegionI EV PAO
Agnes Tauyan	Region PAO
Jan Takamine	NFH Counsel
Cynthia Nojima	NFH associate counsel
Robert Rowland	Navy Region EV Counsel
Carly Minner-cole	assistant council
Port and Harbor	
CWO-4 Galo Moreira	N31A Port Operations Officer
Mac Griffin	HPU LCPO
ENERGY	
Dragos Oprescu	Installation Energy Manager
NAVFAC PAC Environmental	
Cory Campora	NAVPAC SUPV Terrestrial Nat Res (EV22)
Michelle Bejder	NAVPAC SUPV Marine Nat Res (EV24)
NAVFAC Pest Control	
Ed Perales	Pest Control Supervisor
Recreational Groups	
Stephanie Seefeldt	MWR

APPENDIX G STAKEHOLDER NAMES

JBPHH SECURITY	
LCDR Robert Dodge	JBPHH JB3AT
Brian Boyman	JBPHH JB3AT
Joe Clark	JBPHH JB3AT
Ivan Felix	JBPHH JB3AT
CPO Kristopher Griffin	JB2 Harbor Security
Other	
Robert Reynolds	Engineering Equipment Operator Supervisor
External Stakeholders	
USDA	
Darrin Phelps	USDA Wildlife Services
Wil Leon Guerrero	HDOA Plant Quarentine
Darcy Oishi	HDOA Biocontrol
Agricultural lessees	
Larry Jefts	President, Pu'uloa Farms Inc.
Kathy Mara	General Manager, Kapilina homes
Ian Lange	Hunt Properties
Environmental and conservation groups involved in local conservation activities	
Nate Dube	OISC
Federally recognized NHO	
Kai Markell	Office of Hawaiian Affairs
Auntie Kehau	Ali'i Pauahi Hawaiian Civic Club
Shad Kane	Oahu Council of Hawaiian Civic Clubs
Neighboring landowners	
Claire Sullivan	MA'O Farms
Gary Maunakea-Forth	MA'O Farms
James Nakatani	Executive Director, State of Hawaii Agribusiness Development Corporation
Lea Hong	Hawaiian Islands State Director, Trust for Public Lands
Rhonda Suzuki	Environmental Division, Chief, U.S. Army Garrison Hawaii
Local Government Planning groups	
Debra Mendez	Coastal Zone Management
Justine Nihipali	Coastal Zone Management
Michelle Nikota	Dept Parks and Rec City and County of Honolulu
Kasha Malama	Hawaii Community Development Authority
Amy Tsuneyoshi	Board of Water Supply
Scientists with expertise relevant to installation ecosystems	
David Sischo	Snail extinction Prevention Program
Laura Brewington	climate change at east west UH
Steve cole	Bishop Museum
Chip fletcher	Climate Scientist
Steve Smith	Diver
Ku'uilei Rodgers	HIMB
NPS	
Scott Pawlowski	NPS

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Appendix I

Regulatory Status Definitions

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Appendix I Regulatory Status Definitions

Federal Status Codes

(E) Endangered. A species in danger of extinction throughout all or a significant portion of its range.

(T) Threatened. A species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

(C) Candidate. A species under consideration for official listing for which there is sufficient information to support

SAE, E(S/A) Endangered due to similarity of appearance. A species that is endangered due to similarity of appearance with another listed species and is listed for its protection. Species listed as E(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation.

SAT, T(S/A) = threatened due to similarity of appearance. A species that is threatened due to similarity of appearance with another listed species and is listed for its protection. Species listed as T(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation.

(EXPE, XE) Experimental essential population. A species listed as experimental and essential.

(EXPN, XN) Experimental non-essential population. A species listed as experimental and non-essential. Experimental, nonessential populations of endangered species (e.g., red wolf) are treated as threatened species on public land, for consultation purposes, and as species proposed for listing on private land.

(PE) Proposed endangered. Species proposed for official listing as endangered.

(PT) Proposed threatened. Species proposed for official listing as threatened.

(PEXPE, PXE) Proposed experimental population, essential. Species proposed for official listing as experimental and essential.

(PEXPN, PXN) Proposed experimental population, non-essential. Species proposed for official listing as experimental and non-essential.

PSAE, PE (S/A) Proposed endangered, due to similarity of appearance. Species proposed for official listing as endangered due to similarity of appearance with another listed species.

PSAT, PT (S/A) Proposed threatened, due to similarity of appearance. Species proposed for official listing as threatened due to similarity of appearance with another listed species.

(EE) Emergency Endangered - A temporary (240) day listing for emergency purposes when species is at significant, immediate risk.

(SC) Species of Concern - Species that have not been petitioned or been given E, T, or C status but have been identified as important to monitor.

(RT) Resolved Taxon - Species that have been petitioned for listing and for which a Not Warranted 12 month finding or Not Substantial 90-day finding has been published in the Federal Register. Also includes species that have been removed from the candidate list.

(UR) Under Review - Species that have been petitioned for listing and for which a 90 day finding has not been published or for which a 90 day substantial has been published but a 12 Month finding have not yet been published in the Federal Register. Also includes species that are being reviewed through the candidate process, but the CNOR has not yet been signed.

(NL) Not Listed.

State Codes

(SE) State listed as Endangered – Species is in imminent danger of extinction within the state.

(ST) State listed as Threatened - State population listed as Threatened

(StC) State Candidate – Candidate species for listing at the state level

(SCD) State Candidate (Delisting) - Candidate species for de-listing at the state level

(SSC) State Species of Special Concern - Species identified by any state that have not been petitioned or been given E, T, or C status but have been identified as important to monitor.

Other Codes

(TER-E) Territory listed as Endangered – Species is in imminent danger of extinction within the territory.

(TER-T) Territory listed as Threatened – Species population is listed as threatened within the territory.

(TER-C) Territory Candidate – Species population is listed as a Candidate species for listing within the territory.

(TER-D) Territory Candidate (Delisting) – Species population is listed as a candidate species for De-listing within the territory.

(TER-SC) Territory Species of Special Concern – Species identified by any territory that have not been petitioned or been given E, T, or C status but have been identified as important to monitor.

Appendix J
Key Biological Reference Documents for
Main Base and Surrounding Areas

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J-1 Appendix Removed

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**J-2 USFWS Biological Opinion, Endangered Waterbird Air Strike Hazard
Interaction at Hickam Air Force Base, O'ahu**

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850



In Reply Refer To:
2008-F-0186

AUG 26 2009

Mr. Gary O'Donnell
Chief, Environmental Planning Element
75 H Street
Hickam Air Force Base, Hawaii 96853

Subject: Formal Section 7 Consultation on Endangered Waterbird Air Strike Hazard
Interaction at Hickam Air Force Base, Oahu

Dear Mr. O'Donnell:

This Biological Opinion responds to your request for formal consultation regarding activities and operations at Hickam Air Force Base and adverse effects to four species of endangered Hawaiian waterbirds; Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian moorhen (*Gallinule chlororopus sandvicensis*), and Hawaiian duck (*Anas wyvilliana*). At issue is the proposed take of active endangered Hawaiian stilt nests that have been documented in recent history within the Bird and Wildlife Air Strike Hazard (BASH) zone; potential air strike interactions between waterbirds and flight operations; construction activities in support of the aircraft missions; and the continued hazing of listed waterbirds conducted by the United States Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services (Wildlife Services). This response represents the U.S. Fish and Wildlife Service's (Service) Biological Opinion regarding the effects from the proposed project to the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck pursuant to the Endangered Species Act of 1973 (16 U.S.C. 1531), as amended (Act). This consultation is based on your Biological Assessment, information gained during site visits, telephone conversations, electronic mail (email), (see Consultation History and References) and other information available to us. A full administrative record is available at Pacific Islands Fish and Wildlife Office (PIFWO).

CONSULTATION HISTORY

December 18, 2006. Hickam Air Force Base submitted a Biological Assessment to the Service in which it made a determination that the proposed project "may affect, but is not likely to adversely affect" listed Hawaiian waterbirds.



Mr. Gary O'Donnell

2

March 8, 2007. Hickam Air Force Base revised the Biological Assessment to provide further information requested by Peter Cohen (Service biologist).

July 9, 2007. The Service did not concur with Hickam Air Force Base's not likely to adversely affect determination, and in an email recommended initiation of formal consultation based on Hickam Air Force Base request to "take" endangered waterbirds.

July 17, 2007. Aaron Hebshi (Air Force), Darrin Phelps (Wildlife Services), Holly Herod and Aaron Nadig (Service biologists) attended a site visit at Hickam Air Force Base Flight line to discuss the development of a consultation package.

July 19, 2007. Aaron Nadig (Service) provided guidance to Aaron Hebshi (Air Force) via email describing the information necessary to assemble a complete package for formal consultation.

April 18, 2008. The Hickam Air Force Base consultation package was received by PIFWO.

May 16, 2008. A letter was sent to Mr. Gary O'Donnell acknowledging initiation of formal consultation for ongoing activities related to air operations at Hickam Air Force Base.

July 25, 2008. The project scope was changed to include actions for restoration of Oxbow wetlands at Bellows Air Force Station, modification of work at Ahua Reef, and hazing activities for BASH. The Air Force reviewed the changes and commitments with Kadena Air Force Base which maintains management authority for Bellows Air Force Station. A meeting was scheduled by Aaron Hebshi (Air Force) to meet with Flight Safety 15th Air Wing to approve actions near Hickam Air Force Base and was postponed until January 2009.

January 21, 2009. Due to a BASH program Flight Safety 15th Air Wing quarterly meeting, the project description was revised to maintain flight safety. Aaron Hebshi (Air Force) sent the final project description with revisions to Aaron Nadig (Service).

BIOLOGICAL OPINION

Description of the Proposed Action

Site Description

Hickam Air Force Base occupies approximately 2,520 acres and is located on the south shore of Oahu on a coastal plain between Pearl Harbor and the Honolulu International Airport (Figure 1). Much of the land is fill material that was used to construct a base of operations before and during World War II. Hickam Air Force Base is the Headquarters for the Pacific Air Forces and the 15th Air Wing. Although Hickam Air Force Base shares the airfield with Honolulu International Airport, many of the ramp areas and taxiways on Hickam Air Force Base are used exclusively by the Air Force and Hawaii Air National Guard.



Figure 1. Location of Hickam Air Force Base.

Hickam Air Force Base maintains a system of open drainage canals (3.5 miles) to convey water from the runways and ramp areas. Figure 2 shows the drainage canal system in the vicinity of the airfield. A catchment pond, located south of the airfield (Figure 3), is used for irrigation of a nearby golf course. Currently, a temporary leak in the pond's lining keeps water from accumulating and limits the pond's attractiveness to waterbirds; however, surface water has been observed pooled around the catchment area. The pond will need to be repaired in the near future to limit the extent of pooling and improve the drainage in the area.

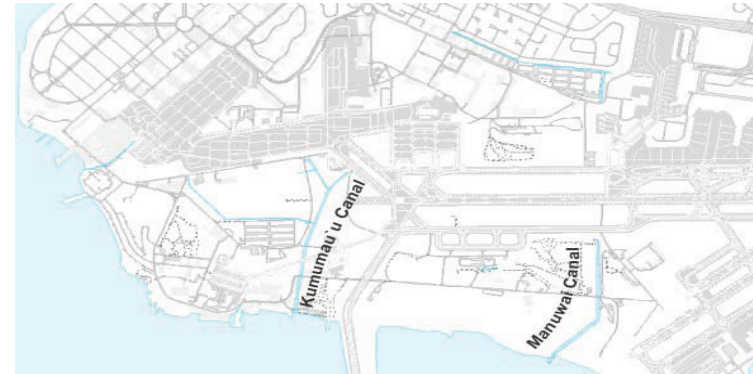


Figure 2. Drainage canals associated with Hickam Air Force Base.

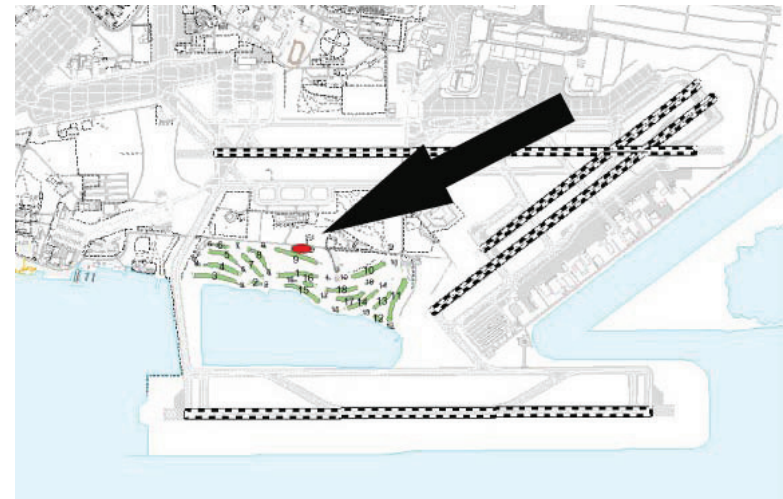


Figure 3. Permanent catchment pond associated with Hickam Air Force Base.

A four-acre wetland (Ahua Reef) and an adjacent expanse of mud and reef flat habitat exist at Hickam Air Force Base (Figure 4) although the wetland is fairly degraded by invasive red mangrove (*Rhizophora mangle*) and pickleweed (*Batis maritima*). The majority of the Hickam Air Force Base is classified as “improved grounds” used for facilities, infrastructure, or landscaping.

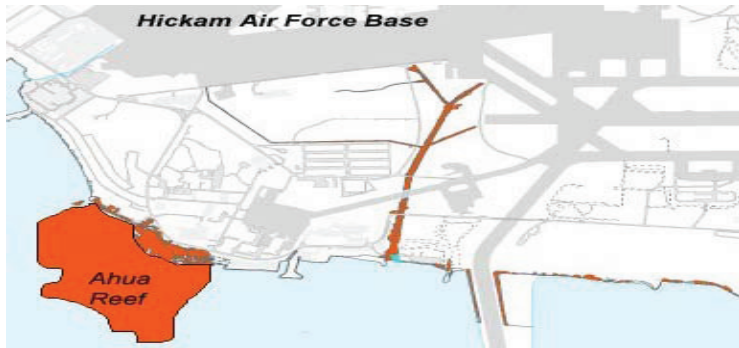


Figure 4. Ahua Reef wetland within Hickam Air Force Base.

Four endangered Hawaiian waterbird conservation areas are within five miles of Hickam Air Force Base (Figure 5). Pouhala Marsh, located 4.3 miles to the northwest of Hickam Air Force Base at Pearl Harbor, is a 70-acre waterbird sanctuary managed by the State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW). The Service manages the Pearl Harbor National Wildlife Refuge (NWR) which is composed of two separate units for Hawaiian waterbirds; the 37-acre Honouliuli wetland and the 25-acre Waiawa wetland. Data from the bi-annual State waterbird counts from Pouhala Marsh and Pearl Harbor NWR show significant populations of endangered Hawaiian waterbirds at these wetlands. Also, a private landowner, Haseko, Inc., maintains a 22-acre, Army Corps of Engineers Wetland Preservation Area in Ewa, about 4.9 miles west of Hickam Air Force Base (Figure 5). Because of the close proximity of the wetlands to Hickam Air Force Base, Hawaiian waterbirds can easily disperse to Hickam Air Force Base in order to forage and nest. Wetland habitat, managed by DOFAW, also exists at Keehi Lagoon in the vicinity of the Honolulu International Airport Reef Runway (east), but bi-annual State waterbird counts from this location are generally low.



Figure 5. Hawaiian waterbird conservation areas in proximity to Hickam Air Force Base.

Summary of Proposed Action

Proposed operations include maintenance of drainage canal systems, ongoing and increasing aircraft operations, construction activities, which may involve the creation of dewatering ponds, and efforts to control bird hazards to aircraft. The action encompasses ongoing operations that the Air Force currently conducts and will continue to conduct into the foreseeable future. The action area pursuant to section 7 regulations consists of “all areas to be affected directly or indirectly by the Federal action.” The action area associated with the proposed action is delineated by the outer perimeter of Hickam Air Force Base installation (see Figure 1) and includes conservation work that will be conducted at Bellows Air Force Station (Figure 6) within the Oxbow wetland of Waimanalo stream.



Figure 6. Bellows Air Force Station.

Proposed Aircraft Operations

Hickam Air Force Base houses the 15th Airlift Wing of the Pacific Air Forces, which currently operates eight C-17 aircraft, 20 F-15 aircraft, and four KC-135 aircraft. Hickam Air Force Base also serves as a stopover hub for military aircraft traveling throughout the Pacific. The current level of air traffic present on the airfield is summarized in Tables 1 and 2; numbers exclude transient (Department of Defense) aircraft using Hickam Air Force Base as a stopover. The level of air traffic is routine and an integral component of Hickam Air Force Base operations, and will continue into the foreseeable future.

Table 1. Current and proposed military aircraft sorties (one sortie is defined as a single aircraft conducting a take-off, flight, and landing) at Hickam Air Force Base.

Aircraft	Sorties: Current (2007)	Sorties: Proposed	Percent Increase
F-22	N/A	4320	50%*
KC-135	495	743	50%
8 C-17s, 1 C-20, 2 C-37s, 1 C-40	2974	~2974	0%

*from current F-15 operations, which will be eliminated when the F-22 beddown occurs.

Table 2. Baseline Operations at Hickam Air Force Base and Honolulu International Airport. Each take-off or landing is considered an operation.

Fiscal Year	Military	Civilian	Total Operations
2003	16,088	289,577	305,665
2004	17,101	303,174	320,275
2005	14,819	315,727	330,546

Data from SAIC (2007), E2m (2008), and 15th AW Wing Aviation Resource Management.

Facility Construction, Renovation, and Demolition

Two beddown activities are currently proposed for Hickam Air Force Base. The Air force is proposing the reassignment of four KC-135 aircraft from Grand Forks Air Force Base, North Dakota, to the KC-135R inventory in Hawaii; additional infrastructure improvements; increase in staffing levels by 154 additional personnel; and construction of a 6,600-square-foot KC-135 Flight Simulator Training Facility. The Hawaii Air National Guard has proposed replacing the existing 20 F-15 aircraft with 20 F-22A aircraft beginning in fiscal year 2011. Demolition and renovation of several buildings and structures, and the construction of additional facilities in support of the beddown are proposed. All construction, renovation, and demolition activities, including the staging of equipment and materials, will occur on previously developed land.

Dewatering Ponds Associated with Construction

Dewatering ponds are occasionally created at new construction sites to collect shunted ground water from excavation activities. In 2006, for instance, construction of new facilities in support of the C-17 beddown required the use of dewatering ponds, which attracted Hawaiian stilts and Hawaiian ducks (or mallard-hybrids). The four dewatering ponds, currently filled, ranged in size between 0.5 and 2 acres. Construction activities in the area of the Hawaii Air National Guard, such as those in support of the F-22 beddown, will create similar dewatering ponds, and are expected to be in use for construction activities over the next five to 10 years (Figure 7) (SAIC 2007). Individual dewatering ponds from the various construction activities may persist for up to four years. Although these dewatering ponds are not permanent structures, such ponds will likely be created for the construction of each new facility. When construction projects are completed, the ponds are filled with coral rubble and soil.

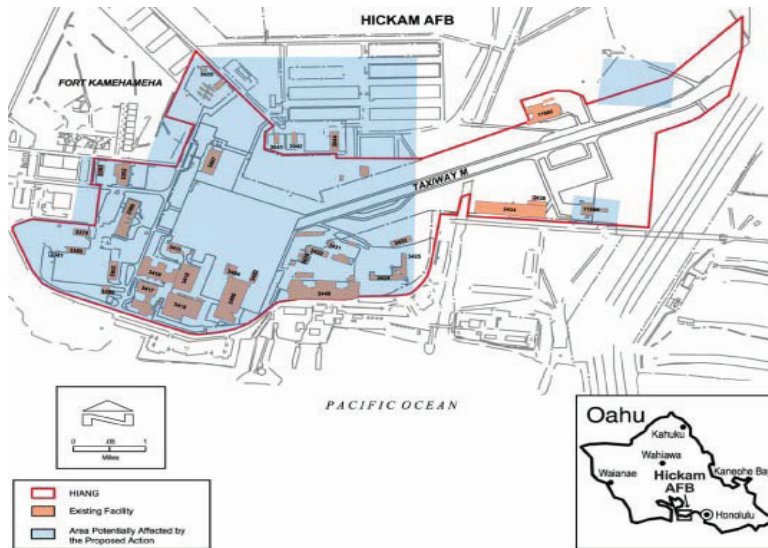


Figure 7. Hickam Air Force project area for F-22A beddown.

Bird and Wildlife Airstrike Hazard Program

To minimize the risk of aircraft collisions with birds or other wildlife, Wildlife Services implements an integrated wildlife control operation within the BASH zone (Figure 8) at Hickam Air Force Base, based on the findings of Linnell's (1995) thesis work. Methods include both lethal and non-lethal techniques. Lethal methods include shooting introduced bird species such as zebra doves (*Geopelia striata*), mynahs (*Acridotheres tristis*), spotted doves (*Streptopelia chinensis*), cattle egrets (*Bubulcus ibis*), and mannikins (*Lonchura* sp.) in high probability bird-strike zones along the runways and taxiways. Non-lethal control includes trapping and relocation, hazing using pyrotechnics, flushing using vehicles or personnel on foot. Only non-lethal control is used for Federally protected and endangered birds such as Pacific golden-plover (*Pluvialis dominica*), Hawaiian stilt, Hawaiian coot, Hawaiian duck, and Hawaiian moorhen. Wildlife Services is authorized to haze endangered birds from airfields in the Hawaiian Islands as an agent of the Service, pursuant to the Service's October 2006, Agent Designation Letter. This agreement, as amended, addresses increases in airports within Hawaii and has been in place since 1991. In addition, each airport maintains a Migratory Bird permit for hazing activities within the designated BASH zone.

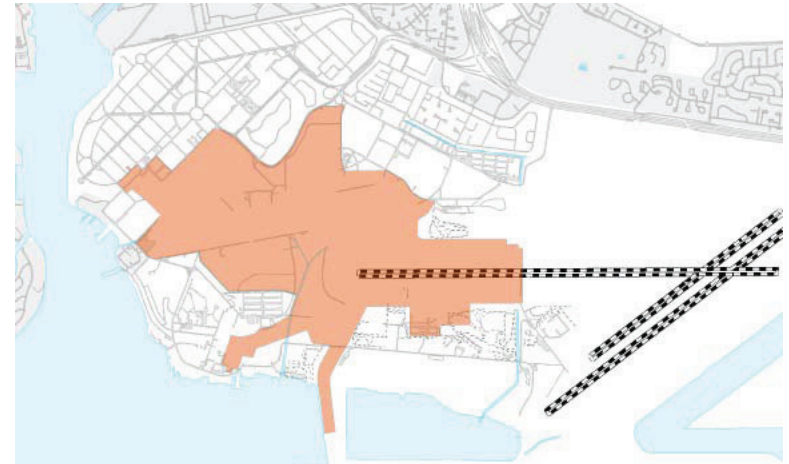


Figure 8. Hickam Air Force Base BASH zone.

Conservation Measures

The following are conservation measures proposed by Hickam Air Force Base to avoid and minimize effects to the endangered Hawaiian waterbirds and are considered part of the project description.

- 1) Minimize nuisance attractants within the BASH zone to prevent attraction and minimize potential interactions between Hawaiian waterbirds and aircraft:
 - a) Develop and implement alternatives to dewatering ponds. Hickam Air Force Base has 3.5 miles of drainage ditches associated with the Airport. When feasible, drainage directly into ditches should be investigated as an alternative to establishing dewatering ponds.
 - b) When the project site mandates use of dewatering ponds, ponds shall be constructed with side slopes that will have a 1.5 horizontal to 1.0 vertical slope (approximately 45 degree slope) which will minimize the potential for creating shallow water habitat for Hawaiian waterbirds. The Hickam Air Force Base will monitor the ponds and immediately repair any edge areas that are not at a 45 degree slope (due to rainstorms, wave action, etc.) to ensure habitat is not created within dewatering ponds. The Hickam Air Force Base shall ensure that water level is continuously maintained at a depth greater than three feet in all dewatering ponds. Ponds shall be covered by a method selected by the Hickam Air Force Base and approved by the Service, to reduce the attractiveness of these features to

- endangered Hawaiian waterbirds. Acceptable methods include the installation and maintenance of systems of bird balls, netting, or tarps to prevent bird access to the ponds.
- c) To minimize the risk of attracting nesting Hawaiian waterbirds, the Hickam Air Force Base will evaluate the BASH program on a quarterly basis to determine where avian attraction or hotspots occur. This will allow Hickam Air Force Base to evaluate habitat modifications for locations that may be attracting waterbirds into the BASH zone.
 - d) If heavy rain events occur during the Hawaiian stilt breeding season (Mid-February through August), Hickam Air Force Base will require Wildlife Services to contact the Flight Safety Office to coordinate any BASH zone staffing increases necessary to prevent Hawaiian stilts from nesting on or around the airfield during these wet periods.
 - e) Hickam Air Force Base will reduce the attractiveness of the drainage canals within the BASH zone. Although the canals draining the runway areas cannot be filled, as that would lead to an increase in standing water in and around the airfield, the Hickam Air Force Base will remove woody vegetation, which can provide cover to the Hawaiian waterbirds, around canals to keep canals open and clear.
 - f) Hickam Air Force Base will repair the water catchment at the golf course to eliminate surface pooling water thus reducing its attractiveness to waterbirds.
- 2) The Air Force will restore wetland areas at Hickam Air Force Base and Bellows Air Force Station to provide habitat outside the BASH zone for endangered Hawaiian waterbirds. The four-acre wetland (Ahua Reef) at Hickam Air Force Base currently is used by Hawaiian stilts for foraging, but a large portion of potential foraging habitat in this wetland is overgrown with mangroves and pickleweed. Likewise, the Oxbow wetland of Waimanalo stream on Bellows Air Force Station (Figure 9) has been overgrown with red mangroves. Air Force will develop a management plan and implement actions to control invasive vegetation and control predators at these two locations beginning in Fiscal Year 2010.
- a) Ahua Reef wetland shall be managed for the following:
 - open water (1-6 inch depth) and mudflat (saturated and dry);
 - interspersed with less than 25 percent cover of pest plants including pickleweed, and red mangrove;
 - minimize predation of adult waterbirds by feral mammalian predators [e.g., cats (*Felis catus*), dogs (*Canis familiaris*)];
 - Air Force shall enforce their policy to restrict domestic pets from Ahua Reef wetland area for the protection of listed waterbirds.
 - b) Bellows Air Force Station Oxbow wetland restoration will include the following:
 - mudflat (dry and saturated) and open water (from less than 1 to 18 inches depth);
 - interspersed 30 to 60 percent cover of tall (3 to 8 feet) emergent vegetation (e.g., cattail), grasses (sprangletop, knot-grass, millet), and sedges (California bulrush, flatsedge, and *Fimbristylis* sp.) that provide seed and green browse and a mosaic of concealment cover, open water, and thermal cover;

- less than 25 percent cover of pest plants including marsh fleabane, pickleweed, water hyssop, California bulrush and California grass;
 - interspersed vegetation with sufficient edge providing visual barriers to maximize territories available for breeding;
 - minimize predation [e.g., mongoose (*Herpestes javanicus*), feral cats, feral dogs, rats (*Rattus* sp.), American bullfrogs (*Rana catesbeiana*), and cattle egrets];
 - Recreation and training in the Oxbow wetland area will be restricted to minimize human disturbance.
- c) Live trapping for feral cats will be conducted year round at Ahua Reef, and mongoose and feral cat trapping will be conducted year round at Bellows Air Force Station Oxbow wetland for the protection of listed waterbirds. Live traps for small mammals and frogs will be checked every 48 hours when trapping activity occurs. Bait stations (utilizing approved rodenticide) will be utilized during the breeding season at Bellows Air Force Station Oxbow wetland to reduce rat predation on listed species.
 - d) Bellows Air Force Station Oxbow wetland will be surveyed on a regular basis for early detection of American bullfrogs. If bullfrogs are discovered, methods should be implemented for immediate eradication.
 - e) Hawaiian ducks are declining primarily due to hybridization with mallard ducks (Engilis and Pratt 1993). Mallard and Hawaiian duck hybrid populations on Oahu are increasing based on DOFAW bi-annual waterbird survey data (Figure 10). Because feral ducks could displace listed ducks and have the potential to perpetuate hybridization, a program of survey and control will be coordinated with PIFWO prior to implementation. Methodology will be based on criteria outlined in the Hawaiian duck-hybrid Identification Key (Eadie et. al. 2009, Fowler et. al. 2008) to address incursions of these hybrid duck at Bellows Air Station Oxbow wetland. Specimens of hybrid ducks shall be retained and disposition of carcasses shall be coordinated with PIFWO.

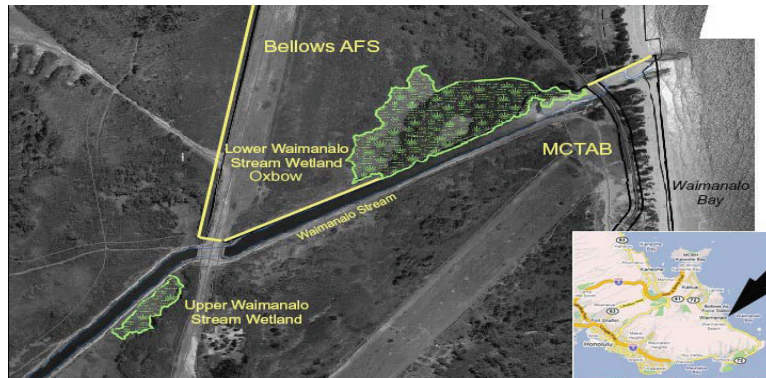
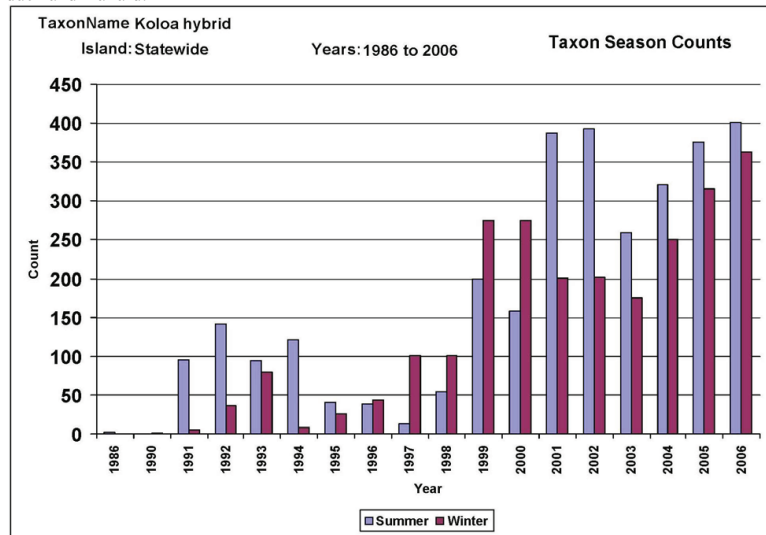


Figure 9. Oxbow Wetland of Waimanalo Stream on Bellows Air Force Station.

Figure 10. State waterbird surveys 1986 – 2006, summer and winter counts of hybrid Hawaiian duck and mallard.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

STATUS OF THE SPECIES

Hawaiian stilt or Ae o (*Himantopus mexicanus knudseni*)

Legal Status

The Hawaiian stilt was listed as an endangered species on October 13, 1970 (Service 1970) pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released in May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4 (c)(2) of the Act which requires five year review after listing. Critical habitat has not been designated for the Hawaiian stilt (Service 2005).

Description

The Hawaiian stilt is a slender wading bird, black above (except for the forehead), white below, and with distinctive long, pink legs. Sexes are distinguished by the color of the back feathers (brownish in the female, black in the male) as well as by voice (females having a lower voice). Downy chicks are well camouflaged and are tan with black speckling. Immature birds have brownish-back and white patches on their cheeks (Pratt *et al.* 1987). A comprehensive summary of the current knowledge of stilts in North America has recently been published by The Birds of North America (Robinson *et al.* 1999).

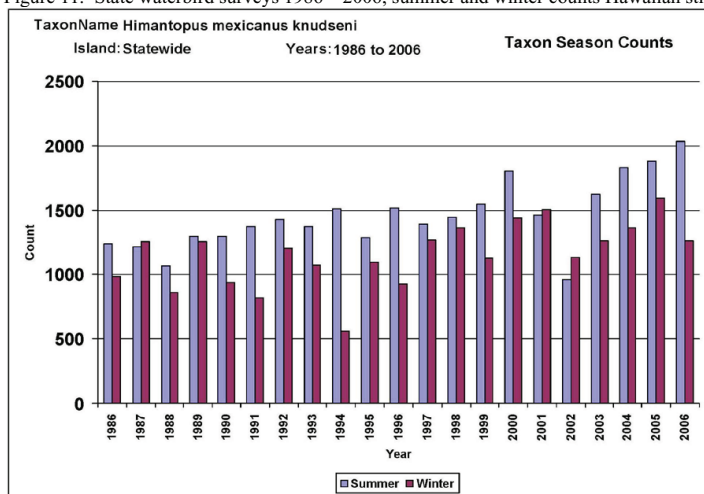
Range and Distribution

Hawaiian stilts were historically known from all of the major Hawaiian Islands, except Lanai and Kahoolawe (Paton and Scott 1985). The first stilts on Lanai were documented in 1989, at the Lanai City wastewater treatment ponds (Hawaii Division of Forestry and Wildlife 1976 to 2003). Stilts are now found on all of the main Hawaiian Islands except Kahoolawe.

Population Densities

By the early 1940s, statewide population numbers were estimated to be between 200 to 1,000 Hawaiian stilts (Munro 1960, Schwartz and Schwartz 1949). However, these population estimates did not account for the Hawaiian stilts present on Niihau and are therefore considered underestimates. Though Hawaiian stilt census data show high year-to-year variability in the number of stilts observed (Engilis and Pratt 1993), long-term census data indicate that statewide populations have been relatively stable or slightly increasing (Reed and Oring 1993). Currently, the population of Hawaiian stilts is considered to be stable to increasing (Service 2005) and is estimated to be between 1,200 to 1,600 birds (Griffin *et al.* 1989; Engilis and Pratt 1993, Hawaii Waterbird Database-Hawaii Natural Heritage Program 2007) (Figure 11). Hawaiian stilts readily disperse between islands and constitute a homogenous metapopulation within Hawaii (Reed *et al.* 1994; Reed *et al.* 1998).

Figure 11. State waterbird surveys 1986 – 2006, summer and winter counts Hawaiian stilt.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Habitat Types

Hawaiian stilts use a variety of aquatic habitats but are limited by water depth and vegetation cover. Hawaiian stilts are known to use ephemeral lakes, anchaline ponds, prawn farm ponds, marshlands and tidal flats. Stilts need early successional marshlands or other aquatic habitat with water depth less than 9 inches, perennial vegetation that is limited and low growing for foraging areas. Native low-growing wetland plants associated with stilt nesting areas include water hyssop (*Bacopa monnieri*); sea purslane (*Sesuvium portulacastrum*); and the sedges, makaloa (*Cyperus laevigatus*) and kaluha (*Bolboschoenus maritimus*) (Robinson *et al.* 1999). They may also use taro (*Colocasia esculenta*) ponds where the full-grown vegetation forms a protective canopy.

Breeding

Hawaiian stilts have higher nesting densities on freshly exposed mudflats, interspersed with low growing vegetation (Service 1983). Nesting has also been documented on low relief islands (natural and man-made) in fresh or brackish ponds, man-made floating nest structures, floating wooden platforms, and cleared level areas near foraging habitats (Shallenberger 1977; Morin 1994; Navy pers. comm. 2008). The nest itself is a simple scrape on the ground. They have also been observed using grass stems and rocks for nesting material (Coleman 1981). Hawaiian stilts defend an area of 66 to 99 feet around the nest and are semi-colonial. The nesting season normally extends from mid-February through August (Robinson *et al.* 1999). Peak nesting varies among years and re-nesting can occur after a loss of a clutch (Robinson *et al.* 1999). Stilts

usually lay three to four eggs that are incubated for approximately 24 days (Coleman 1981; Chang 1990). Chicks are precocial, leaving the nest within 24 hours of hatching. Adults with three-day old chicks have been observed to move three-tenths of a mile from the nest site (Reed and Oring 1993). Young may remain with both parents for several months after hatching (Coleman 1981).

Diet

Stilts are opportunistic feeders. They eat a wide variety of invertebrates and other aquatic organisms available in shallow water and mudflats. Specific organisms taken include water boatmen (Corixidae), beetles (Coleoptera), possibly brine fly (*Ephydra riparia*) larvae, polychaete worms, small crabs, Mozambique tilapia (*Tilapia mossambica*), western mosquito fish (*Gambusia affinis*), and tadpoles (*Bufo* spp.) (Robinson *et al.* 1999; Shallenberger 1977).

Hawaiian coot or Alae keokeo (*Fulica alai*)

Legal Status

The Hawaiian coot was listed as an endangered species on October 13, 1970 (Service 1970) pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released in May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4 (c)(2) of the Act which requires five year review after listing. Critical habitat has not been designated for the Hawaiian coot (Service 2005).

Description

The Hawaiian coot adult males and females have a black head, a slate gray body with white undertail feathers, and a prominent white frontal shield and bill; feet are lobed rather than webbed and are greenish-gray.

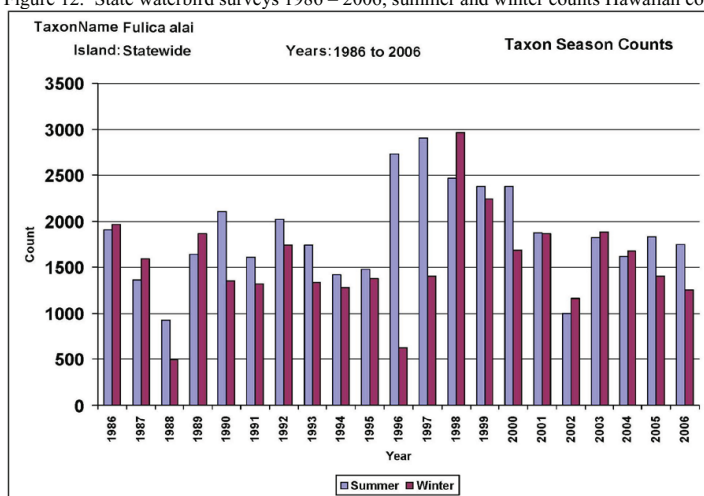
Range and Distribution

Hawaiian coots occur in coastal plain wetlands usually below 1,320 feet elevation on all the main Hawaiian Islands except for Kahoolawe; however, breeding is restricted to relatively few sites. About 80 percent of the population occurs on Kauai (Hanalei, Huleia, Opaekaa), Oahu (coastal wetlands and reservoirs such as Lake Wilson and Nuuanu Reservoir, Kahuku Point and along the windward shore), and Maui (Kanaha and Kealia Ponds, Nuu Pond) (Service 2005). The remaining 20 percent of the population occurs in coastal ponds and playa wetlands, such as Paialoa Pond on Molokai, the Lanai City wastewater treatment pond, Aimakapa, Opaekaa, Waiakea, and Loko Waka ponds on the island of Hawaii (Service 2005).

Population Densities

Island-wide population, based on bi-annual waterbird counts conducted by DOFAW, suggests that the population is stable and is estimated at between 2,000 and 3,000 individuals (Figure 12).

Figure 12. State waterbird surveys 1986 – 2006, summer and winter counts Hawaiian coot.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Habitat Types

Life history and breeding biology are poorly known. The species is somewhat gregarious and uses freshwater and brackish wetlands including agricultural areas (e.g., taro fields) and aquaculture ponds. Hawaiian coot generally occur in low elevation, wetland habitats with suitable emergent plant growth interspersed with open water, especially freshwater wetlands, but also freshwater reservoirs, cane field reservoirs, sewage treatment ponds, taro loi, brackish wetlands, and limited use of saltwater habitats. However, on Kauai, some birds occur in plunge pools above 4,900 feet elevation and on the island of Hawaii, stock ponds up to 6,600 feet elevation. The species typically forages in water less than 12 inches deep, but will dive in water up to 48 inches deep. Compared to Hawaiian moorhen, Hawaiian coots prefer to forage in more open water. Logs, rafts of vegetation, narrow dikes, mud bars, and artificial islands are utilized for resting. Ephemeral wetlands support large numbers of coots during the non-breeding season. Some important habitats are located on NWR and in State waterbird sanctuaries and these sites receive management attention. However, other important habitats are not protected. These unprotected habitats include wetlands facing development or those used for agriculture or aquaculture. Examples include: playa lakes on Niihau, Opaekaa marsh, Lumahai wetlands on Kauai, Amorient prawn farms, Laie wetlands, Uko, Punahoolapa, and Waihee marshes, Waialua lotus fields, and Waipio Peninsula ponds on Oahu, Paialoa and Ooia playa fishponds on Molokai, and Opaekaa, and Waiakea-Loko Waka ponds on the island of Hawaii.

Breeding

Nesting habitat includes freshwater and brackish ponds, irrigation ditches, and taro fields. Floating nests are constructed of aquatic vegetation and found in open water or anchored to emergent vegetation. Open water nests are usually composed of mats of bulrush (*Schoenoplectus* spp.), water hyssop (*Bacopa monnieri*) and Hilo grass (*Paspalum conjugatum*). Nests in emergent vegetation are typically platforms constructed from buoyant stems of species such as bulrush (*Schoenoplectus* spp.). Nesting occurs year round. Nest initiation is tied to rainfall as higher water levels are critical to nest success. Clutch size range from three to ten eggs, and precocial young hatch after a 25 day incubation period.

Diet

Hawaiian coots are generalists and feed on land, grazing on grass adjacent to wetlands, or in the water. They have been observed grazing from the surface of the water, or foraging by diving to obtain food resources. Food items include seeds and leaves, snails, crustaceans, insects, tadpoles, and small fish. The species will travel long distances, including between islands, when local food sources are depleted.

Hawaiian moorhen or Alae Ula (*Gallinula chloropus sandvicensis*)

Legal Status

The Hawaiian moorhen is an endemic subspecies of the North American mainland Common moorhen. The Hawaiian moorhen was listed as an endangered species in 1967 pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released in May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4 (c)(2) of the Act which requires five year review after listing. Critical habitat has not been designated for the Hawaiian moorhen (Service 2005).

Description

The Hawaiian moorhen is a dark, gray bird with a black head and neck and white feathers on their flanks and undertail coverts. They have a very distinctive red frontal shield, and their bill tip is yellow with a red base. Their legs and feet are greenish and without lobes. The Hawaiian moorhen usually measure about 13 inches in length. Both sexes are similar and have chicken-like cackles and croaks. The Hawaiian moorhen is very similar to the common moorhen on the mainland in appearance. A comprehensive summary of the current knowledge of moorhen in North America has recently been published by The Birds of North America (Robinson *et al.* 1999). In Hawaiian legend, these birds were thought to have brought fire from the gods to the Hawaiian people.

Range and Distribution

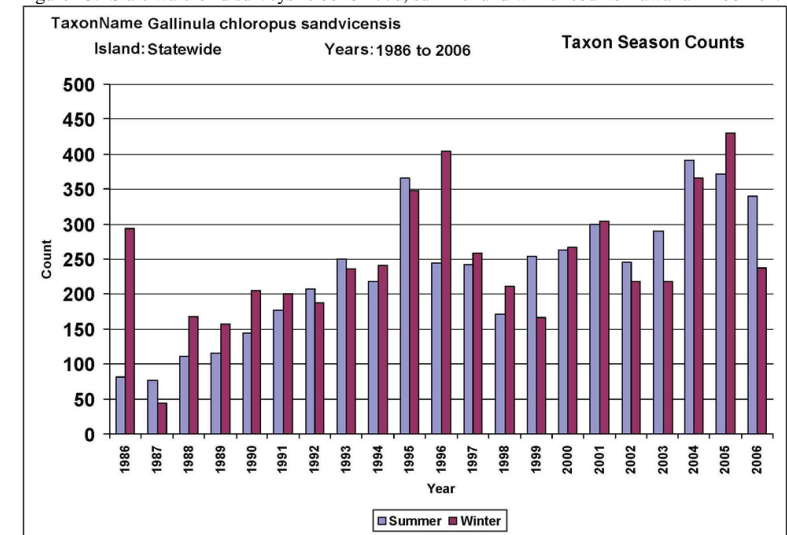
Hawaiian moorhen generally occur in wetland habitats below 410 feet elevation on the islands of Kauai and Oahu, although there have been reports from Keanae Peninsula on Maui and from the island of Hawaii. On Kauai, the largest populations occur in the Hanalei and Wailua river valleys. Hawaiian moorhen also occur in the irrigation canals on the Mana Plains of western Kauai and in taro fields. On Oahu, the species is widely distributed with most birds found between Haleiwa and Waimanalo; small numbers occur at Pearl Harbor and the leeward coast at

Lualualei Valley. Historically, Hawaiian moorhen occurred on all the main Hawaiian Islands except for Lanai and Kahoolawe.

Population Densities

No historical population estimates are available for the endemic Hawaiian moorhen. Because they are such secretive birds, it is difficult to conduct population surveys for this species. It is believed that they were common on the main Hawaiian Islands, except Lanai and Kahoolawe, in the 1800's but radically declined by the mid-1900. Surveys from the 1950's through the 1960's estimated only 57 individuals. Currently Hawaiian moorhen inhabit the islands of Kauai and Oahu (Service 2005). The State attempted a re-introduction of six banded moorhen (three females and three males) on May 18, 1983, to the island of Molokai at Kakahaia NWR. One of the banded birds was found dead January 2, 1985, and a local resident mistook the other five for chickens they were consumed (Dibben-Young 2009). Island-wide population, based on bi-annual waterbird counts conducted by DOFAW, suggests that the population is increasing, but count numbers are variable. Between 1993 and 2003, the average annual number of Hawaiian moorhen observed has been just under 300 individuals (Figure 13). However, these survey numbers are thought to be underestimates because of the moorhen's cryptic behavior. Standard survey methods in these counts include visual and aural detection. Recent research conducted by DesRochers between 2005 and 2007, has shown that passive surveys of cryptic waterbirds underestimate numbers of individuals present in the wetlands. Alternatively, broadcasting vocalizations of cryptic waterbirds to elicit responses increases detection. On average, DesRochers research has shown, broadcasting calls increased moorhen detection by 30 percent.

Figure 13. State waterbird surveys 1986 to 2006, summer and winter counts Hawaiian moorhen.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Habitat Types

Hawaiian moorhen are the most secretive of the native waterbirds, preferring to forage, nest and rest in dense, late succession wetland vegetation. Most birds feeding along the waters edge or in open water will quickly seek cover when disturbed. The preferred habitat for moorhens includes: interspersed dense stands of robust late succession vegetation near open water (approximately 50 percent water to 50 percent vegetation) floating or barely emergent mats of vegetation and water depth less than 3 feet (Service 2005).

Breeding

These birds nest year-round but appear to have two active seasons from November through February and May through August (Service 2005). It is believed that the timing of nesting is related to water levels and late succession wetland vegetation. The Hawaiian moorhen usually lay an average of 5 to 6 eggs, although clutches have been up to 13 eggs, and incubation is about 25 days (Service 2005). Nesting phenology is apparently tied to water levels and the presence of appropriately dense vegetation. Platform nests are constructed in dense vegetation over water or near the waters edge. The particular species of emergent plant used for nest construction is not as important as stem density and vegetation height (Service 2005).

Diet

Hawaiian moorhen are opportunistic feeders and their diet likely varies with habitat, but includes algae, grass seeds, insects, snails, introduced fishes, crustaceans, mollusks, emergent grasses, and wetland plants (Service 2005).

Hawaiian duck or kaloa maoli (*Anas wyvilliana*)

Legal Status

The Hawaiian duck was listed as an endangered species in 1967 (Service 1967) pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released on May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4 (c)(2) of the Act which requires five year review after listing. Critical habitat has not been designated for the Hawaiian duck (Service 2005).

Description

The Hawaiian duck is one of two extant native duck species (Family: Anatidae) found in Hawaii and is closely related to the well-known, but non-native mallard. Both sexes are mottled brown overall similar in appearance to a female mallard. Adult males have darker heads, with distinctive brown chevrons on the breast, flank and back feathers, and olive bills (Englis et. al 2002). Adult females are similar but are smaller than males on average and slightly lighter in color, with plainer, buff colored chin and back feathers (Englis et. al 2002).

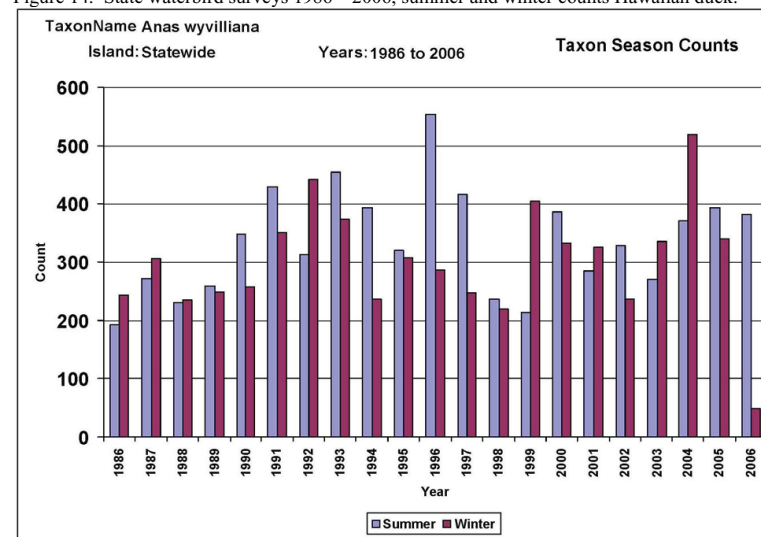
Range and Distribution

Historically, Hawaiian ducks occurred on all the main Hawaiian Islands except for Lanai and Kahoolawe. Currently, Hawaiian ducks are generally found in wetland habitats from sea level to 9,900 feet elevation on all the main Hawaiian Islands except for Kahoolawe; populations on all islands except for Kauai originated from re-introduced birds. On Kauai, populations are found in Hanalei NWR and montane streams. On Oahu, populations are found in Kawainui, Hamakua, and Heeia marshes, James Campbell NWR, and in wetland habitats in or near Punahoolapa, Haleiwa, Pearl Harbor, and Lualualei Valley. On Maui, Hawaiian ducks are found in Kahului, Kanaha and Kealia ponds. On the island of Hawaii populations occur in the Kohala Mountains, in Pololu, Waimanu and Waipio valleys, and Mauna Kea.

Population Densities

The Hawaiian duck population is estimated to be approximately 2,000 individuals with 80 percent of individuals occurring on Kauai (Englis et. al 2002). State bi-annual waterbird survey data count numbers range from 300 to 500 individuals (Figure 14). Because of the remoteness and inaccessibility of some habitats, the State waterbird counts are likely an underestimate. Historically, Hawaiian duck were fairly common in natural and agricultural wetland habitats. By 1949, only about 530 individuals remained, with 30 on Oahu and the remainder on Kauai (Service 2005).

Figure 14. State waterbird surveys 1986 – 2006, summer and winter counts Hawaiian duck.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Habitat Types

Hawaiian ducks occur in a wide variety of natural and artificial wetland habitats including freshwater marshes, flooded grasslands, coastal ponds, streams, montane pools, forest swamplands, taro, lotus, shrimp, and fish ponds, irrigation ditches, reservoirs, and mouths of larger streams (Service 2005). Some important habitats are located on NWR or on State lands and receive management attention. However, other important habitats are not protected. These mostly include wetlands facing development or those used for agriculture or aquaculture. Examples include: playa lakes on Niihau, Opaekaa marsh, Lumahai wetlands on Kauai, Amorient prawn farms, Laie wetlands, Uko, Punahoolapa, and Waihee marshes, Waialua lotus fields, and Waipio Peninsula ponds on Oahu, Paialoa and Ooia playa fishponds on Molokai, and Opaaula, and Waiakea-Loko Waka ponds on the island of Hawaii.

Breeding

Hawaiian ducks nesting biology is poorly understood. Although some pairs nest in lowland habitats on Kauai, Hawaiian ducks have also been observed nesting in the upper Alakai swamp (Service 2005). Nesting occurs year round, but most activity occurs between January and May (Englis et. al 2002). Nests are usually on the ground near water, but few nests are found in areas frequented by humans or areas supporting populations of mammalian predators. Generally eight to ten eggs are laid, and the precocial chicks hatch after an unknown incubation period, but likely less than 30 days.

Diet

Hawaiian ducks forage in a wide variety of freshwater habitats, including artificial wetlands. Movements between feeding and breeding habitats and between Kauai and Niihau occur. The species typically forages in shallow water (less than five inches deep). Like mallards, Hawaiian ducks are opportunistic and their diet includes snails, dragonfly larvae, earthworms, grass seeds, green algae, and seeds/leaf parts of wetland plants. Hawaiian ducks are usually found alone or in pairs and are wary, especially when nesting or molting, although during the winter they may gather in larger numbers to exploit abundant food resources (Service 2005).

Threats and Recovery Needs for all Hawaiian Waterbirds

The primary causes of the decline of the Hawaiian waterbirds are the loss of wetland habitat, predation by introduced animals, hunting in the late 1800's and early 1900's, disease, and environmental contaminants. A significant amount of Hawaii's wetlands have been lost due to human activities. Modification of wetlands includes filling and draining for agriculture, houses, hotels and golf courses. The Service estimates 22,475 acres of wetlands existed within the coastal plains of Hawaii circa 1780 (Service 1990). In 1990, the Service estimated only 15,474 acres remained a decrease of 31 percent (Service 2005). This loss of suitable wetland habitat is compounded by the alteration of wetland plant communities due to invasion by non-native plants. Species such as California grass, pickleweed, water hyacinth, Indian fleabane and red mangrove all present a serious threat by out-competing more desirable species and eliminating open water habitats. Unmanaged vegetation has reduced open water, shallow water, bare ground, and exposed mudflat habitat. All of these habitats are under serious threat without management to control these aggressive plant species (Service 2005).

Other major contributors to the decline of endangered Hawaiian waterbirds are introduced predators. Small Indian mongoose, feral cats, and feral dogs are all presently found within wetlands and pose a serious threat to Hawaiian waterbird reproductive success. All three of these predatory species are known to take eggs, young birds, and even adults. Both cats and dogs are of particular concern because of the close proximity of Hawaii wetlands to urban areas. Other species, such as the cattle egret, American bullfrog, and rats have been observed congregating around nesting waterbirds just prior to chicks hatching or in areas where young chicks have suddenly disappeared from nests (Woodside 1997). Oahu NWR staff have documented predation of waterbird chicks by cattle egret and black-crowned night heron. An American bullfrog was documented preying upon a Hawaiian moorhen chick at Hanalei NWR (Viernes 1995). More recently the key predators study of 2003 to 2004, on James Campbell NWR provided the first multiple observations of Hawaiian stilt chick predation by American bullfrogs, which accounted for 45 percent chick losses over the study period (Eijzenga 2005). Predation by introduced mammals and other native and non-native species is currently the most important factor limiting recovery for the Hawaiian waterbirds (Service 2005, Robinson *et al.* 1999). Recovery of the Hawaiian waterbirds focuses on the following objectives: (1) increase population numbers to a statewide baseline level; (2) establish multiple, viable breeding populations throughout each species' historic range; and (3) establish a network of wetlands on the main islands that are protected and managed for waterbirds (Service 2005).

Threats and Recovery Needs Specific to Hawaiian Duck

Currently the most important threat to the Hawaiian duck population is hybridization with non-native mallards. This is especially problematic on Oahu where most of the individuals are hybrids. In addition, feral pigs (*Sus scrofa*) and goats (*Capra hircus*) significantly reduce the suitability of nesting habitat for Hawaiian ducks along montane streams (Service 2005).

ENVIROMENTAL BASELINE

Status of the Species in the Action Area

Hawaiian stilts, are regular visitors to Hickam Air Force Base, frequently foraging in several watercourses and on the reef flat (Ahua Reef) extending off of the wetland area. However, this habitat does not provide for nesting or loafing opportunities making it marginal habitat for endangered waterbird life cycle needs. Occasional sightings of Hawaiian coots, Hawaiian moorhen, and Hawaiian ducks have been documented at Hickam Air Force Base.

Existing data for endangered Hawaiian waterbirds on Hickam Air Force Base is derived from the State bi-annual waterbird surveys conducted by DOFAW and by Hickam Air Force Base Natural Resources personnel. These data were collected systematically, with each survey being conducted by at least one person familiar with the site and one person experienced in waterbird identification. DOFAW waterbird surveys conducted between 1987 and 2004 encompassed only the reef flats off the Hickam Air Force Base wetland area (Ahua Reef and Fort Kamehameha Flat). Surveys were timed to coincide with low tide. Only the Hawaiian stilt was observed during these surveys averaging zero to four stilts per survey (Tables 3 and 4). Hickam Air Force Base Natural Resources personnel conducted waterbird surveys from 2006 to 2008, and included a broader area of coastline and wetlands. In July 2006, zero endangered waterbirds were observed; in January 2007, two adult stilts were observed at Ahua Reef; and in January 2008, two adult stilts were observed at the mouth of the Manuwai Canal.

The wetland area located at Bellows Air Force Station is not currently used by Hawaiian waterbirds. Unfortunately, the wetland is overgrown with non-native red mangrove and does not currently provide any function for Hawaiian waterbirds.

Between 2002 and 2006, Wildlife Services personnel documented all endangered species hazing events within the Hickam Air Force Base BASH zone. This information also includes data from nesting events and bird aircraft interactions and removal of pre-fledgling chicks from the Hickam Air Force runway (Table 5 and Figure 15). Hazing events can fluctuate from year to year as depicted in Table 5. In 2002 the number of hazing events for the Hawaiian stilt was 28 while in 2006, Wildlife Services documented 340 interactions with Hawaiian stilts. It is not known if these numbers represent many individuals or only a few individuals hazed repetitively. We do know that there is some level of repetitive hazing as it is highly unlikely that 340 individual Hawaiian stilts have passed through the Hickam Air Force Base.

Breeding by Hawaiian stilts though rare, has been documented near Hickam Air Force Base/Honolulu International Airport in 2002 and 2006, as both eggs and chicks have been

removed by Wildlife Services for aircraft safety concerns. Wildlife Services attempts to discourage nesting activities prior to eggs being laid to minimize Hawaiian waterbird mortality.

When comparing State bi-annual waterbird data with BASH data collected by Wildlife Services, it may appear to be inconsistent. However, point in time surveys are only done for a short period of time versus the recorded incidents of hazing which are conducted out throughout the entire year. It is likely that the number of birds within the action area is low because the birds are highly transitory and only utilizing area in and around Hickam for foraging, with the exception of the Hawaiian stilts that have opportunistically attempted nesting during wet years.

Table 3. State waterbird surveys 1987 – 2003, summer counts Fort Kamehameha Flats Hawaiian waterbird count summary report.

Island: Oahu																
Wetland:																
Fort Kam Flats																
Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Season: Summer																
2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Table 4. State waterbird surveys 1987 – 2004, winter counts Fort Kamehameha Flats Hawaiian waterbird count summary report.

Island: Oahu																
Wetland:																
Fort Kam Flats																
Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Season: Winter																
2004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Table 5. Endangered waterbird actions within the BASH 2002-2006, at Honolulu International Airport and Hickam Air Force Base.

Species	Year	Incidents	Disposition
Hawaiian stilt	2002	28	hazed
Hawaiian stilt	2002	1	nest removal-2 eggs
Hawaiian stilt	2003	19	hazed
Hawaiian stilt	2004	36	hazed
Hawaiian stilt	2005	44	hazed
Hawaiian duck	2005	27	hazed
Hawaiian duck	2005	3	aircraft strike
Hawaiian stilt	2006	340	hazed
Hawaiian duck	2006	60	hazed
Hawaiian coot	2006	65	hazed
Hawaiian stilt	2006	2	chick removal

Data: Wildlife Services Letter designee annual reports 2003-2007.

Figure 15. Hawaiian stilt chicks removed from Hickam Air Force Base and Honolulu International Airport Runway 2006.



Photo: Wildlife Services

EFFECTS OF THE ACTION

Potential risks to listed waterbirds from the ongoing and increasing operations at Hickam Air Force Base include: (1) aircraft operations; (2) BASH program at Hickam Air Force Base; (3) short term and permanent water catchments and drainage canals associated with construction and renovation of airport facilities; and (4) management actions related to Bellows Air Force Station Oxbow wetland.

The issue of aircraft flight safety and collision with birds has been well documented and airports are responsible for reducing this risk through various management methods. Between 1998 and 2004, 164 aircraft have been destroyed and 194 people have lost their lives as a result of bird and other wildlife strikes with civil and military aircraft (Richardson et. al. 2000, Thorpe 2003, Wright 2008). Hickam Air Force Base's ongoing operations and forecasted expansion of air operations (SAIC 2007, E2m 2008) will have the potential for waterbird-aircraft collisions. It is anticipated that although there will be an increase in military operations that avoidance and minimization measures will stabilize or decrease potential for interactions. Despite preventative measures on the part of the Hickam Air Force Base and Wildlife Services, there remains the possibility for take of endangered Hawaiian waterbirds due to direct collision with an aircraft. For example, three ducks (one Hawaiian duck and two mallard/Hawaiian duck hybrids) were attracted to a Hickam Air Force Base ditch filled with standing water and were struck in 2005, in a single incident by a commercial aircraft (see Table 5). Mr. Willie Glover from the entomology

department of Hickam Air Force Base, documented a Hawaiian coot with a broken wing, brought to him by personnel who had recovered the bird from the flight line in early 2000 (INRMP 2003). Increased vigilance through interdepartmental and interagency communication of changing conditions (weather and habitat) within the BASH zone, and management to reduce water attractants within the BASH will minimize these lethal interactions with Hawaiian waterbirds.

One method employed to help reduce the potential for bird/aircraft collision is direct hazing of avifauna on the Hickam Air Force Base/Honolulu International Airport by Wildlife Services. Hazing includes endangered Hawaiian waterbirds and is performed in the BASH zone at Hickam Air Force Base. The hazing activities occur seven days a week during Hickam Air Force Base operational hours. Hazing activities include using pyrotechnics, flushing using vehicles or personnel on foot within the BASH zone, results in startle response flushing of foraging waterbirds from the airport area which could result in injury through collision with aircraft, fences, or structures. In addition, Wildlife Services personnel haze waterbirds to preclude nesting activities in the BASH zone. Again, this is necessary for the safe operations of the airport and hazing a pair of birds while attempting to nest reduces the risk of having to destroy an active nest with eggs or chicks. Harassment of waterbirds prior to nesting may also move the pair offsite to establish a nest in a more suitable location. In the last five years, according to data collected by Wildlife Services (see Table 5), one Hawaiian stilt nest was destroyed and two chicks were removed in 2006. These events result in the mortality of eggs and/or young.

The greatest number of hazing incidents recorded over the last five years reported by Wildlife Services was 340 Hawaiian stilts at Hickam Air Force Base/Honolulu International Airport (see Table 5). In 2006, 65 hazing events was recorded for Hawaiian coots along with 60 events for Hawaiian duck (because of Hawaiian duck hybrid identification issues; all birds are documented as Hawaiian ducks) (see Table 5). Since many of these birds are not banded or band identification is not collected, we do not know how many individual birds these numbers actually represent. For example, it is highly unlikely that 340 individual Hawaiian stilts have passed through the Hickam Air Force Base/Honolulu International Airport in one year. It is likely that the number of birds within the action area is low because the birds are highly transitory and only utilizing area in and around Hickam for foraging. In addition, it is anticipated that very few of the hazing incidents may result in injury, and that the hazing overall is an appropriate avoidance and minimization tool to avoid bird-aircraft collisions.

Water attractants within the BASH zone increase the potential for waterbird-aircraft collision resulting in injury and mortality of Hawaiian waterbirds. In March 2006, a pair of Hawaiian stilt nested adjacent to the runway where dewatering ponds and a leaky pipe from a construction project provided a nuisance attractant. Wildlife Services contacted the Service requesting permission to remove the nest from the area in an attempt to reduce the potential for an aircraft strike. In this case, it was determined the nest could remain in place, but the chicks failed to fledge (Darrin Phelps pers. comm.). In 2002, Hawaiian stilts nested within the BASH zone and Service personnel (Law Enforcement) were called to remove the nest due to safety concerns. Facility construction, renovation, and demolition will require short term dewatering ponds (up to 2 years) be constructed. Construction of these ponds will be straight sided and water levels will be maintained so that there will be no shallow water. These dewatering ponds will be covered

(bird balls, nets, tarps, etc.) to reduce attractiveness to the ponds. The permanent airport facility drainage canals are required and also provide waterbird habitat within the BASH zone. To reduce the attractiveness of the canals to waterbirds, Hickam Air Force Base will remove woody vegetation and keep the canals open and clear. In addition, Hickam Air Force Base will repair the water catchment at the golf course to eliminate surface pooling water thus reducing its attractiveness to waterbirds. Eliminating or reducing the attractiveness of these temporary and permanent water sources will help to reduce the number of Hawaiian waterbirds utilizing Hickam Air Force Base thus reducing the harm and harassment to Hawaiian waterbirds.

The loss of wetland habitat has been identified as the primary cause for the decline of the Hawaiian waterbirds (Service 2005). The Air Force's proposed action includes increasing managed wetland habitat for Ahua Reef wetland and Bellows Air Force Station for the benefit of Hawaiian waterbirds. Restoration of Ahua Reef wetland will increase available foraging and loafing habitat. Restoration of the Bellows Air Force Station Oxbow wetland will provide additional foraging, loafing, and nesting habitat. The restored habitat will provide for increased reproduction and numbers of Hawaiian waterbirds. Since Oxbow wetland is currently unsuitable for waterbird use, the improvements to the site (habitat restoration and predator control) will provide additional habitat thus increasing wetland acreage suitable for waterbird nesting.

Predator control is necessary for Hawaiian waterbirds to successfully reproduce. Unfortunately, predator control traps attract the curious Hawaiian moorhen and birds have been captured in the predator traps. The use of predator control traps at Bellows Air Force Station Oxbow wetland may result in take of Hawaiian moorhen once a population becomes established. The trapability of moorhen was demonstrated by a study conducted in 2005 through 2007, by David DesRochers (Tufts University Massachusetts) and Oahu NWR Complex staff (DesRochers et al. 2006). Within a two-year time period, 90 Hawaiian moorhen were banded with 162 captures with no injuries. A moorhen was incidentally captured on James Campbell NWR, Kii Unit on April 2, 2002, which resulted in a broken wing from catching on a hanging bait jar. On July 1, 1994, an adult Hawaiian moorhen was found dead in one of the traps at Hanalei NWR followed an incident on November 27, 1994 where one adult and three juvenile moorhens were captured in one trap where one of the juveniles died. Therefore, due to their curious nature and hence attraction to predator control traps, it is anticipated that Hawaiian moorhen will be captured in live traps which could result in injury or mortality.

The Hawaiian duck is declining primarily due to hybridization with mallard ducks (Engilis and Pratt 1993). Mallard and Hawaiian duck hybrid populations on Oahu are increasing based on data from State bi-annual waterbird surveys (see Figure 10). Because feral ducks have the potential to perpetuate hybridization and could displace listed species, the Air Force will assess a program for hybrid duck surveys and eradication. Any future duck control plan will be coordinated with the Service prior to implementation. The mallard/hybrid duck control plan has long-term beneficial effect of helping to minimize the potential for hybridization of Hawaiian ducks and mallards at the Bellows Air Force Station Oxbow wetland.

Avian botulism outbreaks are common in Hawaii and can be a significant localized cause of waterbird mortality (Pratt and Brisbin 2002). The first documented outbreak in Hawaii occurred on Oahu at Kaelepu pond, which is also known as Enchanted Lake, in Kailua in 1952 (Brock

and Breese 1953). Since then, avian botulism outbreaks have been documented at Hanalei NWR on Kauai (Pratt and Brisbin 2002), Aimakapa pond at Kaloko-Honokahau National Historical Park on Hawaii (Morin 1998), Ohiapilo pond on Molokai, and at Kealia NWR on Maui (Service 2005). Avian botulism is caused by a toxin produced by a widespread bacterium. Normally dormant, these spores release toxins only when certain conditions occur, including warm temperatures and stagnant waters. Birds usually acquire the disease by eating invertebrates containing the toxin. Typical signs in birds include weakness, lethargy, and inability to hold up the head or to fly (Work 2008, pers. comm.). There is a possibility that the proposed project may increase the risk for an outbreak of avian botulism. Botulism can occur in any area with standing fresh or brackish water frequented by waterbirds. The Air Force will maintain surveillance for outbreaks; respond to such outbreaks by removal of carcasses, and post-outbreak waterbird population monitoring.

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur within the area of action subject to consultation. Cumulative effects include the impacts of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. The project areas are under Federal jurisdiction. We are unaware of any future State activities effects within the action area since it is all under Federal jurisdiction.

Conclusion

After reviewing the current status of each species, the environmental baseline for the species within the action area, and the effects, ongoing aircraft missions, construction impacts and management activities, including the cumulative effects, it is our Biological Opinion that implementation of the proposed action is not likely to jeopardize the survival and recovery of the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck. No critical habitat has been designated for these species; therefore, none will be affected.

The proposed action is not likely to jeopardize Hawaiian stilt, Hawaiian coot, Hawaiian moorhen and Hawaiian duck because as discussed in the above environmental baseline, the number of birds within the action area is low. Although they will be impacted by the effects as previously discussed, the loss of birds will have a minimal impact on the status of the species as a whole. In addition, restoration of Bellows Air Force Station Oxbow wetland will provide additional foraging, loafing, and nesting habitat. The restored habitat will provide for increased reproduction and numbers of Hawaiian waterbirds.

Incidental Take Statement

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined (50 CFR 17.3) by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior

patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Air Force so that they become binding conditions in order for the exemption in section 7(o)(2) to apply. The Air Force has a continuing duty to regulate the activity covered by this incidental take statement. If the Air Force (1) fails to assume and implement the terms and conditions or (2) fails to require any contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to any permit or contract, then the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Air Force must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

Amount or Extent of Take

The Service anticipates that take will occur in the form of harm, harassment, and death as a result of Air Force activities described in this Biological Opinion.

Hawaiian stilt

The Service anticipates that one (1) Hawaiian stilt will be harmed, injured or killed due to potential waterbird-aircraft collision at Hickam Air Force Base every five years. The Service anticipates that two (2) Hawaiian stilt nest will be taken resulting in the mortality of up to seven eggs within a five year period. The Service anticipates a maximum of 340 harassment incidents of Hawaiian stilts may result from BASH zone hazing activities annually at Hickam Air Force Base.

Hawaiian coot

The Service anticipates that one (1) Hawaiian coot will be harmed due to potential waterbird-aircraft collision at Hickam Air Force Base every five years. The Service anticipates a maximum of 65 harassment incidents of Hawaiian coot may result from BASH zone hazing activities annually at Hickam Air Force Base.

Hawaiian moorhen

The Service anticipates take of not more than two (2) Hawaiian moorhen in the form of harassment due to capture in predator control traps at Bellows Air Force Station Oxbow wetland annually. Take in the form of injury or death of two (2) Hawaiian moorhen may occur every five years while conducting predator control for the duration of this management action at Bellows Air Force Station Oxbow wetland.

Hawaiian duck

The Service anticipates that one (1) Hawaiian duck will be harmed due to potential waterbird-aircraft collision at Hickam Air Force Base in a five year period. The Service anticipates a maximum of 60 harassment incidents of Hawaiian duck (or Hawaiian duck hybrid if identification is not feasible) may result from BASH hazing activities annually. The Service

anticipates take of not more than two (2) Hawaiian duck that may result in the injury or death through implementing a feral mallard duck removal program once the Bellows Air Force Station Oxbow wetland is restored. This level of take is for the life of the project.

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §703-712), if such take is in compliance with the terms and conditions specified herein.

Effect of Take

In this Biological Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy of the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck.

Reasonable and Prudent Measures

The reasonable and prudent measures given below, with their implementing terms and conditions, are designed to minimize the impacts of incidental take that might otherwise result from the proposed actions. If, during the course of the action, the level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review the reasonable and prudent measures provided. In addition, the Air Force must cease the activities that caused the taking; must immediately provide an explanation of the causes of the taking; and must review with the Service the need for possible modification of the reasonable and prudent measures. The Air Force project incorporates many of the measures to minimize and avoid take of listed species. The Service believes the following Reasonable and Prudent Measures are necessary and appropriate to minimize incidental take of Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck. The measures described below are non-discretionary and must be implemented.

1. Hawaiian waterbird injury and mortality from aircraft interactions will be minimized.
2. Harassment of Hawaiian waterbirds and nest and egg removal of Hawaiian stilt will be minimized.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Air Force must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting or monitoring requirements. These terms and conditions are non-discretionary.

1. The following terms and conditions implement reasonable and prudent measure number one:
 - 1.1. The Air Force will fund a scientific research study to evaluate the effects of hazing activities within the BASH zone. The study will focus on Hawaiian waterbird movement in and around the BASH zone and it should determine the number of individuals actually represented by the harassment incidents and how these hazing incidents affect the long-term survivorship of these individuals. The study will be coordinated and implemented jointly with Air Force and PIFWO.

2. The following terms and conditions implement all reasonable and prudent measures:

- 2.1. Annual reporting, in the form of a written report, of actual numbers of individuals taken will be submitted to PIFWO by the end of the Federal fiscal year (September 30).
- 2.2. Air Force will complete Bellows Air Force Station Oxbow wetland restoration management plan coordinated with our office and finalized on or before completion of restoration efforts in 2010 to 2011. The management plan will include details on vegetation modification, predator control, waterbird monitoring, and an avian botulism surveillance response plan.
- 2.3. Our office will be notified before restoration begins and upon completion of restoration activities at Bellows Air Force Station Oxbow and Ahua Reef wetlands. Notification will be via electronic mail.
- 2.4. A written report will be provided to the Service to document the effectiveness of the waterbird monitoring. The written reports should be a summary documentation and will be submitted via mail to the Service.
- 2.5. The depository designated to receive specimens of Hawaiian waterbirds that are collected is the B.P. Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii, 96817 [phone: (808) 547-3511]. If the B.P. Bishop Museum does not wish to accession the specimens, the Service's Division of Law Enforcement in Honolulu, Hawaii [phone: (808) 861-8525; fax: (808) 861-8515] should be contacted for instructions on disposition.

Conservation Recommendations

Section 7(a)(1) of the Endangered Species Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

1. We recommend that Air Force monitor migratory waterbird and shorebird use at Bellows Air Force Station Oxbow wetlands once restored to determine the effectiveness of the predator control program.
2. We recommend that if Hawaiian moorhen are captured in live traps; attempts should be made to band individual birds. Air Force biologist responsible for Bellows Air Force Station Oxbow wetland will be contacted immediately, and if available, will band the birds and coordinate with PIFWO. Birds should be banded with color bands and U.S. Geological Service's aluminum bands. Banding information will yield important life history information that will aid in recovery of the species.
3. We recommend that Air Force develop a routine monitoring of predator control program as part of the management plan. Goals should be to detect and remove initial animals

within restored Bellows Air Station Oxbow wetland addressed in this Biological Opinion and document rate of detection of newly immigrated animals into trapping area.

Reinitiation Statement

This concludes formal consultation on the proposed project described in this biological opinion. As required in 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law), and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operation causing such take must cease pending reinitiation. Should there be a failure to carry out any or all of the described measures, or if the measures are not effective or are modified in any way without Service coordination, reinitiation of consultation will be required. If you have any questions regarding this Biological Opinion, please contact Fish and Wildlife Biologist Aaron Nadig (808) 792-9400.

Sincerely,



Loyal Mehrhoff
Field Supervisor

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**J-3 JBPHH Main Base and Surrounding Areas
Terrestrial Flora Species List**

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Appendix J-3
JBPHH Main Base and Surrounding Areas
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Acanthaceae	<i>Asystasia gangetica</i>	Chinese violet	-	A	Confirmed	AECOM, 2016
Acanthaceae	<i>Barleria cristata</i>	crested Philippine violet	-	A	Confirmed	AECOM, 2016
Acanthaceae	<i>Graptophyllum pictum</i>	caricature plant	-	A	Confirmed	AECOM, 2016
Acanthaceae	<i>Justicia betonica</i>	squirrel tail	-	A	Confirmed	AECOM, 2016
Acanthaceae	<i>Odontonema cuspidatum</i>	mottled toothedthread	-	A	Confirmed	AECOM, 2016
Acanthaceae	<i>Ruellia prostrata</i>	prostrate wild petunia	-	A	Confirmed	AECOM, 2016
Aizoaceae	<i>Sesuvium portulacastrum</i>	sea purslane	‘ākulikuli	N	Confirmed	AECOM, 2016
Aizoaceae	<i>Trianthema portulacastrum</i>	desert horsepurslane	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Achyranthes aspera</i>	devil's horsewhip	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Alternanthera pungens</i>	khaki weed	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Alternanthera sessilis</i>	sessile joyweed	-	A	Potentially	Char, 2000b
Amaranthaceae	<i>Amaranthus spinosus</i>	spiny amaranth	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Amaranthus viridus</i>	slender amaranth	-	A	Confirmed	AECOM, 2016
Amaryllidaceae	<i>Hippeastrum striatum</i>	striped Barbados lily	-	A	Confirmed	AECOM, 2016
Anacardiaceae	<i>Mangifera indica</i>	mango	manakō	A	Confirmed	AECOM, 2016
Anacardiaceae	<i>Schinus terebinthifolius</i>	Christmas berry	wilelaiki	I	Confirmed	AECOM, 2016
Apiaceae	<i>Centella asiatica</i>	Asiatic pennywort	-	A	Confirmed	AECOM, 2016
Apiaceae	<i>Cyclospermum leptophyllum</i>	marsh parsley	-	A	Confirmed	AECOM, 2016
Apocynaceae	<i>Catharanthus roseus</i>	periwinkle	-	A	Potentially	Char, 2000b
Apocynaceae	<i>Plumeria obtusa</i>	Singapore graveyard flower	-	A	Confirmed	AECOM, 2016
Apocynaceae	<i>Plumeria rubra</i>	frangipani	-	A	Confirmed	AECOM, 2016
Apocynaceae	<i>Thevetia peruviana</i>	luckynut	-	A	Confirmed	AECOM, 2016
Araceae	<i>Alocasia macrorrhizos</i>	giant taro	‘ape	A	Confirmed	AECOM, 2016
Araceae	<i>Lemna perpusilla</i>	minute duckweed	-	A	Confirmed	AECOM, 2016
Araceae	<i>Syngonium podophyllum</i>	arrowhead vine	-	A	Confirmed	AECOM, 2016
Araliaceae	<i>Schefflera actinophylla</i>	octopus tree	-	A	Confirmed	AECOM, 2016
Araucariaceae	<i>Araucaria columnaris</i>	Cook Island pine	-	A	Confirmed	AECOM, 2016
Arecaceae	<i>Cocos nucifera</i>	coconut palm	niu	A	Confirmed	AECOM, 2016
Arecaceae	<i>Dypsis decaryi</i>	triangle palm	-	A	Confirmed	AECOM, 2016
Arecaceae	<i>Livistona chinensis</i>	Chinese fan palm	-	A	Confirmed	AECOM, 2016
Arecaceae	<i>Phoenix dactylifera</i>	date palm	-	A	Confirmed	AECOM, 2016
Asclepiadaceae	<i>Cryptostegia madagascariensis</i>	Madagascar rubber vine	-	I	Confirmed	AECOM, 2016
Asclepiadaceae	<i>Stapelia gigantea</i>	Zulu giant	-	A	Confirmed	AECOM, 2016
Asparagaceae	<i>Agave sisalana</i>	sisal hemp	-	A	Potentially	SWCA, 2015
Asparagaceae	<i>Asparagus densiflorus</i>	asparagus fern	-	A	Confirmed	AECOM, 2016
Asparagaceae	<i>Asparagus setaceus</i>	climbing asparagus-fern	-	A	Confirmed	AECOM, 2016

Category: A = alien; N = native; I = invasive.

Appendix J-3
JBPHH Main Base and Surrounding Areas
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Asparagaceae	<i>Cordyline fruticosa</i>		ti, kī	A	Confirmed	AECOM, 2016
Asteraceae	<i>Ageratina riparia</i>	spreading snakeroot	Hāmākua pāmakani	A	Confirmed	AECOM, 2016
Asteraceae	<i>Ageratum conyzoides</i>	tropical whiteweed	maile hohono	A	Confirmed	AECOM, 2016
Asteraceae	<i>Bidens pilosa</i>	common beggarticks	kī	A	Confirmed	AECOM, 2016
Asteraceae	<i>Calyptracarpus vialis</i>	straggler daisy	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Chromolaena odorata</i>	devil weed	-	I	Potentially	NAVFAC PAC 2006c
Asteraceae	<i>Conyza bonariensis</i>	asthmaweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Cotula australis</i>	Australian waterbuttons	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Cyanthillium cinereum</i>	little ironwood	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Eclipta prostrata</i>	false daisy	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Emilia fosbergii</i>	Florida tasselflower	pualele	A	Confirmed	AECOM, 2016
Asteraceae	<i>Emilia sonchifolia</i>	lilac tasselflower	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Erechtites valerianifolia</i>	tropical burnweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Erigeron belliioides</i>	bellorita	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Flaveria trinervia</i>	clustered yellowtops	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Gamochaeta purpurea</i>	purple cudweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Lactuca serriola</i>	prickly lettuce	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Parthenium hysterophorus</i>	false ragweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Pluchea carolinensis</i>	sourbush	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Pluchea indica</i>	Indian fleabane	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Sonchus oleraceus</i>	sow thistle	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Sphagneticola triloba</i>	Bay Biscayne creeping- oxeye	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Synedrella nodiflora</i>	nodeweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Taraxacum officinale</i>	dandelion	lauhele	A	Confirmed	AECOM, 2016
Asteraceae	<i>Thymophylla tenuiloba</i>	golden fleece	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Tridax procumbens</i>	coat buttons	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Verbesina encelioides</i>	golden crown-beard	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Xanthium strumarium</i>	cocklebur	kikānia	A	Confirmed	AECOM, 2016
Asteraceae	<i>Youngia japonica</i>	Oriental hawksbeard	-	A	Confirmed	AECOM, 2016
Bataceae	<i>Batis maritima</i>	turtleweed	-	A	Confirmed	AECOM, 2016
Bignoniaceae	<i>Roseodendron donnell-smithii</i>	primavera	-	A	Confirmed	AECOM, 2016
Bignoniaceae	<i>Spathodea campanulata</i>	African tulip tree	-	A	Confirmed	AECOM, 2016
Bignoniaceae	<i>Tecoma stans</i>	yellow-elder	-	A	Confirmed	AECOM, 2016
Blechnaceae	<i>Blechnum appendiculatum</i>	palm fern	-	A	Confirmed	AECOM, 2016
Boraginaceae	<i>Carmona retusa</i>	scorpionbush	-	A	Confirmed	AECOM, 2016

Category: A = alien; I = invasive.

Appendix J-3
JBPHH Main Base and Surrounding Areas
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Brassicaceae	<i>Lepidium didymum</i>	lesser swinecress	-	A	Confirmed	AECOM, 2016
Brassicaceae	<i>Lepidium oblongum</i>	veiny pepperweed	-	A	Potentially	Char, 1999
Brassicaceae	<i>Lepidium virginicum</i>	Virginia pepperweed	-	A	Confirmed	AECOM, 2016
Cactaceae	<i>Hylocereus undatus</i>	nightblooming cactus	-	A	Confirmed	AECOM, 2016
Cactaceae	<i>Opuntia ficus-indica</i>	tuna cactus	pānini	A	Confirmed	AECOM, 2016
Cannaceae	<i>Canna indica</i>	Indian shot	-	A	Confirmed	AECOM, 2016
Capparaceae	<i>Gynandropsis gynandra</i>	spiderwisp	-	A	Confirmed	AECOM, 2016
Caricaceae	<i>Carica papaya</i>	papaya	mīkana	A	Confirmed	AECOM, 2016
Caryophyllaceae	<i>Cerastium fontanum</i> ssp. <i>vulgare</i>	mouse-ear chickweed	-	A	Potentially	Char, 2000a
Caryophyllaceae	<i>Spergularia salina</i>	salt sandspurry	-	A	Confirmed	AECOM, 2016
Casuarinaceae	<i>Casuarina equisetifolia</i>	ironwood	-	A	Confirmed	AECOM, 2016
Chenopodiaceae	<i>Atriplex semibaccata</i>	Australian saltbush	-	A	Confirmed	AECOM, 2016
Chenopodiaceae	<i>Atriplex suberecta</i>	peregrine saltbush	-	A	Confirmed	AECOM, 2016
Chenopodiaceae	<i>Chenopodium album</i>	lamb's quarters	-	A	Confirmed	AECOM, 2016
Chenopodiaceae	<i>Chenopodium murale</i>	nettleleaf goosefoot	-	A	Confirmed	AECOM, 2016
Clusiaceae	<i>Clusia rosea</i>	autograph tree	-	A	Confirmed	AECOM, 2016
Combretaceae	<i>Conocarpus erectus</i>	button mangrove	-	A	Confirmed	AECOM, 2016
Commelinaceae	<i>Commelina benghalensis</i>	Benghal dayflower	-	A	Confirmed	AECOM, 2016
Commelinaceae	<i>Commelina diffusa</i>	spreading dayflower	honohono	A	Confirmed	AECOM, 2016
Commelinaceae	<i>Tradescantia spathacea</i>	oyster plant	-	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Cuscuta sandwichiana</i>		kauna'oa	E	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea alba</i>	tropical white morning-glory	-	A	Potentially	Char, 2000b
Convolvulaceae	<i>Ipomoea carica</i>	mile a minute vine	koali 'ai	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea indica</i>	blue morning-glory	koali 'awa	N	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea obscura</i>	obscure morning-glory	-	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea ochracea</i>	fence morning-glory	-	A	Potentially	Char, 1999
Convolvulaceae	<i>Ipomoea triloba</i>	little bell	-	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Jacquemontia ovalifolia</i>	oval-leaf clustervine	pā'ūohi'iaka	N	Confirmed	AECOM, 2016
Convolvulaceae	<i>Merremia aegyptia</i>	hairy woodrose	-	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Merremia tuberosa</i>	wood rose	-	A	Confirmed	AECOM, 2016
Cordiaceae	<i>Cordia dichotoma</i>	fragrant manjack	-	A	Potentially	Char, 1999
Cordiaceae	<i>Cordia sebestena</i>	geiger tree	-	A	Confirmed	AECOM, 2016
Cordiaceae	<i>Cordia subcordata</i>		kou	N	Confirmed	AECOM, 2016
Crassulaceae	<i>Kalanchoe pinnata</i>	cathedral bells	-	A	Confirmed	AECOM, 2016
Cucurbitaceae	<i>Coccinia grandis</i>	scarlet-fruited gourd	-	A	Confirmed	AECOM, 2016
Cucurbitaceae	<i>Cucumis dipsaceus</i>	teasel gourd	-	A	Potentially	CHRH, 2001
Cucurbitaceae	<i>Cucumis melo</i>	cantelope	-	A	Potentially	CHRH, 2001
Cucurbitaceae	<i>Cucurbita pepo</i>	field pumpkin	-	A	Potentially	Char, 1999

Category: A = alien; E = endemic; N = native.

Appendix J-3
JBPBH Main Base and Surrounding Areas
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Cucurbitaceae	<i>Momordica charantia</i>	wild bitter melon	-	A	Confirmed	AECOM, 2016
Cucurbitaceae	<i>Sicyos pachycarpus</i>	paha	kūpala	E	Potentially	CHRH, 2001
Cycadaceae	<i>Cycas revoluta</i>	Japanese sago palm	-	A	Confirmed	AECOM, 2016
Cyperaceae	<i>Bolboschoenus maritimus</i>	cosmopolitan bulrush	kaluhā	N	Potentially	AECOS, 2003
Cyperaceae	<i>Cladium jamaicense</i>	Jamaica swamp sawgrass	‘uki	N	Potentially	AECOS, 2003
Cyperaceae	<i>Cyperus brevifolius</i>	shortleaf spikesedge	kili’o’opu	A	Confirmed	AECOM, 2016
Cyperaceae	<i>Cyperus gracilis</i>	slimjim flatsedge	-	A	Confirmed	AECOM, 2016
Cyperaceae	<i>Cyperus involucratus</i>	umbrella sedge	-	A	Confirmed	AECOM, 2016
Cyperaceae	<i>Cyperus rotundus</i>	nut grass	kili’o’opu	A	Confirmed	AECOM, 2016
Cyperaceae	<i>Kyllinga nemoralis</i>	whitehead spikesedge	kili’o’opu	A	Confirmed	AECOM, 2016
Cyperaceae	<i>Schoenoplectus lacustris</i>	lakeshore bulrush	‘aka’akai	N	Potentially	AECOS & WCP, 2007
Davalliaceae	<i>Davallia fejeensis</i>	lacy hare’s-foot fern	-	A	Potentially	Char, 2000b
Dennstaedtiaceae	<i>Pteridium aquilinum</i> subsp. <i>decompositum</i>	decomposition brackenfern	kilau	A	Confirmed	AECOM, 2016
Ebenaceae	<i>Diospyros sandwicensis</i>	-	lama	E	Confirmed	AECOM, 2016
Ericaceae	<i>Leptecophylla tameiameia</i>	-	pūkiawe	N	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Aleurites moluccanus</i>	-	kukui	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Breynia disticha</i>	snowbush	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Codiaeum variegatum</i>	garden croton	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia albomarginata</i>	rattlesnake weed	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia cyathophora</i>	fire on the mountain	-	A	Potentially	CHRH, 2001
Euphorbiaceae	<i>Euphorbia graminea</i> var. <i>graminea</i>	grassleaf spurge	-	A	Potentially	CHRH, 2001
Euphorbiaceae	<i>Euphorbia heterophylla</i>	Mexican fireplant	kaliko	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia hirta</i>	pillpod sandmat	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia hypericifolia</i>	graceful sandmat	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia hyssopifolia</i>	hyssopleaf sandmat	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia prostrata</i>	ground spurge	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Macaranga tanarius</i>	parasol leaf tree	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Phyllanthus debilis</i>	phyllanthus weed	niruri	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Ricinus communis</i>	castor bean	koli	A	Confirmed	AECOM, 2016
Fabaceae	<i>Acacia confusa</i>	Formosan koa	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Acacia koa</i>	-	koa	E	Confirmed	AECOM, 2016
Fabaceae	<i>Alysicarpus vaginalis</i>	Alyce clover	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Caesalpinia decapetala</i>	cat's claw	puakelekino	A	Confirmed	AECOM, 2016
Fabaceae	<i>Canavalia cathartica</i>	-	maunaloa	N	Confirmed	AECOM, 2016
Fabaceae	<i>Cassia x nealiae</i>	rainbow shower tree	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Chamaecrista nictitans</i>	sensitive plant	lauki	A	Confirmed	AECOM, 2016
Fabaceae	<i>Crotalaria incana</i>	shakeshake	-	A	Confirmed	AECOM, 2016

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Fabaceae	<i>Crotalaria retusa</i>	rattleweed	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Crotalaria pallida</i>	smooth rattlepod	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Desmanthus pernambucanus</i>	pigeon bundleflower	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Desmodium incanum</i>	tickclover	kaimi	N	Confirmed	AECOM, 2016
Fabaceae	<i>Desmodium sandwicense</i>	Hawai'i ticktrefoil	pua pilipili	N	Confirmed	AECOM, 2016
Fabaceae	<i>Desmodium tortuosum</i>	Dixie ticktrefoil	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Desmodium triflorum</i>	three-flowered beggarweed	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Enterolobium cyclocarpum</i>	monkeysoap	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Falcataria moluccana</i>	peacock's plume	-	I	Confirmed	AECOM, 2016
Fabaceae	<i>Indigofera hendecaphylla</i>	creeping indigo	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Indigofera suffruticosa</i>	indigobush	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Leucaena leucocephala</i>	river tamarind	koa haole	A	Confirmed	AECOM, 2016
Fabaceae	<i>Macroptilium atropurpureum</i>	purple bushbean	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Macroptilium lathyroides</i>	wild bushbean	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Medicago polymorpha</i>	bur clover	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Medicago rugosa</i>	wrinkled medick	-	A	Potentially	Char 1999 (Makalapa)
Fabaceae	<i>Mimosa pudica</i>	shameplant	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Neonotonia wightii</i>	perennial soybean	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Pithecellobium dulce</i>	Manila tamarind	'opiuma	A	Confirmed	AECOM, 2016
Fabaceae	<i>Plectranthus parviflorus</i>	little spurflower	'ala'ala wai nui wahine	N	Confirmed	AECOM, 2016
Fabaceae	<i>Prosopis juliflora</i>	long-thorn kiawe	kiawe	I	Confirmed	AECOM, 2016
Fabaceae	<i>Prosopis pallida</i>	common kiawe	kiawe	A	Confirmed	AECOM, 2016
Fabaceae	<i>Samanea saman</i>	monkeypod	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Senna pendula</i>	valamuerto	-	A	Potentially	Char 2000c
Fabaceae	<i>Senna septemtrionalis</i>	arsenic bush	kalamona	A	Confirmed	AECOM, 2016
Fabaceae	<i>Senna surattensis</i>	glossy shower	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Vachellia farnesiana</i> var. <i>farnesiana</i>	sweet acacia	klu	A	Confirmed	AECOM, 2016
Goodinaceae	<i>Scaevola taccada</i>	beach naupaka	naupaka kahakai	N	Confirmed	AECOM, 2016
Heliotropaceae	<i>Euploca procumbens</i>	fourspike heliotrope	-	A	Confirmed	AECOM, 2016
Heliotropaceae	<i>Heliotropium curassavicum</i>	seaside heliotrope	kīpūkai	N	Confirmed	AECOM, 2016
Lamiaceae	<i>Hyptis pectinata</i>	comb hyptis	-	A	Confirmed	AECOM, 2016
Lamiaceae	<i>Leonotis nepetifolia</i>	Christmas candlestick	-	A	Confirmed	AECOM, 2016
Lamiaceae	<i>Ocimum gratissimum</i>	African basil	-	A	Confirmed	AECOM, 2016
Lamiaceae	<i>Stachys arvensis</i>	staggerweed	-	A	Potentially	Char 2000c
Lauraceae	<i>Cassytha filiformis</i>	devil's gut	kauna'oa pehu	N	Confirmed	AECOM, 2016
Lauraceae	<i>Persea americana</i>	avocado	-	A	Confirmed	AECOM, 2016
Lindsaeaceae	<i>Odontosoria chinensis</i>	Chinese creepingfern	pala'a	N	Confirmed	AECOM, 2016

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Lomariopsidaceae	<i>Nephrolepis brownii</i>	Asian swordfern	kupukupu, ni'ani'au	I	Confirmed	AECOM, 2016
Lomariopsidaceae	<i>Nephrolepis exaltata</i>	Boston swordfern	kupukupu	N	Confirmed	AECOM, 2016
Malvaceae	<i>Abutilon grandifolium</i>	hairy Indian mallow	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Abutilon incanum</i>	hoary abutilon	ma'o	N	Confirmed	AECOM, 2016
Malvaceae	<i>Gossypium hirsutum</i>	upland cotton	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Hibiscus rosa-sinensis</i>	Chinese hibiscus	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Malva parviflora</i>	cheese weed	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Malvastrum coromandelianum</i>	false mallow	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Sida acuta</i>	common wireweed	-	A	Potentially	SWCA, 2015
Malvaceae	<i>Sida ciliaris</i>	bracted sida	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Sida cordifolia</i>	great-leaved sida	'ilima	A	Potentially	SWCA, 2015
Malvaceae	<i>Sida fallax</i>	yellow 'ilima	'ilima	N	Confirmed	AECOM, 2016
Malvaceae	<i>Sida rhombifolia</i>	arrowleaf sida	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Sida spinosa</i>	prickly sida	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Talipariti tiliaceum</i>	-	hau	A	Confirmed	AECOM, 2016
Malvaceae	<i>Thespesia populnea</i>	portia tree	milo	A	Confirmed	AECOM, 2016
Malvaceae	<i>Urena lobata</i>	aramina	-	A	Potentially	AECOS, 2003
Malvaceae	<i>Waltheria indica</i>	malva blanca	'uhaloa	N	Confirmed	AECOM, 2016
Melastomaceae	<i>Clidemia hirta</i>	Koster's curse	-	A	Confirmed	AECOM, 2016
Meliaceae	<i>Melia azedarach</i>	chinaberry	-	A	Confirmed	AECOM, 2016
Menispermaceae	<i>Cocculus orbiculatus</i>	queen coralbead	huehue	N	Confirmed	AECOM, 2016
Moraceae	<i>Ficus aurea</i>	strangler fig	-	A	Potentially	SWCA, 2015
Moraceae	<i>Ficus elastica</i>	Indian rubberplant	-	A	Confirmed	AECOM, 2016
Moraceae	<i>Ficus microcarpa</i>	Chinese banyan	-	A	Confirmed	AECOM, 2016
Moraceae	<i>Ficus pumila</i>	climbing fig	-	A	Confirmed	AECOM, 2016
Moringaceae	<i>Moringa oleifera</i>	horseradish tree	-	A	Confirmed	AECOM, 2016
Musaceae	<i>Musa acuminata</i>	banana	-	A	Confirmed	AECOM, 2016
Myoporaceae	<i>Myoporum sandwicense</i>	-	naio	N	Confirmed	AECOM, 2016
Myrsinaceae	<i>Ardisia elliptica</i>	shoebutton ardisia	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Melaleuca quinquenervia</i>	paperbark	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Metrosideros polymorpha</i>	ohia	'ōhi'ā lehua	E	Confirmed	AECOM, 2016
Myrtaceae	<i>Pimenta dioica</i>	allspice	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Psidium cattleianum</i>	strawberry guava	waiawī	I	Confirmed	AECOM, 2016
Myrtaceae	<i>Psidium guajava</i>	common guava	kuawa	N	Confirmed	AECOM, 2016
Myrtaceae	<i>Syzygium cumini</i>	Java plum	-	A	Confirmed	AECOM, 2016
Nyctaginaceae	<i>Boerhavia coccinea</i>	false alena	-	A	Confirmed	AECOM, 2016
Nyctaginaceae	<i>Bougainvillea spectabilis</i>	bougainvillea	-	A	Confirmed	AECOM, 2016
Nyctaginaceae	<i>Mirabilis jalapa</i>	four o'clock flower	-	A	Potentially	CHRH, 2001

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Nymphaeaceae	<i>Nymphaea</i> sp.	water lily	-	A	Potentially	AECOS & WCP, 2007
Ochnaceae	<i>Ochna serrulata</i>	Mickey Mouse plant	-	A	Confirmed	AECOM, 2016
Ochnaceae	<i>Ochna thomasi</i>	Thomas' bird's-eye bush	-	A	Confirmed	AECOM, 2016
Oleaceae	<i>Jasminum multiflorum</i>	star jasmine	-	A	Confirmed	AECOM, 2016
Onagraceae	<i>Ludwigia octovalvis</i>	Mexican primrose willow	alohalua	N	Confirmed	AECOM, 2016
Orchidaceae	<i>Arundina graminifolia</i>	bamboo orchid	-	A	Confirmed	AECOM, 2016
Orchidaceae	<i>Spathoglottis plicata</i>	Philippine ground orchid	-	A	Potentially	Char, 2000a
Oxalidaceae	<i>Averrhoa carambola</i>	star fruit	-	A	Confirmed	AECOM, 2016
Oxalidaceae	<i>Oxalis corniculata</i>	yellow wood sorrel	'ihi'ai	A	Confirmed	AECOM, 2016
Pandanaceae	<i>Pandanus tectorius</i>	Tahitian screwpine	hala	N	Confirmed	AECOM, 2016
Papaveraceae	<i>Argemone mexicana</i>	Mexican prickly poppy	-	A	Confirmed	AECOM, 2016
Passifloraceae	<i>Passiflora edulis</i>	passionflower	liliko'i	A	Confirmed	AECOM, 2016
Passifloraceae	<i>Passiflora foetida</i>	scarletfruit passionflower	-	A	Confirmed	AECOM, 2016
Passifloraceae	<i>Passiflora laurifolia</i>	golden bellapple	-	A	Confirmed	AECOM, 2016
Passifloraceae	<i>Passiflora suberosa</i>	wild passionfruit	huehue haole	A	Confirmed	AECOM, 2016
Phytolaccaceae	<i>Rivina humilis</i>	rougeplant	-	A	Confirmed	AECOM, 2016
Piperaceae	<i>Peperomia humilis</i>	Polynesian peperomia	'ala'ala wai nui	N	Confirmed	AECOM, 2016
Pittosporaceae	<i>Pittosporum undulatum</i>	mock orange	-	A	Confirmed	AECOM, 2016
Plantaginaceae	<i>Bacopa monnieri</i>	-	'ae'ae	N	Confirmed	AECOM, 2016
Plantaginaceae	<i>Plantago lanceolata</i>	English plantain	-	A	Confirmed	AECOM, 2016
Plumbaginaceae	<i>Plumbago auriculata</i>	Cape leadwort	-	A	Confirmed	AECOM, 2016
Plumbaginaceae	<i>Plumbago zeylanica</i>	wild leadwort	'ilie'e	N	Potentially	Department of the Navy, 2001
Poaceae	<i>Andropogon virginicus</i>	broomsedge	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Axonopus compressus</i>	broadleaf carpet grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Axonopus fissifolius</i>	narrowleaved carpetgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Bothriochloa pertusa</i>	pitted beardgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cenchrus ciliaris</i>	buffelgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cenchrus echinatus</i>	southern sandbur	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cenchrus polystachios</i>	feathery pennisetum	-	A	Potentially	Char, 2000a
Poaceae	<i>Cenchrus purpureus</i>	elephant grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Chloris barbata</i>	swollen fingergrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Chloris divaricata</i>	spreading windmill grass	-	A	Potentially	Char, 2000a
Poaceae	<i>Chloris radiata</i>	radiate fingergrass	-	A	Confirmed	AECOM, 2016

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Poaceae	<i>Chloris virgata</i>	feather fingergrass	-	A	Potentially	CHRH, 2001
Poaceae	<i>Chrysopogon aciculatus</i>	golden beardgrass	-	A	Potentially	Char, 2000a
Poaceae	<i>Coix lacryma-jobi</i>	Job's tears	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cynodon dactylon</i>	Bermuda grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cynodon x magennisii</i>	Tifdwarf Bermuda	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Dactyloctenium aegyptium</i>	crowfoot grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Dichanthium aristatum</i>	Angleton bluestem	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Digitaria ciliaris</i>	Henry's crabgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Digitaria insularis</i>	sourgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Digitaria setigera</i>	East Indian crabgrass	kukaepua'a	N	Potentially	Char, 2000a
Poaceae	<i>Echinochloa crus-galli</i> var. <i>crus-galli</i>	large barnyard grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Ehrharta erecta</i>	panic veldtgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Eleusine indica</i>	goosegrass	manienie ali'i	A	Confirmed	AECOM, 2016
Poaceae	<i>Eragrostis cilianensis</i>	stink grass	-	A	Potentially	CHRH, 2001
Poaceae	<i>Eragrostis pectinacea</i>	tufted lovegrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Eragrostis tenella</i>	Japanese lovegrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Heteropogon contortus</i>	tanglehead	pili	N	Confirmed	AECOM, 2016
Poaceae	<i>Leptochloa fusca</i> subsp. <i>uninervia</i>	sprangletop	-	A	Potentially	CHRH, 2001
Poaceae	<i>Megathyrsus maximus</i>	Guinea grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Melinis minutiflora</i>	molasses grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Melinis repens</i>	rose Natal grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Oplismenus hirtellus</i>	basket grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Paspalum conjugatum</i>	Hilo grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Paspalum fimbriatum</i>	Panama grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Paspalum scrobiculatum</i>	ricegrass	mau'u laiki	N	Potentially	Char, 2000a
Poaceae	<i>Paspalum vaginatum</i>	seashore paspalum	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Poa pratensis</i>	Kentucky bluegrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sacciolepis indica</i>	Glenwood grass	-	A	Potentially	Char, 2000b
Poaceae	<i>Setaria palmifolia</i>	palmgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Setaria parviflora</i>	yellow bristlegrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Setaria verticillata</i>	bristly foxtail	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sporobolus diandrus</i>	Indian dropseed	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sporobolus indicus</i>	smutgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Stenotaphrum secundatum</i>	St. Augustine grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Themeda villosa</i>	Lyon's grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Urochloa distachya</i>	-	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Urochloa mutica</i>	paragrass	-	A	Confirmed	AECOM, 2016
Polygonaceae	<i>Antigonon leptopus</i>	Mexican creeper	-	A	Confirmed	AECOM, 2016

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Polygonaceae	<i>Coccoloba uvifera</i>	seagrape	-	A	Confirmed	AECOM, 2016
Polypodiaceae	<i>Lepisorus thunbergianus</i>	weeping fern	‘ekaha	N	Potentially	Char, 2000b
Polypodiaceae	<i>Phlebodium aureum</i>	golden polypody	-	A	Confirmed	AECOM, 2016
Polypodiaceae	<i>Phymatosorus grossus</i>	musk fern	laua’e	A	Confirmed	AECOM, 2016
Pontedariaceae	<i>Eichhornia crassipes</i>	water hyacinth	-	A	Potentially	AECOS & WCP, 2007
Portulacaceae	<i>Portulaca oleracea</i>	pigweed	akulikuli kula	N	Confirmed	AECOM, 2016
Portulacaceae	<i>Portulaca pilosa</i>	chisme	‘ihi	A	Confirmed	AECOM, 2016
Portulacaceae	<i>Talinum paniculatum</i>	big talinum	-	A	Potentially	Char, 2000b
Primulaceae	<i>Anagallis arvensis</i>	scarlet pimpernel	-	A	Confirmed	AECOM, 2016
Proteaceae	<i>Grevillea robusta</i>	silk oak	-	A	Confirmed	AECOM, 2016
Proteaceae	<i>Macadamia integrifolia</i>	macadamia nut	-	A	Confirmed	AECOM, 2016
Psilotaceae	<i>Psilotum nudum</i>	whisk fern	moa	N	Confirmed	AECOM, 2016
Pteridaceae	<i>Adiantum capillus-veneris</i>	maidenhair fern	‘iwa‘iwa	N	Confirmed	AECOM, 2016
Pteridaceae	<i>Adiantum raddianum</i>	delta maidenhair	-	A	Confirmed	AECOM, 2016
Pteridaceae	<i>Cheilanthes viridis</i>	green cliffbrake	-	A	Confirmed	AECOM, 2016
Pteridaceae	<i>Doryopteris decipiens</i>	-	kumuniu	E	Potentially	NAVFAC PAC, 2006a
Pteridaceae	<i>Pteris vittata</i>	cliff brake	-	A	Confirmed	AECOM, 2016
Rhizophoraceae	<i>Rhizophora mangle</i>	red mangrove	-	I	Confirmed	AECOM, 2016
Rosaceae	<i>Osteomeles anthyllidifolia</i>	Hawai‘i hawthorn	‘ūlei	N	Confirmed	AECOM, 2016
Rubiaceae	<i>Morinda citrifolia</i>	Indian mulberry	noni	A	Confirmed	AECOM, 2016
Rubiaceae	<i>Oldenlandia corymbosa</i>	flattop mille grains	-	A	Confirmed	AECOM, 2016
Rubiaceae	<i>Paederia foetida</i>	skunk vine	maile pilau	I	Confirmed	AECOM, 2016
Rubiaceae	<i>Psydrax odorata</i>	-	alahe’e	N	Confirmed	AECOM, 2016
Rubiaceae	<i>Spermacoce remota</i>	buttonweed	-	A	Confirmed	AECOM, 2016
Rutaceae	<i>Citrus aurantiifolia</i>	key lime	-	A	Potentially	Char, 2000b
Rutaceae	<i>Murraya paniculata</i>	orange jasmine	-	A	Confirmed	AECOM, 2016
Santalaceae	<i>Santalum ellipticum</i>	coastal sandalwood	‘iliahialo’e	E	Confirmed	AECOM, 2016
Santalaceae	<i>Santalum freycinetianum</i>	sandalwood	‘iliahi	E	Potentially	NAVFAC PAC, 2006a
Sapindaceae	<i>Cardiospermum grandiflorum</i>	balloon vine	-	A	Confirmed	AECOM, 2016
Sapindaceae	<i>Dodonaea viscosa</i>	hopbush	‘a‘ali‘i	N	Confirmed	AECOM, 2016
Sapindaceae	<i>Filicium decipiens</i>	fern tree	-	A	Confirmed	AECOM, 2016
Sapindaceae	<i>Harpullia pendula</i>	tulipwood	-	A	Confirmed	AECOM, 2016
Sapotaceae	<i>Chrysophyllum oliviforme</i>	satinalf	-	A	Confirmed	AECOM, 2016
Sapotaceae	<i>Sideroxylon persimile</i>	bully tree	-	A	Confirmed	AECOM, 2016
Scrophulariaceae	<i>Buddleja asiatica</i>	dog tail	-	A	Confirmed	AECOM, 2016
Solanaceae	<i>Capsicum annuum</i> var. <i>glabriusculum</i>	red pepper	nioi	A	Potentially	Department of the Navy, 2001
Solanaceae	<i>Cestrum nocturnum</i>	night jasmine	iki he po	I	Confirmed	AECOM, 2016
Solanaceae	<i>Datura stramonium</i>	jimsonweed	-	A	Potentially	Department of the Navy, 2001

Category: A = alien; E = endemic; N = native; I = invasive.

Appendix J-3
JBPBH Main Base and Surrounding Areas
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Solanaceae	<i>Nicandra physalodes</i>	apple of Peru	-	A	Confirmed	AECOM, 2016
Solanaceae	<i>Nicotiana glauca</i>	tree tobacco	-	A	Confirmed	AECOM, 2016
Solanaceae	<i>Physalis angulata</i>	cutleaf groundcherry	-	A	Potentially	AECOS, 2005
Solanaceae	<i>Solanum americanum</i>	purple nightshade	pōpolo	A	Confirmed	AECOM, 2016
Solanaceae	<i>Solanum lycopersicum</i>	garden tomato	-	A	Confirmed	AECOM, 2016
Solanaceae	<i>Solanum melongena</i>	eggplant	-	A	Potentially	Department of the Navy, 2001
Solanaceae	<i>Solanum seaforthianum</i>	Brazilian nightshade	-	A	Confirmed	AECOM, 2016
Solanaceae	<i>Solanum torvum</i>	turkeyberry	-	A	Confirmed	AECOM, 2016
Strelitziaceae	<i>Strelitzia reginae</i>	bird-of-paradise	-	A	Confirmed	AECOM, 2016
Thelypteridaceae	<i>Cyclosorus dentatus</i>	wood fern	-	A	Potentially	Department of the Navy, 2001
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	parasitic maiden fern	-	A	Confirmed	AECOM, 2016
Thymelaeaceae	<i>Wikstroemia oahuensis</i>	O'ahu false ohelo	'ākia	E	Confirmed	AECOM, 2016
Tiliaceae	<i>Heliocarpus americanus</i>	white moho	-	A	Confirmed	AECOM, 2016
Tiliaceae	<i>Triumfetta semitriloba</i>	burweed	-	A	Confirmed	AECOM, 2016
Turneraceae	<i>Turnera ulmifolia</i>	yellow alder	-	A	Confirmed	AECOM, 2016
Typhaceae	<i>Typha latifolia</i>	common cattail	-	I	Confirmed	AECOM, 2016
Urticaceae	<i>Pilea microphylla</i>	rockweed	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Citharexylum caudatum</i>	juniper berry	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Citharexylum spinosum</i>	fiddlewood	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Duranta erecta</i>	golden dewdrop	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Lantana camara</i>	lantana	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Stachytarpheta cayennensis</i>	snakeweed	oi	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Stachytarpheta jamaicensis</i>	light blue snakeweed	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Verbena litoralis</i>	seashore vervain	'ōwī	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Vitex rotundifolia</i>	roundleaf chastetree	pōhinahina	N	Confirmed	AECOM, 2016
Vitaceae	<i>Cissus rotundifolia</i>	Venezuelan treebine	-	A	Confirmed	AECOM, 2016
Vitaceae	<i>Leea guineensis</i>	Hawaiian holly	leea	A	Confirmed	AECOM, 2016
Zingiberaceae	<i>Alpinia mutica</i>	shell ginger	-	A	Confirmed	AECOM, 2016
Zingiberaceae	<i>Hedychium flavescens</i>	yellow ginger	'awapuhi melemele	A	Confirmed	AECOM, 2016

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Appendix J-3
JBPBH Main Base and Surrounding Areas
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Zygophyllaceae	<i>Guaiacum officinale</i>	lignum-vitae	-	A	Confirmed	AECOM, 2016
Zygophyllaceae	<i>Tribulus terrestris</i>	puncture vine	-	A	Potentially	Department of the Navy, 2001

Notes: A = alien; E = endemic; N = native; I = invasive; - = no data; CNRH = Commander Navy Region Hawaii , NAVFAC = Naval Facilities Engineering Systems Command, SWCA = SWCA Environmental Consultants

Rules: (1) If a species is native, it is classified as non-invasive.
(2) Invasive species list obtained from Hawaii Invasive Species Council at: <https://dlnr.hawaii.gov/hisc/> and the Pacific Island Ecosystems at Risk project <http://www.hear.org/Pier/locations/pacific/hawaii/specieslist.htm>
(3) For species not listed in Integrated Taxonomic Information System, refer to: <http://www.worldfloraonline.org/>
(4) Native status removed for species not listed on U.S. Department of Agriculture as native to Hawai'i: <https://plants.usda.gov/>
(5) Ornamental species only present in the study area as part of landscaping were not included in this appendix

Appendix 3 References

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**J-4 JBPHH Main Base and Surrounding Areas
Terrestrial Fauna Species List**

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Appendix J-4
JBPBH Main Base and Surrounding Areas
Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Bird Species							
Alaudidae	<i>Alauda arvensis</i>	Eurasian skylark	-	MBTA	A	Offsite, within 5 miles	NAVFAC PAC, 2006a
Anatidae	<i>Anas acuta</i>	northern pintail	koloa mapu	MBTA	N	Offsite, within 5 miles	NAVFAC PAC, 2006a
Anatidae	<i>Anas americana</i>	American wigeon	-	MBTA	N	Offsite, within 5 miles	NAVFAC PAC, 2006a
Anatidae	<i>Anas clypeata</i>	northern shoveler	-	MBTA	N	Offsite, within 5 miles	NAVFAC PAC, 2006a
Anatidae	<i>Anas crecca</i>	green-winged teal	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Anatidae	<i>Anas crecca carolinensis</i>	American green-winged teal	-	-	N	Potentially	NAVFAC PAC, 2006a
Anatidae	<i>Anas cyanoptera</i>	cinnamon teal	-	-	N	Potentially	NAVFAC PAC, 2006a
Anatidae	<i>Anas discors</i>	blue-winged teal	-	-	N	Potentially	NAVFAC PAC, 2006a
Anatidae	<i>Anas penelope</i>	Eurasian wigeon	-	-	N	Potentially	NAVFAC PAC, 2006a
Anatidae	<i>Anas platyrhynchos</i>	mallard	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Anatidae	<i>Anas querquedula</i>	garganey	-	-	N	Potentially	NAVFAC PAC, 2006a
Anatidae	<i>Anas wyvilliana</i>	Hawaiian duck	koloa	FE, SE, MBTA	E	Potentially	Hamer Environmental, 2016
Anatidae	<i>Anser albifrons</i>	greater white-fronted goose	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Anatidae	<i>Aythya affinis</i>	lesser scaup	-	MBTA	N	Offsite, within 5 miles	NAVFAC PAC, 2006a
Anatidae	<i>Aythya collaris</i>	ring-necked duck	-	MBTA	A	Confirmed	NAVFAC PAC, 2006a
Anatidae	<i>Branta hutchinsii</i>	cackling goose	-	MBTA	N	Potentially	Pyle and Pyle, 2017
Anatidae	<i>Branta sandvicensis</i>	Hawaiian goose	nene	FE, SE, MBTA	N	Potentially	Pyle and Pyle, 2017
Anatidae	<i>Bucephala albeola</i>	bufflehead	-	-	N	Confirmed	NAVFAC PAC, 2006a
Apodidae	<i>Aerodramus bartschi</i>	Mariana swiftlet	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Ardeidae	<i>Bubulcus ibis</i>	cattle egret	-	MBTA	I	Confirmed	Hamer Environmental, 2016
Ardeidae	<i>Nycticorax nycticorax</i>	black-crowned night-heron	'auku'u	MBTA	N	Confirmed	Hamer Environmental, 2016
Cardinalidae	<i>Cardinalis cardinalis</i>	northern cardinal	-	MBTA	A	Confirmed	Hamer Environmental, 2016

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Appendix J-4
JBPBH Main Base and Surrounding Areas
Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Cettiidae	<i>Horornis diphone</i>	Japanese bush warbler	-	-	A	Confirmed	Hamer Environmental, 2016
Charadriidae	<i>Charadrius semipalmatus</i>	semi-palmated plover	-	MBTA	N	Potentially	NAVFAC PAC, 2006
Charadriidae	<i>Pluvialis fulva</i>	Pacific golden-plover	kōlea	MBTA	N	Confirmed	Hamer Environmental, 2016
Charadriidae	<i>Pluvialis squatarola</i>	black-bellied plover	-	MBTA	N	Potentially	NAVFAC PAC, 2006
Columbidae	<i>Columba livia</i>	rock pigeon, rock dove	-	-	A	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Geopelia striata</i>	zebra dove	-	-	A	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Spilopelia chinensis</i>	spotted dove	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Amandava amandava</i>	red avadavat	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Estrilda astrild</i>	common waxbill	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Estrilda melpoda</i>	orange-cheeked waxbill	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Euodice cantans</i>	African silverbill	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura atricapilla</i>	chestnut munia	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura oryzivora</i>	Java sparrow	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura punctulata</i>	nutmeg mannikin	-	-	A	Confirmed	Hamer Environmental, 2016
Falconidae	<i>Falco peregrinus</i>	peregrine falcon	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Fregatidae	<i>Fregata minor</i>	great frigatebird	‘iwa	MBTA	N	Potentially	NAVFAC PAC, 2006a
Fringillidae	<i>Crithagra mozambica</i>	yellow-fronted canary	-	-	A	Confirmed	Hamer Environmental, 2016
Fringillidae	<i>Haemorhous mexicanus</i>	house finch	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Hydrobatidae	<i>Oceanodroma castro</i>	band-rumped storm petrel	‘akē‘akē	FE, SE	N	Confirmed	Pyle and Pyle, 2017
Laridae	<i>Gygis alba</i>	white tern	manu o kū	ST (on O‘ahu) MBTA	N	Confirmed	VanderWerf and Downs , 2018

Category: A= alien; N = native.

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; MBTA = Migratory Bird Treaty Act protected; - = no data.

Appendix J-4
JBPHH Main Base and Surrounding Areas
Species List - Fauna

Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Laridae	<i>Chroicocephalus philadelphia</i>	Bonaparte's gull	-	-	N	Potentially	NAVFAC PAC, 2006a
Laridae	<i>Hydroprogne caspia</i>	Caspian tern	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Laridae	<i>Larus californicus</i>	California gull	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Laridae	<i>Larus delawarensis</i>	ring-billed gull	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Laridae	<i>Leucophaeus atricilla</i>	laughing gull	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Laridae	<i>Leucophaeus pipixcan</i>	Franklin's gull	-	-	N	Potentially	NAVFAC PAC, 2006
Laridae	<i>Onychoprion fuscatus</i>	sooty tern	'ewa'ewa	MBTA	N	Potentially	Pyle and Pyle, 2017
Laridae	<i>Sternula antillarum</i>	least tern	-	-	N	Potentially	NAVFAC PAC, 2006
Leiothrichidae	<i>Leiothrix lutea</i>	red-billed leiothrix	-	-	A	Confirmed	Hamer Environmental, 2016
Mimidae	<i>Mimus polyglottos</i>	northern mockingbird	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Muscicapidae	<i>Copsychus malabaricus</i>	white-rumped shama	-	-	A	Confirmed	Hamer Environmental, 2016
Pandionidae	<i>Pandion haliaetus</i>	osprey	-	MBTA	N	Confirmed	NAVFAC, 2020
Passeridae	<i>Passer domesticus</i>	house sparrow	-	-	A	Confirmed	Hamer Environmental, 2016
Phaethontidae	<i>Phaethon lepturus</i>	white-tailed tropicbird	koa'e, koa'e kea	MBTA	N	Potentially	Pyle and Pyle, 2017
Phasianidae	<i>Francolinus erckelii</i>	Erckel's francolin	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Francolinus francolinus</i>	black francolin	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Francolinus pondicerianus</i>	gray francolin	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Gallus gallus</i>	red junglefowl	moa	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Pavo cristatus</i>	common peafowl	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Phasianus colchicus</i>	ring-necked pheasant	-	-	A	Confirmed	Hamer Environmental, 2016
Procellariidae	<i>Pterodroma sandwichensis</i>	Hawaiian Petrel	'ua'u	FE, SE, MBTA	E	Potentially	Young et al., 2019
Procellariidae	<i>Puffinus newelli</i>	Newell's Shearwater	'a'o	FE, SE, MBTA	E	Potentially	Young et al., 2019

Category: A= alien; E = endemic; I = invasive; N = native.

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Appendix J-4
JBPHH Main Base and Surrounding Areas
Species List - Fauna

Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Psittacidae	<i>Psittacula krameri</i>	rose-ringed parakeet	-	-	I	Confirmed	Hamer Environmental, 2016
Pycnonotidae	<i>Pycnonotus cafer</i>	red-vented bulbul	-	-	I	Confirmed	Hamer Environmental, 2016
Pycnonotidae	<i>Pycnonotus jocosus</i>	red-whiskered bulbul	-	-	I	Confirmed	Hamer Environmental, 2016
Rallidae	<i>Fulica alai</i>	Hawaiian coot	‘ālae ke‘oke‘o	FE, SE, MBTA	E	Confirmed	NAVFAC, 2020
Rallidae	<i>Gallinula chloropus galeata</i>	Hawaiian common moorhen	‘ālae ‘ula	FE, SE, MBTA	E	Confirmed	NAVFAC, 2020
Recurvirostridae	<i>Himantopus mexicanus knudseni</i>	Hawaiian stilt	ae‘o	FE, SE, MBTA	E	Confirmed	Hamer Environmental, 2016
Scolopacidae	<i>Arenaria interpres</i>	ruddy turnstone	‘akekeke	MBTA	N	Confirmed	Hamer Environmental, 2016
Scolopacidae	<i>Calidris acuminata</i>	sharp-tailed sandpiper	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Calidris alba</i>	sanderling	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Calidris alpina</i>	dunlin	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Calidris canutus</i>	red knot	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Calidris ferruginea</i>	curlew sandpiper	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Calidris himantopus</i>	stilt sandpiper	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Calidris melanotos</i>	pectoral sandpiper	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Calidris minutilla</i>	least sandpiper	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Gallinago gallinago</i>	common snipe	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Limnodromus scolopaceus</i>	long-billed dowitcher	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Limosa lapponica</i>	bar-tailed godwit	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Limosa limosa</i>	black-tailed godwit	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Phalaropus tricolor</i>	Wilson's phalarope	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Philomachus pugnax</i>	ruff	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Tringa flavipes</i>	lesser yellowlegs	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Tringa incana</i>	wandering tattler	‘ūlili	MBTA	N	Confirmed	Hamer Environmental, 2016
Scolopacidae	<i>Tringa melanoleuca</i>	greater yellowlegs	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Scolopacidae	<i>Tringa stagnatilis</i>	marsh sandpiper	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Strigidae	<i>Asio flammeus sandwichensis</i>	Hawaiian short-eared owl	pueo	MBTA	E	Confirmed	Hamer Environmental, 2016

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Species List - Fauna

Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Sturnidae	<i>Acridotheres tristis</i>	common myna	piha'ekelo	-	A	Confirmed	Hamer Environmental, 2016
Thraupidae	<i>Paroaria coronata</i>	red-crested cardinal	-	-	A	Confirmed	Hamer Environmental, 2016
Thraupidae	<i>Sicalis flaveola</i>	saffron finch	-	-	A	Confirmed	Hamer Environmental, 2016
Threskiornithidae	<i>Plegadis chihi</i>	white-faced ibis	-	MBTA	N	Potentially	NAVFAC PAC, 2006a
Tytonidae	<i>Tyto alba</i>	barn owl	-	MBTA	I	Confirmed	Hamer Environmental, 2016
Zosteropidae	<i>Zosterops japonicus</i>	Japanese white-eye	-	-	A	Confirmed	Hamer Environmental, 2016
Invertebrate							
Buthidae	<i>Isometrus maculatus</i>	lesser brown scorpion	kopiana	-	A	Potentially	USFWS, 2010
Culicidae	<i>Culex quinquefasciatus</i>	southern house mosquito	makika	-	I	Potentially	Cordell, 2021
Curculionidae	<i>Hypothenemus hampei</i>	coffee berry borer	-	-	I	Potentially	Cordell, 2021
Curculionidae	<i>Xylodendrus compactus</i>	black twig borer	-	-	I	Potentially	Cordell, 2021
Eulophidae	<i>Quadrastichus erythrinae</i>	erythrina gall wasp	-	-	I	Potentially	Cordell, 2021
Formicidae	<i>Wasmannia auropunctata</i>	little fire ant	-	-	I	Potentially	Cordell, 2021
Limacodidae	<i>Darna pallivitta</i>	nettle caterpillar	-	-	I	Potentially	Cordell, 2021
Scarabaeidae	<i>Oryctes rhinoceros</i>	coconut rhinoceros beetle	-	-	I	Confirmed	Cordell, 2021
Scolopendridae	<i>Scolopendra subspinipes</i>	centipede	kanapī	-	A	Potentially	USFWS, 2010
Sparassidae	<i>Heteropoda venatoria</i>	cane spider	-	-	A	Potentially	USFWS, 2010
Spiraxidae	<i>Euglandina rosea</i>	rosy wolfsnail	-	-	I	Potentially	Cordell, 2021
Tephritidae	<i>Bactrocera dorsalis</i>	oriental fruit fly	-	-	I	Potentially	Cordell, 2021
Varroidae	<i>Varroa destructor</i>	varroa mite	-	-	I	Potentially	Cordell, 2021
Terrestrial Mammal Species							
Bovidae	<i>Capra hircus</i>	domestic goat	kao	-	I	Potentially	AECOM, 2016
Canidae	<i>Canis lupus familiaris</i>	feral dog	ʻilio hihīu	-	I	Potentially	AECOM, 2016
Cervidae	<i>Axis axis</i>	axis deer	kia	-	I	Potentially	AECOM, 2016
Felidae	<i>Felis catus</i>	feral cat	-	-	I	Confirmed	AECOM, 2016
Herpestidae	<i>Herpestes javanicus</i>	mongoose	manakuke	-	I	Confirmed	AECOM, 2016

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Appendix J-4
JBPHH Main Base and Surrounding Areas
Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Muridae	<i>Mus musculus</i>	house mouse	‘iole	-	I	Potentially	AECOM, 2016
Muridae	<i>Rattus exulans</i>	Polynesian rat	‘iole	-	I	Potentially	AECOM, 2016
Muridae	<i>Rattus norvegicus</i>	Norway rat	‘iole	-	I	Potentially	AECOM, 2016
Muridae	<i>Rattus rattus</i>	roof rat	‘iole	-	I	Confirmed	AECOM, 2016
Suidae	<i>Sus scrofa</i>	feral pig	pua‘a	-	I	Potentially	Department of the Navy, 2001
Vespertilionidae	<i>Lasiurus cinereus</i>	Hawaiian hoary bat	‘ōpe‘ape‘a	FE, SE	E	Potentially	B. Wolfe, personal communication, July 21, 2019
Terrestrial Reptile Species							
Chamaeleonidae	<i>Trioceros jacksonii</i>	Jackson's chameleon	-	-	I	Potentially	Cordell, 2021
Emydidae	<i>Trachemys scripta elegans</i>	red-eared slider	-	-	A	Potentially	USFWS, 2010
Gekkonidae	<i>Hemidactylus frenatus</i>	house gecko	mo‘o‘alā	-	A	Confirmed	NAVFAC, 2006b
Gekkonidae	<i>Hemidactylus garnotii</i>	Indo-Pacific gecko	-	-	A	Confirmed	NAVFAC, 2006b
Gekkonidae	<i>Lepidodactylus lugubris</i>	mourning gecko	-	-	A	Confirmed	NAVFAC, 2006b

Category: A= alien; E = endemic; I = invasive; N = native.

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; MBTA = Migratory Bird Treaty Act protected; - = no data.

Notes: NAVFAC = Naval Facilities Engineering Systems Command; USFWS = U.S. Fish and Wildlife Service; SOH DOT = State of HI Department of Transportation.

Rules: (1) MBTA designations obtained from U.S. Fish and Wildlife Service at: <https://www.fws.gov/birds/management/managed-species/migratory-bird-treaty-act-protected-species.php>

(2) If a species is native, it is classified as non-invasive.

(3) Invasive species list obtained from Hawaii Invasive Species Council at: <https://dlnr.hawaii.gov/hisc/> and the Pacific Island Ecosystems at Risk project <http://www.hear.org/Pier/locations/pacific/hawaii/specieslist.htm>

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J-5 Study Area Occurrence Definitions

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Appendix J-5

Occurrence Definitions for Species with Potential to Occur at JBPHH

Confirmed – This species has been “confirmed present” on site by a professional biologist or registered voucher is on file at the state level. Significant species activities on site include: feeding, breeding, propagating, roosting, or nesting. This status does not typically include transient species (see Potentially).

Potentially – This species has been not been confirmed on site; however, suitable habitat may be available for the species to make use of. No surveys have yielded positive confirmed sightings. This status is used for transient species occurrences, such as migrating birds, fish, or insects.

Offsite within 5 miles – Species is not confirmed present on site, but has been found (confirmed present on land) within 5 miles of the site or installation.

Confirmed within 5 miles of nearshore waters – Species has been confirmed present within 5 miles of the site, within (or upon) nearshore waters. This status is intended primarily for aquatic species. The ownership or control of the nearshore waters is not important here.

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J-6 Feral Cat Policy

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DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, D.C. 20350-2000

IN REPLY REFER TO

5090
Ser N456M/1U595820
10 JAN 2002

From: Chief of Naval Operations

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG
POPULATIONS ON NAVY PROPERTY

Ref: (a) SECNAVINST 6401-1A, of 16 Aug 94, Veterinary Health
Services
(b) AFPMB TIM #37, Guidelines for Reducing Feral/Stray
Cat Populations on Military Installations in the
United States
(c) OPNAVINST 6250.4B, dtd 27 Aug. 1998, Pest Management
Programs
(d) Executive Order 13112 of 3 Feb 1999, Invasive Species

1. This letter clarifies the application of reference (a) regarding the prevention of free roaming (also called wild, feral or stray) cat and dog populations on Navy installations. The objective is to prevent injury or disease to Navy personnel, and eliminate adverse impacts on native wildlife. It requires Navy commands to institute pro-active pet management procedures in order to prevent establishment of free roaming cat and dog populations. Free roaming cats and dogs pose a potential public health threat to personnel on Navy installations, and they pose a threat to wildlife including endangered species and migratory birds.

2. Existing policy at Paragraph 4-2c(4) of reference (a) states "Dogs, cats, and other privately-owned or stray animals will not be permitted to run at large on military reservations." Consistent with this policy, Navy commands must ensure the humane capture and removal of free roaming cats and dogs. Consistent with this requirement, Trap/Neuter/Release (TNR) programs will no longer be established on Navy land. All existing TNR programs on Navy land must be terminated no later than 1 January 2003.

3. Responsible pet ownership is a key factor in eliminating free roaming cat and dog populations. In consultation with supporting Army Veterinary Office, installations shall implement appropriate pet management measures to preclude establishment

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG
POPULATIONS ON NAVY PROPERTY

of feral cat/dog populations, including, but not limited to the following:

Require installation residents to keep and feed pet animals indoors or under close supervision when outdoors (such as on leash and collar or other physical control device - cage, fenced yard etc.).

Encourage neutering or spaying of cats and dogs before they reach reproductive age (exceptions to this policy can be made on a case by case basis as determined by the Installation Commander).

Require routine vaccinations of cats and dogs for rabies and other diseases as required by federal, state and local laws and ordinances. A current vaccination record is required at time of registration of pets.

Require microchipping registration (or other system of pet identification approved by supporting veterinary office) of all pet cats and dogs brought onto installations. Installation residents must register cats and dogs and have pets wear registration or identification tags at all times.

Prohibit the feeding of feral animals on the installation.

Provide educational materials to pet owners regarding installation regulations and general pet management.

Enforce prohibition of abandonment of animals on installations.

Comply with all humane and animal control regulations at the federal, state and local level (and their equivalents in host nation countries).

Navy installations in Europe that do not have a supporting veterinary office contact 100th Medical Detachment (VA HQ) (011) 49-622-177-2868; for all other locations that do not have a supporting veterinary office the POC is the VETCOM HQ, Commander (210) 221-6522.

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG
POPULATIONS ON NAVY PROPERTY

4. Effective prevention, management and elimination of feral cat and dog populations requires close coordination and cooperation between natural resources, pest management, security, veterinary, and housing personnel to develop and implement an effective and humane program. Reference (b) provides information for preventing free roaming cat populations on military installations. General pest management guidelines are detailed in reference (c). Every effort should be made to work with other federal, state and local agencies to support reference (a) and reference (d) by eliminating free roaming cat and dog populations on Navy land. Navy commands should work with local animal control agencies to determine the best approach for the ultimate disposition of the captured animals. Every effort should be made, if practical, to find homes for adoptable feral cats and dogs.

5. My point of contact on this issue is Mr. Joe Cook, CNO N456M, at (703) 602-5335, or DSN 332-5335.


WILLIAM G. MATTHEIS

Deputy Director, Environmental
Protection, Safety and Occupational
Health Division

Distribution:

CINCLANTFLT (N465)
CINCPACFLT (N465)
COMNAVRESFOR (01E, N46)
CNR (91)
CNET (44)
COMNAVSECGRU (N443)
COMNAVTELCOM (N451)
BUMED (NEGC-EPWR)
COMNAVAIRSYSCOM (AIR.OY)
COMSPAWARESYSCOM (07-1)
COMNAVSUPSYSCOM (4A2, 421)
COMNAVSEASYSYSCOM (SEA 00T)
COMNAVFACECOM (ENV, 09)
CINCUSNAVEUR (N4, N76)
COMSC (N00EP)
COMNAVMETOCCOM (N13)

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG
POPULTIONS ON NAVY PROPERTY

Distribution:
CHBUMED (NEHC-EPWR)
DIRSSP (SP20161)
ONI (411)

Copy to:
OASN (I&E)
OAGC (I&E)
CNO, N44, N46, 09BF
CMC, LFL
COMNAVREG MIDLANT
COMNAVREG SE
NTC GREAT LAKES
COMNAVRESFOR
COMNAVREG SW
COMNAVREG PEARL HARBOR
COMNAVMARIANAS
COMNAVREG NW
CNFJ

CNFK
PACNAVAFACENGCOM PEARL HARBOR HI (CODE 23)
LANTNAVAFACENGCOM NORFOLK VA (CODE 2032)
SOUTHWESTNAVAFACENGCOM SAN DIEGO CA (CODE 03EN)
SOUTHNAVAFACENGCON CHARLESTON SC (CODE 064)
ENDFLDACT NE PHILADELPHIA PA (CODE 18)
ENGFLDACT WEST SAN BRUNO CA (CODE 053)
ENGFLDACT CHES WASHINGTON DC (CODE 20E)
ENGFLDACT NW POULSBO WA (CODE 05EC4)
CO PWC GREAT LAKES
CO PWC GUAM
CO PWC JACKSONVILLE
CO PWC NORFOLK
CO PWC PEARL HARBOR
CO PWC PENSACOLA
CO PWC SAN DIEGO
CO PWC SAN FRANSICO BAY
CO PWC WASHINGTON DC
CO PWC YOKOSUKA
CO CBC PORT HUENEME
CO CBC GULFPORT
OESO
MESO
DODVSA/OTSG (Chief Animal Medicine)

J-7 Supporting Images and Information for Marine Resources

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Appendix J-7
Marine Resources Supporting Appendix



Photograph 1: Fossil reef platform habitat along the east side of Waipi'o Peninsula.

Note: Green macroalgae is *Caulerpa cf. verticillata*.

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Marine Resources Supporting Appendix



Photograph 2: Sloping bottom habitat along the east side of Waipio Peninsula.

Note: Typical mix of sand, **shell hash**, macroalgae including *Gracilariaria salicornia* (gorilla ogo) and *Caulerpa* cf. *verticillata*, sponges including *Mycale armata* (orange keyhole sponge), and *Opheodesoma spectabilis* (conspicuous sea cucumber).

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Marine Resources Supporting Appendix



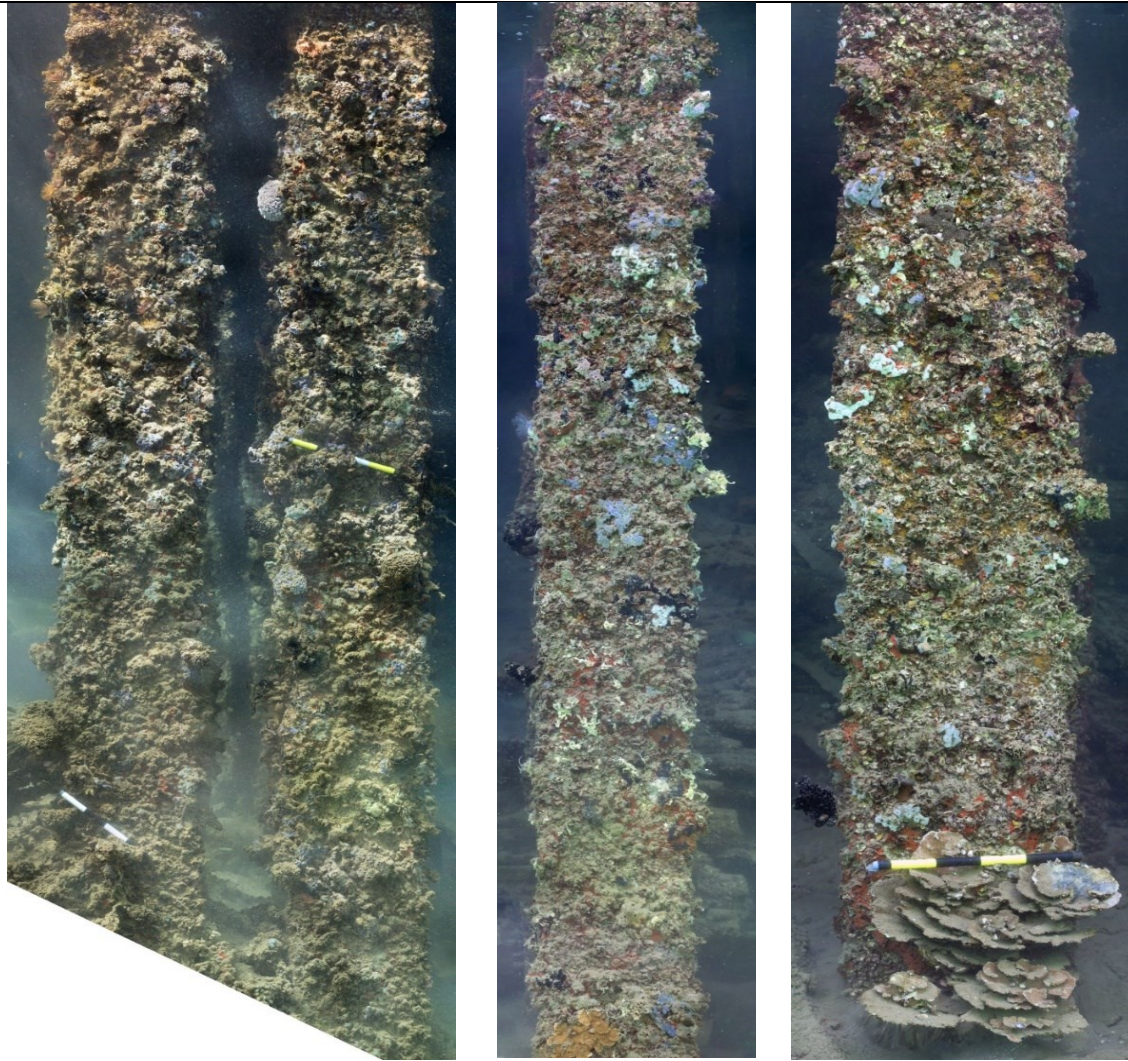
Photograph 3: Orthomosaic photograph of dredge cut wall habitat within the Dry Dock 5 survey area.

Appendix J-7
Marine Resources Supporting Appendix



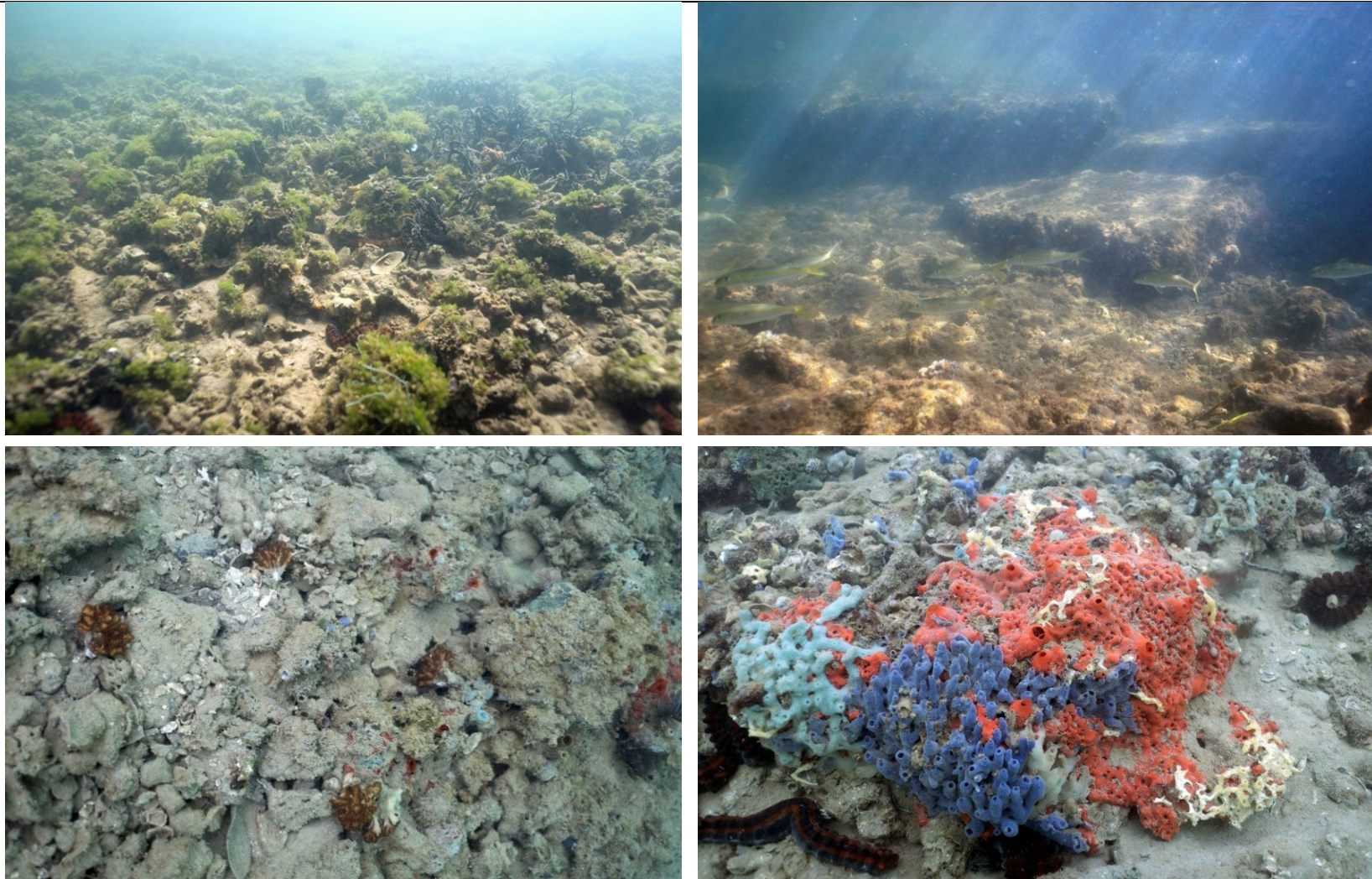
Photograph 4: Photograph of the Pearl Harbor floor habitat with holes from burrowing infauna.

Appendix J-7
Marine Resources Supporting Appendix



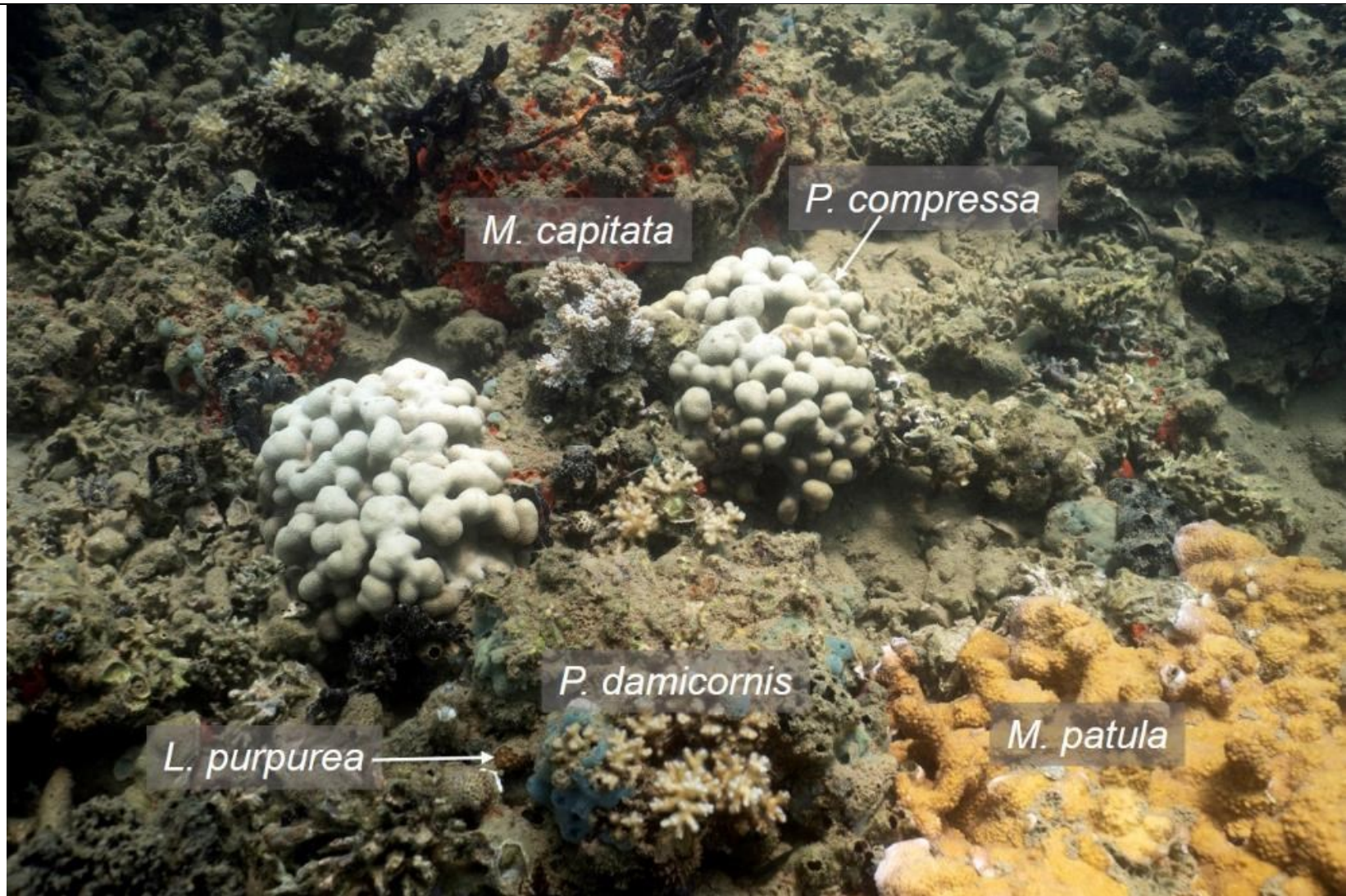
Photographs 5, 6, and 7 (left to right): Orthomosaic photographs of sessile invertebrates on submerged pilings within the Dry Dock 5 survey area.

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Marine Resources Supporting Appendix



Photographs 8, 9, 10, and 11 (clockwise): Representative orthomosaic photographs of Limestone Fossil Reef and Platform in Pearl Harbor.

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Marine Resources Supporting Appendix



Photograph 12: Examples of coral species found in Pearl Harbor. The photograph was taken offshore of the submerged concrete structures at the south end of Ford Island.

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Marine Resources Supporting Appendix



Photograph 13: Colony of *Montipora capitata* at the shelf edge on the west side of the south end of the Ford Island survey area.

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Marine Resources Supporting Appendix



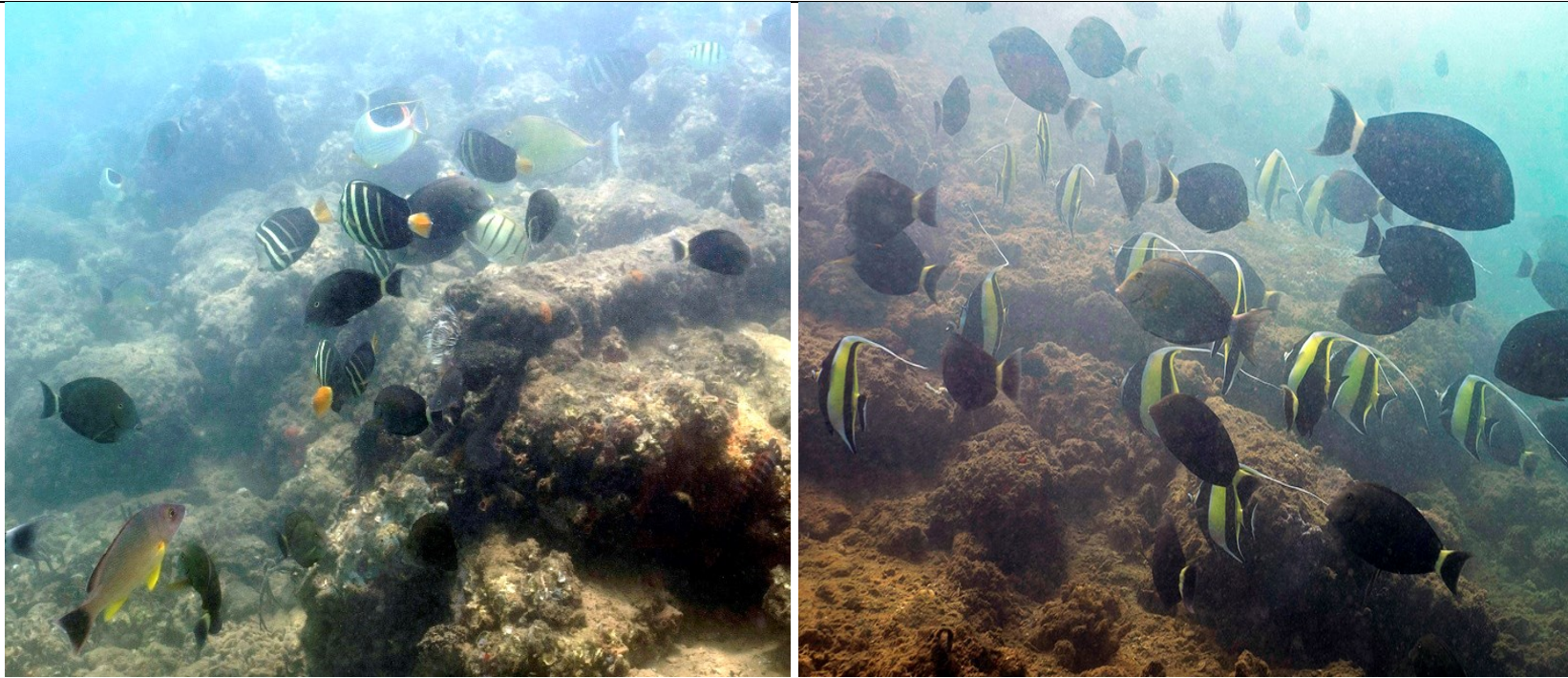
Photograph 14: Portion of large, contiguous patch of finger coral (*Porites compressa*) observed within the Dry Dock 5 survey area.

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Marine Resources Supporting Appendix



Photograph 15: Conspicuous sea cucumbers (*Opheodesoma spectabilis*).

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Marine Resources Supporting Appendix



Photographs 16 (left) and 17 (right): Schools of fishes in Pearl Harbor. Photograph 16 shows *Acanthurus blochii*, *A. triostegus*, *Chaetodon ephippium*, *Lutjanus fulvus*, *Naso unicornis*, and *Zebrasoma veliferum* near the coral patch west of Bulkhead 1461. Photograph 17 shows *A. blochii* and *Zanclus cornutus* off the southwest side of Ford Island.

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Marine Resources Supporting Appendix



Photograph 18 (left) and 19 (right): Organge keyhole sponge (*Mycale armata*). Photograph 18 shows the species growing in association with gorilla ogo (*Gracilaria salicornia*) and conspicuous sea cucumber (*Opheodesoma spectabilis*) off the south end of Ford Island. Photograph 19 is a close up image of the orange keyhole sponge, abundantly populated with Savigny's brittle star (*Ophiactis savignyi*) and one spaghetti worm (*Loimia medusa*) on the east side of Waipi'o Peninsula, south of Nevada Point.

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Marine Resources Supporting Appendix

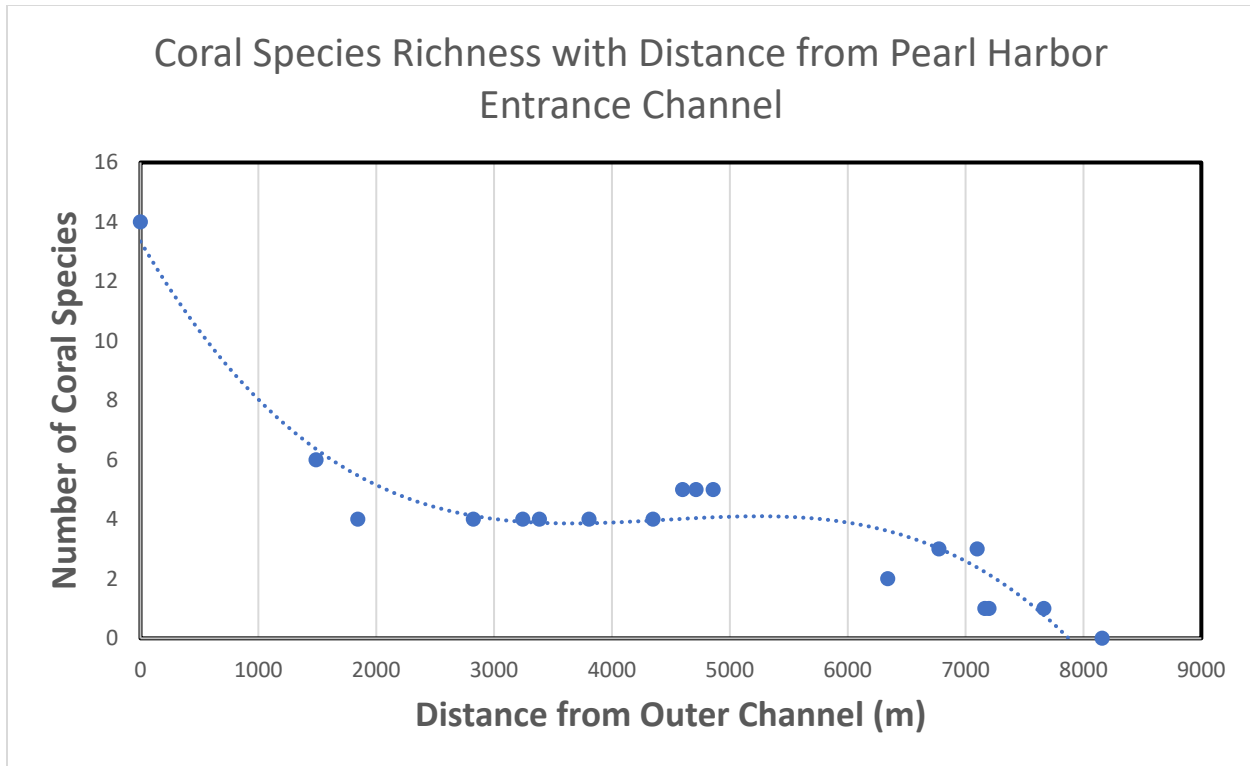


Figure 1 Coral Species Richness with Distance from Pearl Harbor Entrance Channel

Table 1 Summary of Threats to Hawaiian Monk Seals

<i>Threat Type</i>	<i>Description</i>
Crucial: ongoing sources of mortality that are apparent at most sites in Northwest Hawaiian Islands.	
Food limitation	Food limitation regulates the population growth in Northwest Hawaiian Islands and is evidenced by the decline in juvenile survival rate and significantly smaller pup and juvenile sizes. In contrast, pups in the Main Hawaiian Islands tend to be larger when they are weaned than when they are weaned in Northwest Hawaiian Islands.
Marine debris entanglement	Hawaiian monk seals have one of the highest documented entanglement rates of any pinniped species, and marine debris and fishing gear are chronic forms of pollution affecting the Northwest Hawaiian Islands. Despite dwindling numbers of Hawaiian monk seals, the number of monk seals found entangled has not changed and the accumulation rate of marine debris at Northwest Hawaiian Islands has remained unchanged.
Shark predation	There has been a significant increase in shark predation on monk seal pups born at French Frigate Shoals, where shark related injury and mortality of pre-weaned pups have been conspicuously higher than other sites. Field observations indicate that shark predation may also be compromising recovery of Hawaiian monk seals at Midway and Kure Atoll.
Serious: ongoing impacts with potential for range-wide concern	
Disease	Mortality events in the Northwest Hawaiian Islands have led to concern about the presence of diseases in monk seal populations. There is heightened concern about monk seal exposure to diseases that they have not previously encountered, such as leptospirosis, toxoplasmosis, and West Nile virus. The lack of antibodies in monk

Appendix J-7
Marine Resources Supporting Appendix

Table 1 Summary of Threats to Hawaiian Monk Seals

<i>Threat Type</i>	<i>Description</i>
	seals to these diseases makes them extremely vulnerable to potential infection. The frequency of the outbreaks is rare but the potential for devastating effects is of great concern should the diseases spread throughout the population.
Loss of terrestrial habitat	A significant issue of concern for Hawaiian monk seals in Northwest Hawaiian Islands is the loss of terrestrial habitat as a result of environmental factors such as storms and sea level rise. Sea level rise over the longer term may threaten a large portion of the resting and pupping habitat at Northwest Hawaiian Islands.
Fishery interaction	Species management actions by NOAA Fisheries have limited direct and indirect fisher interactions with Hawaiian monk seals in the Northwest Hawaiian Islands; however, Hawaiian monk seals in the Main Hawaiian Islands have required interventions due to embedded hooks from recreational fishing and recent mortalities in gillnets.
Male aggression	The primary identified cause of adult and immature female mortality affecting the recovery potential in monk seal population in the 1980s and early 1990s, was injury and often death caused by multiple (Hawaiian monk seal) male aggression. Attacks by single adult males have also resulted in several monk seal mortalities at most or all locations. These behaviors range from normal pinniped male harassment of younger animals to an aberrant level of focused aggression, especially directed toward weaned pups.
Human interaction	Hawaiian monk seals in the Northwest Hawaiian Islands avoid beaches for breeding where people have often disturbed them, but sightings of monk seals in the Main Hawaiian Islands have increased, resulting in increased human interactions by beachgoers. These interactions increase the concern about harassment of seals. Recent successful monk seal pupping events on popular Main Hawaiian Islands beaches have occurred, despite the major management challenges to staff, volunteers, resources, public outreach, and collaboration. Disturbance of seals on Main Hawaiian Islands beaches may limit seals' ability to make use of habitats. If the Main Hawaiian Islands population grows, in both absolute number and proportion of total abundance, disturbance will become a larger management challenge.
Moderate: possible localized impacts but are not considered serious or immediate cause of concern.	
Biotoxins	In 1978, a significant number of Hawaiian monk seals died on Laysan Island, and high levels of ciguatoxin and maitoxin were detected in the livers of two seals. Remote sensing of monk seal habitat has indicated that the potential impact of dangerous algal blooms could contain harmful species.
Vessel groundings	Hawaiian monk seals may potentially be injured or killed by vessel grounding that result in the release of hazardous materials, including oil or fuel spills, rotting bait, lost gear that creates entanglement hazards, and human disturbance resulting from a grounding incident. These events are typically episodic and affect a limited area when they occur. To date, no seal mortalities have been attributed to vessel groundings.
Contaminants	Hawaiian monk seals are exposed to organochlorines with concentrations of polychlorinated biphenyls found in biological samples. In the Northwestern Hawaiian Islands, contaminants originating from human occupation have been identified in Hawaiian monk seal habitat. The effects of these compounds on monk seal health, reproduction, and survival are unknown.

Notes: NOAA = National Oceanic and Atmospheric Administration.

Source: NOAA Fisheries, 2007.

J-8 Pearl Harbor and Nearshore Training Areas Marine Species List

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Appendix J-8
JBPHH Main Base and Surrounding Areas
Species List - Marine

<i>Family Name</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Category</i>	<i>Regulatory Status</i>	<i>Location</i>	<i>Reference</i>
Coral							
Acroporidae	<i>Montipora capitata</i>	rice coral	ko'a, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Acroporidae	<i>Montipora dilatata</i>	coral	ko'a, 'āko'ako'a	Native	SGCN	Both	Smith, 2015
Acroporidae	<i>Montipora flabellata</i>	blue rice coral	ko'a, 'āko'ako'a	Native	SGCN	Pearl Harbor	NAVFAC PAC, 2020
Acroporidae	<i>Montipora patula</i>	spreading coral	ko'a, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Acroporidae	<i>Montipora tuberculosa</i>	coral	ko'a, 'āko'ako'a	Native	SGCN	Ocean	Smith, 2015
Acroporidae	<i>Montipora turgescens</i>	lumpy rice coral	ko'a, 'āko'ako'a	Native	SGCN	Both	Smith, 2015
Acroporidae	<i>Montipora verrilli</i>	Verrill's ringed rice coral	ko'a, 'āko'ako'a	Native	SGCN	Ocean	Smith, 2015
Agariciidae	<i>Leptoseris incrustans</i>	swelling coral	ko'a, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Agariciidae	<i>Pavona duerdeni</i>	flat lobe coral, pork chop coral	ko'a, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Agariciidae	<i>Pavona varians</i>	corrugated coral	ko'a, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Antipathidae	<i>Antipathes grandis</i>	black coral	‘ekaha kū moana	Native	MUS	Ocean	Federal Register, 2019
Antipathidae	<i>Antipathes griggi</i>	black coral	‘ekaha kū moana	Native	MUS	Ocean	Federal Register, 2019
Antipathidae	<i>Myriopathes ulex</i>	black coral	‘ekaha kū moana	Native	MUS	Ocean	Federal Register, 2019
Clavulariidae	<i>Carijoa cf. riisei</i>	snowflake coral	-	Non-native	-	Both	Coles et al., 2009
Clavulariidae	<i>Carijoa riisei</i>	snowflake coral	-	Non-native	-	Both	NAVFAC PAC, 2020
Coralliidae	<i>Hemicorallium laauense</i>	red coral	-	Native	MUS	Ocean	Federal Register, 2019
Coralliidae	<i>Pleurocorallium secundum</i>	pink coral	-	Native	MUS	Ocean	Federal Register, 2019
Corallimorpharia (Order)	Unidentified species	corallimorph	-	Native	-	Both	NAVFAC PAC, 2020
Dendrophylliidae	<i>Cladopsammia gracilis</i>	stony cup coral	-	Native	-	Ocean	Smith et al., 2006
Fungiidae	<i>Lobactis scutaria</i>	oval mushroom coral	-	Native	-	Ocean	Smith, 2015
Isididae	<i>Acanella sp.</i>	bamboo coral	-	Native	MUS	Ocean	Federal Register, 2019
Leptastreaeidae	<i>Leptastrea bewickensis</i>	bewick coral	ko'a, 'āko'ako'a	Native	SGCN	Ocean	Smith et al., 2006
Leptastreaeidae	<i>Leptastrea purpurea</i>	mosaic coral	ko'a, 'āko'ako'a	Native	SGCN	Both	Rodgers et al., 2020

Regulatory Status: MUS = Management Unit Species; SGCN = State of Hawai'i Species of Greatest Conservation Need; - = no data.

Appendix J-8
JBPHH Main Base and Surrounding Areas
Species List - Marine

<i>Family Name</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Category</i>	<i>Regulatory Status</i>	<i>Location</i>	<i>Reference</i>
Merulinidae	<i>Cyphastrea agassizi</i>	Agassiz's coral	ko'a, 'āko'ako'a	Native	-	Ocean	Smith et al., 2006
Merulinidae	<i>Cyphastrea ocellina</i>	ocellated coral	ko'a, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2018a
Parazoanthidae	<i>Kulamanamana haumea</i>	Hawaiian gold coral	ko'a, 'āko'ako'a	Native	MUS	Ocean	Federal Register, 2019
Pocilloporidae	<i>Pocillopora damicornis</i>	lace coral	ko'a, 'āko'ako'a	Native	SGCN	Both	Rodgers et al., 2020
Pocilloporidae	<i>Pocillopora grandis</i>	antler coral	ko'a, 'āko'ako'a	Native	-	Both	NAVFAC PAC, 2020
Pocilloporidae	<i>Pocillopora ligulata</i>	thin cauliflower coral	ko'a, 'āko'ako'a	Native	SGCN	Ocean	Smith et al., 2006
Pocilloporidae	<i>Pocillopora meandrina</i>	cauliflower coral	ko'a, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Pocilloporidae	<i>Pocillopora verrucosa</i>	-	ko'a, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Poritidae	<i>Porites compressa</i>	finger coral	pō haku puna, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Poritidae	<i>Porites evermanni</i>	Evermann's coral	pō haku puna, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Poritidae	<i>Porites lobata</i>	lobe coral	pō haku puna, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Poritidae	<i>Porites</i> sp.	coral	ko'a, 'āko'ako'a	Native	SGCN	Both	NAVFAC PAC, 2020
Psammocoridae	<i>Cycloseris explanulata</i>	coral	ko'a, 'āko'ako'a	Native	-	Ocean	Smith et al., 2006
Psammocoridae	<i>Psammocora nierstraszi</i>	coral	ko'a, 'āko'ako'a	Native	SCGN	Ocean	Smith, 2015
Fish							
Acanthuridae	<i>Acanthurus blochii</i>	ringtail surgeonfish	pualu	Native	-	Both	MRC, 2021
Acanthuridae	<i>Acanthurus dussumieri</i>	eyestripe surgeonfish	palani	Native	-	Both	MRC, 2021
Acanthuridae	<i>Acanthurus guttatus</i>	whitespotted surgeonfish	'api	Native	-	Both	NAVFAC PAC, 2018a
Acanthuridae	<i>Acanthurus leucopareius</i>	whitebar surgeonfish	māikoiko	Native	-	Both	Coles et al., 2009
Acanthuridae	<i>Acanthurus nigrofusus</i>	brown surgeonfish	mā'i'i'i	Native	-	Both	MRC, 2021
Acanthuridae	<i>Acanthurus nigroris</i>	blue-lined surgeonfish	maiko	Native	-	Both	Smith et al., 2006
Acanthuridae	<i>Acanthurus olivaceus</i>	orangeband surgeonfish	na'ena'e	Native	-	Both	Smith et al., 2006

Regulatory Status: MUS = Management Unit Species; SGCN = State of Hawai'i Species of Greatest Conservation Need; - = no data.

Appendix J-8
JBPBH Main Base and Surrounding Areas
Species List - Marine

<i>Family Name</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Category</i>	<i>Regulatory Status</i>	<i>Location</i>	<i>Reference</i>
Acanthuridae	<i>Acanthurus triostegus</i>	convict surgeonfish	manini	Native	-	Both	MRC, 2021
Acanthuridae	<i>Acanthurus xanthopterus</i>	yellowfin surgeonfish	pualu	Native	-	Both	MRC, 2021
Acanthuridae	<i>Ctenochaetus strigosus</i>	goldring bristletooth	kole	Endemic	-	Both	MRC, 2021
Acanthuridae	<i>Naso brevirostris</i>	paletail unicornfish	kala lōlō	Native	-	Both	Smith et al., 2006
Acanthuridae	<i>Naso hexacanthus</i>	sleek unicornfish	kala lōlō, 'ōpelu kala	Native	-	Both	MRC, 2021
Acanthuridae	<i>Naso lituratus</i>	orangspine unicornfish	umaumalei	Native	-	Both	MRC, 2021
Acanthuridae	<i>Naso unicornis</i>	bluespine unicornfish	kala	Native	-	Both	MRC, 2021
Acanthuridae	<i>Zebrasoma flavescens</i>	yellow tang	lau'ipala	Native	-	Both	MRC, 2021
Acanthuridae	<i>Zebrasoma velifer</i>	sailfin tang	māneoneo	Native	-	Both	MRC, 2021
Albulidae	<i>Albula virgata</i>	longjaw bonefish	'o'io	Endemic	-	Both	Smith et al., 2006
Apogonidae	<i>Foa brachygramma</i>	bay cardinalfish	'upāpalu	Endemic	-	Both	NAVFAC PAC, 2018a
Apogonidae	<i>Pristiapogon kallopterus</i>	iridescent cardinalfish	'upāpalu	Native	-	Both	MRC, 2021
Apogonidae	Unidentified species	cardinalfish	'upāpalu	Native	SGCN	Both	MRC, 2021
Atherinidae	<i>Atherinomorus insularum</i>	Hawaiian silverside	'iao	Native	SGCN	Both	Smith et al., 2006
Aulostomidae	<i>Aulostomus chinensis</i>	trumpetfish	nūnū	Native	-	Both	Smith et al., 2006
Balistidae	<i>Sufflamen bursa</i>	lei triggerfish	humuhumu lei	Native	-	Both	Smith et al., 2006
Balistidae	<i>Rhinecanthus rectangulus</i>	wedge triggerfish	humuhumu nukunuku a pua'a	Native	-	Both	Smith et al., 2006
Belonidae	<i>Tylosurus</i> sp.	needlefishes	'ahu	Native	-	Both	Wolfe et al., 2017
Berycidae	<i>Beryx decadactylus</i>	alfonsin	-	Non-native	-	Both	WPRFMC, 2018
Berycidae	<i>Beryx splendens</i>	alfonsin	kinmedai	Native	MUS	Ocean	WPRFMC, 2009a
Blenniidae	<i>Omobranchus elongatus</i>	blenny	pāo'o (pāno'o)	Native	-	Pearl Harbor	Englund et al., 2000
Blenniidae	<i>Omobranchus ferox</i>	fang-toothed blenny	pāo'o (pāno'o)	Non-native	-	Pearl Harbor	Englund et al., 2000
Blenniidae	Unidentified species	blenny	pāo'o (pāno'o)	Native	-	Both	Coles et al., 2009
Bothidae	<i>Bothus pantherinus</i>	leopard flounder	pāki'i				
Carangidae	<i>Caranx ignobilis</i>	giant trevally	ulua aukea	Native	SGCN	Both	MRC, 2021
Carangidae	<i>Caranx mate</i>	yellowtail scad	omaka	Native	-	Both	Coles et al., 2009

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Appendix J-8
JBPBH Main Base and Surrounding Areas
Species List - Marine

<i>Family Name</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Category</i>	<i>Regulatory Status</i>	<i>Location</i>	<i>Reference</i>
Carangidae	<i>Caranx melampygus</i>	bluefin trevally	'ōmilu	Native	-	Both	MRC, 2021
Carangidae	<i>Decapterus macarellus</i>	mackeral scad	opelu	Native	-	Both	NAVFAC PAC, 2018a
Carangidae	<i>Gnathanodon speciosus</i>	golden trevally	ulua pa'opa'o	Native	-	Both	Wolfe et al., 2017
Carangidae	<i>Scomberoides lysan</i>	leatherback	lai	Native	-	Both	Wolfe et al., 2017
Carangidae	<i>Selar crumenophthalmus</i>	bigeye scad	'akule	Native	-	Ocean	U.S. Navy Office of Naval Research, 2001
Carcharhinidae	<i>Carcharhinus longimanus</i>	oceanic whitetip shark	manō	Native	FT, ST, SGCN	-	NAVFAC PAC, 2018a
Carcharhiniformes (Order)	Unidentified species	shark	manō	Native	-	Both	NAVFAC PAC, 2016
Centrolophidae	<i>Hyperoglyphe japonica</i>	ratfish	medai	Native	MUS	Ocean	WPRFMC, 2009a
Chaetodontidae	<i>Chaetodon auriga</i>	threadfin butterflyfish	kīkākapu	Native	-	Both	MRC, 2021
Chaetodontidae	<i>Chaetodon ephippium</i>	saddled butterflyfish	kīkākapu	Native	-	Both	MRC, 2021
Chaetodontidae	<i>Chaetodon lunula</i>	raccoon butterflyfish	kīkākapu	Native	-	Both	MRC, 2021
Chaetodontidae	<i>Chaetodon lunulatus</i>	oval butterflyfish	kapuhili	Native	-	Both	MRC, 2021
Chaetodontidae	<i>Chaetodon miliaris</i>	milletseed butterflyfish	lau wiliwili	Endemic	-	Both	Coles et al., 2009
Chaetodontidae	<i>Chaetodon multicinctus</i>	multiband butterflyfish	kīkākapu	Endemic	-	Both	Smith et al., 2006
Chaetodontidae	<i>Chaetodon quadrimaculatus</i>	fourspot butterflyfish	lauhau	Native	-	Both	Smith et al., 2006
Chaetodontidae	<i>Chaetodon unimaculatus</i>	teardrop butterflyfish	kīkākapu	Native	-	Both	Smith et al., 2006
Chaetodontidae	<i>Forcipiger flavissimus</i>	forcepsfish	lau wiliwili nukunuku 'oi'oi	Native	-	Both	Smith et al., 2006
Chanidae	<i>Chanos chanos</i>	milkfish	awa	Native	-	Both	NAVFAC PAC, 2018a
Chimaeridae	<i>Chimaera monstrosa</i>	rabbit fish	-	Non-native	-	Both	WPRFMC, 2018
Cichlidae	<i>Sarotherodon melanotheron</i>	blackchin tilapia	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Cirrhitidae	<i>Paracirrhites arcatus</i>	arc-eye hawkfish	piliko'a	Native	-	Both	MRC, 2021
Cirrhitidae	<i>Paracirrhites forsteri</i>	blackside hawkfish	hilu piliko'a	Native	-	Both	Smith et al., 2006
Clupeidae	Unidentified species	herrings and sardines	-	-	-	Pearl Harbor	Englund et al., 2000

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Cyprinidae	<i>Cyprinus carpio</i>	carp	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Cypriniformes (Order)	Unidentified species	carp or koi	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Cyprinodontiformes (Order)	Unidentified species	poeciliids or mosquitofish	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Diodontidae	<i>Diodon hystrix</i>	porcupinefish	kōkala	Native	-	Both	MRC, 2021
Elopidae	<i>Elops hawaiiensis</i>	Hawaiian tenpounder	awa'aua	Native	SGCN	Both	Smith et al., 2006
Engraulidae	<i>Encrasicholina purpurea</i>	Hawaiian anchovy	nehu	Native	SGCN	Both	NAVFAC PAC, 2018a
Fistulariidae	<i>Fistularia commersonii</i>	cornetfish	nūnū peke	Native	-	Both	Wolfe et al., 2017
Gobiidae	<i>Asterropteryx semipunctata</i>	halespotted goby	'o'opu	Native	-	Both	Smith et al., 2006
Gobiidae	<i>Bathygobius fuscus</i>	dusky frillgoby	'o'opu.	Native	-	Both	Smith et al., 2006
Gobiidae	<i>Gnatholepis anjerensis</i>	eyebars goby	-	Native	-	Both	Smith et al., 2006
Gobiidae	<i>Psilogobius mainlandi</i>	Hawaiian shrimp goby	'o'opu	Endemic	SGCN	Both	Smith et al., 2006
Gobiidae	<i>Mugilogobius cavifrons</i>	goby	'o'opu	Non-native	-	Pearl Harbor	Englund et al., 2000
Gobiidae	<i>Oxyurichthys longhotus</i>	goby	'o'opu	Endemic	SGCN	Pearl Harbor	Englund et al., 2000
Holocentridae	<i>Myripristis amaenus</i>	brick soldierfish	'ū'ū	Native	-	Both	Smith et al., 2006
Holocentridae	<i>Myripristis</i> sp.	soldierfish	'ū'ū	Native	-	Both	MRC, 2021
Holocentridae	<i>Neoniphon sammara</i>	spotfin squirrelfish	'ala'ihī	Native	-	Both	MRC, 2021
Holocentridae	<i>Sargocentron spiniferum</i>	saber squirrelfish	'ala'ihī	Native	-	Both	MRC, 2021
Holocentridae	<i>Sargocentron punctatissimum</i>	peppered squirrelfish	'ala'ihī	Native	-	Both	Smith et al., 2006
Kuhliidae	<i>Kuhlia sandvicensis</i>	reticulated flagtail	āholehole	Native	-	Both	Coles et al., 2009
Kuhliidae	<i>Kuhlia xenura</i>	Hawaiian flagtail	āholehole	Endemic	SGCN	Both	MRC, 2021
Kyphosidae	<i>Kyphosus</i> spp.	sea chub	nenuē	Native	-	Both	Wolfe et al., 2017
Kyphosidae	<i>Kyphosus elegans</i>	Pacific chub	nenuē	Native	-	Both	Coles et al., 2009
Labridae	<i>Anampses cuvier</i>	pearl wrasse	-	Native	-	Both	Coles et al., 2009
Labridae	<i>Cheilodactylus inermis</i>	cigar wrasse	-	Native	-	Both	Coles et al., 2009

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Labridae	<i>Coris flavovittata</i>	blackstripe wrasse	Hilu	Endemic	SGCN	Both	Coles et al., 2009
Labridae	<i>Coris gaimard</i>	yellowtail coris	hinālea 'akilolo	Native	-	Both	Smith et al., 2006
Labridae	<i>Coris venusta</i>	elegant coris	hinālea	Endemic	SGCN	Both	Smith et al., 2006
Labridae	<i>Gomphosus varius</i>	bird wrasse	hinālea 'iwi	Native	-	Both	Smith et al., 2006
Labridae	<i>Bodianus alboteniatus</i>	Hawaiian hogfish	'a'awa	Endemic	-	Both	Smith et al., 2006
Labridae	<i>Labroides phthirophagus</i>	Hawaiian cleaner wrasse	hinālea	Endemic	-	Both	Smith et al., 2006
Labridae	<i>Oxycheilinus unifasciatus</i>	ringtail wrasse	po'ou	Native	-	Both	Smith et al., 2006
Labridae	<i>Pseudocheilinus octotaenia</i>	eightline wrasse	hinālea	Native	-	Both	Smith et al., 2006
Labridae	<i>Pseudojuloides cerasinus</i>	belted wrasse	'ōmaka	Native	-	Both	Smith et al., 2006
Labridae	<i>Stethojulis balteata</i>	belted wrass	'ōmaka	Endemic	-	Both	Coles et al., 2009
Lethrinidae	<i>Monotaxis grandoculis</i>	bigeye emperor	mu	Native	-	Both	Wolfe et al., 2017
Lutjanidae	<i>Aphareus rutilans</i>	silverjaw snapper	lehi	Native	MUS	Ocean	WPRFMC, 2009a
Lutjanidae	<i>Aprion virescens</i>	gray jobfish	uku	Native	MUS	Ocean	WPRFMC, 2009a
Lutjanidae	<i>Etelis carbunculus</i>	squirrelfish snapper	ehu	Native	MUS	Ocean	WPRFMC, 2009a
Lutjanidae	<i>Etelis coruscans</i>	red snapper	onaga	Native	MUS	Ocean	WPRFMC, 2009a
Lutjanidae	<i>Lutjanus coeruleolineatus</i>	blueline snapper	-	Non-native	-	Pearl Harbor	Coles et al., 1997
Lutjanidae	<i>Lutjanus fulvus</i>	blacktail snapper	to'au	Native	-	Both	MRC, 2021
Lutjanidae	<i>Lutjanus kasmira</i>	bluestriped snapper	ta'ape	Non-native	-	Both	NAVAC PAC, 2018a
Lutjanidae	<i>Pristipomoides filamentosus</i>	pink snapper	opakapaka	Native	MUS	Ocean	WPRFMC, 2009a
Lutjanidae	<i>Pristipomoides seiboldii</i>	Von Siebold's snapper	kalekale	Native	MUS	Ocean	WPRFMC, 2009a
Lutjanidae	<i>Pristipomoides zonatus</i>	Brigham's snapper	gindai	Native	MUS	Ocean	WPRFMC, 2009a
Monacanthidae	<i>Cantherhines dumerilii</i>	barred filefish	'ō'ili	Native	-	Both	Smith et al., 2006
Monacanthidae	<i>Cantherhines sandwichiensis</i>	squaretail filefish	'ō'ili lepa	Native	-	Both	Smith et al., 2006
Monacanthidae	<i>Pervagor spilosoma</i>	Fantail filefish	'ō'ili 'uwi 'uwi	Endemic	-	Both	Coles et al., 2009

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Mugilidae	<i>Mugil cephalus</i>	striped mullet	'ama'ama	Native	-	Pearl Harbor	NAVFAC PAC, 2018a
Mugilidae	<i>Osteomugil engeli</i>	mullet (small)	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Mullidae	<i>Mulloidichthys flavolineatus</i>	yellowstripe goatfish	weke 'ā	Native	-	Both	MRC, 2021
Mullidae	<i>Mulloidichthys vanicolensis</i>	yellowfin goatfish	weke 'ula	Native	-	Both	MRC, 2021
Mullidae	<i>Parupeneus cyclostomus</i>	blue goatfish	moano 'ukali	Native	-	Both	MRC, 2021
Mullidae	<i>Parupeneus multifasciatus</i>	manybar goatfish	moano	Native	-	Both	MRC, 2021
Mullidae	<i>Parupeneus porphyreus</i>	whitesaddle goatfish	kūmū	Endemic	SGCN	Both	MRC, 2021
Mullidae	<i>Parupeneus trifasciatus</i>	double bar goatfish	moano	Native	-	Both	Smith et al., 2006
Mullidae	<i>Upeneus taeniopterus</i>	bandtail goatfish	'upāpalu	Native	-	Both	MRC, 2021
Muraenidae	<i>Echidna nebulosa</i>	snowflake eel	puhi kāpā	Native	-	Both	Wolfe et al., 2017
Muraenidae	<i>Echidna polyzona</i>	barred moray	puhi	Native	-	Both	Wolfe et al., 2017
Muraenidae	<i>Gymnothorax melatremus</i>	dwarf eel	puhi	Native	-	Both	NAVFAC PAC, 2018a
Muraenidae	<i>Gymnothorax meleagris</i>	whitemouth moray	puhi 'ōni'o	Native	-	Both	Smith et al., 2006
Muraenidae	<i>Gymnothorax</i> spp.	eel	puhi	Native	-	Both	Wolfe et al., 2017
Muraenidae	<i>Gymnothorax flavimarginatus</i>	yellowmargin moray	puhi paka	Native	-	Both	Smith et al., 2006
Myliobatidae	<i>Aetobatus narinari</i>	spotted eagle ray	hīhīmanu	Native	-	Both	NAVFAC PAC, 2016
Myliobatidae	<i>Manta birostris</i>	manta ray	hahalua	Native	FT, SGCN	Both	NAVFAC PAC, 2016
Ostraciidae	<i>Ostracion meleagris</i>	spotted boxfish	moa	Native	-	Both	Coles et al., 2009
Pentacerotidae	<i>Pentaceros richardsoni</i>	Pacific armorhead	kusakari tsubodai	Native	MUS	Ocean	WPRFMC, 2009a
Pinguipedidae	<i>Parapercis schauinslandii</i>	redspotted sandperch	-	Native	-	Both	NAVFAC PAC, 2018a
Poeciliidae	<i>Limia</i> cf. <i>vittata</i>	Cuban limia	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Poeciliidae	<i>Poecilia mexicana</i>	molly	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Poeciliidae	<i>Gambusia affinis</i>	Western mosquitofish	-	Non-native	-	Pearl Harbor	Englund et al., 2000

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Poeciliidae	<i>Limia vittata</i>	banded limia, Cuban limia, striped mudfish	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Poeciliidae	<i>Poecilia latipinna</i>	sailfin molly	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Poeciliidae	<i>Poecilia reticulata</i>	molly	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Poeciliidae	Unidentified species	South American loricator armored catfish	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Poeciliidae	<i>Xiphophorus helleri</i>	green swordtail	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Pomacanthidae	<i>Centropyge potteri</i>	Potter's Angelfish	-	Endemic	-	Both	
Pomacanthidae	<i>Pomacanthus imperator</i>	emperor angelfish	-	Native	-	Both	Smith et al., 2006
Pomacentridae	<i>Abudefduf abdominalis</i>	Hawaiian sergeant	mamo	Endemic	-	Both	MRC, 2021
Pomacentridae	<i>Abudefduf sordidus</i>	blackspot sergeant	kūpīpī	Native	-	Both	MRC, 2021
Pomacentridae	<i>Abudefduf vaigiensis</i>	Indo-Pacific sergeant	mamo	Native	-	Both	MRC, 2021
Pomacentridae	<i>Chromis ovalis</i>	oval chromis	-	Endemic	SGCN	Both	
Pomacentridae	<i>Chromis vanderbilti</i>	blackfin chromis	-	Native	-	Both	Coles et al., 2009
Pomacentridae	<i>Dascyllus albisella</i>	Hawaiian dascyllus	'alo'ilo'i	Endemic	-	Both	MRC, 2021
Pomacentridae	<i>Plectroglyphidodon imparipennis</i>	brighteye damselfish	mamo	Native	-	Both	Smith et al., 2006
Pomacentridae	<i>Plectroglyphidodon johnstonianus</i>	blue-eye damselfish	mamo	Native	-	Both	Smith et al., 2006
Pomacentridae	<i>Pycnochromis hanui</i>	chocolate-dip chromis		Endemic	SGCN	Both	
Pomacentridae	<i>Stegastes fasciolatus</i>	Hawaiian gregory	-	Native	-	Ocean	Smith et al., 2006
Priacanthidae	Aff. <i>Heteropriacanthus cruentatus</i>	glasseye	-	Native	-	Both	NAVFAC PAC, 2018a
Priacanthidae	Aff. <i>Priacanthus meeki</i>	Hawaiian bigeye	‘āweoweo	Native	-	Both	NAVFAC PAC, 2018a
Priacanthidae	<i>Heteropriacanthus cruentatus</i>	glasseye	‘āweoweo	Native	-	Both	Smith et al., 2006
Scaridae	<i>Calotomus carolinus</i>	star-eyed parrotfish	pōnūhūhū	Native	-	Both	NAVFAC PAC, 2018a
Scaridae	<i>Chlorurus perspicillatus</i>	spectacled parrotfish	uhu uliuli, uhu 'ahu'ula	Endemic	SGCN	Both	NAVFAC PAC, 2018a

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Scaridae	<i>Chlorurus spilurus</i>	bullethead parrotfish	uhu uliuli, uhu 'ahu'ula	Native	-	Both	MRC, 2021
Scaridae	<i>Scarus psittacus</i>	palenose parrotfish	uhu	Native	-	Both	Wolfe et al., 2017
Scaridae	<i>Scarus rubroviolaceus</i>	redlip parrotfish	pālukaluka, uhu 'ele'ele	Native	-	Both	MRC, 2021
Scaridae	<i>Scarus</i> sp.	parrotfish	uhu	Native	-	Both	Coles et al., 2009
Scaridae	Unidentified spp. (adults)	parrotfish	uhu	Native	-	Both	NAVFAC PAC, 2018a
Scaridae	Unidentified spp. (juveniles)	parrotfish	uhu	Native	-	Both	NAVFAC PAC, 2018a
Scombridae	<i>Thunnus alalunga</i>	albacore	ahi palaha	Native	-	Both	WPRFMC, 2009a
Scombridae	<i>Thunnus obesus</i>	bigeye tuna	ahi, po'onui	Native	-	Both	WPRFMC, 2009a
Scombridae	<i>Thunnus thynnus</i>	Atlantic bluefin tuna	-	Non-native	-	Ocean	WPRFMC, 2009a
Scorpaenidae	<i>Sebastapistes coniota</i>	speckled scorpionfish	-	Endemic	-	Both	Coles et al. 2009
Serranidae	<i>Cephalopholis argus</i>	peacock grouper	roi	Non-native	-	Pearl Harbor	Smith et al., 2006
Serranidae	<i>Hyporthodus quernus</i>	Hawaiian grouper	hapu'upu'u	Native	MUS	Ocean	WPRFMC, 2009a
Siluriformes (Order)	Unidentified species	armored catfish	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Sphyaenidae	<i>Sphyaena barracuda</i>	great barracuda	kākū	Native	-	Both	Wolfe et al., 2017
Sphyaenidae	<i>Sphyaena</i> sp.	barracuda	kākū	Native	-	Both	MRC, 2021
Synbranchiformes (Order)	Unidentified species	rice paddy eel	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Syndontidae	<i>Saurida gracilis</i>	slender lizardfish	'ulae	Native	-	Both	NAVFAC PAC, 2018a
Syngnathidae	<i>Hippocampus kuda</i>	smooth seahorse	-	Native	SGCN	Both	Smith et al., 2006
Synodontidae	<i>Synodus dermatogenys</i>	bluestripe lizardfish	'ulae	Native	-	Both	Wolfe et al., 2017
Synodontidae	<i>Synodus</i> sp.	lizardfish	'ulae	Native	-	Both	MRC, 2021
Tetraodontidae	<i>Arothron hispidus</i>	stripe belly puffer	o'opu hue	Native	-	Both	MRC, 2021
Tetraodontidae	<i>Canthigaster coronata</i>	crowned toby	o'opu hue	Endemic	-	Both	Smith et al., 2006
Tetraodontidae	<i>Canthigaster jactator</i>	Hawaiian whitespotted toby	-	Endemic	-	Both	Coles et al., 2009
Xiphiidae	<i>Xiphias gladius</i>	swordfish	a'uku	Native	-	Both	WPRFMC, 2018
Zanclidae	<i>Zanclus cornutus</i>	moorish idol	kihikihi	Native	-	Both	MRC, 2021

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Flora							
Bataceae	<i>Batis maritima</i>	pickleweed	-	Non-native	-	Ocean	Kay et al., 1995
Bonnemaisoniaceae	<i>Asparagopsis</i> sp.	seaweed	limu	Native	-	Ocean	SEI & MRC 2018
Bonnemaisoniaceae	<i>Asparagopsis taxiformis</i>	red sea plume	limu kohu	Native	-	Pearl Harbor	NAVFAC 2020v
Boodleaceae	<i>Cladophoropsis</i> cf. <i>membranacea</i>	seaweed	limu	Native	-	Ocean	Kay et al., 1995
Boodleaceae	<i>Cladophoropsis</i> sp.	seaweed	limu	Native	-	Both	Kay et al., 1995
Caulerpaceae	<i>Caulerpa</i> sp.	seaweed	limu	Native	-	Both	NAVFAC 2020c
Caulerpaceae	<i>Caulerpa</i> cf. <i>verticillata</i>	seaweed	limu	Native	-	Both	Rodgers et al., 2020
Cladophoraceae	<i>Cladophora</i> sp.	seaweed	limu	Native	-	Ocean	Kay et al., 1995
Codiaceae	<i>Codium</i> sp.	seaweed	limu	Native	-	Ocean	Kay et al., 1995
Corallinaceae	<i>Jania</i> sp.	seaweed	limu	Native	-	Ocean	Kay et al., 1995
Cystocloniaceae	<i>Hypnea</i> sp.	seaweed	limu	Non-native	-	Ocean	Kay et al., 1995
Dasycladaceae	<i>Neomeris</i> sp.	seaweed	limu	Native	-	Both	NAVFAC PAC, 2018b
Delesseriaceae	<i>Martensia fragilis</i>	seaweed	limu	Native	-	Ocean	Kay et al., 1995
Desmarestiaceae	<i>Desmarestia</i> sp.	seaweed	limu	Native	-	Both	NAVFAC PAC, 2020
Dichotomosiphonaceae	<i>Avrainvillea amadelpha</i>	seaweed	limu	Non-native	-	Both	Coles et al., 2009
Dictyotaceae	<i>Dictyota</i> sp.	seaweed	limu	Native	-	Both	NAVFAC PAC, 2020
Dictyotaceae	<i>Lobophora variegata</i>	seaweed	limu	Native	-	Both	Coles et al., 2009
Dictyotaceae	<i>Padina</i> sp.	peacock tail seaweed	limu	Native	-	Both	Coles et al., 2009
Gelidiellaceae	<i>Gelidiella</i> sp.	seaweed	limu	Native	-	Both	Rodgers et al., 2020
Gracilariaceae	<i>Gracilaria salicornia</i>	gorilla ogo	limu	Non-native	-	Ocean	Kay et al., 1995
Gracilariaceae	<i>Gracilaria</i> sp.	seaweed	limu	Non-native	-	Ocean	Kay et al., 1995
Halimedaceae	<i>Halimeda</i> sp.	seaweed	limu	Native	-	Ocean	Kay et al., 1995
Halymeniaceae	<i>Grateloupia</i> sp.	seaweed	limu	Native	-	Both	NAVFAC PAC, 2020
Hydrocharitaceae	<i>Halophila decipiens</i>	Caribbean seagrass	-	Non-native	-	Ocean	-
Hydrocharitaceae	<i>Halophila hawaiiiana</i>	Hawaiian seagrass	limu	Native	-	Ocean	Kay et al., 1995
Liagoraceae	<i>Liagora</i> sp.	seaweed	limu	Native	-	Ocean	Kay et al., 1995
-	<i>Broneteli</i> sp.	seaweed	limu	Native	-	Both	NAVFAC 2020a
-	Unidentified species	seaweed	limu	Native	-	Both	Kay et al., 1995

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Appendix J-8
JBPBH Main Base and Surrounding Areas
Species List - Marine

<i>Family Name</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Category</i>	<i>Regulatory Status</i>	<i>Location</i>	<i>Reference</i>
Oscillatoriaceae	<i>Lyngbya</i> sp.	blue-green algae	limu	Native	-	Ocean	Kay et al., 1995
Phormidioideae	<i>Symploca</i> sp.	seaweed	limu	Native	-	Ocean	Kay et al., 1995
Pterocladaceae	<i>Pterocladia</i> sp.	seaweed	limu	Native	-	Both	NAVFAC PAC, 2018a
Rhizophoraceae	<i>Rhizophora racemosa</i>	red mangrove	kukunaokalā	Non-native	-	Both	Coles et al., 2009
Rhodomelaceae	<i>Acanthophora spicifera</i>	seaweed	limu	Non-native	-	Ocean	Kay et al., 1995
Rhodomelaceae	<i>Laurencia</i> sp.	seaweed	limu	Native	-	Both	Coles et al., 2009
Spyridiaceae	<i>Spyridia</i> sp.	seaweed	limu	Native	-	Both	Coles et al., 2009
Unidentified	Unidentified species	foraminifera	-	Native	-	Both	Coles et al., 2009
Invertebrate							
Actiniaria (Order)	Unidentified species	sea anemone	okole	Native	-	Pearl Harbor	NAVFAC PAC, 2020
Aglajidae	<i>Chelidonura hirundinina</i>	headshield slug, swallowtail aglaja	-	Native	-	Pearl Harbor	Coles et al., 2009
Aiptasiidae	<i>Exaiptasia diaphana</i>	glass anemone	okole	Native	-	Pearl Harbor	Rodgers et al., 2020
Alpheidae	<i>Alpheus</i> spp.	snapping shrimp	-	Native	-	Pearl Harbor	Coles et al., 2009
Alpheidae	<i>Synalpheus streptodactylus</i>	cymbidium gentle touch orchid	-	Native	-	Pearl Harbor	Coles et al., 2009
Alpheidae	<i>Synalpheus thai</i>	shrimp	-	Native	-	Pearl Harbor	Coles et al., 2009
Amphinomidae	<i>Eurythoe complanata</i>	orange fireworm	aha huluhulu	Native	-	Pearl Harbor	Coles et al., 2009
Amphipoda (Order)	Unidentified species	amphipod	-	-	-	Pearl Harbor	Coles et al., 2009
Anomiidae	<i>Monia nobilis</i>	saddle oyster	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Aoridae	<i>Grandidierella</i> sp.	anchialine amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Aoridae	<i>Lembos</i> sp.	amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Aplysiidae	Unidentified species	aplysia	-	Native	-	Pearl Harbor	Coles et al., 2009
Apseudidae	<i>Apseudes</i> sp.	tanaisid	-	Native	-	Ocean	Smith et al., 2006
Arcidae	<i>Arca ventricosa</i>	ventricose ark	-	Native	-	Pearl Harbor	Rodgers et al., 2020
Ascididae	<i>Phallusia nigra</i>	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Ascididae	<i>Ascidia</i> sp. A	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Ascididae	<i>Ascidia</i> sp. B	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Ascididae	<i>Ascidia</i> spp.	sea squirt	-	Native	-	Pearl Harbor	Coles et al., 2009
Ascididae	<i>Ascidia sydneyensis</i>	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Balanidae	<i>Amphibalanus amphitrite</i>	barnacle	-	Non-native	-	Pearl Harbor	Coles et al., 2009

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Balanidae	<i>Amphibalanus eburneus</i>	barnacle	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Balanidae	<i>Amphibalanus reticulatus</i>	barnacle	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Balanidae	<i>Balanus</i> sp.	barnacle	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Biemnidae	<i>Biemna fistulosa</i>	sponge	-	Cryptogenic	-	Both	NAVFAC PAC, 2020
Boloceroiidae	<i>Boloceroiides mcmurrichi</i>	muddy shore anemone	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Bougainvilliidae	Unidentified species	hydrozoa	-	Native	-	Pearl Harbor	Coles et al., 2009
Bugulidae	<i>Bugula neritina</i>	brown bryozoan	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Bugulidae	<i>Virididentula dentata</i>	fan/blue-green bryozoan	-	Non-native	-	Ocean	Kay et al., 1995
Caecidae	<i>Caecum</i> spp.	caecum	-	-	-	Ocean	Smith et al., 2006
Callichiridae	<i>Corallianassa borrailei</i>	-	-	Native	-	Pearl Harbor	Coles et al., 2009
Calyptraeidae	<i>Bostrycapulus aculeatus</i>	slipper snail, slipper limpet	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Calyptraeidae	<i>Crucibulum spinosum</i>	spiny cup-and-saucer snail	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Cambaridae	<i>Procambarus clarkii</i>	crayfish	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Campanulariidae	<i>Clytia cf. gracilis</i>	hydrozoa	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Campanulariidae	<i>Clytia thornelyi</i>	hydrozoa	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Campanulariidae	<i>Obelia dichotoma</i>	hydrozoa	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Campanulariidae	Unidentified species	hydrozoa	-	Native	-	Pearl Harbor	Coles et al., 2009
Caprellidae	Unidentified species	skeleton shrimp	-	-	-	Ocean	Kay et al., 1995
Cardiidae	<i>Fragum fragum</i>	white strawberry cockle	-	-	-	Both	NAVFAC PAC, 2020
Cassidae	<i>Cassis cornuta</i>	horned helmet	pū, 'olē	Native	-	Pearl Harbor	Coles et al., 2009
Cerithiidae	<i>Cerithium zebrum</i>	sea snail	pūpū	Native	-	Ocean	Kay et al., 1995
Cerithiidae	<i>Cerithidium perparvulum</i>	sea snail	-	Native	-	Pearl Harbor	Coles et al., 2009
Chaetopteridae	Unidentified species	parchment worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Chaetopteridae	<i>Chaetopterus</i> sp.	parchment worm	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Chaetopteridae	Unidentified species	tube worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Chalinidae	<i>Cladocroce burapha</i>	sponge	-	Cryptogenic	-	Pearl Harbor	Rodgers et al., 2020
Chalinidae	<i>Haliclona (Haliclona) violacea</i>	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009

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Chalinidae	<i>Haliclona (Reniera) sp. 1</i>	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Chalinidae	<i>Haliclona (Reniera) sp. 2</i>	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Chalinidae	<i>Haliclona (Soestella) coerulea</i>	sponge	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Chalinidae	<i>Haliclona sp.</i>	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Chamidae	<i>Chama cf. asperella</i>	violet-mouthed jewel box bivalve	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Chamidae	<i>Chama fibula</i>	violet-mouthed jewel box bivalve	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Chamidae	<i>Chama limbula</i>	violet-mouthed jewel box bivalve	-	Native	-	Pearl Harbor	Coles et al., 2009
Chamidae	<i>Chama sp.</i>	violet-mouthed jewel box bivalve	-	Native	-	Pearl Harbor	Smith et al., 2006
Chamidae	<i>Chama elatensis</i>	leafy jewel box	-	Native	-	Pearl Harbor	Coles et al., 2009
Chondropsidae	<i>Strongylacidon kaneohe</i>	sponge	-	Native	-	Pearl Harbor	NAVFAC PAC, 2020
Chromodorididae	<i>Hypselodoris infucata</i>	nudibranch	-	Native	-	Pearl Harbor	Coles et al., 2009
Chthamalidae	<i>Chthamalus proteus</i>	barnacle	-	Non-native	-	Both	NAVFAC PAC, 2020
Cidaridae	<i>Chondrocidaris gigantea</i>	rough-spined urchin	-	Native	-	Both	Coles et al., 2009
Cidaridae	<i>Eucidaris metularia</i>	slate pencil/ ten-lined urchin	-	Native	-	Pearl Harbor	Coles et al., 2009
Cirratulidae	Unidentified species	cirratulid worms	-	Native	-	Pearl Harbor	Coles et al., 2009
Cirratulidae	<i>Cirriformia sp.</i>	cirratulid worms	-	Native	-	Both	Coles et al., 2009
Coelosphaeridae	<i>Lissodendoryx (Lissodendoryx) similis</i>	demosponge	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Colomastigidae	<i>Colomastix kapiolani</i>	amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Colomastigidae	<i>Colomastix lunailo</i>	amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Colomastigidae	<i>Colomastix pusilla</i>	amphipod	-	Non-native	-	Ocean	Smith et al., 2006
Conidae	<i>Conus ebreus</i>	Hebrew cone snail	pūpū pōniuniu/pūpū 'ala	Native	-	Pearl Harbor	Coles et al., 2009

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Conidae	<i>Conus eugrammatus</i>	cone snail	pūpū pōniuniu/pūpū 'ala	Native	-	Ocean	Smith et al., 2006
Conidae	<i>Conus leopardus</i>	leopard cone snail	pūpū pōniuniu/pūpū 'ala	Native	-	Ocean	Smith et al., 2006
Conidae	<i>Conus lividus</i>	livid cone snail	pūpū pōniuniu/pūpū 'ala	Native	-	Ocean	Smith et al., 2006
Conidae	<i>Conus miles</i>	soldier cone snail	pūpū pōniuniu/pūpū 'ala	Native	-	Ocean	Smith et al., 2006
Conidae	<i>Conus striatus</i>	striated cone snail	pūpū pōniuniu/pūpū 'ala	Native	-	Both	Smith et al., 2006
Conidae	<i>Conus vexillum</i>	vexillum cone snail	pūpū pōniuniu/pūpū 'ala	Native	-	Pearl Harbor	Coles et al., 2009
Corophiidae	<i>Corophium</i> sp.	amphipod	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Corophiidae	<i>Laticorophium baconi</i>	amphipod	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Corophiidae	<i>Monocorophium acherusicum</i>	amphipod	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Crambeidae	<i>Monanchora clathrata</i>	sponge	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Cuspidariidae	<i>Cuspidaria hawaiiensis</i>	bivalve	-	Native	-	Pearl Harbor	Coles et al., 2009
Cuspidariidae	<i>Cuspidaria</i> spp.	bivalve	-	Native	-	Pearl Harbor	Coles et al., 2009
Cylindroleberididae	<i>Parasterope</i> sp.	ostracod	-	Native	-	Pearl Harbor	Coles et al., 2009
Cymatiidae	<i>Cymatium</i> sp.	triton sea snail	-	Native	-	Pearl Harbor	Coles et al., 2009
Cypraeidae	<i>Cypraea</i> spp.	cowry shell	leho	Native	-	Pearl Harbor	Coles et al., 2009
Cypridinidae	<i>Paravargula</i> sp.	ostracod	-	Native	-	Pearl Harbor	Coles et al., 2009
Darwinellidae	<i>Chelonaplysilla violacea</i>	sponge	-	Native	-	Both	NAVFAC PAC, 2020
Diadematidae	<i>Diadema paucispinum</i>	long-spined sea urchin	-	Native	-	Both	Coles et al., 2009
Diadematidae	<i>Echinothrix diadema</i>	long-spined urchin	wana	Native	-	Both	Coles et al., 2009
Diadematidae	<i>Echinothrix calamaris</i>	black banded sea urchin	wana	Native	-	Both	Kay et al., 1995
Dialidae	<i>Diala semistriata</i>	-	-	Native	-	Pearl Harbor	Coles et al., 2009
Dictyodendrillidae	<i>Dictyodendrilla</i> sp.	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Didemnidae	<i>Didemnum</i> cf. <i>candidum</i>	gray colonial ascidian	-	Non-native	-	Pearl Harbor	Coles et al., 2009

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Didemnidae	<i>Didemnum edmondsoni</i>	sea squirt	-	Native	-	Pearl Harbor	Coles et al., 2009
Didemnidae	<i>Didemnum perlucidum</i>	white crust tunicate	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Didemnidae	<i>Didemnum</i> sp.	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Didemnidae	<i>Diplosoma</i> cf. <i>spongiforme</i>	encrusting ascidian, jelly synascidian	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Didemnidae	<i>Diplosoma listerianum</i>	encrusting ascidian, gray encrusting compound tunicate	-	Non-native	-	Both	NAVFAC PAC, 2020
Discodorididae	<i>Jorunna funebris</i>	dotted nudibranch	-	Native	-	Pearl Harbor	Coles et al., 2009
Dorvilleidae	<i>Schistomeringos</i> sp.	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Dorvilleidae	Unidentified species	polychaete worm	-	-	-	Pearl Harbor	Coles et al., 2009
Dysideidae	<i>Dysidea arenaria</i>	horny sponge	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Dysideidae	<i>Dysidea</i> sp.	horny sponge	-	Native	-	Both	Coles et al., 2009
Echinometridae	<i>Echinometra mathaei</i>	rock-boring urchin	‘ina	Native	-	Ocean	Smith et al., 2006
Echinometridae	<i>Echinostrephus aciculatus</i>	needle-spined urchin	-	Native	-	Both	Coles et al., 2009
Echinometridae	<i>Heterocentrotus mamillatus</i>	redpencil urchin	hauke'uke 'ula'ula	Native	-	Pearl Harbor	Coles et al., 2009
Epialtidae	<i>Hyastenus borrailei</i>	spider crab	-	Native	-	Both	Coles et al., 2009
Eulimidae	<i>Melanella</i> spp.	sea cucumber snail	-	Native	-	Pearl Harbor	Coles et al., 2009
Eunicidae	<i>Leodice antennata</i>	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Eunicidae	<i>Lysidice unicornis</i>	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Eunicidae	<i>Marphysa corallina</i>	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Eunicidae	<i>Marphysa</i> sp.	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Eunicidae	<i>Nicidion cariboea</i>	paddle-footed annelid	-	Native	-	Pearl Harbor	Coles et al., 2009
Eunicidae	Unidentified species	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Fissurellidae	<i>Diodora octagona</i>	keyhole limpet, slit Impet	-	Native	-	Pearl Harbor	Coles et al., 2009
Fissurellidae	<i>Diodora ruppelli</i>	Rüppell's keyhole limpet	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Fissurellidae	<i>Diodora</i> sp.	keyhole limpet, slit Impet	-	Native	-	Pearl Harbor	Coles et al., 2009

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Fissurellidae	Unidentified species	keyhole limpet, slit Impet	-	-	-	Pearl Harbor	Englund et al., 2000
Gerridae	<i>Halobates</i> (<i>Halobates</i>) <i>hawaiiensis</i>	Hawaiian pelagic water strider	-	Native	-	Pearl Harbor	Coles et al., 2009
Glyceridae	Unidentified species	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Gonodactylidae	<i>Gonodactylaceus falcatus</i>	Philippine mantis shrimp	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Grapsidae	<i>Metopograpsus messor</i>	grasid crab	-	Native	-	Pearl Harbor	Coles et al., 2009
Grapsidae	<i>Metopograpsus thukuhar</i>	thukuhar shore-crab, alamihi crab	-	Native	-	Pearl Harbor	Coles et al., 2009
Grapsidae	<i>Pachygrapsus</i> sp.	rock crab	-	Native	-	Pearl Harbor	Coles et al., 2009
Haleciidae	<i>Halecium</i> sp.	hydrozoa	-	Native	-	Pearl Harbor	Coles et al., 2009
Halichondriidae	<i>Ciocalypa</i> sp.	sponge	-	Cryptogenic	-	Pearl Harbor	Rodgers et al., 2020
Halichondriidae	<i>Halichondria</i> (<i>Halichondria</i>) <i>coerulea</i>	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Halichondriidae	<i>Halichondria</i> sp.	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Halichondriidae	<i>Hymeniacidon</i> sp.	sponge	-	Native	-	Pearl Harbor	Rodgers et al., 2020
Halichondriidae	<i>Topsentia dura</i>	sponge	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Halichondriidae	<i>Topsentia</i> sp.	sponge	-	Native	-	Both	Coles et al., 2009
Halichondriidae	<i>Ciocalypa</i> sp.1	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Halichondriidae	<i>Topsentia halichondrioides</i>	sponge	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Haminoeidae	<i>Aliculastrum debile</i>	haminoeids	-	Native	-	Pearl Harbor	Coles et al., 2009
Hiatellidae	<i>Hiatella arctica</i>	wrinkled rock-borer clam, Arctic hiatella	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Hipponicidae	<i>Antisabia imbricata</i>	hoof snails	-	Native	-	Pearl Harbor	Coles et al., 2009
Hipponicidae	<i>Pilosabia trigona</i>	hoof snails	-	Native	-	Pearl Harbor	Smith et al., 2006
Holothuriidae	<i>Actinopyga mauritiana</i>	white-spotted sea cucumber	Ioli	Native	-	Both	NAVFAC PAC, 2020
Holothuriidae	<i>Actinopyga varians</i>	Pacific white-spotted sea cucumber	Ioli	Native	-	Both	NAVFAC PAC, 2020
Holothuriidae	<i>Holothuria</i> (<i>Halodeima</i>) <i>atra</i>	black sea cucumber	Ioli	Native	-	Both	Coles et al., 2009

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Holothuriidae	<i>Holothuria (Lessonothuria) pardalis</i>	leopard sea cucumber	loli	Native	-	Both	Coles et al., 2009
Holothuriidae	<i>Holothuria (Thymiosycia) impatiens</i>	impatient sea cucumber	koko	Native	-	Pearl Harbor	Coles et al., 2009
Holothuriidae	<i>Holothuria</i> sp.	sea cucumber	loli	Native	-	Both	NAVFAC PAC, 2020
Holothuriidae	<i>Holothuria_ (Stauropora) cf. dofleinii</i>	sea cucumber	loli	Native	-	Pearl Harbor	Coles et al., 2009
Holothuriidae	<i>Labidodemas semperianum</i>	sea cucumber	loli	Native	-	Pearl Harbor	Englund et al., 2000
Hydrophilidae	<i>Tropisternus salsamentus</i>	water scavenger beetle	-	Non-native	-	Both	Coles et al., 2009
Hydrozoa (Class)	Unidentified species	hydrozoa	-	Native	-	Pearl Harbor	Coles et al., 2009
Hymedesmiidae	<i>Hamigera</i> sp.	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Iotrochotidae	<i>Iotrochota purpurea</i>	sponge	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Iotrochotidae	<i>Iotrochota</i> sp.	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Ischyroceridae	<i>Erichthonius brasiliensis</i>	amphipod	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Ischyroceridae	<i>Erichthonius</i> sp.	amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Isognomonidae	<i>Isognomon californicus</i>	purse shell	nahaweale	Native	-	Pearl Harbor	Coles et al., 2009
Isognomonidae	<i>Isognomon legumen</i>	pod tree oyster	nahaweale	Native	-	Pearl Harbor	Coles et al., 2009
Isognomonidae	<i>Isognomon perna</i>	rayed tree oyster	nahaweale	Native	-	Pearl Harbor	Coles et al., 2009
Isognomonidae	<i>Isognomon</i> sp.	purse shell	nahaweale	Native	-	Pearl Harbor	Coles et al., 2009
Lepraliellidae	<i>Celleporaria</i> sp.	bryozoan	-	Native	-	Pearl Harbor	Coles et al., 2009
Leptocheliidae	<i>Chondrochelia dubia</i>	amphipod	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Leucettidae	<i>Leucetta solida</i>	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Leucothoidae	<i>Leucothoe hyhelia</i>	amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Leucothoidae	<i>Leucothoe</i> sp. 1	amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Littorinidae	<i>Littoraria scabra</i>	scabra periwinkle	-	Native	-	Pearl Harbor	Coles et al., 2009
Lucinidae	<i>Ctena bella</i>	divergent lucine	-	Native	-	Pearl Harbor	Coles et al., 2009
Lumbrineridae	Unidentified species	polychaete worm	-	-	-	Pearl Harbor	Coles et al., 2009
Lumbrineridae	<i>Lumbrineris dentata</i>	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Lumbrineridae	Unidentified species	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009

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Appendix J-8
JBPHH Main Base and Surrounding Areas
Species List - Marine

<i>Family Name</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Category</i>	<i>Regulatory Status</i>	<i>Location</i>	<i>Reference</i>
Lysianassidae	<i>Arugella ewa</i>	copepod	-	Native	-	Pearl Harbor	Smith et al., 2006
Lysiosquillidae	<i>Lysiosquillina maculata</i>	common banded zebra matnis shrimp	-	Native	-	Pearl Harbor	Coles et al., 2009
Maeridae	<i>Maera</i> sp.	benthic amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Maeridae	<i>Quadrimaera pacifica</i>	benthic amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Maeridae	<i>Elasmopus</i> sp.	benthic amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Malacostraca (Class)	Unidentified species (larvae)	-	-	Native	-	Pearl Harbor	Wolfe et al., 2017
Margaritidae	<i>Pinctada galtsoffi</i>	Hawaiian pearl oyster	-	Native	-	Pearl Harbor	Coles et al., 2009
Margaritidae	<i>Pinctada</i> sp.	bivalve	-	Native	-	Both	NAVFAC PAC, 2018a
Margaritidae	<i>Pinctada margaritifera</i>	black-lipped pearl oyster	-	Native	SGCN	Pearl Harbor	Rodgers et al., 2020
Microcionidae	<i>Clathria (Thalysias) maunaloa</i>	vermilion clathria, sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Microcionidae	<i>Clathria</i> sp.	vermilion clathria, sponge	-	Native	-	Both	Coles et al., 2009
Microcionidae	<i>Clathria</i> sp.	vermilion clathria	-	Native	-	Pearl Harbor	Coles et al., 2009
Mitridae	<i>Nebularia</i> sp.	mitre	aha'aha	Native	-	Pearl Harbor	Coles et al., 2009
Mycalidae	<i>Mycale armata</i>	sponge	-	Non-native	-	Pearl Harbor	Wang et al., 2009
Mycalidae	<i>Mycale (Carmia) phyllophila</i>	sponge	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Mycalidae	<i>Mycale (Carmia) cecilia</i>	sponge	-	Non-native	-	Pearl Harbor	MRC, 2021
Mycalidae	<i>Mycale (Mycale) grandis</i>	sponge	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Mycalidae	<i>Mycale (Zygomycale) parishii</i>	sponge	-	Non-native	-	Pearl Harbor	NAVFAC PAC, 2020
-	Unidentified species	crab	-	Native	-	Pearl Harbor	Coles et al., 2009
-	Unidentified species	bryozoan	-	Native	-	Pearl Harbor	Coles et al., 2009
-	Unidentified species	-	-	Native	-	Pearl Harbor	NAVFAC PAC, 2020
-	Unidentified species	bivalve	-	Native	-	Both	NAVFAC PAC, 2018a
-	Unidentified species	sponge	-	-	-	Both	NAVFAC PAC, 2020
Naididae	<i>Limnodriloides</i> sp.	clitellate oligochaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009

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Appendix J-8
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Species List - Marine

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Nereididae	<i>Perinereis curvata</i>	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Nereididae	Unidentified species	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Neritidae	<i>Nerita picea</i>	black nerite	pipipi, pipipi kai	Native	SGCN	Pearl Harbor	Coles et al., 2009
Niphatidae	<i>Gelliodes fibrosa</i>	gray encrusting sponge	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Niphatidae	<i>Gelliodes</i> sp.	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Oceaniidae	<i>Corydendrium parasiticum</i>	hydrozoa	-	Cryptogenic	-	Ocean	Smith et al., 2006
Octopodidae	<i>Octopus cyanea</i>	octopus	he'e mauili	Native	SGCN	Both	Wolfe et al., 2017
Octopodidae	<i>Octopus</i> sp.	octopus	he'e mauili	Native	-	Pearl Harbor	Coles et al., 2009
Ophiactidae	<i>Ophiactis savignyi</i>	Savigny's brittle star	-	Cryptogenic	-	Pearl Harbor	NAVFAC PAC, 2020
Ophidiasteridae	<i>Linckia guildingi</i>	comet starfish	-	Native	-	Both	Coles et al., 2009
Ophiocomidae	<i>Ophiocoma erinaceus</i>	brittle star	-	Native	-	Ocean	Kay et al., 1995
Orbitestellidae	<i>Orbitestella regina</i>	-	-	Native	-	Both	NAVFAC PAC, 2020
Oreasteridae	<i>Culcita novaeguineae</i>	cushion star	-	Native	-	Pearl Harbor	Coles et al., 2009
Ostreidae	<i>Crassostrea</i> sp.	eastern oyster	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Ostreidae	<i>Crassostrea</i> sp.	oyster	-	Native	-	Pearl Harbor	Coles et al., 2009
Ostreidae	<i>Dendostrea sandvicensis</i>	Hawaiian oyster	-	Native	-	Pearl Harbor	Coles et al., 2009
Ostreidae	Unidentified species	oyster	-	-	-	Pearl Harbor	Coles et al., 2009
Pakynidae	Unidentified species	amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Pandalidae	<i>Heterocarpus spp</i>	deepwater shrimp	-	Native	MUS	Ocean	WPRFMC, 2009a
Panopeidae	<i>Acantholobulus pacificus</i>	mud crab	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Panopeidae	<i>Panopeus lacustris</i>	knot-fingered mud crab	-	Non-native	-	Pearl Harbor	Englund et al., 2000
Panopeidae	<i>Acantholobulus pacificus</i>	-	-	Non-native	-	Pearl Harbor	
Panopeidae	<i>Panopeus lacustris</i>	knot-fingered mud crab	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Parthenopidae	<i>Parthenope</i> sp.	cirratulid worms	-	Native	-	Both	NAVFAC PAC, 2020
Pennariidae	<i>Pennaria disticha</i>	hydrozoa	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Petrosiidae	<i>Petrosia</i> sp.	sponge	-	Native	-	Pearl Harbor	Coles et al., 2009
Phascolosomatidae	<i>Phascolosoma (Phascolosoma) stephensoni</i>	sipunculid	-	Native	-	Both	Kay et al., 1995

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Phasianellidae	<i>Hiloe variabilis</i>	-	-	Native	-	Pearl Harbor	Coles et al., 2009
Photidae	<i>Photis hawaiiensis</i>	amphipod	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Phyllodocidae	Unidentified species	polychaete worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Pilumnidae	<i>Pilumnus oahuensis</i>	common hairy crab	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Pilumnidae	<i>Pilumnus taeniola</i>	common hairy crab	-	Native	-	Pearl Harbor	Coles et al., 2009
Pilumnidae	<i>Pilumnus vespertilio</i>	common hairy crab, bad day hair crab	-	Native	-	Pearl Harbor	Coles et al., 2009
Plagioeciidae	<i>Diaperoforma</i> sp.	bryozoan	-	Native	-	Pearl Harbor	Rodgers et al., 2020
Plakinidae	<i>Plakortis simplex</i>	sponge	-	Non-native	-	Pearl Harbor	NAVFAC PAC, 2020
Plakobrachidae	<i>Plakobrachus ocellatus</i>	sacoglossan sea slug	-	Native	-	Pearl Harbor	NAVFAC PAC, 2020
Pleurobranchidae	<i>Pleurobranchus grandis</i>	sidegill slug, tiled pleurobranch	-	Native	-	Pearl Harbor	Coles et al., 2009
Podoceridae	<i>Podocerus brasiliensis</i>	amphipod	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Polyceridae	<i>Tambja morosa</i>	gloomy nudibranch	-	Native	-	Pearl Harbor	Coles et al., 2009
Polyclinidae	<i>Polyclinum</i> sp.	sea squirt	-	Native	-	Pearl Harbor	Rodgers et al., 2020
Portunidae	<i>Gonioinfradens paucidentatus</i>	penaeid shrimp	-	Native	-	Pearl Harbor	Smith et al., 2006
Portunidae	<i>Podophthalmus vigil</i>	stalk-eyed swimmer crab	-	Native	-	Pearl Harbor	Coles et al., 2009
Portunidae	<i>Thalamita bevisi</i>	penaeid shrimp	-	Native	-	Pearl Harbor	Coles et al., 2009
Portunidae	<i>Thalamita integra</i>	penaeid shrimp	niho kīlou	Native	-	Pearl Harbor	Coles et al., 2009
Portunidae	<i>Thalamita</i> sp.	penaeid shrimp	-	Native	-	Pearl Harbor	Smith et al., 2006
Portunidae	<i>Thranita crenata</i>	mangrove, blue-pincher, notched swimming crab	niho kīlou	Native	-	Pearl Harbor	Smith et al., 2006
Portunidae	<i>Portunus sanguinolentus</i>	three-spotted swimmer crab	-	Native	-	Pearl Harbor	Smith et al., 2006
Pseudosquillidae	<i>Pseudosquilla ciliata</i>	ciliated mantis shrimp	-	Native	-	Pearl Harbor	Coles et al., 2009
Pycnogonidae	Unidentified species	sea spider	-	Native	-	Ocean	Kay et al., 1995
Pyramidellidae	Unidentified species	pyramid shell	-	Native	-	Pearl Harbor	Coles et al., 2009
Pyramidellidae	<i>Hinemoa indica</i>	sea snail	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Pyuridae	<i>Herdmania mauritiana</i>	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Pyuridae	<i>Herdmania pallida</i>	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Pyuridae	<i>Herdmania</i> sp.	sea squirt	-	Native	-	Pearl Harbor	Coles et al., 2009

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Pyuridae	<i>Microcosmus exasperatus</i>	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Raninidae	<i>Ranina ranina</i>	spanner crab	papa'akualoa	Native	-	Both	WPRFMC, 2009a
Raspailiidae	<i>Raspailia (Clathriodendron) darwinensis</i>	sponge	-	Cryptogenic	-	Both	Coles et al., 2009
Rissoidae	<i>Haurakia marmorata</i>	sea snail	-	Native	-	Ocean	Kay et al., 1995
Rissoidae	<i>Parashiela ambulata</i>	minute sea snail, micromollusc	-	Native	-	Pearl Harbor	Coles et al., 2009
Rissoinidae	<i>Apataxia cerithiiformis</i>	rice shell	-	Native	-	Pearl Harbor	Coles et al., 2009
Sabellidae	<i>Amphiglena mediterranea</i>	bristle worm	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Sabellidae	<i>Potamethus</i> sp.	feather duster worm	-	Native	-	Pearl Harbor	Rodgers et al., 2020
Sabellidae	<i>Sabellastarte sanctijosephi</i>	feather duster worm	-	Non-native	-	Both	Rodgers et al., 2020
Sabellidae	<i>Sabellastarte spectabilis</i>	feather duster worm	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Sabellidae	Unidentified species	feather duster worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Sabellidae	<i>Amphiglena</i> sp.	bristle worm	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Sabellidae	<i>Branchioma nigromaculatum</i>	feather duster worm	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Sabellidae	<i>Branchioma</i> sp.	feather duster worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Sabellidae	<i>Potamilla</i> sp.	feather duster worm	-	Native	-	Both	NAVFAC PAC, 2020
Sabellidae	<i>Sabellastarte</i> sp.	feather duster worm	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Schizoporellidae	<i>Schizoporella</i> cf. <i>errata</i>	bryozoan	-	Non-native	-	Pearl Harbor	Rodgers et al., 2020
Schizoporellidae	<i>Schizoporella unicornis</i>	bryozoan	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Semelidae	<i>Rocheffortina sandwichensis</i>	mussels	-	Native	-	Pearl Harbor	Coles et al., 2009
Seraphsidae	Unidentified species	polychaete worm	-	-	-	Pearl Harbor	NAVFAC PAC, 2020
Serpulidae	<i>Filograna implexa</i>	coral worm	-	Non-native	-	Pearl Harbor	Coles et al., 1997
Serpulidae	<i>Salmacina dysteri</i>	tube worm	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Serpulidae	<i>Serpula</i> sp.	tube worm	-	Native	-	Pearl Harbor	Coles et al., 2009

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Serpulidae	<i>Serpula vermicularis</i>	tube worm	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Serpulidae	Unidentified species	tube worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Serpulidae	Unidentified species	tube worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Serpulidae	<i>Hydroides brachyacantha</i>	tube worm	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Serpulidae	<i>Hydroides crucigera</i>	tube worm	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Serpulidae	<i>Hydroides elegans</i>	tube worm	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Serpulidae	<i>Hydroides</i> sp.	tube worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Serpulidae	<i>Pileolaria militaris</i>	tube worm	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Serpulidae	<i>Simplaria pseudomilitaris</i>	tube worm	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Serpulidae	<i>Spirobranchus kraussii</i>	tube worm	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Serpulidae	Unidentified species	tube worm	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Siphonariidae	<i>Siphonaria normalis</i>	limpet	-	Native	SGCN	Pearl Harbor	Coles et al., 2009
Sphenopidae	<i>Palythoa</i> sp.	palythoa	-	Native	-	Both	NAVFAC PAC, 2020
Sphenopidae	<i>Palythoa tuberculosa</i>	rubbery zoanthid	-	Native	-	Pearl Harbor	Coles et al., 2009
Spintheridae	<i>Spinther japonicus</i>	polychaete worm	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Spionidae	Unidentified species	polychaete worm	-	-	-	Pearl Harbor	Coles et al., 2009
Spirorbinae (subfamily)	Unidentified species	polychaete worm	-	Native	-	Pearl Harbor	NAVFAC PAC, 2020
Spondylidae	<i>Spondylus</i> sp.	spiny oyster	-	Native	-	Both	NAVFAC PAC, 2018a
Spondylidae	<i>Spondylus violacescens</i>	cliff oyster	-	Native	-	Pearl Harbor	Coles et al., 2009
Stenopodidae	<i>Stenopus hispidus</i>	coral naded shrimp	-	Native	-	Pearl Harbor	Coles et al., 2009
Stenothoidae	Unidentified species	amphipod	-	Native	-	Pearl Harbor	Coles et al., 2009
Styelidae	<i>Cnemidocarpa irene</i>	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Styelidae	<i>Polyandrocarpa sagamiensis</i>	sea squirt	-	Native	-	Pearl Harbor	Coles et al., 2009
Styelidae	<i>Polyandrocarpa zorritensis</i>	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Styelidae	<i>Polycarpa aurita</i>	sea squirt	-	Native	-	Both	Coles et al., 2009
Styelidae	<i>Polycarpa cryptocarpa</i>	sea squirt	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009

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Styelidae	<i>Symplegma</i> sp.	sea squirt	-	Native	-	Pearl Harbor	Coles et al., 2009
Styelidae	<i>Botrylloides</i> sp.	ladder tunicate	-	Native	-	Pearl Harbor	Coles et al., 2009
Styelidae	<i>Polycarpa</i> sp.	sea squirt	-	Native	-	Pearl Harbor	Coles et al., 2009
Styelidae	<i>Styela canopus</i>	sea squirt	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Suberitidae	<i>Pseudosuberites</i> sp.	sea squirt	-	Native	-	Pearl Harbor	Coles et al., 2009
Suberitidae	<i>Suberites aurantiacus</i>	lobate sponge	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Syllidae	<i>Trypanosyllis</i> sp.	Syllid worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Syllidae	Unidentified species	Syllid worm	-	Native	-	Pearl Harbor	NAVFAC PAC, 2020
Synaptidae	<i>Opheodesoma spectabilis</i>	conspicuous sea cucumber	loli	Native	-	Pearl Harbor	Coles et al., 2009
Synaptidae	<i>Polyplectana kefersteinii</i>	sea cucumber	loli	Native	-	Pearl Harbor	Coles et al., 2009
Tedaniidae	<i>Tedania (Tedania) ignis</i>	fire sponge	-	Cryptogenic	-	Pearl Harbor	Coles et al., 2009
Terebellidae	<i>Loimia medusa</i>	Medusa spaghetti worm	kauna'oa	Native	-	Pearl Harbor	Coles et al., 2009
Terebellidae	<i>Thelepus setosus</i>	spaghetti worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Teredinidae	<i>Teredo</i> sp.	shipworm, termite of the sea	-	Native	-	Pearl Harbor	Rodgers et al., 2020
Tethyidae	<i>Tethya</i> sp.	sponge	-	-	-	Ocean	Kay et al., 1995
Tornidae	<i>Lophocochlias parvissimus</i>	minute sea snail, micromollusc	-	Native	-	Pearl Harbor	Coles et al., 2009
Toxopneustidae	<i>Tripneustes gratilla</i>	striped/collector urchin	hawa'e maoli	Native	-	Pearl Harbor	NAVFAC PAC, 2020
Umbraculidae	<i>Umbraculum umbraculum</i>	Atlantic umbrella slug	-	Native	-	Pearl Harbor	Coles et al., 2009
Veneridae	<i>Lioconcha fastigiata</i>	dark pitar venus	-	Cryptogenic	-	Pearl Harbor	NAVFAC PAC, 2020
Veneridae	<i>Periglypta reticulata</i>	reticulated Venus	-	Native	-	Both	Coles et al., 2009
Vermetidae	<i>Eualetes tulipa</i>	worm snail	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Vermetidae	<i>Thylacodes variabilis</i>	tube worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Vermetidae	Unidentified species	tube worm	-	Native	-	Pearl Harbor	Coles et al., 2009
Vermetidae	<i>Petalochonchus keenae</i>	tube worm	-	Native	-	Both	Coles et al., 2009
Vesiculariidae	<i>Amathia verticillata</i>	spaghetti/ bushy bryozoan	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Vesiculariidae	<i>Amathia distans</i>	bryozoan	-	Non-native	-	Pearl Harbor	Coles et al., 2009

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<i>Family Name</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Category</i>	<i>Regulatory Status</i>	<i>Location</i>	<i>Reference</i>
Watersiporidae	<i>Watersipora subtorquata</i>	red-rust bryozoan	-	Non-native	-	Pearl Harbor	Coles et al., 2009
Xanthidae	<i>Cyclodius nitidus</i>	crab	-	Native	-	Pearl Harbor	Coles et al., 2009
Xanthidae	<i>Cyclodius</i> sp.	crab	-	Native	-	Pearl Harbor	NAVFAC PAC, 2020
Xeniidae	<i>Xenia elongata</i>	common pulsing brown xenia	-	Non-native	SGCN	Both	Rodgers et al., 2020
Zoanthidae	<i>Zoanthus</i> sp.	zoanthid	-	Native	SGCN	Pearl Harbor	Coles et al., 2009
Zoanthidae	<i>Zoanthus</i> sp. (white)	zoanthid	-	Native	-	-	NAVFAC PAC, 2018a
Mammal							
Balaenidae	<i>Eubalaena japonica</i>	north Pacific right whale	koholā	Native	FE, MMPA, SGCN	Ocean	NAVFAC PAC, 2018a
Balaenopteridae	<i>Balaenoptera borealis</i>	sei whale	koholā	Native	FE, SE, MMPA, SGCN	Ocean	NAVFAC PAC, 2018a
Balaenopteridae	<i>Balaenoptera physalus</i>	fin whale	koholā	Native	FE, SE, MMPA, SGCN	Ocean	NAVFAC PAC, 2016
Balaenopteridae	<i>Megaptera novaeangliae</i>	humpback whale	koholā kuapi’o	Native	FE, SE, MMPA, SGCN	Both	NAVFAC PAC, 2018a
Balaenopteridae	<i>Balaenoptera musculus</i>	blue whale	koholā	Native	FE, MMPA, SGCN	Ocean	NAVFAC PAC, 2018a
Delphinidae	<i>Pseudorca crassidens</i>	false killer whale	none	Native	FE, SE, MMPA, SGCN	Ocean	NAVFAC PAC, 2016
Delphinidae	<i>Stenella coeruleoalba</i>	striped dolphin	none	Non-native	FE, MMPA, SGCN	Ocean	NAVFAC PAC, 2016
Delphinidae	<i>Stenella longirostris</i>	spinner dolphin	nai’a	Native	MMPA, SGCN	Both	NAVFAC PAC, 2018a
Kogiidae	<i>Kogia breviceps</i>	pygmy sperm whale	-	Native	MMPA, SGCN	Ocean	NAVFAC PAC, 2016
Phocidae	<i>Neomonachus schauinslandi</i>	Hawaiian monk seal	‘ilio holo I ka uaua	Native	FE, MMPA, SGCN	-	NAVFAC PAC, 2018a
Physeteridae	<i>Physeter macrocephalus</i>	sperm whale	koholā, palaoa	Native	FE, SE, MMPA, SGCN	Ocean	NAVFAC PAC, 2018a

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; FT = federally listed threatened; ST = state listed threatened; SGCN = State of Hawai‘i Species of Greatest Conservation Need; MMPA = Marine Mammal Protection Act; - = no data.

Appendix J-8
JBPBH Main Base and Surrounding Areas
Species List - Marine

<i>Family Name</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Category</i>	<i>Regulatory Status</i>	<i>Location</i>	<i>Reference</i>
Reptile							
Cheloniidae	<i>Chelonia mydas</i>	green sea turtle	honu	Native	FT, ST, SGCN	Both	NAVFAC PAC, 2020
Cheloniidae	<i>Eretmochelys imbricata</i>	hawksbill sea turtle	honu'ea	Native	FE, SE, SGCN	Both	NAVFAC PAC, 2018a
Cheloniidae	<i>Lepidochelys olivacea</i>	olive ridley sea turtle	-	Native	FT, ST, SGCN	-	NAVFAC PAC, 2018a
Cheloniidae	<i>Caretta caretta</i>	loggerhead sea turtle	-	Native	FT, ST, SGCN	-	NAVFAC PAC, 2018a
Dermochelyidae	<i>Dermochelys coriacea</i>	leatherback sea turtle	-	Native	FE, SE, SGCN	-	NAVFAC PAC, 2018a

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; FT = federally listed threatened; ST = state listed threatened; SGCN = State of Hawai'i Species of Greatest Conservation Need; MMPA = Marine Mammal Protection Act; MUS = Management Unit Species; - = no data.

Notes: NAVFAC PAC = Naval Facilities Engineering Systems Command, Pacific; SEI = Sea Engineering Incorporated; MRC = Marine Research Consultants.

Rules: (1) "Native/Non-native/Cryptogenic" - Where there is mention of Non-native in one reference and Cryptogenic in another "Cryptogenic" is used.
(2) Column Ocean: If there is a reference of the species occurring around southern O'ahu/O'ahu/main Hawaiian Islands, then can note a species as Ocean.
(3) CFR 2019 - This rule reduces the number of MUS from 205 species or families to 11 in the American Samoa FEP, from 227 species or families to 13 in the Marianas FEP, and from 173 species or families to 20 in the Hawai'i FEP.
(4) Native v. Non-native - Native is used when the organism cannot be identified to species, and there is a record of a Non-native status for an organism of the same genus but with a species name.

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J-9 Marine Mammal Sightings within Pearl Harbor

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Appendix J-9
Marine Mammal Live Sightings within Joint Base Pearl Harbor-Hickam

Table 1 Documented Sightings of Hawaiian Monk Seals at Joint Base Pearl Harbor-Hickam (2012 to 2019)

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
1/3/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/4/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
1/5/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
1/6/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/7/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
1/8/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
1/8/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
1/9/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
1/15/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
1/17/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
1/17/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
1/20/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/25/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
1/29/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
1/29/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
2/1/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
2/3/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/6/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
2/16/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
2/23/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
2/29/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
3/10/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/12/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/12/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/15/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
3/15/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
3/22/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
3/25/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
3/26/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Unknown
3/26/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Unknown
3/26/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Unknown
3/26/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
3/28/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/3/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
4/3/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/4/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
4/4/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
4/5/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
4/6/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
4/8/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
4/8/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
4/11/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
4/12/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/12/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
4/15/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
4/16/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
4/16/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
4/18/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
4/18/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
4/18/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/19/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
4/19/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
4/22/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/23/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
4/23/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/28/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
4/29/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
4/30/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
5/3/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
5/6/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
5/6/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/7/2012	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Female
5/7/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
5/14/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
5/15/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
5/17/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
5/30/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/4/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/4/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
6/4/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/6/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/8/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
6/10/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/22/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
6/25/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
6/28/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
7/1/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
7/8/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
7/9/2012	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
7/10/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
7/12/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/19/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/22/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/23/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/24/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/24/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/25/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/25/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/27/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
7/29/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/29/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/29/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
7/30/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/30/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
7/30/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
8/1/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
8/2/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
8/7/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
8/13/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
8/22/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/22/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
8/23/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
8/24/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/25/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/26/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/27/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
8/28/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/29/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/2/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/2/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/3/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/4/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/4/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
9/4/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/4/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
9/5/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/5/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
9/5/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/6/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
9/6/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/7/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/9/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/10/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/10/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/10/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
9/10/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
9/12/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/13/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/16/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
9/18/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/20/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/20/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/20/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/20/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
9/23/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/24/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/25/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
9/30/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
10/1/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
10/22/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
10/25/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
10/29/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/18/2012	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
11/18/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
11/19/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
11/20/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/20/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/21/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
11/23/2012	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/28/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
12/9/2012	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
12/16/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
12/19/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
12/19/2012	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
1/3/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
1/9/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/2/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/11/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
2/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
2/18/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
2/18/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
2/21/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
2/21/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
2/22/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/22/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/28/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/28/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
3/3/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
3/6/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/6/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
3/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
4/10/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/11/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/6/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
5/13/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
5/13/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
5/15/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Female
5/15/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Unknown
5/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
5/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Nursing pup	Female
5/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
5/27/2013	Hawaiian Monk Seal	REEF RUNWAY	Nursing pup	Female
5/27/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
5/30/2013	Hawaiian Monk Seal	REEF RUNWAY	Nursing pup	Female
5/30/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
6/3/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
6/4/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
6/6/2013	Hawaiian Monk Seal	REEF RUNWAY	Nursing pup	Female
6/6/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
6/13/2013	Hawaiian Monk Seal	REEF RUNWAY	Nursing pup	Female
6/13/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
6/16/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
6/20/2013	Hawaiian Monk Seal	REEF RUNWAY	Nursing pup	Female
6/20/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
6/27/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
6/27/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
6/27/2013	Hawaiian Monk Seal	REEF RUNWAY	Nursing pup	Female

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
6/27/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
6/30/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/30/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
6/30/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
7/4/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
7/4/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
7/7/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
7/7/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
7/11/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/11/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
7/14/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/14/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/18/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
7/18/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/21/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
7/22/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/22/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
7/25/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
7/25/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/28/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
7/28/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/29/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
8/1/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
8/1/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
8/4/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
8/5/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
8/6/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Unknown
8/6/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
8/7/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
8/8/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
8/8/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
8/8/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
8/11/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/11/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
8/11/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
8/14/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/15/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
8/18/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
8/20/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
8/20/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
8/29/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
8/29/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
9/5/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
9/8/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
9/9/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/9/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/10/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
9/10/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
9/12/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
9/13/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/16/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
9/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
9/21/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/21/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/21/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/22/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/22/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/24/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
9/25/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/29/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/29/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/30/2013	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
9/30/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/30/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
9/30/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
10/1/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
10/1/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
10/1/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
10/3/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
10/8/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
10/10/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
10/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
10/17/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
10/18/2013	Hawaiian Monk Seal	PEARL HARBOR	Unknown	Unknown
10/21/2013	Hawaiian Monk Seal	PEARL HARBOR	Unknown	Unknown
10/21/2013	Hawaiian Monk Seal	PEARL HARBOR	Unknown	Unknown
10/24/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
10/26/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
10/27/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
10/31/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
10/31/2013	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/7/2013	Hawaiian Monk Seal	PEARL HARBOR	Unknown	Unknown
11/7/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
11/10/2013	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
11/14/2013	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Male
11/14/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
11/19/2013	Hawaiian Monk Seal	PEARL HARBOR	Weaned pup	Female
11/19/2013	Hawaiian Monk Seal	PEARL HARBOR	Weaned pup	Female
11/21/2013	Hawaiian Monk Seal	REEF RUNWAY	Weaned pup	Female
11/21/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
11/23/2013	Hawaiian Monk Seal	PEARL HARBOR	Weaned pup	Female
11/24/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
11/30/2013	Hawaiian Monk Seal	PEARL HARBOR	Weaned pup	Female
12/21/2013	Hawaiian Monk Seal	PEARL HARBOR	Unknown	Unknown
12/26/2013	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
12/28/2013	Hawaiian Monk Seal	HICKAM AIR FORCE BASE	Unknown	Unknown
1/16/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
1/16/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
1/16/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
1/23/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
1/30/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
1/30/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
2/20/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
2/27/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
3/6/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
3/6/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
3/6/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
3/6/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
3/9/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
3/12/2014	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
3/13/2014	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/13/2014	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
4/3/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
4/3/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/10/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
4/10/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/17/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
4/17/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
4/24/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
4/24/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
5/4/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/8/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
5/8/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
5/11/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/11/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/12/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/14/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/14/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/19/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/22/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
5/26/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/26/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/28/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/1/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/1/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/2/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
6/5/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
6/5/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
7/6/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/6/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/10/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/17/2014	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
7/17/2014	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
7/17/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
7/17/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
7/24/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
7/24/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/31/2014	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
8/14/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
8/28/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
9/4/2014	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
9/4/2014	Hawaiian Monk Seal	REEF RUNWAY	Adult	Male
9/4/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
9/25/2014	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
11/28/2014	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
12/3/2014	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/8/2015	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
1/8/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
1/15/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
1/21/2015	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
1/23/2015	Hawaiian Monk Seal	PEARL HARBOR	Unknown	Unknown
2/19/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
3/26/2015	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
4/2/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
4/2/2015	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
4/21/2015	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
4/23/2015	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
4/30/2015	Hawaiian Monk Seal	REEF RUNWAY	Adult	Female
5/28/2015	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
6/18/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
7/9/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
7/30/2015	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
8/6/2015	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
8/13/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
8/13/2015	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
8/20/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
8/20/2015	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
8/27/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
9/17/2015	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/18/2015	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
10/22/2015	Hawaiian Monk Seal	REEF RUNWAY	Juvenile	Female
11/12/2015	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
11/19/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
11/26/2015	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
2/26/2016	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
2/28/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/3/2016	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
3/14/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/23/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/24/2016	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
3/25/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/26/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
4/1/2016	Hawaiian Monk Seal	REEF RUNWAY	Subadult	Male
4/14/2016	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
5/10/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
5/12/2016	Hawaiian Monk Seal	REEF RUNWAY	Unknown	Unknown
7/1/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/12/2016	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
8/16/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/18/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/24/2016	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
8/25/2016	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
8/27/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/16/2016	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
10/22/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Unknown
10/30/2016	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
11/17/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/23/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/24/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/26/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
12/7/2016	Hawaiian Monk Seal	PEARL HARBOR	Adult	Unknown
12/13/2016	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
12/14/2016	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
12/29/2016	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
1/15/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/12/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Male
2/13/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/13/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/14/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/17/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
2/18/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/19/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/20/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/22/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/26/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/26/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/27/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/2/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/5/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/8/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/9/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
3/11/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
3/13/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/21/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Unknown
3/22/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
4/2/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
5/1/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
5/28/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
6/1/2017	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
6/11/2017	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
6/24/2017	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
8/3/2017	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
8/3/2017	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Male
8/11/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
8/11/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
8/12/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
8/12/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
8/13/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
8/13/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
8/17/2017	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
8/19/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
8/19/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
8/26/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
9/5/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
9/7/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
9/20/2017	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
9/28/2017	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
10/2/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
10/3/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
10/5/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
10/6/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
10/7/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
10/7/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Unknown
10/8/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
10/8/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
10/9/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Male
10/10/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
10/15/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
10/21/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
10/24/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
10/25/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
10/29/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
10/31/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
11/7/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
11/8/2017	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
11/9/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
11/17/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
11/18/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/18/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
11/18/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
11/24/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
11/25/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
12/7/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
12/12/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
12/17/2017	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
12/20/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
12/23/2017	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
1/5/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/6/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
1/7/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/15/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
1/16/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
1/17/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/18/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
1/18/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/19/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
1/19/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
1/20/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
1/20/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
1/22/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
1/23/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/24/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/24/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/25/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
1/25/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
1/25/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
1/26/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/26/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
1/27/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
1/28/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/30/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
2/2/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
2/4/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/4/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/5/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/6/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/7/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
2/16/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/16/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/3/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
3/4/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
3/5/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/9/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/11/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
3/17/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
3/18/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/19/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/21/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/22/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/26/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/28/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
3/28/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/29/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/30/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
3/31/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
4/9/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
4/9/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
4/10/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
4/10/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
4/14/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
4/15/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
4/16/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
4/17/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
4/17/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
5/7/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
5/9/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
5/19/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
5/20/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
5/20/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
5/25/2018	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
5/25/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
5/26/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
5/27/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
5/31/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
6/9/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
6/10/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
6/24/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
8/12/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
8/12/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
8/14/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
8/16/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
8/16/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
8/17/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
8/18/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
8/18/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Male
8/18/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
8/18/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
8/22/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Male
9/1/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
9/1/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
9/2/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
9/3/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
9/4/2018	Hawaiian Monk Seal	HICKAM AIR FORCE BASE	Adult	Female
9/4/2018	Hawaiian Monk Seal	PEARL HARBOR	Adult	Unknown
9/5/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
9/5/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
9/6/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/7/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/7/2018	Hawaiian Monk Seal	NIMITZ BEACH	Subadult	Male
9/8/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
9/8/2018	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
9/10/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
9/10/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
9/10/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
9/11/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
9/13/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Male
9/14/2018	Hawaiian Monk Seal	HICKAM AIR FORCE BASE	Adult	Female
9/14/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/15/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/15/2018	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
9/16/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/16/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Male
9/16/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Male
9/16/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
9/17/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/18/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/19/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/20/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/21/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/23/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/24/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/25/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/25/2018	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
9/26/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/27/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
9/28/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
10/10/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
10/14/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
10/15/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
10/20/2018	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
10/29/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
11/1/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
11/5/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
11/5/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
11/7/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Juvenile	Female
11/11/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/11/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
11/12/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/12/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
11/13/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/13/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
11/14/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/15/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
11/17/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
11/20/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
11/21/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Male
11/26/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
12/2/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
12/6/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
12/9/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
12/9/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
12/10/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
12/10/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
12/11/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
12/13/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
12/14/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
12/15/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
12/16/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
12/20/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
12/20/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
12/21/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
12/23/2018	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
12/24/2018	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
12/25/2018	Hawaiian Monk Seal	HICKAM AIR FORCE BASE	Juvenile	Female
12/25/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
12/27/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
12/28/2018	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
12/29/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Male
12/29/2018	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
1/3/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/4/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/4/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
1/6/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
1/6/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/7/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
1/7/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
1/8/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/9/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/10/2019	Hawaiian Monk Seal	IROQUOIS POINT	Juvenile	Female

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
1/11/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
1/12/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/12/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/13/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
1/13/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
1/13/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
1/18/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
1/21/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/24/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
1/25/2019	Hawaiian Monk Seal	IROQUOIS POINT	Juvenile	Female
1/25/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
1/26/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/29/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
1/30/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/31/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
1/31/2019	Hawaiian Monk Seal	IROQUOIS POINT	Juvenile	Female
1/31/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/1/2019	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
2/2/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
2/3/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/3/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
2/3/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/4/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/4/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/7/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/8/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/9/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
2/9/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/10/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/12/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/14/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
2/14/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/15/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
2/15/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/16/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
2/16/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/17/2019	Hawaiian Monk Seal	IROQUOIS POINT	Juvenile	Female
2/17/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
2/17/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/18/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/19/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
2/20/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/21/2019	Hawaiian Monk Seal	IROQUOIS POINT	Juvenile	Female
2/21/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
2/22/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/23/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/24/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
2/25/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/26/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
2/27/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
2/28/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female

<i>Sighting Date</i>	<i>Species</i>	<i>Beach Name / Reported Location</i>	<i>Seal Age Class</i>	<i>Seal Sex</i>
2/28/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/1/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/2/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/3/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/4/2019	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
3/5/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
3/7/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
3/14/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Male
3/16/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
3/17/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
3/19/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
3/19/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/20/2019	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
3/21/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
3/21/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/22/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
3/23/2019	Hawaiian Monk Seal	NIMITZ BEACH	Adult	Female
3/23/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
3/29/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
3/30/2019	Hawaiian Monk Seal	IROQUOIS POINT	Unknown	Unknown
3/31/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
4/1/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
4/9/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
4/17/2019	Hawaiian Monk Seal	PEARL HARBOR	Unknown	Unknown
4/26/2019	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
4/27/2019	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
5/2/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
5/3/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
5/4/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
5/7/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Male
5/10/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
5/14/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
5/15/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
5/16/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
5/16/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown
5/17/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
5/18/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
5/26/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
5/28/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
5/29/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
6/3/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
6/14/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
6/15/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
6/16/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Adult	Female
7/11/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
7/12/2019	Hawaiian Monk Seal	IROQUOIS POINT	Adult	Female
7/29/2019	Hawaiian Monk Seal	NIMITZ BEACH	Unknown	Unknown
7/29/2019	Hawaiian Monk Seal	WHITE PLAINS BEACH	Unknown	Unknown

Source: NMFS PIFSC, 2018; Johanos, 2019.

Table 2 Sightings and Observations of Marine Mammals within Joint Base Pearl Harbor Hickam Installation Logged by Patricia Coleman and Aaron Hebshi from 1998 to 2009

<i>Species</i>	<i>Date</i>	<i>Time</i>	<i>Sightings and Observations</i>
Whale	3/21/98		Whale and calf enter PH/back side of Ford Island/Saturday morning; traffic stopped; effort made to boom off West Loch; kept watch 'til sunset; gone Sunday morning.
Whale			PH1 William Goodwin photographs whale in Pearl Harbor
Whale	same season, later		USS LOUISVILLE (sub) departing channel glanced whale
Whale			Tower reporting procedure put in place to watch for whales during season and to pass word to other traffic
	6/1/99		Coral collision Kaneohe, LCU from USS PELELIU, June JTFX
Whale	1/18/00		Six whales sighted approximately 2 miles out from Papa Hotel
Whale			Four reported by TWR 7, two reported by CLINGER
Whale	5/26/00		Cynthia Pang advises OSOT team has observed at various times:
Whale	2/20/01	8:28 a.m.	USS CHICAGO - Whale seen, entrance Papa Hotel
Whale	2/21/01		USS CHARLOTTE - Saw whales 2-3 miles away - channel between Molokai & Oahu
Whale	2/27/01		NMFS called by Signal Tower of whale in Pearl Harbor -- error. Meant Buoys 1 & 2, not in harbor
Whale	1/6/04	6:00 p.m.	USS COLUMBIA - Departing Pearl Harbor, whales either side, 200 yds Buoys 1 & 2
Whale	1/21 or 1/22/2004	5:45 p.m.	KISKA - whale between Buoys 1 & 2
Whale	2/5/04	5:00 p.m.	HOPPER (inbound) whales headed east (DH) between 1&2
Whale	2/12/04	5:15 p.m.	Whale observed in vicinity of PH entrance Buoy 1
Whale	2/26/04	11:00 a.m.	Security boats - whales between Buoys 1 & 2
Dolphins	3/18/04	9:30 a.m.	Pod of dolphins seen by vessel inbound Buoy 7 security boat
Monk Seal	4/12/04	9:09 a.m.	Monk seal 100' off Hickam O'Club. Spotted by Danny aboard Tug Lanai transiting from Victor Pier to Alpha Docks
Whale	2004 December		Port Ops advises whale sighting PH (Papa Hotel)
Monk Seal	1/16/05	4:00 p.m.	Monk seal basing at Iroquois Point harbor
Whale	1/19/05	10:48 a.m.	Ctrl Tower reports two whales spotted headed east at Buoys 1 & 2
Whale	1/20/05	10:00 a.m.	Whales seen 1MSW Buoys 1 & 2
	1/24/05	1:00 p.m.	Channel marker 7 at IP - Buoy 7, "injured" presumed, no fishing line
Monk Seal			Monk seal - hauled out on beach
Whale	2/1/05	5:40 p.m.	Outbound sub reports two whales headed west 500 yds off Buoys 1 & 2
Monk Seal	2/11/05		Monk seal - White Sands Beach
Monk Seal	2/16/05		Monk seal - White Sands Beach
Monk Seal	3/4/05	10:30 a.m.	Monk seal basking, White Plains
Seal	3/10/05	2:47 p.m.	Seal at White Plains
Monk Seal	3/11/05	9:02 a.m.	Monk seal - White Plains
Monk Seal	4/30/05	9:45 a.m.	Monk seal - White Plains
Monk Seal	2005 May		USS RUSSELL firing - 50 cal - VIP saw spout - firing stopped

<i>Species</i>	<i>Date</i>	<i>Time</i>	<i>Sightings and Observations</i>
Monk Seal	2006 February	3:20 p.m.	NOAA calls - advises charter boat saw HMS entangled S of Niihau. Advised PMRF
Whale		4:10 p.m.	Whale sighted 1,000 yds west of Buoy 1
Whale	3/27/06	10:00 a.m.	Whale headed E 2 NM S of reef runway
Whale		1:30 p.m.	Whale 300 yds Buoys 1 & 2 headed east
Whale		1:45 p.m.	Two whales west of Buoys 1 & 2, 300 NM
Whale	4/3/06	-	Flt departing PMRF saw adult whale & calf
Whale	5/1/06	-	Tower reports two whales, Buoys 3 & 4, headed east
Monk Seal	5/19/06	7:20 a.m.	White Plains Beach cottage HMS
Monk Seal	12/5/06	2:15 p.m.	Iroquois Point/Hammer Point HMS hauled out
Whale	1/22/07	9:14 a.m.	Whale headed SW at Papa Hotel - report from ship to tower
Monk Seal	6/4/07	9:00 a.m.	HMS White Plains Beach
Monk Seal	7/5/07	819am	HMS West Loch area; traffic advised
Coral Legend Whales	12/9/08		From: Dick, Mike J CIV (PMRF 7322) Sent: Tuesday, December 09, 2008 8:07; From BSURE techs: Whales heard this morning, 1st time noticed this season.
Hawaiian Monk Seal	1/13/09		From: Hommon, Rebecca M CIV CNRH, N00L Sent: Tuesday, January 13, 2009 9:35 AM Tower reported 4 whales sighted 5 miles offshore of Buoys 1 & 2 which are the buoys the furthest out to line up to enter Pearl Harbor. Whales were headed SE. Tower will advise all incoming/outgoing traffic. VR Beck

Source: NAVFAC PAC, 2011a.

Table 3 Sightings and Observations of Humpback Whales within Joint Base Pearl Harbor Hickam in January 2019

<i>Date</i>	<i>Location</i>	<i>Notes</i>
1/10/19	Pearl Harbor Entrance Channel near buoys 7 & 8	Mother and Calf
1/11/19	Near Dry Dock 4 moving toward Hospital Point	Mother and Calf
1/12/19	NOAA side of Ford Island to Rainbow Bay Marina	Mother and Calf
1/13/20	Entrance to Middle Loch	Mother and Calf

Source: NRH, 2019

Appendix 8 References

Johanos, T.C. (2019). Hawaiian Monk Seal Research Program Hawaiian monk seal survey data collected in the main Hawaiian Islands, 2008-2019. US National Oceanographic Data Center.

National Marine Fisheries Service (NMFS) Pacific Islands Fisheries Science Center (PIFSC). (2018). Documented Sightings of Hawaiian Monk Seals within Joint Base Pearl Harbor Hickam Installation on the Island of Oahu for the years 2012 to 2018 . Internal Report IR-18-015. October 3.

Navy Region Hawaii (NRH). (2019). Pearl Harbor Humpback Whale Sighting. Summary of Observations and Protective Measures. January.

Commander, Navy Region Hawaii (CNRH). (2011). Integrated Natural Resources Management Plan.

**J-10 DON and USFWS 1980 Overlay Refuge Agreement
and 1964, 1968, and 1972 Cooperative Agreements**

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STATUS OF REAL ESTATE TRANSACTION
PACDOCKS 11011/1 (11-66)

ITEM	ACTION	DATE	BY
Legal Description			
Recording N/A			
Microfilm	To Nav Fac	11/1/74	J. E. H.
on working copies 5/14/73 - J. E. H. Summary Map need (partly on)			
Inventory	Entered	4/20/73	L. A. B.
Grantor-Grantee Index	(Blind - 9-6-130A) 9-1-196A	5/14/73	J. E. H.
District Land Register	(Blind - 9-7- 9-1-196A	5/14/73	J. E. H.
Amendment			
Termination Indefinite			

COMMENTS Use Agreement for Wildlife Refuge - 36.65 acres
at NAD West Loch (Salt Evaporation area) - DLR 9-1-196A
and 24.5 acres at Pearl City (Waiawa) Peninsula -
DLR 9-6-130A (SEE ALSO RE-1084)
AMENDMENT No. I to USE AGREEMENT
CHANGES DESCRIPTION FOR WAIAWA SITE, ADDS P.C. PENIN. SITE

AMENDMENT NO. 1
TO
USE AGREEMENT NF(R)-10935
BETWEEN
DEPARTMENT OF THE NAVY
AND
U. S. DEPARTMENT OF THE INTERIOR,
FISH AND WILDLIFE SERVICE
FOR LAND AT
U. S. NAVAL BASE, PEARL HARBOR
U. S. NAVAL MAGAZINE, LUALUALEI, WEST LOCH BRANCH

1. THIS AMENDMENT, made and entered into this 12th day of
MAY, 1980, by and between the Department of
the Navy (hereinafter called the "Navy") and the Department
of the Interior, Fish and Wildlife Service, formerly known
as the Bureau of Sport Fisheries and Wildlife (hereinafter
called the "Wildlife Service"):

WITNESSETH:

WHEREAS, by Use Agreement NF(R)-10935, made and entered
into as of the 17th day of October 1972, the Navy did provide
for the exclusive use by the Wildlife Service certain lands
under the control of the Navy for the operation, preserva-
tion and maintenance of wildlife refuges for rare and
endangered species as part of the National Wildlife Refuge
System; and

WHEREAS, the U.S. Naval Ammunition Depot, Oahu, has
been redesignated the U.S. Naval Magazine, Lualualei; and

WHEREAS, the Navy has made available and the Wildlife
Service has agreed to accept for the uses and purposes
aforesaid, certain additional lands at the Waiawa and Pearl
City Peninsulas, Island of Oahu; and

WHEREAS, it is desired that lands obtained by Civil Action be delineated separately and differentiated from those formerly under the waters of Pearl Harbor in Presidential Executive Order No. 8143; and

WHEREAS, the Wildlife Service has requested and the Navy is willing to grant a right-of-way for use of an additional portion of the aforesaid Waiawa Peninsula for purposes of installing a water pump and a waterline to provide an adequate supply of fresh water to the bird habitats.

NOW, THEREFORE, the said Use Agreement is amended in the following respect and to the following extent:

a. Article 1 is revised as follows:

"1. The Wildlife Service shall have exclusive right to use the lands described and shown on Exhibits 'B,' 'C,' 'D' and 'E,' attached hereto and made a part hereof, together with the necessary rights of ingress and egress. Additionally, the Wildlife Service shall have the right to use a 10-foot wide right-of-way, as shown on Exhibit 'F,' attached hereto and made a part hereof, for purposes of installing a water pump and a 4-inch waterline to provide fresh water to the bird habitats on Waiawa Peninsula."

b. The attachment Exhibit "A" is deleted and in lieu thereof is replaced by the following exhibits, attached hereto and made a part hereof:

(1) Exhibit "C," narrative description of two parcels of land encompassing the former "Bird Habitat-Pearl City Peninsula," adding 2.7 acres of reclaimed land thereto and retitled "Bird Habitat-Waiawa Peninsula";

(2) Exhibit "D," narrative description of an additional 13.43 acres of reclaimed land at the Pearl City Peninsula and titled "Bird Habitat-Pearl City Peninsula";

(3) Exhibit "E," Real Estate Drawing No. RE-1148, on which the changes above are delineated; and

(4) Exhibit "F," portion of Real Estate Summary Map Y&D Drawing No. 998648, on which the water pump location and 10-foot right-of-way alignment are depicted.

2. Except as herein amended, all other conditions of Use Agreement NE(R)-10935 remain in full force and effect.

DEPARTMENT OF THE NAVY

By

[Signature]
In Direction of the Commander, Naval Facilities
Engineering Command, acting under the direction
of the Secretary of the Navy

Date:

12 MAY 1980

DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

By

[Signature]

Date:

12-1-78

BIRD HABITAT - WAIAWA PENINSULA

(FORMERLY CALLED BIRD HABITAT - PEARL CITY PENINSULA)

PARCEL 1-A

Land Situated at Waiawa, Ewa, Oahu, Hawaii

Being portions of Royal Patent 4475, Land Commission Award 7713, Apana 46 to V. Kamamalu, and Royal Patent 198, Land Commission Award 1696, Apana 3 to Namomoku, acquired by the United States of America in Civil Action No. 464 filed in the U. S. District Court for the District of Hawaii, and the Declaration of Taking filed therein on October 21, 1941, said pleading being recorded in the Bureau of Conveyances of the State of Hawaii in Liber 1986 at page 7.

Beginning at the southwest corner of this parcel of land, being also a point herenow accepted as being at former high water mark between said Civil 464 and Presidential Executive Order No. 8143 dated May 26, 1939, the coordinates of said point referred to Government Survey Triangulation Station "Ewa Church" being 2,287.14 feet South and 832.44 feet West and running by azimuths measured clockwise from true South:

Following along the former high water mark of Pearl Harbor Middle Loch (now reclaimed lands of said Presidential Executive Order No. 8143) for the next thirteen (13) courses, the direct azimuths and distances between points on the original high water mark being:

1. 154° 00' 00" 57.39 feet;
2. 160° 10' 00" 120.00 feet;
3. 168° 20' 00" 160.00 feet;
4. 186° 45' 00" 30.00 feet;

5. 168° 10' 00" 100.00 feet;
6. 159° 30' 00" 115.00 feet;
7. 165° 40' 00" 100.00 feet;
8. 161° 55' 00" 78.00 feet;
9. 95° 40' 00" 190.00 feet;
10. 78° 40' 00" 95.00 feet;
11. 117° 25' 00" 35.00 feet;
12. 165° 00' 00" 30.00 feet;
13. 200° 00' 00" 93.43 feet; thence
14. 250° 30' 00" 751.77 feet along remainder of R.P. 4475, L.C. Aw. 7713, Ap. 46 to V. Kamamalu (along remainder of U.S. Civil 464) along south edge of existing dirt road;
15. 318° 00' 00" 480.00 feet along same, portion being along remainder of R.P. 198, L.C. Aw. 1696, Ap. 3 to Namomoku (along remainder of U.S. Civil 464);
16. 353° 00' 00" 240.00 feet along remainder of R.P. 4475, L.C. Aw. 7713, Ap. 46 to V. Kamamalu (along remainder of U.S. Civil 464) along top of bank to the 1/2-inch pipe;
17. 38° 18' 36" 147.13 feet along same along top of bank to a 1/2-inch pipe (previous point of beginning for Bird Habitat-Pearl City Peninsula);
18. 47° 19' 00" 133.00 feet along same along top of bank;
19. 50° 27' 00" 488.35 feet along same to the point of beginning and containing an area of 13.759 acres, more or less.

PARCEL 1-B

Being a portion of Reclaimed Land (Fill) in Pearl Harbor set aside by Presidential Executive Order No. 8143 dated May 26, 1939, said reclaimed land abutting on the above described Parcel 1-A, and being an extension of Waiawa Peninsula situated at Waiawa, Ewa, Oahu, Hawaii.

Beginning at the southeast corner of this parcel of land, at a point herenow accepted as being at the former high water mark at shoreline between Pearl Harbor Middle Loch and the westerly boundary of Royal Patent 4475, Land Commission Award 7713, Apana 46 to V. Kamamalu (being also the westerly boundary of U.S. Civil 464), the coordinates of said point of beginning referred to Government Survey Triangulation Station "Ewa Church" being 2,287.14 feet South and 832.44 feet West and running by azimuths measured clockwise from true South:

1. 50° 27' 00" 632.00 feet, more or less, along remainder of Reclaimed Land (Fill) in Presidential Executive Order No. 8143 to present high water mark at shoreline of Pearl Harbor Middle Loch;

thence following the sinuosities of the present high water mark at shoreline of Pearl Harbor Middle Loch. along remainder of Presidential Executive Order No. 8143 for the next three (3) courses, the direct azimuths and distances between points on said present high water mark being approximately:

2. 144° 00' 00" 430.00 feet;
3. 181° 20' 00" 465.00 feet;
4. 201° 52' 08" 460.69 feet; thence

5. 250° 30' 00" 68.00 feet, more or less, along remainder of Reclaimed Land (Fill) in Presidential Executive Order No. 8143, to former high water mark between said Presidential Executive Order No. 8143 and U.S. Civil 464;

thence following along the former high water mark of Pearl Harbor Middle Loch, being also along the westerly boundary of U.S. Civil 464, for the next thirteen (13) courses, the direct azimuths and distances between points on the original high water mark being:

6. 20° 00' 00" 93.43 feet;
7. 345° 00' 00" 30.00 feet;
8. 297° 25' 00" 35.00 feet;
9. 258° 40' 00" 95.00 feet;
10. 275° 40' 00" 190.00 feet;
11. 341° 55' 00" 78.00 feet;
12. 345° 40' 00" 100.00 feet;
13. 339° 30' 00" 115.00 feet;
14. 348° 10' 00" 100.00 feet;
15. 6° 45' 00" 30.00 feet;
16. 348° 20' 00" 160.00 feet;
17. 340° 10' 00" 120.00 feet;
18. 334° 00' 00" 57.39 feet to the point of beginning and containing an area of 13.43 acres, more or less.

BIRD HABITAT - PEARL CITY PENINSULA

PARCEL 2

Being a portion of Reclaimed Land (Fill) in Pearl Harbor set aside by Presidential Executive Order No. 8143 dated May 26, 1939, said reclaimed land being an extension of Pearl City Peninsula situated at Manana-nui, Ewa, Oahu, Hawaii.

Beginning at the northeast corner of this parcel of land, being also the southeast corner of Parcel 3 of City and County of Honolulu's Civil Action No. 8279 (Final Order of Condemnation recorded in the Bureau of Conveyances of the State of Hawaii in Liber 4170 at page 268), and being, further, the westernmost corner of Lot 138, as shown on Map 6 of Land Court Application 601, the coordinates of said point of beginning referred to Government Survey Triangulation Station "Ewa Church" being 3,754.60 feet South and 930.45 feet East and running by azimuths measured clockwise from true South:

1. 349° 55' 00" 538.90 feet along said Land Court Application 601;
2. 332° 50' 00" 776.00 feet along same;
3. 313° 45' 00" 140.00 feet along same to the southwest corner of Lot 320 (Map 6) of said Land Court Application 601;
4. 77° 24' 00" 30.00 feet, more or less, along remainder of Reclaimed Land (Fill) in Presidential Executive Order No. 8143 to present high water mark at shoreline of Pearl Harbor Middle Loch;

thence along sinuosities of said present high water mark at shoreline of Pearl Harbor

Middle Loch for the next eight (8) courses, the direct azimuths and distances between points on said shoreline being approximately:

5. 51° 00' 00" 180.00 feet;
6. 152° 00' 00" 170.00 feet;
7. 92° 15' 00" 300.00 feet;
8. 144° 15' 00" 660.00 feet;
9. 214° 10' 00" 550.00 feet;
10. 85° 40' 00" 65.00 feet;
11. 171° 45' 00" 40.00 feet;
12. 190° 54' 40" 246.20 feet to the southern boundary of Parcel 3 of City and County of Honolulu's Civil Action 8279;
13. 265° 04' 30" 100.00 feet, more or less, along said City and County of Honolulu's Parcel 3 of Civil Action 8279 to the point of beginning and containing an area of 11.35 acres, more or less.

USE AGREEMENT
BETWEEN
DEPARTMENT OF THE NAVY
AND
U. S. BUREAU OF SPORT FISHERIES AND WILDLIFE
FOR LAND AT
U. S. NAVAL BASE, PEARL HARBOR
U. S. NAVAL AMMUNITION DEPOT, OAHU

THIS AGREEMENT between the Department of the Navy (hereinafter called the "Navy") and the U. S. Bureau of Sport Fisheries and Wildlife (hereinafter called the "Bureau") provides for the use by the Bureau of certain lands under the control of the Navy for the operation, preservation and maintenance of wildlife refuges for rare and endangered species on the following terms and conditions:

1. The Bureau shall have exclusive right to use the lands as shown and described on Exhibits "A" and "B," attached hereto and made a part hereof, together with the necessary rights of ingress and egress.
2. The said lands shall be used exclusively for the operation, preservation and maintenance of wildlife refuges as part of the National Wildlife Refuge System according to management plans previously approved by the Navy.
3. The improvements placed upon the lands by or on behalf of the Bureau shall remain the property of the Bureau and shall be carried on its inventory.
4. All work performed under this Agreement shall be at no expense to the Navy.
5. The Bureau shall reimburse the Navy in accordance with applicable statutes and regulations for the cost of utilities and services furnished, if any.

ORIGINAL

NAD PR 1-00003AA, PWC PR 1-00020 AD

6. No construction on the property shall be undertaken without the prior approval of the Commander, Pacific Division, Naval Facilities Engineering Command.

7. The Navy reserves the right to enter on the lands hereinabove described at any time for the purposes of inspecting the same to determine compliance by the Bureau with the terms and conditions of this Agreement.

8. This Agreement shall be effective as of 31 OCT 1972 and shall remain in effect until terminated by mutual consent of both parties or by the Navy in accordance with other provisions of this Agreement.

9. This Agreement may be terminated by the Navy at any time:

- (a) during a national emergency declared by the President or Congress; and
- (b) in the event that for any reason the premises cease to be used for the specified purposes.

10. If required by the Navy, the Bureau shall remove its improvements and restore the property of the Navy when the use is terminated.

DEPARTMENT OF THE NAVY

By

H. A. Locke
By direction of the Commander, Naval Facilities
Engineering Command, acting under the direction
of the Secretary of the Navy

3 OCT 1972

Date

DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND
WILDLIFE

By

John D. Findlay

OCT 17 1972

Date

BIRD HABITAT - PEARL CITY PENINSULA

PROPERTY BOUNDARY DESCRIPTION

Beginning at a 1/2 inch diameter iron pipe on the Southeasterly corner of this tract of land, which point is also designated as point "A", having coordinates calculated as 1,886.01 south, 358.12 west in reference to Ewa Church origin and as shown on a Department of the Navy Pearl City Peninsula Sanitary Landfill Area Development Plan, NAVFAC Drawing No. 1258992, dated March 1, 1970, thence running by azimuths measured clockwise from true south:

1. 47° 19' 00" 133.00 feet along top of bank to point A-1
2. 50° 27' 00" 1,020.00 feet to point B
3. 140° 00' 00" 180.00 feet to point C
4. 150° 00' 00" 160.00 feet to point D
5. 181° 00' 00" 380.00 feet to point E
6. 186° 30' 00" 530.00 feet to point F
7. 250° 30' 00" 800.00 feet along south edge of existing dirt road to point G
8. 318° 00' 00" 480.00 feet to point H
9. 353° 00' 00" 240.00 feet along top of bank to a 1/2 inch pipe point P-0
10. 38° 18' 36" 147.13 feet along top of bank to point of beginning and containing an area of 24.5 ACRES more or less.

BIRD HABITAT - PEARL CITY PENINSULA

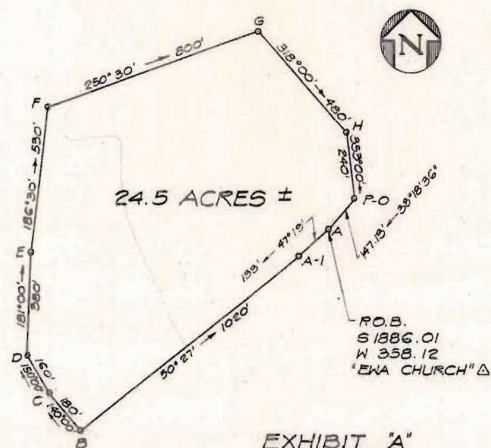


EXHIBIT 'A'
DATED 5-24-72

PWC PR 1-00020 AD

BIRD HABITAT - SALT PONDS, WEST LOCH

PROPERTY BOUNDARY DESCRIPTION

Beginning at a point on the west boundary of Lot 303 as shown on the 14th Naval District Public Works Department Map Showing Navy Land Under Lease to Ewa Plantation Company, Ltd., P.W. Drawing No. 0A-N1-2016, dated November 28, 1949, which point is also situated on the Southwesterly corner of Lot 51 (vacant), herein designated as Point "A", having coordinates calculated as 7,272.54 south, 17,214.92 east in reference to "Kapuai New" origin, thence running by azimuths measured clockwise from true south:

1. along the east side of O.R.&L. Right of Way on a curve to the left having a radius of 1930.00 feet, the chord azimuth and distance being:
171° 44' 15" 858.19 feet to point B
2. 248° 02' 00" 30.00 feet to point C
3. 289° 08' 30" 2,089.50 feet to point D
4. 32° 06' 00" 100.00 feet to point E
5. 72° 34' 00" 57.70 feet to point F
6. 342° 34' 00" 179.30 feet to point G
7. 37° 25' 00" 572.90 feet to point H
8. 92° 21' 00" 441.40 feet to point I
9. 155° 52' 00" 164.70 feet to point J
10. 120° 48' 00" 113.60 feet to point K
11. 45° 37' 00" 194.80 feet to point L
12. 122° 19' 00" 864.61 feet to point of beginning and containing an area of 36.65 ACRES more or less.

BIRD HABITAT - SALT PONDS, WEST LOCH

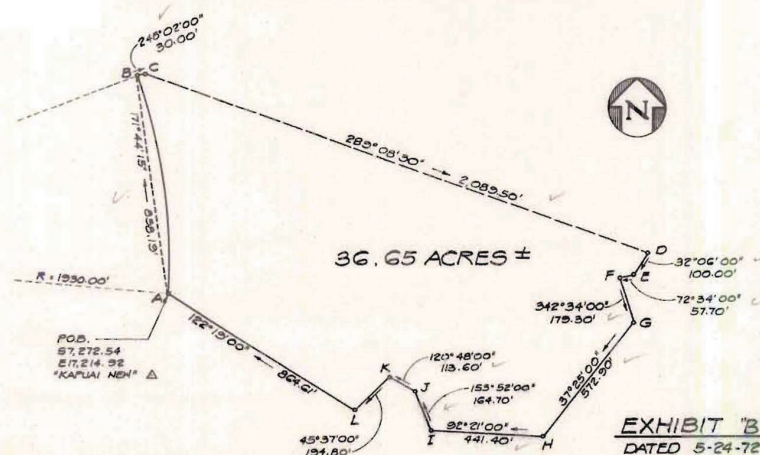
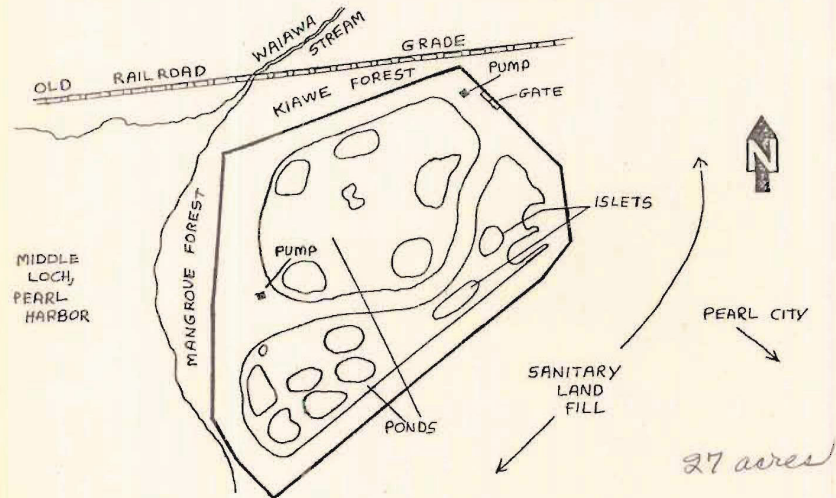


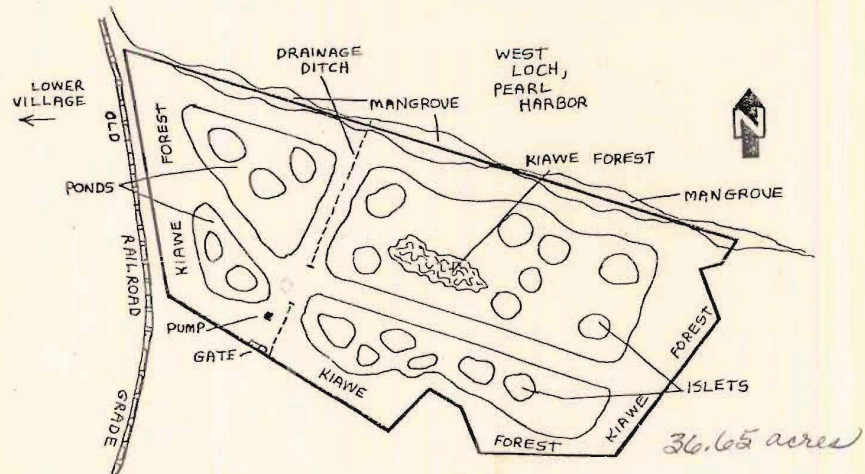
EXHIBIT 'B'
DATED 5-24-72

NAD PR 1-00003 AA

WAIAWA UNIT - PEARL HARBOR NATIONAL WILDLIFE REFUGE, OAHU



HONOLULU UNIT - PEARL HARBOR NATIONAL WILDLIFE REFUGE, OAHU



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A G R E E M E N T
FOR THE CONSERVATION AND DEVELOPMENT
OF FISH AND WILDLIFE

THIS AGREEMENT, made and entered into as of the 1st day
of August, 19 64, by and between the Department of
the Navy, the Department of Interior, by their respective authorized
representatives, and the State of Hawaii, by its Board of Land and
Natural Resources,

W I T N E S S E T H:

The parties hereto, in accordance with the authority contained
in Title 10, U. S. Code, Section 2671, Public Laws 86-797, approved
September 15, 1960, as implemented by regulations prescribed by
the Secretary of Defense, and Chapters 14A and 103A of the Revised
Laws of Hawaii, 1955, do hereby approve and adopt the following
cooperative agreement for the protection, development and management
of fish and wildlife resources at the U. S. Naval Ammunition Depot,
Oahu, Hawaii,

in the City and County of Honolulu, State of Hawaii (hereinafter
referred to as the Installation).

1. There shall be jointly completed by representatives of the
three above named participating agencies, at the earliest practical
time, a general inventory review of fish and wildlife resources
presently existing on the Installation. This inventory will encompass
the following objectives:

a. Locate principal land and water areas suitable for fish
and wildlife.

b. List the principal species of wildlife, condition of
their range and a census of the population.

c. Describe water areas as to location, type and acreage;
with principal fish species known to be present and observations on
the quality of the aquatic habitat.

d. Define the areas that necessarily are restricted and
those areas suitable and available for use under this agreement.

e. Outline a long range general program with a detailed five (5) year plan of the immediate objectives and potential for fish and wildlife resources.

f. This plan will be reviewed annually by the agencies concerned.

2. To implement that phase of the conservation program which is of mutual interest to the Installation, the Department of Interior and the State of Hawaii, the following representation is recognized,

a. Under the authority delegated to him by higher command, the Commanding Officer of the Installation, hereinafter referred to as the Commander, is recognized as the official representative of the Department of the Navy.

b. Under authority vested in him, the Regional Director, Bureau of Sport Fisheries, hereinafter referred to as the Regional Director, is recognized as the official representative of the Department of Interior.

c. By authority of the Board of Land and Natural Resources, the Chairman of said Board, hereinafter referred to as the Chairman, or his successor, shall be designated as the official representative of the Department of Land and Natural Resources for the purpose of this agreement.

d. In this agreement, the Department of Land and Natural Resources, State of Hawaii, through its Division of Fish and Game, the U. S. Bureau of Sport Fisheries and Wildlife and the Installation will assist each other in preparing and carrying out a well-balanced fish and wildlife program for the Installation.

e. The Bureau of Sport Fisheries and Wildlife and the Department of Land and Natural Resources, State of Hawaii, through its Division of Fish and Game, will aid the Installation by providing within the limits of available funds, the following plans and services:

(1) Assistance in development of a master fish and wildlife management plan for the Installation, which plan will be placed in operation only after they have the approval of the Commander,

the Regional Director and the Chairman. Such plan will be made a part of this agreement on approval.

(2) Furnish such personnel as may be available to prepare the management plan and advise in the development and improvement of the designated fish and wildlife areas.

f. The Installation will assist the Bureau of Sport Fisheries and Wildlife and the Hawaii Division of Fish and Game in the following:

(1) Execution of the master fish and wildlife management and habitat improvement plans, mutually approved by the three agencies, insofar as they may be done without injury to the primary mission of the Installation,

(2) Make available equipment to be utilized for wildlife development, when such employment will not interfere with the primary purpose of such equipment.

(3) Regulate hunting and fishing on the Installation subject to applicable laws, rules and regulations of the State of Hawaii and applicable Federal laws and regulations.

(4) In the event that Navy regulations or procedures or Federal law require that action in respect to lands of the Installation be taken or approved by an authority other than the Commander, it is understood that he will initiate the necessary steps to obtain such approval or action in respect to such actions concerning said lands as is mutually agreeable to the Commander, the Regional Director and the Chairman.

g. The carrying out of this agreement will in no way interfere with the primary purpose of the area.

h. Stocking or trapping and transplanting of fish or game will be done only by mutual consent of the three agencies.

i. Officers of the Hawaii Division of Fish and Game and the U. S. Bureau of Sport Fisheries and Wildlife shall have authority to enforce applicable State and Federal laws in accordance with their respective jurisdiction.

j. Employees of the Hawaii Division of Fish and Game and the U. S. Bureau of Sport Fisheries and Wildlife who need access to the Installation for the purposes of this program shall, upon coordination with the Commander of the Installation, be issued an identification card and pass permit, DD Form 1221, and be granted such access.

3. This cooperative agreement recognizes the primary mission of the Installation to be its military function. Due to the security requirements of the Installation, the public will be allowed to participate in the harvest of fish and game only as invited guests of personnel authorized by the Commander of the Installation.

4. Licenses, permits, and fees for hunting, fishing and trapping shall be required in accordance with applicable State and Federal laws and military regulations. The Commander may require payment of a hunting fee, provided hunting is allowed on the Installation or he may in lieu of a hunting fee require a prescribed number of hours of labor on habitat improvement, propagation of wildlife or similar related work. All monies collected and all labor required shall be expended in direct furtherance of the fish, game or wildlife conservation program on the Installation.

5. The Regional Director, Bureau of Sport Fisheries and Wildlife, Department of Interior, will designate the agencies of the Federal Government, and the State of Hawaii, through its Board of Land and Natural Resources will designate the State agencies to provide technical guidance and assistance to the Installation in fish and wildlife management. The assistance rendered will be given by separate activities as time and budgetary limitations permit.

6. This agreement will be in effect indefinitely, and may be modified, amended or terminated only by mutual agreement by the authorized representatives of the three agencies; provided, however, that the Commander upon written notice to the Regional Director and Board of Land and Natural Resources shall have the right to terminate this agreement in whole or in part at any time when, in the opinion of the

Commander, the primary mission of the Installation or other requirements of the National Defense make it necessary to do so. The intent of this restriction is to insure the continuity of the wildlife and land management program.

IN WITNESS WHEREOF the parties hereto have executed this instrument as of the day, month, and year first above written.

DEPARTMENT OF THE NAVY
UNITED STATES OF AMERICA

By

H.A. Hanna
Commanding Officer
U. S. Naval Ammunition Depot
Oahu, Hawaii

DEPARTMENT OF INTERIOR
UNITED STATES OF AMERICA

By

(Sgd) Paul T. Quigg
Regional Director
Bureau of Sport Fisheries and
Wildlife

STATE OF HAWAII

By

John P. Long
Chairman and Member
Board of Land and Natural Resources
State of Hawaii

APPROVED AS TO FORM
Charles M. Jensen
Deputy Attorney General

By

C. L. Summers
Member
Board of Land and Natural Resources
State of Hawaii

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FIRST AMENDMENT TO
COOPERATIVE AGREEMENT
FOR THE CONSERVATION AND MANAGEMENT OF FISH AND WILDLIFE
DATED AUGUST 1, 1964

WHEREAS, the Commanding Officer, U. S. Naval Ammunition Depot, Oahu, Hawaii, the Regional Director, U. S. Bureau of Sport Fisheries and Wildlife, and the Hawaii State Department of Land and Natural Resources represented by its Board of Land and Natural Resources, entered into the above titled Cooperative Agreement dated August 1, 1964; and

WHEREAS, the parties hereto, in accordance with the provisions of Condition 6 of said Agreement, desire to specifically designate the area described in Exhibit "A", attached hereto and hereby made a part hereof, as a wildlife refuge for rare and endangered species.

WHEREAS, the State of Hawaii, through its Department of Transportation, desires to fully develop and improve the wildlife habitat thereon, as mitigation for the wildlife habitat which will be lost in the construction of the Reef Runway (State of Hawaii Project No. 0-93-8(3)) in Keehi Lagoon.

NOW, THEREFORE, said Agreement is amended to designate that portion of the Honouliuli Salt Ponds, West Loch, Pearl Harbor, as described in Exhibit "A" attached hereto, as a wildlife refuge for rare and endangered species.

The State of Hawaii, through its Department of Transportation, shall, at its own expense, prepare a plan for the development and improvement of said area as wildlife habitat. Upon approval of the plan by the cooperating agencies, the Department of Transportation shall, at its own expense, develop and improve the area according to the approved plan.

DUPLICATE ORIGINAL

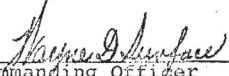
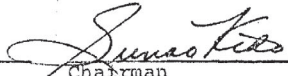
Upon approval of said developments and improvements by the cooperative agencies, all Class 2 properties and associated equipment shall be transferred to the U. S. Bureau of Sport Fisheries and Wildlife. The area shall be maintained and operated by the U. S. Bureau of Sport Fisheries and Wildlife, at its own expense, as part of the National Wildlife Refuge System.

Except as herein amended, all other conditions of the Cooperative Agreement of August 1, 1964, shall remain in full force and effect.

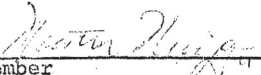
IN WITNESS WHEREOF, the parties hereto have executed this instrument as of the 17 day of NOV, 1972.

DEPARTMENT OF THE NAVY

STATE OF HAWAII

 _____ Commanding Officer U. S. Naval Ammunition Depot Oahu, Hawaii	 _____ Chairman Board of Land and Natural Resources
--	--


Date: _____



Member
Board of Land and Natural
Resources

Date: NOV 17 1972

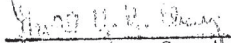
DEPARTMENT OF THE INTERIOR



Regional Director
Bureau of Sport Fisheries
and Wildlife

Date: OCT 17 1972

APPROVED AS TO FORM



Deputy Attorney General
Dec. 5, 1972

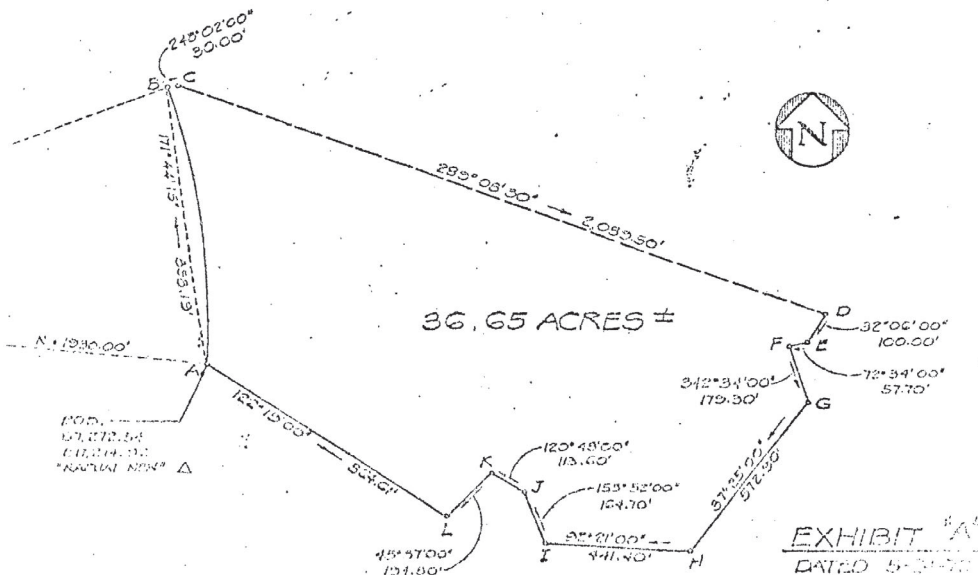
BIRD HABITAT - SALT PONDS, WEST LOCH

PROPERTY BOUNDARY DESCRIPTION

Beginning at a point on the west boundary of Lot 303 as shown on the 14th Naval District Public Works Department Map Showing Navy Land Under Lease to Ewa Plantation Company, Ltd., P.W. Drawing No. OA-NI-2016, dated November 28, 1949, which point is also situated on the Southwesterly corner of Lot 51 (vacant), herein designated as Point "A", having coordinates calculated as 7,272.54 south, 17,214.92 east in reference to "Kapuai New" origin, thence running by azimuths measured clockwise from true south:

1. along the east side of O.R.&L. Right of Way on a curve to the left having a radius of 1930.00 feet, the chord azimuth and distance being:
171° 44' 15" 858.19 feet to point B
2. 246° 02' 00" 30.00 feet to point C
3. 289° 08' 30" 2,089.50 feet to point D
4. 32° 06' 00" 100.00 feet to point E
5. 72° 34' 00" 57.70 feet to point F
6. 342° 34' 00" 179.30 feet to point G
7. 37° 25' 00" 572.90 feet to point H
8. 92° 21' 00" 441.40 feet to point I
9. 155° 52' 00" 164.70 feet to point J
10. 120° 48' 00" 113.60 feet to point K
11. 45° 37' 00" 194.80 feet to point L
12. 122° 19' 00" 864.61 feet to point of beginning and containing an area of 36.65 ACRES more or less.

BIRD HABITAT - SALT PONDS, WEST LOCH



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COOPERATIVE AGREEMENT
FOR THE CONSERVATION AND MANAGEMENT OF FISH AND WILDLIFE
RESOURCES AT U. S. NAVAL BASE, PEARL HARBOR

THIS AGREEMENT, made and entered into as of the 18th day of July, 1968, by and between the Department of the Navy, the Department of the Interior and the State of Hawaii, through their duly designated representatives whose signatures appear below:

W I T N E S S E T H :

The parties hereto, in accordance with the authority contained in (1) Title 10, U. S. Code, Section 2671, (2) Public Law 86-797, approved September 15, 1960, and the policy declared in (3) Public Law 89-669, approved October 15, 1966, all as implemented by regulations prescribed by the Secretary of Defense, and in accordance with Chapters 14A and 103A of the Revised Laws of Hawaii, 1955, do hereby approve and adopt the following Cooperative Agreement relating to the conservation, protection, development, and management of fish and wildlife resources at the U. S. Naval Base, Pearl Harbor, specifically described as the water in Pearl Harbor, in the City and County of Honolulu, State of Hawaii, lying between extreme high-water mark and the sea in and about the entrance channel to said harbor, within an area bounded by the extreme high water mark, a line bearing from the southwestern corner of the Puuloa Naval Reservation to the Ahua Point Lighthouse hereinafter referred to as the Installation.

1. For the implementation of this Cooperative Agreement the following representations are recognized:

a. Under the authority delegated to him by higher command, the Commander, U. S. Naval Base, Pearl Harbor hereinafter referred to as the Commander, is recognized as the official representative of the Department of the Navy.

b. Under authority vested in them, the Regional Director, U. S. Bureau of Sport Fisheries and Wildlife, and

the Hawaii Area Director, U. S. Bureau of Commercial Fisheries, hereinafter referred to as the Directors, are recognized as the official representatives of the Department of Interior.

c. Under the authority vested by laws of the State of Hawaii, the Department of Land and Natural Resources is recognized as the official agency representing the State of Hawaii. Under authority of the Board of Land and Natural Resources, the Chairman of the Board, hereinafter referred to as the Chairman, is recognized as the official representative of the Department of Land and Natural Resources, State of Hawaii.

2. There shall be jointly completed by representatives of the above named participating agencies, at the earliest practical time, a general inventory review of the fish and wildlife resources presently existing on the Installation. This inventory will encompass the following objectives:

a. Locate principal areas suitable for fish and wildlife.

b. List the principal species of fish and wildlife, condition of their range and a census of the population.

c. Define all areas that are (1) necessarily restricted and (2) suitable and available for use under this Agreement.

d. Outline the long range objectives and potentials for a fish and wildlife resources management program.

3. In implementing this Cooperative Agreement, the Department of Land and Natural Resources, State of Hawaii, through its Division of Fish and Game, the U. S. Bureau of Sport Fisheries and Wildlife, through its local office, the

U. S. Bureau of Commercial Fisheries, and the Installation will cooperate in preparing and carrying out a well-balance fish and wildlife management program for the Installation.

a. The U. S. Bureau of Sport Fisheries and Wildlife, the U. S. Bureau of Commercial Fisheries, and the Hawaii Division of Fish and Game will aid the Installation by providing, within the limits of resources available to them, the following:

(1) A survey and inventory of the Installation's present fish and wildlife resources including commercial fishery potential.

(2) A fish and wildlife management and habitat improvement plan including commercial fishery use. Such plan must be acceptable to, and approved by the Commander, the Directors and the Chairman.

(3) Counsel and assistance in program implementation.

b. The Installation will assist the U. S. Bureau of Sport Fisheries and Wildlife, the U. S. Bureau of Commercial Fisheries, and the Hawaii Division of Fish and Game in the following:

(1) Execution of the plans and programs mutually approved by the three agencies, insofar as it may be done without injury to the primary mission of the Installation and within the limitations of resources available.

(2) Regulate any fishing permitted on the Installation subject to applicable fishing laws, and regulations of the State of Hawaii and the Federal Government.

4. This Cooperative Agreement recognizes the primary mission of the Installation to be its military function. The execution of this Agreement shall in no way interfere with this function. Because of the Installation's safety and security requirements it is expected the fish and wildlife resources will be managed primarily for conservation reserve purposes, limited permissible commercial fishing, and for such recreational use as may be practicable. Should the harvest of any wildlife or fish species be determined necessary for proper management, a mutually agreeable harvest plan will be established. Should public fishing ever become feasible, access for such public use will be controlled and granted by the Commander.

5. The implementation of this Cooperative Agreement, or any conservation and management plans resulting therefrom, shall in no way become the basis or justification for change in the Water Quality Standards for Pearl Harbor by the State of Hawaii and the U. S. Department of Interior.

6. Stocking, trapping or transplanting of fish, oysters or wildlife by State and Federal Fish and Wildlife agencies will be done only upon mutual consent of the parties hereto.

7. Officers of the Hawaii Division of Fish and Game, the U. S. Bureau of Sport Fisheries and Wildlife, and the U. S. Bureau of Commercial Fisheries shall have authority to enforce applicable State and Federal laws in accordance with their respective jurisdiction.

8. Employees of the Hawaii Division of Fish and Game, the U. S. Bureau of Sport Fisheries and Wildlife and the U. S. Bureau of Commercial Fisheries who need access to the Installation for the purposes of this program shall, upon

coordination with the Commander, be issued an identification card and pass permit, DD Form 1221, and be granted such access.

9. The Commander, Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) will assist the Commander by:

a. Providing technical assistance and counsel in the development and implementation of the Installation's Fish and Wildlife conservation and management program.

b. Establishing and maintaining liaison and working relationships with local, State and Federal fish and wildlife management organizations and agencies and obtaining supplemental professional services therefrom.

c. Reviewing, proposed management plans and annual increments, making pertinent comments and recommendations. Providing coordination with other natural resources management programs for optimum multiple-use. Incorporating the approved fish and wildlife management plan into the Installation's Master Land Use and Management Plan.

d. Submitting required reports and copies of plans and annual increments to the Commander, Naval Facilities Engineering Command (NAVFACENGCOM).

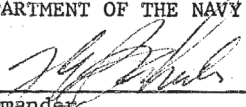
10. This Cooperative Agreement will be in effect indefinitely, but may be modified or amended by mutual agreement of the Commander, the Directors and the Chairman; however, the Commander upon written notice to the Directors and the Chairman shall have the right to terminate or suspend this Agreement in whole or in part at any time when in the opinion of the Commander, the primary mission of the Installation or other requirements of the National Defense

make it necessary to do so. Only mutual agreement by the Commander, the Directors and the Chairman may terminate this Agreement for other reasons. The intent of this restriction is to insure the continuity of the Installation's natural resources management programs. Any management plan approved shall be made a part of this Agreement and will be reviewed annually by the agencies concerned.

11. Should Navy regulations, procedures or Federal law require approval or action by an authority other than the Commander, he will initiate the steps necessary to secure such approval or action.

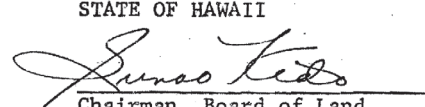
IN WITNESS WHEREOF the parties hereto have executed this instrument as of the day, month and year first above written.

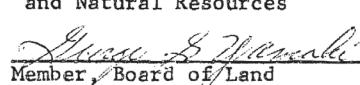
DEPARTMENT OF THE NAVY


Commander
U. S. Naval Base
Pearl Harbor

Date: JUL 18 1968


STATE OF HAWAII


Chairman, Board of Land
and Natural Resources



Member, Board of Land
and Natural Resources

Date: _____

DEPARTMENT OF INTERIOR


Regional Director
Bureau of Sport Fisheries
and Wildlife

Date: AUG 14 1968


Hawaii Area Director
Bureau of Commercial Fisheries

Date: 26 July 1968

INTERNAL REVIEW, RECOMMENDATIONS AND APPROVALS
ON THE
COOPERATIVE AGREEMENT
FOR THE CONSERVATION AND MANAGEMENT OF FISH AND WILDLIFE
RESOURCES AT U. S. NAVAL BASE, PEARL HARBOR

~~with addition of~~
APPROVED BY:

[Signature]
Commanding Officer
U. S. Naval Station
Pearl Harbor
Date: 21 June 1968

REVIEWED AND APPROVED BY:

[Signature]
Legal Officer
U. S. Naval Base
Pearl Harbor
Date: 24 June 1968

APPROVED BY:

[Signature]
Commanding Officer
U. S. Naval Shipyard
Pearl Harbor
Date: 25 June 1968

APPROVED AND RECOMMENDED BY:

[Signature]
Head of Management Department
Pacific Division, Naval
Facilities Engineering Command
Date: 19 June 1968

APPROVED BY:

[Signature]
Commanding Officer
Public Works Center
Pearl Harbor
Date: 24 June 1968

APPROVED AND RECOMMENDED BY:

[Signature]
Staff Conservationist
Pacific Division, Naval
Facilities Engineering Command
Date: 19 June 1968

APPROVED BY:

[Signature]
Commanding Officer
Naval Supply Center
Pearl Harbor
Date: 1 July 1968

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FIRST AMENDMENT TO
COOPERATIVE AGREEMENT
FOR THE CONSERVATION AND MANAGEMENT OF FISH AND WILDLIFE
DATED JULY 18, 1968

WHEREAS, the Commander U. S. Naval Base, Pearl Harbor; the Regional Director, U. S. Bureau of Sport Fisheries and Wildlife; the Hawaii Area Director, U. S. Bureau of Commercial Fisheries; and the Hawaii State Department of Land and Natural Resources represented by the Chairman of the Board of Land and Natural Resources entered into the above titled Cooperative Agreement dated July 18, 1968;

WHEREAS, Condition 10 of the said Agreement provides for modification or amendment thereof by mutual consent of the parties thereto; and

WHEREAS, said Agreement included only water areas of Pearl Harbor;

NOW, THEREFORE, the said Agreement is amended to include Naval Base lands of Pearl Harbor. There shall be a joint inspection of these lands by representatives of the above named participating Agencies to locate and identify areas which are of existing or potential value to wildlife resources. Thereafter, the said representatives will cooperate in preparing a well balanced management program for such wildlife resources. When this program has been approved by the participating Agencies, it will be applied to the approved land areas of the Pearl Harbor Naval Base.

ORIGINAL

Except as herein amended, all other conditions of the Cooperative Agreement of July 18, 1968, remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this instrument as of the 5th day of May, 1970.

DEPARTMENT OF THE NAVY

[Signature]
Commander
U. S. Naval Base
Pearl Harbor

Date: 1 May 1970

APPROVED AS TO FORM

[Signature]
Deputy Attorney General

4-77-70

STATE OF HAWAII

[Signature]
Chairman
Board of Land and Natural
Resources

[Signature]
Member, Board of Land and
Natural Resources

Date: April 27, 1970

DEPARTMENT OF INTERIOR

For [Signature]
Regional Director
Bureau of Sport Fisheries and
Wildlife

Date: April 16, 1970

[Signature]
Acting Hawaii Area Director
Bureau of Commercial Fisheries

Date: April 27, 1970

INTERNAL REVIEW, RECOMMENDATIONS AND APPROVALS
ON THE
FIRST AMENDMENT TO COOPERATIVE AGREEMENT
FOR THE CONSERVATION AND MANAGEMENT OF FISH AND WILDLIFE
RESOURCES AT U. S. NAVAL BASE, PEARL HARBOR

APPROVED BY:

M. Stuart
Commanding Officer
U. S. Naval Station
Pearl Harbor

Date: 13 April 1970

REVIEWED AND APPROVED BY:

Frank B. L.
Legal Officer
U. S. Naval Base
Pearl Harbor

Date: 10 April 1970

APPROVED BY:

K. E. Wilson
Commanding Officer
U. S. Naval Shipyard
Pearl Harbor

Date: 13 April 1970

APPROVED AND RECOMMENDED BY:

J. M. Adams Acting
Head of Management Department
Pacific Division, Naval
Facilities Engineering Command

Date: 10 April 1970

APPROVED BY:

J. H. H.
Commanding Officer
Navy Public Works Center
Pearl Harbor

Date: APR 10 1970

APPROVED BY:

A. B. Barlett
Commanding Officer
Naval Supply Center
Pearl Harbor

Date: APR 13 1970

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Musding Sh. A
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SECOND AMENDMENT TO
COOPERATIVE AGREEMENT
FOR THE CONSERVATION AND MANAGEMENT OF FISH AND WILDLIFE
DATED JULY 18, 1968

WHEREAS, the Commander U. S. Naval Base, Pearl Harbor; the Regional Director, U. S. Bureau of Sport Fisheries and Wildlife; the Hawaii Area Director, U. S. Bureau of Commercial Fisheries; and the Hawaii State Department of Land and Natural Resources, represented by its Board of Land and Natural Resources, entered into the above titled Cooperative Agreement dated July 18, 1968 and the First Amendment thereto executed May 5, 1970; and

WHEREAS, the parties hereto, in accordance with the provisions of Condition 10 of said Agreement, desire to specifically designate the area described in Exhibit "A", attached hereto and hereby made a part hereof, as a wildlife refuge for rare and endangered species.

WHEREAS, the State of Hawaii, through its Department of Transportation, desires to fully develop and improve the wildlife habitat thereon, as mitigation for the wildlife habitat which will be lost in the construction of the Reef Runway (State of Hawaii Project No. 0-93-8(3)) in Keehi Lagoon.

NOW, THEREFORE, the said Agreement is amended to designate that portion of the Pearl City (Waiawa) Peninsula, Pearl Harbor, as described in Exhibit "A", as a wildlife refuge for rare and endangered species.

The State of Hawaii, through its Department of Transportation, shall, at its own expense, prepare a plan for the development and improvement of said area as wildlife habitat. Upon approval of the plan by the cooperating agencies, the

DUPLICATE ORIGINAL

Department of Transportation shall, at its own expense, develop and improve the area according to the approved plan.

Upon approval of said developments and improvements by the cooperative agencies, all Class 2 properties and associated equipment shall be transferred to the U. S. Bureau of Sport Fisheries and Wildlife. The area shall be maintained and operated by the U. S. Bureau of Sport Fisheries and Wildlife, at its own expense, as part of the National Wildlife Refuge System.

Except as herein amended, all other conditions of the Cooperative Agreement of July 18, 1968 and the First Amendment thereto shall remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this instrument as of the 17 day of NOV, 1972.

DEPARTMENT OF THE NAVY

STATE OF HAWAII

John L. Butts Jr.
Commander
U. S. Naval Base
Pearl Harbor, Hawaii

James K. Kono
Chairman
Board of Land and Natural
Resources

Date: 11 SEP 1972

Merton H. Hagg
Member
Board of Land and Natural
Resources

Date: NOV 17 1972

DEPARTMENT OF INTERIOR

John H. Lindley
Regional Director
Bureau of Sport Fisheries
and Wildlife

APPROVED AS TO FORM
David Y. Y. Chang
Deputy Attorney General
Dec. 5, 1972

Date: OCT 17 1972

PROPERTY BOUNDARY DESCRIPTION

Beginning at a 1/2 inch diameter iron pipe on the Southeasterly corner of this tract of land, which point is also designated as point "A", having coordinates calculated as 1,886.01 south, 358.12 west in reference to Ewa Church origin and as shown on a Department of the Navy Pearl City Peninsula Sanitary Landfill Area Development Plan, NAVFAC Drawing No. 1258992, dated March 1, 1970, thence running by azimuths measured clockwise from true south:

1. 47° 19' 00" 133.00 feet along top of bank to point A-1
2. 50° 27' 00" 1,020.00 feet to point B
3. 140° 00' 00" 180.00 feet to point C
4. 150° 00' 00" 160.00 feet to point D
5. 181° 00' 00" 380.00 feet to point E
6. 186° 30' 00" 530.00 feet to point F
7. 250° 30' 00" 800.00 feet along south edge of existing dirt road to point G
8. 318° 00' 00" 430.00 feet to point H
9. 353° 00' 00" 240.00 feet along top of bank to a 1/2 inch pipe point P-0
10. 38° 18' 36" 147.13 feet along top of bank to point of beginning and containing an area of 24.5 ACRES more or less.

BIRD HABITAT - PEARL CITY PENINSULA

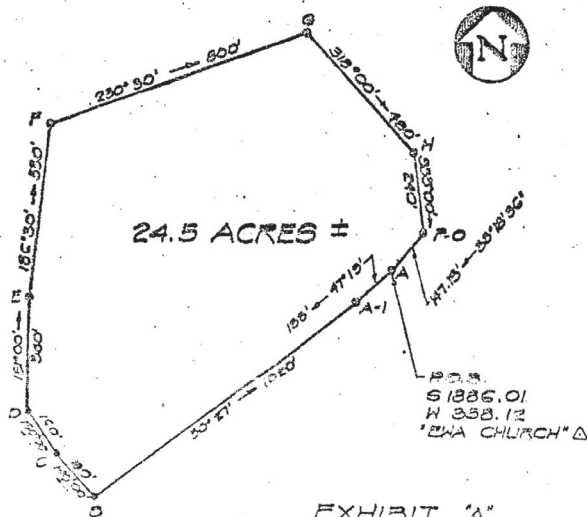


EXHIBIT 'A'
DATED 5-24-72

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FIRST AMENDMENT TO
COOPERATIVE AGREEMENT
FOR THE CONSERVATION AND MANAGEMENT OF FISH AND WILDLIFE
DATED AUGUST 1, 1964

WHEREAS, the Commanding Officer, U. S. Naval Ammunition Depot, Oahu, Hawaii, the Regional Director, U. S. Bureau of Sport Fisheries and Wildlife; and the Hawaii State Department of Land and Natural Resources represented by its Chairman, entered into the above titled Cooperative Agreement dated August 1, 1964; and

WHEREAS, the parties hereto, in accordance with the provisions of Condition 6 of said Agreement, desire to specifically designate the area described in Exhibit "A", attached hereto and hereby made a part hereof, as a wildlife refuge for rare and endangered species.

WHEREAS, the State of Hawaii, through its Department of Transportation, desires to fully develop and improve the wildlife habitat thereon, as mitigation for the wildlife habitat which will be lost in the construction of the Reef Runway (State of Hawaii Project No. 0-93-8(3)) in Keehi Lagoon.

NOW, THEREFORE, the said Agreement is amended to designate that portion of the Honouliuli Salt Ponds, West Loch, Pearl Harbor, as described in Exhibit "A" attached hereto, as a wildlife refuge for rare and endangered species.

The State of Hawaii, through its Department of Transportation, shall, at its own expense, prepare a plan for the development and improvement of said area as wildlife habitat. Upon approval of the plan by the cooperating agencies, the Department of Transportation shall, at its own expense, develop and improve the area according to the approved plan.

End (2)

Upon approval of said developments and improvements by the cooperative agencies, all Class 2 properties and associated equipment shall be transferred to the U. S. Bureau of Sport Fisheries and Wildlife. The area shall be maintained and operated by the U. S. Bureau of Sport Fisheries and Wildlife, at its own expense, as part of the National Wildlife Refuge System.

Except as herein amended, all other conditions of the Cooperative Agreement of August 1, 1964, shall remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this instrument as of the _____ day of _____, 1972.

DEPARTMENT OF THE NAVY

STATE OF HAWAII

/s/ Wayne D. Surface
Commanding Officer
U. S. Naval Ammunition Depot
Oahu, Hawaii

Chairman
Board of Land and Natural
Resources

Date: 6 SEP 1972

Member
Board of Land and Natural
Resources

Date: _____

DEPARTMENT OF THE INTERIOR

/s/ John D. Hindley
Regional Director
Bureau of Sport Fisheries
and Wildlife

Date: 17 OCT 1972

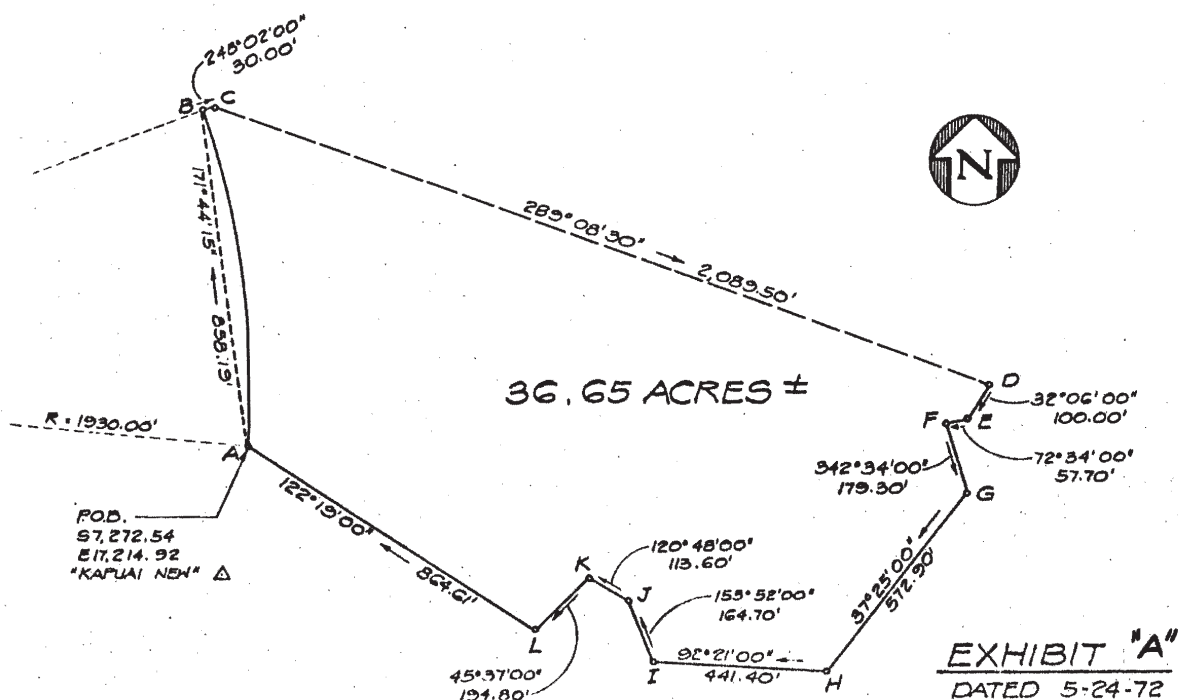
D HABITAT - SALT PONDS, WEST H

PROPERTY BOUNDARY DESCRIPTION

Beginning at a point on the west boundary of Lot 303 as shown on the 14th Naval District Public Works Department Map Showing Navy Land Under Lease to Ewa Plantation Company, Ltd., P.W. Drawing No. OA-N1-2016, dated November 28, 1949, which point is also situated on the Southwesterly corner of Lot 51 (vacant), herein designated as Point "A", having coordinates calculated as 7,272.54 south, 17,214.92 east in reference to "Kapuai New" origin, thence running by azimuths measured clockwise from true south:

1. along the east side of O.R.&L. Right of Way on a curve to the left having a radius of 1930.00 feet, the chord azimuth and distance being:
171° 44' 15" 858.19 feet to point B
2. 248° 02' 00" 30.00 feet to point C
3. 289° 08' 30" 2,089.50 feet to point D
4. 32° 06' 00" 100.00 feet to point E
5. 72° 34' 00" 57.70 feet to point F
6. 342° 34' 00" 179.30 feet to point G
7. 37° 25' 00" 572.90 feet to point H
8. 92° 21' 00" 441.40 feet to point I
9. 155° 52' 00" 164.70 feet to point J
10. 120° 48' 00" 113.60 feet to point K
11. 45° 37' 00" 194.80 feet to point L
12. 122° 19' 00" 864.61 feet to point of beginning and containing an area of 36.65 ACRES more or less.

BIRD HABITAT - SALT PONDS, WEST LOCH



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SECOND AMENDMENT TO
COOPERATIVE AGREEMENT
FOR THE CONSERVATION AND MANAGEMENT OF FISH AND WILDLIFE
DATED JULY 18, 1968

WHEREAS, the Commander U. S. Naval Base, Pearl Harbor; the Regional Director, U. S. Bureau of Sport Fisheries and Wildlife; the Hawaii Area Director, U. S. Bureau of Commercial Fisheries; and the Hawaii State Department of Land and Natural Resources, represented by its Chairman, entered into the above titled Cooperative Agreement dated July 18, 1968 and the First Amendment thereto executed May 5, 1970; and

WHEREAS, the parties hereto, in accordance with the provisions of Condition 10 of said Agreement, desire to specifically designate the area described in Exhibit "A", attached hereto and hereby made a part hereof, as a wildlife refuge for rare and endangered species.

WHEREAS, the State of Hawaii, through its Department of Transportation, desires to fully develop and improve the wildlife habitat thereon, as mitigation for the wildlife habitat which will be lost in the construction of the Reef Runway (State of Hawaii Project No. 0-93-8(3)) in Keehi Lagoon.

NOW, THEREFORE, the said Agreement is amended to designate that portion of the Pearl City (Waiawa) Peninsula, Pearl Harbor, as described in Exhibit "A", as a wildlife refuge for rare and endangered species.

The State of Hawaii, through its Department of Transportation, shall, at its own expense, prepare a plan for the development and improvement of said area as wildlife habitat. Upon approval of the plan by the cooperating agencies, the

Enc(1)

Department of Transportation shall, at its own expense, develop and improve the area according to the approved plan.

Upon approval of said developments and improvements by the cooperative agencies, all Class 2 properties and associated equipment shall be transferred to the U. S. Bureau of Sport Fisheries and Wildlife. The area shall be maintained and operated by the U. S. Bureau of Sport Fisheries and Wildlife, at its own expense, as part of the National Wildlife Refuge System.

Except as herein amended, all other conditions of the Cooperative Agreement of July 18, 1968 and the First Amendment thereto shall remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this instrument as of the _____ day of _____, 1972.

DEPARTMENT OF THE NAVY

STATE OF HAWAII

151 John L. Butler, Jr.
Commander
U. S. Naval Base
Pearl Harbor, Hawaii

Chairman
Board of Land and Natural
Resources

Date: 11 SEP 1972

Member
Board of Land and Natural
Resources

Date: _____

DEPARTMENT OF INTERIOR

151 John D. Hindley
Regional Director
Bureau of Sport Fisheries
and Wildlife

Date: 17 OCT 1972

BIRD HABITAT - PEARL CITY PENINSULA

PROPERTY BOUNDARY DESCRIPTION

Beginning at a 1/2 inch diameter iron pipe on the Southeasterly corner of this tract of land, which point is also designated as point "A", having coordinates calculated as 1,886.01 south, 358.12 west in reference to Ewa Church origin and as shown on a Department of the Navy Pearl City Peninsula Sanitary Landfill Area Development Plan, NAVFAC Drawing No. 1258992, dated March 1, 1970, thence running by azimuths measured clockwise from true south:

- | | | | |
|-----|--------------|---------------|--|
| 1. | 47° 19' 00" | 133.00 feet | along top of bank to point A-1 |
| 2. | 50° 27' 00" | 1,020.00 feet | to point B |
| 3. | 140° 00' 00" | 180.00 feet | to point C |
| 4. | 150° 00' 00" | 160.00 feet | to point D |
| 5. | 181° 00' 00" | 380.00 feet | to point E |
| 6. | 186° 30' 00" | 530.00 feet | to point F |
| 7. | 250° 30' 00" | 800.00 feet | along south edge of existing dirt road to point G |
| 8. | 318° 00' 00" | 480.00 feet | to point H |
| 9. | 353° 00' 00" | 240.00 feet | along top of bank to a 1/2 inch pipe point P-0 |
| 10. | 38° 18' 36" | 147.13 feet | along top of bank to point of beginning and containing an area of 24.5 ACRES more or less. |

BIRD HABITAT - PEARL CITY PENINSULA

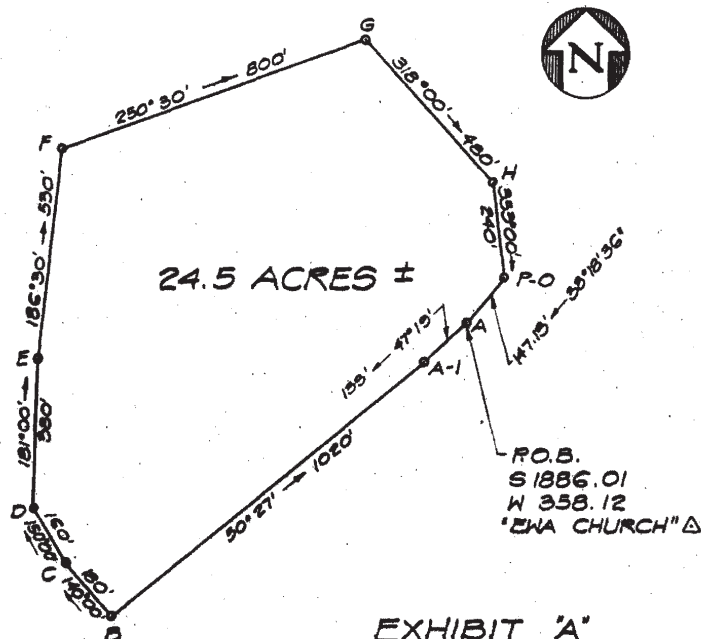


EXHIBIT 'A'
DATED 5-24-72

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J-11 JBPHH Fallout Bird Response SOP

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FEDERALLY-PROTECTED WEDGE-TAILED SHEARWATER FALLOUT SEASON RESPONSE GUIDELINES FOR JBPHH

November thru December is “annual shearwater fallout” season on base and around the islands. Juvenile Wedge-tailed Shearwaters (seabirds) are learning to fly, often get disoriented by city lights, fly inland instead of toward the sea, fall to ground and get injured or become vulnerable to predators, road kill, etc.



WHAT TO DO IF A SHEARWATER IS FOUND

Contact NAVFAC HI Environmental (808) 722-7285

Working hours: seabird will be picked up

After hours: response may be delayed until next day, seabird may need to be secured

How and When to Handle Shearwaters

If the seabird is in a safe location, and will be picked up soon, then leave it there.

However, if after hours and/or seabird is in harm's way (e.g. road kill, predation),

- Secure the seabird in a container like a cardboard box.
- When handling (see picture), cusp the bird "firmly without squeezing".
- Keep wings close to body. Birds have strong muscles, but fragile bones.
- Gloves are desirable; although their bite is not hard, their fish-catching beak is very sharp.
- A towel or t-shirt may be used to cover seabird prior to handling.
- Keep the box in a quiet location until picked up.



Forest and Kim Starr 2004

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J-12 JBPHH Sea Turtle and Hawaiian Monk Seal Sighting SOP

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Reporting Process for Sightings of Pearl Harbor's Marine Animals

Step 1
SIGHTING



TURTLES



SEALS



Step 2
STOP!

~ OBSERVE FROM AFAR ~ DO NOT APPROACH ~ DO NOT TOUCH ~
"Please Help to Protect Them"

Step 3
WHAT TO DO?

If you see or find a floating turtle, call POC below.

Hawaiian Monk Seals are a **HIGHLY ENDANGERED SPECIES** that occasionally come out of the water to rest. If sighted, call POC below.

Step 4
WHY?

*This is a **SERIOUS ISSUE***: Protected by the Federal Endangered Species Act & Marine Mammal Protection Act

Step 5
ASSESS

1. Location?
2. Is it **DEAD** or **INJURED**?
3. Anyone maintaining visibility?
Obtain caller information.

1. Location?
2. Date and time of sighting?
3. Is it **SLEEPING**, **HOOKED**, or **SWIMMING**?
4. Is it on shore?

Step 6
CALL NAVY POC to contact NOAA

Navy POCs: 1) NAVFAC HI Natural Resources Manager
Normal Business Hours: 220-8371
2) Port Ops Tower 24hrs: 474-6262

NOAA contact normal business hours:

Turtles 983-5730, Seals 256-9840; After hours pager 288-5685



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Sea Turtle Monitoring Standard Operating Procedure
Natural Resources Program
Joint Base Pearl Harbor- Hickam
Oahu, HI. 2017

Introduction:

Hawaiian green sea turtles (*Chelonia mydas*) are a distinct and threatened population protected under the Endangered Species Act. Green sea turtles (GST) are known to bask and nest on O'ahu. There are 12 nesting locations recorded on O'ahu by NOAA. Less than 1 GST is estimated per year to nest on Ewa Beach adjacent to Iroquois Point Housing. Extensive foraging occurs in Pearl Harbor as well as reports of mating. There are no basking locations acknowledged by PIFSC Marine Turtle Research Program that occur on JBPHH or Navy property. The endangered and more elusive hawksbill sea turtle (*Eretmochelys imbricate*) also occurs in the Hawaiian Islands, but is rare to Oahu. Observations of any turtle activities are currently directed to the Marine Turtle Research Program.

Objective:

The objective for nesting surveys is to identify, protect, and sustain nesting activity on O'ahu. Species data can contribute to sea turtle status, recovery goals and the designation of critical habitat. To reduce the impacts on sea turtles while surveying beaches, USFWS Best Management Practices (USFWS BMPs) will be implemented.

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 Kauai with a record 6 hatched nests in 2015.
- Adult Size: Carapace length: 40 inches; 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 imbricate*)

- 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.
- 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.

Standard Operating Procedures:

Pre- Nesting Season: Prior to May 1

1) Planning and Preparation:

- a) Check/update USFWS, NOAA, and DAR contacts before nesting season. Ensure a permitted biologist can assist in excavating nests if nesting site is found.
- b) Determine whether beach is a high human use area (e.g., recreation, training operations, military use, or ATV/off-road vehicle use) or known high turtle nesting area (average of ≥ 3 nests per year).
- c) Remind Iroquois Housing and White Planes Military Cabins of Turtle nesting season and when nesting surveys will be taking place. Have any nest sightings reported to JBPHH N.R. and NOAA Marine Turtle Research Program.
- d) Map shoreline to estimate distance and duration of survey
- e) Create/update survey sheets and nesting/ nest excavation SOP
- f) Call for volunteers through public outreach
- g) Gather and organize all needed materials (See Materials)

Nesting Season Survey Methods: May 1 – July 31

1) Location: See Iroquois Housing-Ewa Beach Survey Map

- Iroquois Point - current survey area

*White Planes and Nimitz Beach, JBPHH property do not have historical nesting data and are not included in the upcoming proposed critical habitat designations. Thus, at this time (April 2017) White Planes and Nimitz Beach will not be surveyed.

2) Frequency and Duration:

Survey frequency is based on human usage and nesting usage of the beaches during nesting season. A *low human use or low nesting use* beach area is suggested to have weekly or biweekly surveys. A *high human use or high nesting (>3nests)* beach is to be surveyed every morning.

- a) Surveys will take place at sunrise walking the entire stretch of beach (Fig.7). At least two surveyors are needed (See Survey Methods). Ideally four surveyors can pair up and split off in two to simultaneously cover each half of the survey site.

3) Materials:

- a) Survey sheets
- b) GPS
- c) Camera
- d) Roll of flagging tape with stakes
- e) Radio/ Cell phone to contact N.R. manager for found nest
- f) Contacts of Iroquois Housing Security, USFWS, DAR, NOAA,
- g) Orange construction mesh and posts to create a nest barrier for a found nest
- h) Materials for a lighting shield to block out noxious light sources
- h) Binoculars
- i) Plenty of water, sunscreen, hat, etc.

4) Survey Methods:

- a) Two surveyors are paired up. One surveyor is to walk the upper dune while the second surveyor walks mid way between the water line and the high tide line. This can be adjusted depending on the layout of the beach.
- b) The survey site encompasses the entire stretch of beach that is Navy property (Fig.7). The beach can be surveyed in sections based on the number of surveyors. For example, if there are four surveyors the beach can be split in half. A survey pair can then walk one half of the beach while the other pair surveys the other half.
- c) Each surveyor will look to each side for turtle tracks as well as large pits in sand (Fig.1).
- d) Record data on survey sheet: time, GPS location, assigned nest/dig #, fenced nest Y/N, point of contact.
- e) Enter data into JBPHH sea turtle database.

5) Upon Finding a Turtle Nest and Dig Sights: Do not walk within 1 meter (m) of nest site. This can compact sand and inhibit hatchlings from emerging properly.

- a) **Analyze the tracks:** A female sea turtle may dig in several spots before finding an acceptable spot to deposit her eggs. Therefore it is difficult to determine whether a dig is a true nest or a false dig.
 - 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.1&2).
 2. If the same turtle tracks lead to multiple digs, it is likely that there are only eggs in the last dig
 - 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 to the water (Fig.3).
- b) After analyzing tracks, **assign I.D(s)** for confirmed nest as well as associated dig(s). Do not walk within 1 meter (m) of nest site and **do not search for eggs**. This can compact sand and inhibit hatchlings from emerging properly.
 - i) When nest is found: ID the first confirmed nest of the season as "Nest 1" and so on.
 - ii) When multiple digs are found: I.D the associated nest as "Nest 1" and all of its associated false digs as "Dig 1- a," "1- b," etc., beginning with the furthest dig from the assumed nest sight.
- c) **Record** date and time found, GPS coordinates of each individual dig and nest, general location description on how to locate, and photographs.
- d) **Create a barrier** around the nest Site ASAP and flag the dig(s) to exclude persons and vehicles. This can be done by zip-tying orange "construction" netting to posts (Fig.3).
- e) **Alert Security and Rec. Facilities** to have beach visitors steer clear of nest site.
- f) **Post signage** around barrier.

6) Reporting Turtle Dig: Field Biologist>NR Manager>USFWS

- a) Field Biologist is to call NR Manager and report nest ASAP.
- b) Send an email to NR manager with all nest(s) and dig(s) information. Report time, date, location, GPS coordinates, description, and Nest I.Ds.
- c) The NR Manager should then forward the email and report to USFWS, DAR, and NOAA within 24 hours.
- d) The field biologist should call and alert any beach dispatch/security and alert them of nest.
- e) Enter data into JBPHH sea turtle database.

Monitoring Nests:

- 1) Day 1-49: Check nest twice a week, assuring nest barrier is properly in place and nothing has disturbed the nest.
- 2) Prior to Day 50: Assess lighting impacts on nests to determine if any light sources may impact the orientation of emerging hatchlings. Check nest at night to make sure no lights are visible from nest site. Identified light sources should be turned off. Arrange with housing facilities, recreation, or road construction to have lights turned off or mitigated. If lighting can't be reduced create a lighting shield around the nest. This can be done with plants, or by any other means.
- 3) Day 50: Raise the Makai side of mesh fencing 5 in. up off the ground so that hatchlings can easily make it to the ocean, but would be barricaded from heading toward land. Create a "causeway" between nest and ocean to avoid interference of beach traffic and prevent vehicles running over hatchlings and/or creating deep ruts (Fig.6).
 - a) The hatchling causeway should start on either side of the nest and fan out, becoming wider closer to the water
 - b) Using the same posts used for the nest barrier, place them ~6m apart and use a mallet to secure them firmly in sand.
 - c) String poles together with wire cable. Hang flagging on the wire cable to make more visible.
 - 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.
- 4) Day 50-75: Check nest daily, looking for signs of hatching at sunrise. Hatchlings usually emerge during the night or early morning.
 - a) Signs of hatched nest:
 - i) Hatchling tracks leading away from the dig (Fig.4).
 - 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. Also, wind/rain can easily erase hatch signs.
 - c) There are often crab tracks in and around turtle digs which can look very similar to turtle hatchling tracks, especially if wind or rain has obscured them, however, crab tracks are made up of more linear marks while hatchlings 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) The NR Manager can then forward the email to USFWS, DLNR DAR, and NMFS within 24 hours of hatch date.
 - iv) Enter data into PMRF sea turtle database
 - b) Remove nest barrier and causeway barrier.
 - c) Notify beach authorities that hatching took place.

After Hatch Date:

1) Schedule Excavation: (See Sea Turtle Nest Excavation SOP below)

- 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 NOAA Turtle Biologist to excavate the nest.
- c) Digs are excavated to ensure no turtle hatchlings are trapped under the surface of the sand and also to count eggshells or unhatched eggs and collect samples for DNA analysis.

2) Continue Monitoring: Monitor nest after 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: Record number of hatched and unhatched eggs, as well as any stranded hatchlings.

- i) Collect egg shells and unhatched eggs and put them in separate bags; the state conducts DNA analysis on unhatched eggs.
- ii) Count eggshells. 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, allowing 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 the turtles can essentially “warm up” before hitting 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 excavation findings:

- i) Field Biologist will call NR Manager and report excavation ASAP. NR Manager will then notify USFWS, DAR, and NMFS/NOAA that an excavation has taken place.
- ii) Send an email to the 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 JBPHH 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 JBPHH 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 JBPHH sea turtle database.
- 3) Follow up with groups who may also need a copy of data, and or SOP.

Figures, Descriptions, and Survey Map



Figure 1. Arrow-shaped green sea turtle tracks leading away from nest site



Figure 2. Clearly defined, fresh GST tracks



Figure 3. Green sea turtle tracks leading out of dig site



Figure 4. Hatchling tracks leading toward ocean

Placing Barrier Around Nest:

- a) Place posts 3 m apart in a circle, with a 2 m radius from the mound and the depression. Using a mallet secure the poles in the sand.
- b) Wrap orange plastic mesh around poles, hooking the material in place with zip ties.
- c) Place signage indicating this is a federally protected, sensitive area, and disturbing it can lead to fines/imprisonment.
- d) Document fencing effort with time, date, and photos and enter into JBPHH sea turtle database.

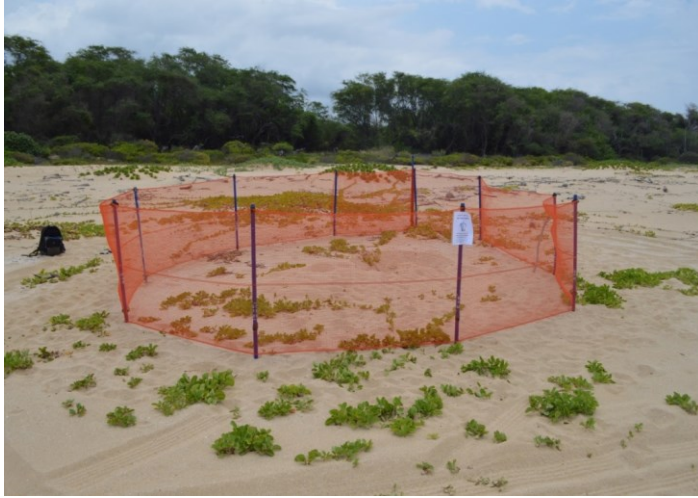


Figure 5. Temporary exclusionary zone around green sea turtle nest with appropriate signage attached to pole



Figure 6. Fenced off "causeway" at Day 50. Preventing vehicle traffic between nest and ocean for hatchlings to safely enter the sea.

Iroquois Housing- Ewa Beach Survey Map

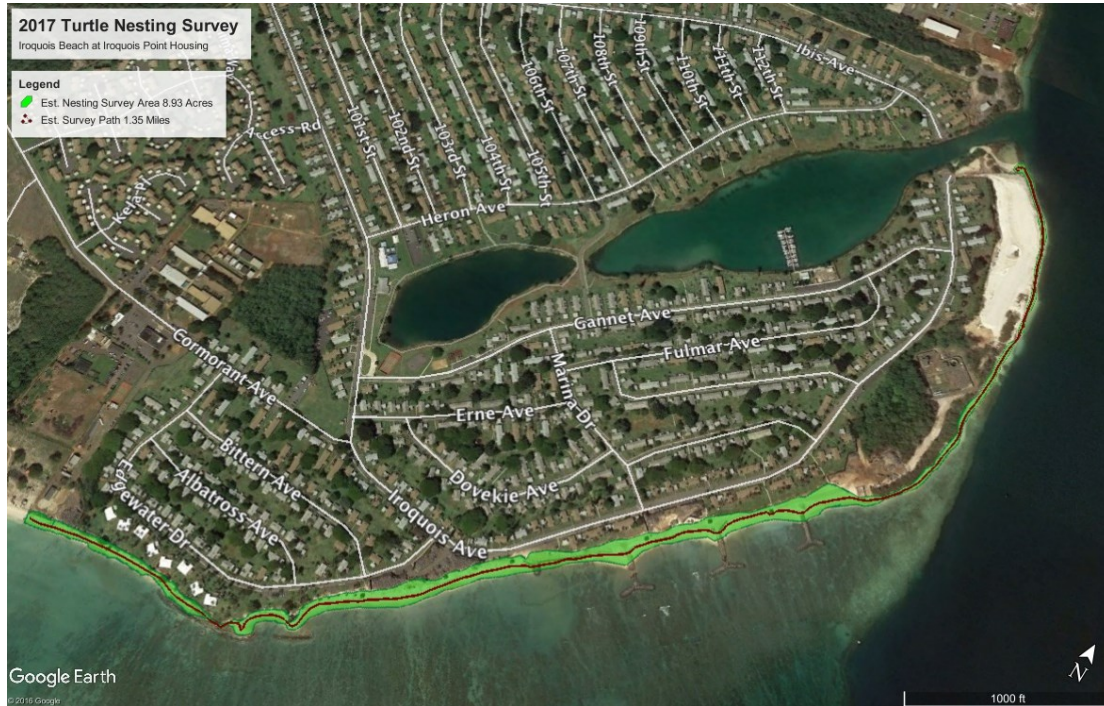


Figure 7. Iroquois Point nesting survey location taken from a 2014 satellite image. The east section of the beach has experienced heavy geographic changes. Light green indicates the estimated 8.93 acres of survey area with the estimated 1.35 miles of walked beach marked in red.



Figure 8. A survey section of the west side of Iroquois Beach. Iroquois Housing maintenance yard is shown in the left corner.



Figure 9. Survey section of Iroquois Beach following Fig. 8.



Figure 10. Survey section of Iroquois Beach following Fig.9.



Figure 11. Survey Section of Iroquois Beach following Fig. 10. The narrow area of beach to the right of this photo has changed. Surveyors may experience extreme narrowing of the beach, rock and wreckage blockades, and heavy vegetation.



Figure 12. Survey section of Iroquois Beach following Fig.11. This section of beach has changed from this photo. Surveyors may experience extreme narrowing of the beach, rock and wreckage blockades, and heavy vegetation. The large area filled with beach sand shown here is now entirely covered with Kiawe and other vegetation.

Best Management Practices for Sea Turtle Basking and Nesting Habitat

1) Lighting- The objectives are to provide appropriate dark beach areas for female sea turtle nesting and to prevent mortality of hatchlings and adults (e.g., female directional disorientation after nesting, hatchling sea turtle directional disorientation after nest emergence). Wildlife-friendly lighting can be substituted for exterior lighting at beachfront homes, streets, sidewalks and pavilions along the coast.

- Light pollution from exterior lights (porches/decks, pathway and ambience lighting) as well as windows should be minimized during nesting season. This can be encouraged through education and offering alternatives such as light shielding or motion sensor porch lights.
- Properties needing light adjustments if nests are discovered:
Iroquois Ave Homes (5197,5209 A&B, 5223, 5229A, 5227, 5231B, 5245)
Edgewater Dr. Homes (5387,5371,5375, 5399 *, 5397, 5391 *)

2) ATV's/Heavy Machinery- The use of ATV's, trucks that would offload sand, or machinery that would clean or sift trash on the beach poses threats to GST nests, their hatchlings, surveying efforts, and GST habitat. Such machinery could potentially crush a GST nest and could inhibit or significantly delay hatchlings, causing unnecessary exertion when accessing the beach. Tire tracks and beach cleaning machines also remove detections (i.e. tracks, digs, and nests) of nesting females. Tampering of sand will also remove tracks of newly hatched juveniles that would otherwise indicate hatchling success. Removing signs (tracks, digs, and nests) of GTS occupancy interferes with surveying efforts and therefore the ability to detect an ESA listed species for proper land management. In addition, machinery that offloads new sand or rakes sand could alter the beach profile and grain size of the sand dune. Steepness of the beach dune and or course sand could deter nesting females.

- Vehicles should be prohibited from beaches during nesting season, especially if a nest is found.
- Security and beach maintenance vehicles should be discouraged from driving on the beach during nesting season.
- Sand should not be altered in any way during nesting season (i.e., offloading, removing, or racking sand).
- Security personnel can patrol the beach by parking and walking to the beach to inspect coves rather than drive on beach.

3) Human Disturbance- Sea turtles are protected under State and Federal laws. Basking turtles are not to be disturbed or harassed by humans. Altering the behavior of a protected species in any way can be a form of harassment. This includes:

Discouraging a turtle to bask, nest or feed

Touching a turtle in any way other than cutting a fishing line or other entanglement debris

Being within 10 ft of a turtle

Feeding or splashing a turtle

- Kapilina Beach Homes security is to enforce the 10ft distance rule and to respond to on shore turtles rapidly. Violations of the 10ft rule, such as standing or having a camera closer than 10ft of a turtle should be reported to 1ST JBPHH NR and 2nd DLNR, USFWS, or NOAA.

4) Sand Height to Wall - Kapilina Beach Homes beach wall has a clearance of 5ft or more. In some locations the beach sand and the wall are flush. In these areas turtles are at the highest risk of falling 5ft+. To prevent turtles falling over the wall, turtles should be blocked to avoid such a hazard.

*A 2ft gap between the height of the wall and the sand is suggested

5) Irrigation Along the Shoreline- Department of Land and Natural Resources Administrative Rules Chapter 13-5-42-22 state that "irrigation must be maintained within the property, and under no circumstances extend seaward of the shoreline." Maintenance of landscaping, such as irrigation along the beach shoreline can expand vegetation that would encroach GST sandy beach habitat. In compliance to state law, irrigation along landscaped areas on the beach shoreline shall not encourage vegetation to extend onto the beach.

6) Dogs – Dogs are considered a predatory threat to the GST. JBPHH does not encourage domestic pets in areas where species listed under the Endangered Species Act (ESA) inhabit. Hawaiian Green Sea Turtle and Hawaiian Monk Seal are ESA species and should therefore be protected.

- Please eliminate designated dog beaches or
- Enforce strict dog policies. Dogs are allowed in designated areas on leash only.
- Domestic animals are prohibited in the presence of an ESA species

J-13 Biosecurity Plan for JBPHH

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BIOSECURITY PLAN FOR JOINT BASE PEARL HARBOR-HICKAM

December 2021

Prepared for:

Naval Facilities Engineering Systems Command, Hawai'i

Recommended Citation:

Naval Facilities Engineering Systems Command, Biosecurity Plan for Joint Base Pearl Harbor-Hickam. 2021

Prepared for NAVFAC Hawai'i, JBPHH by C. Vanderwoude.

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List of Abbreviations and acronyms

15 WG	15 th Wing
154 WG	154 th Wing
515 AMOW	515 th Air Mobility Operations Wing
AFPMB	Armed Forces Pest Management Board
BAC	Biosecurity Advisory Committee
BTS	Brown Tree Snake
CBP	United States Customs and Boarder Protection
CES	Centralized Examination Stations
CNIC	Commander Navy Installations Command
CNMI	Commonwealth of the Northern Mariana Islands
CONUS	Continental United States
CRB	Coconut Rhinoceros Beetle
DHS	Department of Homeland Security
DoD	Department of Defense
EPA	Environmental Protection Agency
IAS	Invasive Alien Species
ICS	Incident Command System
IEPD	Installation Environmental Program Director
INRMP	Integrated Natural Resources Management Plan
IPMP	Integrated Pest Management Plan
JBPHH	Joint Base Pearl Harbor Hickam
HDOA	Hawai'i Department of Agriculture
HIBP	Hawai'i Interagency Biosecurity Plan
MAF	Ministry of Agriculture and Forestry
NAVFAC Hawai'i	Naval Facilities Engineering Systems Command Hawai'i
NISC	National Invasive Species Council
NIMS	National Incident Management System
OCONUS	Outside of the Continental United States
OPNAV	Office of the Chief of Naval Operations
PACAF	Pacific Air Forces
RBP	Regional Biosecurity Plan for Micronesia and Hawai'i
RIFA	Red Imported Fire Ant
ROD	Rapid Ōhi'a Death
USFWS	United States Fish and Wildlife Service
USDA	United States Department of Agriculture
USDA APHIS	USDA Animal and Plant Health Inspection Service

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1. OVERVIEW

Invasive species ... “now freed from those constraints in the long-sequestered and gentle environment of Hawai‘i and enjoying extraordinary reproductive success, they variously choke, consume, pauperize, and crowd out native species too weak to exist.” E.O. Wilson, 2002¹

1.1 OVERVIEW

The entry and proliferation of invasive species is one of the greatest threats to United States (U.S.) agriculture, the environment and human health. From invisible pathogens, such as Rapid Ōhi‘a Death (*Ceratocystis spp.*) (ROD), microscopic weed seeds, insect pests such as the red imported fire ant (*Solenopsis invicta*) to the giant Burmese pythons (*Python bivittatus*) of Florida, invasive species run the gamut of sizes, life forms and impacts. In many cases, their likely distribution or magnitude of impacts in their new locations are not known in advance. Most are accidental introductions, traveling unseen with their host commodity or hitch-hiking with cargo, people or the vessels that transport them. Some are deliberate introductions, either imported specifically for release or escaping the confines of aquaria, barns or cages. Regardless of their origins or the means by which they became established, these pests cost the nation many billions of dollars annually.

Hawai‘i is the most “invaded” U.S. state, home to over 5,000 invasive species, and on average, 89 new species are added annually². Many of these species have little or no impact, either to agriculture or the environment. Some, however, cause dramatic changes to the agricultural and ecological landscape. The strawberry guava (*Psidium cattleianum*), Moluccan albizia (*Falcataria moluccana*), ROD, coqui frogs (*Eleutherodactylus sp.*) and the small Asian mongoose (*Herpestes javanicus*) for example, have dramatically altered Hawai‘i’s ecosystems. As long-distance travel and world trade increase, so does the threat of invasive species. Biosecurity, or the defense against the ingress of these species, is primarily focused at international ports of entry where the vast majority of people and goods cross the borders between jurisdictions.

The Department of Defense (DoD) manages 25 million acres of land spread across more than 500 installations³. Many of these installations include areas of high quality natural habitat and are actively managed to conserve and enhance these values. Responsibility for management of these habitats is divided between DoD Pest Management, Operations and Maintenance, and Natural Resources programs.

In recent years, there has been an increasing focus on invasive species management on military installations. Policies relating to the environmental management of DoD installations³ are based on directives, orders and regulations, to which DoD is subject⁴⁻¹². In part, these policies outline directions for the management of invasive species and require installations to prevent, control and monitor invasive species on DoD assets.

The primary planning documents that address these policies are installation-specific Integrated Natural Resources Management Plans (INRMP)¹⁴ as required by the Sikes Act¹², and Integrated Pest Management Plans (IPMP)¹⁵. Additionally, biosecurity plans may be required as part of an installation INRMP⁷. The Defense Transportation Regulation⁵ also requires that the Military Services shall comply with the National Invasive Species Management Plan¹⁶ developed by the National Invasive Species Council (NISC).

This plan, the Biosecurity Plan for Joint Base Pearl Harbor-Hickam (JBPHH), is subordinate to the INRMP¹⁴ for this facility. This is a long-term planning document to guide natural resource managers in the development and improvement of invasive species detection, response, and management. This document is subject to period updates consistent with adaptive management of natural resources at JBPHH. It is developed in order to better understand current practices and suggest actions to improve invasive species management at this installation. It is prepared in plain English with a minimum of duplicated information or jargon and assumes the reader is familiar with operations at JBPHH, the INRMP and IPMP and have some familiarity with laws, regulations, policies and other planning documents that may apply. Referencing style has been selected to maximize the readability of the text and provide access to literature cited.

1.2 JOINT BASE PEARL HARBOR-HICKAM

The DoD manages several installations in the State of Hawai'i. Central to these installations is JBPHH, which acts as a logistics hub for military aircraft, submarines and ships, personnel, materials and other cargo¹⁷. JBPHH is the first port of call for all international and most inter-state military arrivals to the state. An INRMP¹⁴ and an IPMP¹⁵ have been prepared and outline the installation-wide management of natural resources and pest management. Information contained in those plans is not repeated here and the reader is directed to those documents for additional detail.

JBPHH Main Base is located on the south shore of the Island of O'ahu, in the State of Hawai'i, and is immediately adjacent to the city of Honolulu. It incorporates Naval Station Pearl Harbor and Hickam Airfield. These were previously managed as separate installations and merged in 2010 as a result of the recommendations of the 2005 Base Realignment and Closure Commission¹⁸. The merging of the two bases provided efficiencies for both the U.S. Air Force and U.S. Department of the Navy (Navy).

Naval Station Pearl Harbor provides berthing, shore side support and maintenance to U.S. military vessels and submarines in the central Pacific. Facilities at Pearl Harbor are able to provide support to the largest ships in the fleet. Housing, personnel and family support are also provided and are an integral part of the shore side activities.

Hickam Airfield is home to the 15th Wing (15 WG) and 67 partner units including Headquarters of

Pacific Air Forces (PACAF), Hawai'i Air National Guard and the 154th Wing (154 WG) of the Hawai'i Air National Guard. The Air Mobility Command's 515th Air Mobility Operations Wing (515 AMOW) provides tactical and strategic airlift within the Pacific region. Additionally, Hickam supports 140 tenant and associate units.

1.3 RELEVANT LAWS, REGULATIONS, ORDERS AND POLICIES RELATING TO BIOSECURITY AT JBPHH

The main laws, regulations and policies relating to managing biosecurity and invasive species risks by DoD are listed below.

1.3.1 Sikes Act¹²

This act describes the planning, development, maintenance and coordination of wildlife, fish and game conservation and rehabilitation on military reservations, and integrates them with installation management, as well as directing the preparation of installation-specific Integrated Natural Resource Management Plans. An overarching provision of this act and other instructions is that the primary installation mission is not compromised by these plans or elements.

1.3.2 The Endangered Species Act of 1977¹⁹

The Endangered Species act of 1977 (section 7) requires the DoD to ensure that any action they undertake or fund will not jeopardize endangered species or their habitat. It requires DoD to consult with the U.S. Fish and Wildlife Service (USFWS) and authorizes USFWS to approve or reject any actions considered to breach the provisions of the act. This may include the movement of materials, equipment and personnel from areas with known invasive species risks (e.g. the brown tree snake [*Boiga irregularis*] [BTS]).

1.3.3 Executive Order 11987⁹

Is related to exotic organisms and directs DoD to “restrict the introduction of exotic species into any natural ecosystem of the United States”⁹.

1.3.4 Executive Order 13112¹⁰

Executive Order (E.O.) 13112, in part, orders federal agencies to “*prevent the introduction of invasive species*”, increase coordination of Federal activities to control and minimize the economic, ecological, and human health impacts caused by invasive species.

It requires DoD to:

- Prevent, detect, respond rapidly, control and monitor populations of such species on land held or managed by DoD.
- Consult with the NISC and comply with the National Invasive Species Plan¹⁶.

1.3.5 Executive Order 13751¹¹

In 2016 Executive Order 13751 further expanded the duties of the DoD under EO13112 to include a requirement to provide annual reports to the National Invasive Species Council (of which the DoD Secretary is a member) and to *“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”*

Additional relevant directions include:

- *“Strengthen, policy and regulatory frameworks pertaining to the prevention, eradication, and control of invasive species and address regulatory gaps, inconsistencies, and conflicts.”*
- *“consider the impacts of climate change”*
- *“promoting open data and data analytics; harnessing technological advances in remote sensing technologies, molecular tools, cloud computing, and predictive analytics; and using tools such as challenge prizes, citizen science and crowdsourcing”[†]*

1.3.6 DoD Instruction 4715.03⁷

This instruction directs effective land stewardship where it does not conflict with the overarching mission of the installation and directs plans, programs, and budgets to achieve, monitor, and maintain compliance with all applicable federal natural resources statutory and regulatory requirements, Executive Orders and Presidential Memoranda⁷. It directs all installations to develop an Integrated Natural Resource Plan that includes biosecurity management.

1.3.7 DoD Instruction 4150.07⁶

This outlines pest management for DoD installations and requires them to use integrated pest management principles when controlling or eradicating pest species; and requires DoD to *“plan, program, and budget to achieve, monitor, and maintain compliance with all applicable Federal natural resources statutory and regulatory requirements, E.O.s, and Presidential Memorandums.”* [sic]

The Quarantine Regulations of the Navy⁸ appear to exclude Hawai'i from any quarantine provisions by referring to Continental United States (CONUS) locations only. However, this appears to conflict with DoD policy *“that all organizations and personnel involved in the movement of DoD-sponsored cargo, personal property, and accompanied baggage will take those steps necessary to prevent the spread of agricultural pests. This includes movement not only across national borders, but any movement that has the potential to introduce invasive species to a new area.”* The U.S. Air Force Instruction 24-203²⁰ and the Armed Forces Pest Management Board (AFPMB) guide for disinsection of aircraft²¹ details the requirements for the transportation of air cargo.

1.3.8 Environmental Program Readiness Manual OPNAV M 5090.1²²

[†] This list is edited to highlight key directives.

This manual contains the Navy's policy guidance for environmental readiness. It discusses requirements, delineates responsibilities, and issues policy guidance for the management of the environmental, natural, and cultural resources for all Navy ships and shore activities.

1.3.9 Defense Transportation Regulations ⁴⁻⁵

The Defense Transportation Regulations⁴⁻⁵ and relevant Navy instructions, such as OPNAV Instruction 6210.2A⁸, outline the DoD requirements for personnel and cargo entering the U.S., but appear to exclude Hawai'i from many quarantine provisions by restricting them to CONUS locations only. However, this appears to conflict with DoD policy *"that all organizations and personnel involved in the movement of DoD-sponsored cargo, personal property, and accompanied baggage will take those steps necessary to prevent the spread of agricultural pests. This includes movement not only across national borders, but any movement that has the potential to introduce invasive species to a new area."*³. The U.S. Air Force Instruction 24-203²⁰ and the AFPMB guide for disinsection of aircraft²¹ provide detail of the requirements for the transportation of air cargo.

1.4 APPLICABLE REGIONAL, NATIONAL AND STATE PLANS

1.4.1 Regional Biosecurity Plan for Micronesia and Hawai'i

The Regional Biosecurity Plan for Micronesia and Hawai'i (RBP)²³ outlines the overarching DoD regional policies and guidelines for biosecurity practices within the Pacific region. This plan was initiated and funded by the Navy in preparation for relocation of personnel within the Asia-Pacific region, and acts as a tool for interagency coordination, prevention, management and control of invasive species. The RBP makes recommendations for the State of Hawai'i, U.S. Territory of Guam, Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia, Republic of the Marshall Islands, Republic of Palau, DoD, Agriculture and Interior. The goal of the plan is to minimize harmful impacts to ecological, social, cultural and economic resources. Objectives include collaboration efforts, prevention, monitoring, early detection, rapid response, management, eradication, education and outreach, research, policy and restoration.

1.4.2 National Invasive Species Plan¹⁶

This plan has been developed by the National Invasive Species Council (NISC), of which the Secretary of Defense is a committee member¹⁶. DoD is required to comply with relevant elements of this plan.

1.4.3 Hawai'i Interagency Biosecurity Plan

The 2017-2027 Hawai'i Interagency Biosecurity Plan (HIBP)²⁴ is a ten year plan developed by the Hawai'i Department of Agriculture (HDOA) and presents a state biosecurity strategy that includes recommendations for relevant agencies, whether state, federal or neither. Although advisory in

nature, it takes a holistic approach to providing a seamless strategic plan for the entire state. The plan is as a reference for statewide biosecurity policies for all relevant agencies. While acknowledging that HDOA has limited jurisdiction on federal land, the plan contains a number of implementation tasks relevant to installation command (see section 6).

1.4.4 JBPHH management plans

As a provision of the Sikes Act, JBPHH is required to develop an INRMP and IPMP. These were completed in 2012¹⁴ and 2013¹⁵, respectively and describe the management of natural resources and pest management for JBPHH. This biosecurity plan is a sub-plan of the INRMP.

1.5 CURRENT BIOSECURITY PRACTICES

The biosecurity systems that operate at JBPHH are not greatly different from those at other ports of entry. Responsibility for preventing the entry of invasive species into the U.S. is delegated to U.S. Customs and Border Protection (CBP). The State of Hawai'i, through the HDOA regulates the movement of agricultural items inbound from other states as well as the movement of agricultural items between islands.

1.5.1 U.S. Customs and Border Protection

After the terrorist attacks on the U.S. in 2001, the U.S. Congress passed the Homeland Security Act of 2002. The Department of Homeland Security (DHS) was formed in 2003 to enact the provisions of this act and a number of agencies with responsibilities related to terrorism, customs and immigration, naturalization, emergency response and national biosecurity were merged and/or re-organized under the umbrella of the new department. Of special note is the incorporation of parts of the U.S. Department of Agriculture (USDA) with biosecurity and quarantine responsibilities with the newly formed U.S. Customs and Border Protection (CBP). These changes dramatically alter how border control activities are managed. CBP now administer customs, immigration and biosecurity responsibilities as a single administrative organization.

U.S. Customs and Border Protection utilize a combination of risk-based inspections, written declarations from incoming vessels and pre-clearance at ports of origin, which is standard practice worldwide²⁵. Standards and protocols are not substantially different from those at civilian international airports and seaports. For biosecurity purposes, Hawai'i, Alaska, the U.S. territories of Guam, American Samoa, Northern Mariana Islands, Puerto Rico and the U.S. Virgin Islands are treated as foreign ports of origin.

1.5.2 Centralized Examination Stations

Customs and Border Protection is authorized to enforce, inspect, search and examine any shipment imported and/or exported in and out of the U.S. (19 USC 1467). The task of routine inspections is contracted to Centralized Examination Stations (CES) which are privately owned and approved to

carry out these inspections on behalf of CBP. There is a single approved CES in Honolulu – Island Movers, Inc. (<https://www.islandmovers.com>). Almost all JBPHH cargo that requires inspection is inspected by this CES.

1.5.3 U.S. Fish and Wildlife Service (USFWS)

The Endangered Species Act of 1977 (section 7)¹⁹ requires the DoD to ensure that any action they undertake or fund will not jeopardize endangered species or their habitat. It requires DoD to consult with the U.S. Fish and Wildlife Service (USFWS) and authorizes USFWS to approve or reject any actions considered to breach the provisions of the act. This may include the movement of materials, equipment and personnel from areas with known invasive species risks (e.g. the BTS).

1.5.4 Hawai'i Department of Agriculture

State-level biosecurity is the responsibility of the government of Hawai'i and is administered by the HDOA acting under the Hawai'i Revised Statutes²⁶ and Title 4 of the Hawai'i Administrative Rules²⁷. HDOA generally limits biosecurity inspections to potted plants, soil, propagative material and at times, produce^{13, 26, 28}. From a jurisdictional perspective, vessels and aircraft originating from another location in Hawai'i or CONUS are the responsibility of HDOA operating under state statutes. Those originating from a foreign port are managed by CBP with legislative authority from federal laws. State and federal jurisdiction is mutually exclusive: CBP do not regulate domestic aircraft or vessels; and HDOA does not have authority to enforce federal statutes.

1.5.5 Species-specific programs.

HDOA Plant Quarantine has a Memorandum of Understanding (MOU) with the Hawai'i Air Force National Guard and the Navy in Hawai'i to formalize reporting of BTS arrival of flights from BTS locations. HDOA inspects incoming flights whenever possible²⁹. This activity links with control and inspection activities in Guam to manage introduction risks for Hawai'i³⁰⁻³².

The coconut rhinoceros beetle (*Oryctes rhinoceros*) (CRB) was discovered in Honolulu in 2013³³ and subsequently spread throughout several areas of JBPHH. Since that time, a statewide response has been active and this includes survey and monitoring on lands managed by JBPHH. Since initial detection and mitigation efforts, CRB detections have decreased in initial hot spots, but have spread to additional zones on JBPHH and in West and Central O'ahu. CRB is currently absent from neighbor islands.

Ōhi'a (*Metrosideros polymorpha*) is a culturally and ecologically significant tree species native to Hawai'i. Two fungal pathogens (*Ceratocystis lukuohia* and *C. huliohia*) have recently been identified as the causal agent of ROD; a devastating fungal pathogen of ōhi'a trees³⁴. First identified from affected ōhi'a trees on Hawai'i Island, it appears to be spreading throughout the archipelago. The State of Hawai'i restricts the movement of ōhi'a wood and plants between islands and advises hygiene procedures for persons and materials moving from infested locations³⁵.

1.5.6 Department of Defense Joint Base Pearl Harbor-Hickam

Remaining biosecurity and environmental services for JBPHH are provided through Naval Facilities Engineering Command Systems Hawai'i (NAVFAC HI) in cooperation and collaboration with JBPHH command. Current pest management (including invasive species) is also managed by NAVFAC HI in cooperation and collaboration with JBPHH command and the installation pest controller. The environmental planning group is primarily engaged in implementing DoD natural resource policy. The installation pest control group has the considerable responsibility of installation-wide structural pest control activities. However, few biosecurity-specific activities are presently undertaken by these groups with notable exceptions such as the BTS Interdiction³¹, CRB³⁶ and green waste programs³⁷.

1.6 LIMITATIONS OF CURRENT PRACTICES

Current biosecurity practices at JBPHH are not substantially different from those at equivalent civilian international or domestic airports and seaports. However, the Quarantine Regulations of the Navy⁸, the DoD agricultural inspection and cleaning standards²⁶, entry requirements for military personnel⁵ and agricultural products⁴ all indicate that DoD holds itself to a higher biosecurity standard compared with requirements at non-military U.S. international ports of entry. Other agencies have jurisdictional authority for biosecurity at national (CBP) and state (HDOA) levels at JBPHH and their practices may not deliver the higher standards adopted by DoD in policy and operational practices. In order to meet those standards relating to biosecurity and invasive species management, additional activities and procedures may be required. These will need to be:

- More comprehensive than currently accepted practice;
- Fit within the current framework without hindering or replicating those activities; and
- Should not compromise the primary mission or purpose of the installation.

It is convention to further divide a biosecurity system into separate logical elements. These are usually grouped according to where in the supply chain they can be implemented: pre-border or prevention; at the border or detection; post-border or ongoing control, response, research and outreach/training. Prevention activities are further divided into identification of risks and development of pre-border tactics to address those risks. Outreach/training is a topic that transcends these groups and is an integral part of every element. Issues related to research will not be included in this plan, but there is a strong need for greater knowledge, and its importance should not be overlooked. The following chapters will address the issues of prevention, detection, ongoing control and response. A final chapter will cover a broader discussion of the issues.

This plan is divided into sections that correspond to where in the logistics chain they are implemented. A brief analysis of the major target organisms and a description of entry pathways are described in section 2. Section 3 outlines the pre-border activities that may be appropriate to reduce incursion risks before exotic organisms arrive at the border. Biosecurity at the border

(section 4) includes activities that can be taken at JBPHH to further reduce the number of potential incursion events to the U.S., Hawai'i and neighbor islands. The requirements for planning response procedures is outlined in section 5, while the final section 6 discusses how the recommendations contained in this plan contribute to the Regional Biosecurity Plan for Micronesia and Hawai'i and the Hawai'i Interagency Biosecurity Plan.

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2. PATHWAYS AND RISKS

“Invasive species have broad and far-reaching impacts on the health and safety of military personnel and operations. Invasives cause injury, transmit disease-causing pathogens, and adversely impact safety and security by obscuring unexploded ordnance, serving as fuel for wildfires, and impeding line-of-site monitoring for security forces personnel.” DoD, 2017³

Biosecurity systems are greatly improved when resources can be allocated to the physical locations and organisms that pose the highest risks. Identifying high-risk locations (a clear understanding of where to look), and a knowledge of target organisms (what to look for) will increase the efficiency and effectiveness of any biosecurity system. Detailed risk analyses for invasive species that threaten Hawai‘i and the Pacific region may be found in the Regional Biosecurity Plan (RBP) for Micronesia and Hawai‘i²³, and are not repeated in this document.

2.1 POTENTIAL THREAT PATHWAYS

A biosecurity “pathway” is defined as a mechanism by which an exotic organism can travel to a new location, either as a hitchhiker or associated with a specific commodity. Once identified, biosecurity pathways provide information on “where” to search for, or intercept, biosecurity breaches. For JBPHH, the major pathways are associated with the inwards movement of people, trash, cargo and machinery. For management purposes, pathways can be further refined by the source location, pathway type and commodity type. These constitute a practical way to classify risks and develop solutions.

The major pathways for JBPHH are similar for both Hickam Field and Pearl Harbor and include:

- Cargo incoming from international sources including deployment and redeployment of military equipment and supplies
- Cargo incoming from other OCONUS locations (domestic movements)
- Trash and packaging from vessels and cargo deposited at JBPHH
- Contaminants on vessels and aircraft (such as bird strikes and pests established on vessels)
- Transport of personnel, gear, military supplies and equipment to and from JBPHH to other islands within the state.

2.1.1 “Outward” pathways

Hawai‘i is the only U.S. state that does not have a common land boundary with another jurisdiction. The ocean barrier between Hawai‘i and other jurisdictions forms a natural quarantine barrier for the state. As a result, there are only limited access points for international and interstate movement of people and goods into Hawai‘i. These access points can be utilized as effective control points for quarantine agencies. The same ocean barrier between islands of the Hawaiian

archipelago provides additional quarantine barriers for many pests. Therefore, the distribution of many invasive species within Hawai'i may not necessarily include all islands. For example, the little fire ant (*Wasmannia auropunctata*) (LFA) is widespread on Hawai'i island, absent from Lanai, Nihau and Molokai or under eradication on the remaining islands³⁸. However, the invasive species landscape changes frequently as pests spread to other islands. The Hawai'i Invasive Species Council (HISC) website (<http://dlnr.Hawai'i.gov/hisc/>) has information on the current distributions of invasive species within Hawai'i and should be checked periodically for changes.

JBPHH is one of these access points in Hawai'i. JBPHH operates as a logistics hub for the receipt and further distribution of foreign and domestic DoD materiel, personnel and other cargo. Movement of these items between JBPHH and other locations within the state is therefore a pathway for the introduction of invasive species to Hawai'i and their spread between islands. JBPHH is therefore a potential hub for invasive species into Hawai'i as well as their spread within the state.

The agency with jurisdiction for inspecting commodities transported between the Hawaiian islands is the Hawai'i Department of Agriculture. The administrative rules of the department limit inspections by HDOA inspectors to propagative material (living plants or plant parts capable of taking root and growing to maturity), but reserve a right to inspect other agricultural commodities on a random basis²⁸. Other items are specifically regulated, including regulated pests, soil and manure, and some specific commodities including taro, papaya, banana and coffee[‡]. Therefore, other commodities, general cargo, DoD personnel and materiel moving between islands are normally not inspected.

Typical biosecurity operations worldwide focus exclusively on incoming threats – preventing the possibility of new and unwanted organisms becoming established within the target location. Threat prevention for the outward movements of commodities is generally viewed as the responsibility of the receiving jurisdiction. A notable exception is the comprehensive prevention program for BTS in Guam³⁹. Since 1993, the USDA has managed a successful program that has prevented the outward spread of this species³¹. Although not normally a consideration for biosecurity systems, incorporating similar “outwards” biosecurity practices for JBPHH could be a strategy for reducing biosecurity risks for DoD installations statewide.

2.2 RISK ORGANISMS

The invasive species landscape is constantly changing as new organisms breach the quarantine barrier, threaten to do so, are eradicated or continue to spread. Distinguishing between new organisms and those already present often requires specialist identification to determine if an organism is indeed a biosecurity threat. This confounds any attempt to list, assess and address

[‡] The lists of regulated pests and commodities change periodically.

invasive alien species (IAS) or issues in a static planning document. Often, newly discovered species are not on the biosecurity “radar” and are therefore almost impossible to address in a biosecurity plan. This is even more problematic on JBPHH where many first detectors do not have biosecurity responsibilities as core duties and may not recognize new invasive species when they are encountered. This general lack of species-level knowledge hampers attempts to integrate biosecurity detection with other installation activities or utilizing base personnel for reporting or intercepting new organisms.

An alternative approach is to identify and highlight “focus species” which are known risk species that can be used as a surrogate or indicator for a broader suite of species with similar appearance and habits. Such an approach allows biosecurity messages to be more clearly communicated to all personnel and serves to focus detection and prevention activities. Additionally, it allows for the development of generalized detection protocols and outreach messages which are more relevant and cost effective to implement. This plan and recommendations utilize this “focus species” approach as a means of delivering key awareness and reporting messages to non-specialized personnel.

Knowledge of the organisms that pose the greatest biosecurity risks allows managers to refine search methodologies and increase the effectiveness and efficiency of prevention activities. A detailed and comprehensive assessment of risk organisms is provided in the RBP for Micronesia and Hawai‘i (Vol 3)²³. These organisms can be classified according to their general form: (i) vertebrates (mammals, birds and reptiles), (ii) plants (living plants, seeds or other propagative material) and (iii) invertebrates (including insects, arachnids, crustaceans and worms).

2.3 FOCUS SPECIES

2.3.1 Terrestrial mammals

Terrestrial mammals include domestic pets (dogs and cats) as well as rodents (mice, rats, gerbils and hamsters). Importation of terrestrial mammals to the U.S. is regulated by the USDA Animal and Plant Health Inspection Service (APHIS). Regulations vary depending on the species being imported, country of origin and the presence of rabies and foot and mouth disease of the source country.

The entry of non-domestic terrestrial mammals into Hawai'i from other parts of the U.S. is regulated by the HDOA Plant Quarantine Branch through Hawai'i Administrative Rules (HAR) Chapter 4-72²⁸. Some species are prohibited including ferrets, gerbils and hamsters⁴⁰. The importation of domestic pets and livestock is regulated by the HDOA Animal Industry Division under Chapter 4-29 of the HAR. Certain breeds are prohibited. These are listed in HAR Chapter 4-71⁴⁰.

The Commander Navy Installations Command (CNIC) has established protocols for the transport of domestic pets to JBPHH. These protocols ensure that all relevant laws and regulations are being followed and that state and federal regulators are included⁴¹. Illegal introductions are not covered.

Commensal rodents (mice, rats and other rodents found in association with human activity) are an additional biosecurity risk. Their management at JBPHH is the responsibility of Facilities Support Services Branch. Routine management by this program is sufficient to address this issue.

The main terrestrial mammal of concern within Hawai'i is the small Asian mongoose. The mongoose is a weasel-like animal with a total body length of approximately 2 feet. It was introduced to Hawai'i in the late 1800's as a means to control rats in cane plantations. In the time since their introduction, the mongoose has spread throughout the islands, becoming a predator of birds and decimating bird populations⁵. Currently, this species is widespread in Hawai'i, Maui and O'ahu, but absent from Kauai, Molokai and Lanai. Therefore, it is a risk organism within the state



The small Indian mongoose is a weasel-like mammal that is generally active in the day and sleeps at night. They can be identified by their long, slender, brown furry body, short legs, sharp claws and pronounced teeth.

Native to India, this species was introduced in the 1880's by the sugar industry on Maui and O'ahu to control rats. Instead, the mongoose has had major impacts to native birds and other small fauna. Though widespread throughout the State, this species is not established on Kauai.

In accordance with the Hawai'i Department of Agriculture, Animal Industry Division Quarantine Rules (HAR 142-92), this animal cannot be bred or kept as pets.

Image source: Wikipedia.com

for Kauai, Molokai and Lanai. As a result, the mongoose is an ideal “focus species” candidate, and biosecurity messages related to mammals should focus on this species

2.3.2 Birds



The red-whiskered bulbul approximately seven inches tall, black/gray with a white chest, and has a red patch under the tail and eye. Males and females look alike.

This species was likely brought in as pet from their native range of India and Burma. They impact agriculture and home gardens by feeding on crops. They are also problematic because they spread invasive seeds, such as miconia, through their droppings.

Bulbul are also known for their aggressive behavior where they will out compete other species. This species can also be a vector for diseases such as: Newcastle disease, pullorum-typhoid disease, West Nile virus and avian bird flu.

Only known to be present on O'ahu.

Image source: Hawai'i Invasive Species Council

Birds are vectors of pathogens and other diseases of economic and human significance including Newcastle disease, pullorum-typhoid disease, West Nile virus and avian bird flu. Other bird species are invasive, potentially causing ecological harm to the environment. The transportation of birds through international and interstate borders is regulated by USDA APHIS and HDOA, respectively. Some species are prohibited⁴⁰.

The greatest potential risk for introduction of birds as vectors of disease is the result of military aircraft experiencing bird strikes on flights into JBPHH from international source points. An additional inter-island risk organism is the red-whiskered bulbul (*Pycnonotus jocosus*). This species is present on the island of O'ahu, but not other Hawaiian Islands. Intra-state transport of this species is prohibited; however, Bulbuls could potentially travel as stowaways in maritime vessels or aircraft.

The red-whiskered bulbul is an ideal focus species as it represents a known threat to the neighbor islands of Hawai'i.



The brown tree snake (BTS) ranges from 18 inches when hatched to 9 feet, but is most commonly seen as 3-6 feet long. The snake has a dark brown back that is sometimes banded with a creamy yellow underbelly.

BTS are known to stow away in cargo. If established, BTS would threaten native birds, because they prey on birds and their eggs. BTS also prey on reptiles and their eggs, small mammals and household pets. They can also be problematic by getting into electrical boxes and transformers causing power outages.

Native to the South Pacific and Australia, once accidentally introduced to Guam, the snakes populations were unchecked because there were no predators.

Image source: Pavel Kirillov

2.3.3 Reptiles

Reptiles (snakes, lizards and frogs) are cold blooded organisms found in all continents except Antarctica. There are no native snakes in Hawai'i and the native fauna are not adapted to their presence. The most iconic reptile from a biosecurity perspective is the BTS. Native to the Solomon Islands and tropical Australia, BTS was accidentally transported to Guam in 1946 most likely as a stowaway associated with the movement of military equipment. Impacts to the environment and public health have been substantial. A successful and well documented outbound prevention program was initiated in 1993 by USDA².

The projected economic and human health impacts to Hawai'i resulting from the introduction of BTS exceed \$500 million annually⁷.



An additional threat to Hawai'i is the coqui frog (*Eleutherodactylus* sp.). This species, known for its loud nocturnal chirruping "ko-kee" mating call, is widespread on the island of Hawai'i, but absent or very restricted on other islands. The coqui can easily stow away in vehicles and cargo, outbound from JBPHH to neighbor islands. Both the BTS and coqui are excellent focus species, serving to highlight inbound as well as outbound risks from reptiles.

Coqui are tree frogs approximately 1 inch long, yellow to brown in color with a distinctive "ko-kee" mating call. The disciples of the mating call can be comparable to that of a lawn mower in heavily infested areas. This annoyance can impact tourism and decrease property values.

When introduced to Hawai'i, these Puerto Rico natives had no natural predators, and their populations soared. Eating primarily insects, these frogs can have impacts on native insect species and beneficial insects such as pollinators.

Coqui can easily hitch a ride in potted plants and other equipment, such as vehicles. If you see or hear a coqui, report it.



Image: United States Department of Agriculture



Red imported fire ant (RIFA) are a mounding species not known to be established in Hawai'i. Ants are reddish-brown in color, 1/8 to 1/4 inches in size with head size being proportionate to the body; no big-headed workers.

When these ants are disturbed, they will swarm and sting causing pustules and welts to people, pets, livestock and wildlife. RIFA can also farm pest insects causing crop damage and inhabit electrical boxes and outlets causing damage.

The red imported fire ant causes US\$ billions annually in the continental U.S. where it has been established for almost a century.

Hawai'i is currently the only U.S. state with a suitable climate that is free of this species.

Image source: C. Vanderwoude

2.3.4 Invertebrates

The variety of invertebrates (insects, spiders and allies, worms and mollusks) exceed that of all other life forms combined⁸. Their small size and often cryptic nature predisposes invertebrates to escaping detection at the border. Many invertebrate species are pests of food commodities and directly associated with the transport of produce. Biosecurity systems prioritize border inspections of produce according to these relationships. However, many invertebrates are stowaways or hitch-hikers, without clear associations between a species and a commodity. These species are more difficult to target and more likely to be transported by military activities.

Crawling insects are easily transported in association with people and their possessions. They are capable of contaminating both the cargo being moved and the containers or packaging used during transport. One important group of invasive crawling insects are ants. They are readily transported to new locations and many have severe economic, human and ecological impacts⁹. Invasive ants have several key characteristics that enhance their ability to move to new locations¹⁰ including a propensity for colony expansion, multidomous colony structure and the ability to survive for weeks or months without access to food resources¹¹.

The annual economic impact of some species, such as the red imported fire ant (*Solenopsis invicta* or *RIFA*) is measured in US\$ billions¹²⁻¹⁴. This species, widespread in the southern U.S., Taiwan, Okinawa, China and spreading through Japan and Australia, is absent from the Hawaiian Islands, the only non-infested U.S. state with a climate suited to this species. Several other species are equally concerning. The hairy crazy ant (*Nylanderia fulva*) is rapidly invading the southern U.S. mainland. The

LFA is widespread on Hawai'i Island, but largely absent on other Hawaiian Islands. An unknown species of *Lepisota* has recently been detected at several locations in the Pacific region including Guam, Darwin and Perth.

However, of all invertebrate threats, the RIFA is arguably the most serious, and poses an invasion risk for cargo originating in several countries including and especially the U.S., Australia, Japan and China, and would have a devastating impact on the economy and environment of Hawai'i. For these reasons, it is an ideal focus species representing crawling invertebrates.

Flying invertebrates also pose serious biosecurity risks. They are also especially difficult to contain upon discovery at the border. The Asian honey bee (*Apis cerana*) out-competes the domestic honey bee, cannot be managed for honey production and often carries parasites and pathogens that threaten domestic apiaries. The African honey bee (*Apis mellifera*) is substantially more aggressive than its domestic European counterpart. Currently this species is spreading rapidly through southern U.S., but is unknown in Hawai'i. JBPHH does not support feral bee colonies because they could host pests and parasites that increase risk for domestic European honey bee colonies and could result in economic impacts to those businesses. Additionally, if African honey bees are introduced to O'ahu, unmonitored feral bee colonies may allow that species to become established on the island.

The CRB is widespread in the Pacific region and causes extensive damage to coconut and other palms, including native pritchardia species. It has recently been detected at JBPHH ³³ and has spread from there to other locations on O'ahu.

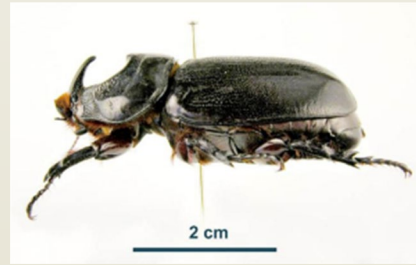


Image source: Peter Lillywhite, Museum Victoria, Pests and Diseases Image Library

Coconut rhinoceros beetle (CRB) are a blackish-brown horned beetle ranging from 1-2.5 inches long. In the larval stage, grubs are 2-4 inch long, c-shaped and are commonly found in mulch.

At night, adult CRB fly and chew through coconut palm fronds to feed on the sap and egg are laid in dead palms. CRB also impacts betelnut, banana, pineapple, sugarcane and pandanas species. The damage causes a characteristic V-shaped pattern on the fronds and can kill the trees or open them up to disease.

CRB was first detected in Hawai'i at JBPHH and a rapid response is underway. So far CRB is confined to O'ahu.



Typical damage by coconut rhinoceros beetle.

Image Source: [Mark Benavente](#)

The source of this invasion is unknown, but may possibly be from Guam⁴². JBPHH is immediately adjacent to the Honolulu International Airport and it is possible the beetles were dislodged from the wheel well of a commercial or military aircraft during landing. CRB are absent from the Hawaiian Islands (except O'ahu) and the continental U.S. making it a serious outwards biosecurity risk.

A stout and resilient insect, the CRB is a good focus species for JBPHH. There are clear pathways to Honolulu via Asian and Pacific sources frequented by military aircraft, it can survive extreme conditions for short periods and is a potential contaminant of cargo and the interior of aircraft, especially wheel wells and other external hiding places.

Although the list of potential invertebrate pests and pathogens is extensive, some warrant special mention. Hawai'i has many unique plant species which appear to be especially vulnerable to the entry of invasive invertebrates and pathogens. A detailed analysis of risks and pathways has been prepared by the USDA⁴³ to which the reader is referred for more detail.

2.3.5 Plants

There are 97 weeds listed on the Hawai'i Noxious Plant List^{26 44}. Of these, 30 species are not present in Hawai'i and the remaining 67 are distributed across one or more islands in the state. Propagules of these species (seeds, cuttings, rooted material, etc.) can potentially enter JBPHH or be transported between islands in the state by a variety of means. Identification of plant propagules when intercepted at the border is often difficult, requiring expert identification. Often, personnel are not able to distinguish between species already present in the state and those on the Noxious Plant List are not available at short notice. Seeds can be especially difficult to identify correctly.

A precautionary approach for noxious plants is therefore recommended. Any vegetative material likely to be propagative (seeds, foliage, flowers, cuttings, etc.) should be treated as a biosecurity threat, with procedures designed to detect and prevent their entry through the border.

2.4 SUMMARY AND RECOMMENDATIONS

JBPHH is one of the few access points into Hawai'i for the entry goods and people from interstate and international sources. As a logistics and transport hub for DoD in Hawai'i, JBPHH offers an opportunity to incorporate the bulk of biosecurity activities, including outwards biosecurity practices for transport between JBPHH and other islands in the Hawaiian archipelago. Existing DoD protocols, standard operating procedures and hygiene practices are already available for preparing personnel, gear, materials and other cargo for transport to new locations^{4 5 8 20 37 45-47}, and these could be implemented facility-wide.

The invasive species landscape changes constantly. Existing invasive species are not always established on each island and those new to Hawai'i or the U.S. continue to arrive. Personnel

responsible for biosecurity at JBPHH face the daunting task of continually keeping abreast of new arrivals and changes in distribution of existing species. Other base personnel, for whom biosecurity is not a core responsibility, can be valuable first detectors and often are the first to observe newly arrived invasive species. Prompt action and reporting of these observations can be extremely valuable component of the JBPHH biosecurity program. However, it is unrealistic to expect these personnel to be able to identify newly arrived invasive species and distinguish them from the existing fauna and flora in Hawai'i. As an alternative, messages for biosecurity awareness and training could be simplified by using representative focus species for each of the major groups of organisms: birds, reptiles and frogs, crawling and flying invertebrates and plants.

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3. PRE-BORDER BIOSECURITY

“Preventing invasive alien species from reaching Hawai‘i’s borders is the most cost-effective strategy to manage threats from invasive species.” Hawai‘i Interagency Biosecurity Plan, 2017²⁴

Activities that make up the management spectrum of a biosecurity system may be divided into broad categories determined by where in the logistics chain they are implemented. Convention divides these activities into pre-border, border and post-border¹. Examples of pre-border actions include “pre-clearance” systems and ballast water exchange for maritime vessels. Two successful pre-border systems are the BTS Containment Program on Guam² and the Sea Container Hygiene system developed in New Zealand³ and later adopted by Australia⁴.

Pre-border biosecurity offers many tangible benefits. First, prevention activities are generally more cost effective than the cost of containment or eradication. For example, the introduction of red imported fire ants to Australia triggered a \$320 million eradication program⁵. Second, actions at the border designed to detect invasive species before they become established, are by nature, imperfect. A degree of “slippage” occurs⁵ which allows some organisms to escape and become established. Early intervention including pre-border actions, potentially reduce mitigation costs further downstream.

3.1 OFF-SHORE RISK MANAGEMENT FOR CARGO, EQUIPMENT AND VEHICLES

The Armed Forces Pest Management Board has prepared Technical Guide No. 31, Guide for Agricultural and Public Health Preparation of Military Gear and Equipment for Deployment and Redeployment, for the cleaning and preparation of personal and unit gear, equipment and vehicles prior to their redeployment from OCONUS to CONUS locations. For movements between OCONUS locations the reader is directed to contact the responsible U.S. authorities. The guide has been updated on a number of occasions, most recently in 2008, 2012¹² and 2017⁹.

Although it is uncertain whether these procedures are being used for redeployment of materials or vehicles to JBPHH, the standard operating procedures and standards contained in this guide are a useful and practical guide for pre-border quarantine systems that may be employed for JBPHH.

3.2 SEA CONTAINER HYGIENE SYSTEMS

In 2006, the New Zealand Ministry of Agriculture and Forestry tested a system of off-shore pre-cleaning of sea containers in order to reduce high rates of live and material contamination of sea

cargo arriving from Pacific nations⁴⁸ (Papua New Guinea and the Solomon Islands). Historical contamination rates had previously been as high as 17% (live ants) and 50% (general contamination)⁴. The system included thorough pre-cleaning of containers, application of insecticides to outer surfaces of containers, pest management at source ports and storage in designated “clean” areas. The trial resulted in dramatic reductions of interception rates (0.13% for ants and <6% total contamination)⁴. In subsequent years, this system was refined and expanded¹³. Recently this concept has also been adopted by the Australian Government Department of Agriculture, Water and the Environment¹⁴.

3.3 INTERDICTION OF KNOWN RISK ORGANISMS

The BTS is an invasive species currently established in Guam. Since 1993, the USDA has coordinated a comprehensive program of survey, trapping and inspection to ensure this species is not transported to other locations². This effort is further supported by the Brown Tree Snake Control and Eradication Act of 2004¹⁵ which appropriated ongoing funds to support this program. The success of this program can be measured by the absence of this species elsewhere in the world[§], especially Hawai‘i where the economic and ecological impacts are predicted to be severe¹⁶. There are regular military flights and voyages between Guam and JBPHH, and Hawai‘i directly benefits from this program. However, some snakes are still intercepted in Hawai‘i on shipments from Guam¹⁷.

The CRB was detected at Mamala Bay Golf Course and parts of JBPHH in 2013¹⁸. Although the actual pathway has not been established, most likely adult beetles trapped in the wheel-wells of an aircraft (civilian or military) were released from this location immediately prior to aircraft landing. This pest has already spread well beyond JBPHH. However, the risks associated with likely pathways have not been fully addressed. Additional vigilance for this species is warranted for movements of ships and aircraft between Guam, American Samoa and Hawai‘i, as well as other infested source ports⁵⁴.

The red imported fire ant (*Solenopsis invicta*) is a devastating invasive ant species that costs the U.S. economy billions annually⁴⁹. Since their arrival in the 1930s, this species has spread from Mobile, Alabama, where it was first detected, to cover most of the southern states in the U.S.⁵⁰. Of all the states with suitable habitat for this species, Hawai‘i is the only state where this pest is absent. A pre-border inspection/interdiction program similar to that for the BTS in Guam, could be established at infested ports in the U.S. to minimize the risk of introducing this species to Hawai‘i.

[§] Except in Australia and the Solomon islands where it is a native species

3.4 HOUSEHOLD EFFECTS AND PERSONNEL TRANSFERS

JBPHH is a large facility with a regular turnover of personnel. New staff deploy to JBPHH from a variety of foreign and U.S. locations, each accompanied by household effects and personal possessions. Transport of these items from foreign locations undergoes screening and inspection (if required by CBP). Approximately 2% of shipments are physically inspected. Complete inspection of all household shipments for the presence of contaminants may not be possible or practical upon arrival to JBPHH. Transferees from U.S. locations may not be aware that many common invasive species endemic to their previous posting location are not present in Hawai'i. Likewise, moving contractors that pack and ship household effects may also be unaware of the risks that invasive species on CONUS may pose to Hawai'i. Thus, when packing and/or moving personal belongings, adequate precautions may not be taken due to a lack of awareness.

An alternative strategy consisting of increased awareness of biosecurity issues amongst new transferees could reduce incidents where invasive species stow away with household possessions. Items such as personal watercraft, vehicles, plants, gardening equipment and items that have been in contact with soil, pose a greater risk than general household items. Providing transferees with clear information describing these risks prior to travel will reduce these risks.

3.5 SUMMARY AND RECOMMENDATIONS

Recommendations for pre-border risk management for JBPHH are as follows:

	Recommendations to strengthen pre-border biosecurity
3.a	Review JBPHH rules, practices and procedures to ensure they comply with relevant Executive Orders ⁹⁻¹¹ and DoD policies contained in Defense Transportation Regulations Part V ⁵ .
3.b	Mandatory adoption of TG31 ⁶⁰ for all materiel, vehicles, equipment and personal items arriving or being transshipped through JBPHH will dramatically reduce the risks of spreading invasive species and comply with Executive Orders 13112 ¹⁰ and 13751 ¹¹ as well as the DoD policies in Defense Transportation Regulations Part V ⁵ .
3.c	Consideration be given to implementing a system similar to the New Zealand / Australian sea container hygiene system for general cargo and containerized items.
3.d	Review existing BTS prevention program and develop a similar pre-border protocol for CRB. Strengthen on-shore survey trapping and interception activities for these species at JBPHH to include intensive trapping at both sea port and airport cargo areas.
3.e	Develop a pre-border prevention program for the red imported fire ant to be implemented at applicable source locations for cargo shipments to Hawai'i. Strengthen on-shore survey trapping and interception activities for this species at JBPHH, including include regular (annual or more frequent) surveys at both sea port and airport cargo areas.

3.f	Provide transferees to JBPHH with clear information regarding the importance of invasive species and their impacts to Hawai'i ecosystems and economy. Include instructions for cleaning and disinfestation of household items and personal possessions.
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4. BIOSECURITY AT THE BORDER

“All conveyances ...entering the Customs Territory of the United States (CTUS) from a foreign port or place will be subject to a complete customs inspection upon arrival at the first U.S. port of entry. ... Personnel, accompanied baggage, personal property, and cargo and the associated documentation are also subject to inspection.” DoD, 2018⁵

4.1 BACKGROUND

JBPHH is a large and complex facility that is the receiving and distribution point for military personnel, materiel and cargo, both from foreign and domestic locations. It houses, amongst other facilities, a sea port for vessels and submarines from domestic and foreign locations, as well as an airport for military aircraft and air cargo. Additionally, JBPHH acts as a central transport hub that serves other DoD facilities on O‘ahu and the neighbor islands of Maui, Kauai and Hawai‘i, as well as acting as a staging area for trans-shipping. DoD follows the ballast and hull fouling regulations as outlined in the Department of Navy Environmental Readiness Manual²² and the Naval Ships’ Technical Manual Chapter 81⁵¹ (updated Sept 2019⁴⁶). The complexity of biosecurity operations at JBPHH are further compounded by jurisdictional issues. The Department of Homeland Security CBP is responsible for inspection and interdiction of items arriving at JBPHH from foreign locations. At the time that the Department of Homeland Security CBP was formed, many biosecurity functions were performed by USDA APHIS working under a memorandum of understanding between the two agencies⁵². These functions are now almost totally performed by CBP officers.

Domestic trade is regulated by the State of Hawai‘i through HDOA Plant Quarantine Branch. HDOA authority is broadly limited to protecting agriculture. The State of Hawai‘i does not regulate international trade, and has only limited power to regulate trade from other U.S. states. Undoubtedly, personnel from state and federal agencies work closely together in an operational context; however, data sharing and jurisdictional limits still exist.

DoD therefore, has limited ability to alter national and state biosecurity systems as these responsibilities lie with different agencies. However, in order to comply with DoD policies and instructions³ and Executive Orders⁹⁻¹¹, additional biosecurity actions are needed at the border, and these should be developed to supplement and complement activities already undertaken by CBP and HDOA.

4.2 POINT OF ENTRY SURVEY AND MONITORING

A systematic program of surveys and monitoring at all operational areas at JBPHH is likely to detect the arrival and establishment of exotic species before these are able to spread beyond facility boundaries.

By their nature, such surveys are specific to the target organisms or species groups, and for this reason several survey programs will be needed in order to detect all likely target species. The theme of using “focus” species in each of the four target groups (mammals, reptiles and frogs, birds and insects) will continue to shape key messages and protocols.

While CBP monitors goods and personnel at the international border and the HDOA regulates the inwards movement of goods and personnel from domestic locations, there will exist a degree of slippage (goods that have been cleared without meeting import standards or cleared goods that have exotic species attached or present in packaging and containers ⁵³. Replicating existing inspection systems or further inspection of these goods as they pass through control points will create jurisdictional issues and further complicate an already complex logistics chain without improving detection rates.

However, opportunities to strengthen the border against incursions do exist. While some JBPHH site-surveys are conducted as part of larger pre-border programs such as the BTS interdiction program and CRB response^{31, 39}, there is no ongoing systematic survey schedule designed to detect other potential invasive species. The breadth of species and species groups potentially able to establish at JBPHH requires specialized survey protocols. At the very least, general detection surveys for target animals organisms described in “2.3 Focus species” should be conducted annually. In contrast to intercepting and destroying all propagative material without a specific need to identify the organism (see section 2.3.5), once invasive plants have become established, they must be identified in order to determine its status as an organism of international, state, and island importance.

4.3 BORDER DETECTION OF “FOCUS” SPECIES

4.3.1 Mammals (Asian Mongoose)

The presence of any exotic mammal not already known in Hawai‘i is an urgent and reportable discovery. The small Asian mongoose is a species that is already present on the island of O‘ahu where JBPHH is located, but absent from some of the other islands in the Hawaiian archipelago. Additionally, they are present on Okinawa and Amami, the Caribbean islands, South America and islands of Fiji. It is absent from CONUS locations.

Being a relatively large organism in comparison with insects and other threat species, existing biosecurity practices by the CBP should be capable of detecting the entry of individuals in vessels

and aircraft. Mongoose are already present on O‘ahu, and are therefore could contaminate outbound cargo and materials. Additional care needs to be taken to keep JBPHH free of this species and ensure it is prevented from spreading to other Hawaiian islands or CONUS.

4.3.2 Reptiles and Amphibians (BTS and Coqui Frog)

The BTS invaded Guam in the late 1940s, where, over the past 70 years, have spread across the entire island. BTS have been responsible for contributing to the extinction of many of endemic bird species in Guam, and the loss of those species has resulted in catastrophic impacts to the ecology of protected areas.

The BTS Control and Eradication Act of 2004 appropriated recurring funds to prevent the accidental movement of BTS from Guam to other locations. These funds are used primarily to detect and remove snakes from cargo shipments originating in Guam and bound for other destinations, including Hawai‘i. This program has been very effective, evidenced by an absence of detections at new locations since the program commenced.

There are several other reptile on the injurious wildlife list in Hawai‘i⁴⁰. These include the veiled chameleon (*Chameleo calyptratus*), Jackson’s chameleon (*Chameleo jacksonii*) and the coqui (*Eleutherodactylus coqui*) (Figure 4.1). Table 4.1 lists the known distribution of these species within Hawai‘i.

Table 4.1 Status of invasive reptiles and frogs on the islands of Hawai‘i

Species	Description	O‘ahu	Big island	Maui	Kauai
veiled chameleon	Up to 12 inches. Both males and females possess a head “casque” that reaches 2 inches in height at maturity.	Absent	Absent	Established	Detected in 2004
Jackson’s chameleon	Up to 24 inches. Males have 3 horns but females do not.	Established	Established	Established	Absent
coqui frog	About 1 inch. Distinctive “ko-kee” call.	Detected occasionally	Widespread	Small outbreaks	Detected occasionally



Figure 4.1 Invasive frogs and reptiles present in the Hawaiian islands. (From left) Jackson's chameleon, the veiled chameleon and the coqui frog (image source: *Hawai'i Invasive Species Council*).

The chameleons are distinctive, much larger than other reptiles in Hawai'i (10-24 inches length at maturity) and thus are easy to distinguish from smaller species. The coqui frog has a distinctive "ko-kee" call which is relatively easy to identify at night.

4.3.3 Birds

Discovery of any bird or bird parts on vessels or cargo, whether alive or dead, is actionable. Birds can carry avian bird flu (Influenza A virus subtype H5N1 and other strains as yet unknown) which are also transmissible to humans and other animals. The mortality rate in humans who are infected with the avian bird flu is about 60%. The mortality of infected wild and domestic avian fauna is also very high^{55, 56}.

Bird strikes, an incident where a bird or birds collide with a moving aircraft, are common. NAVFAC HI has an existing reporting system for bird strikes with aircraft. This system should be reviewed to determine that all bird strikes are currently being reported.

4.3.4 Invertebrates (ants and other invasive species)

Many invasive invertebrates are plant pests that infest specific host plants or crops. It is expected that CBP would intercept these based on risk assessments and host plant specificity. However, some invertebrates are not associated with a specific commodity. Ants, for example, are "hitch-hiker" pests associated with general cargo and transport of people. Ants (especially invasive ants) are able to successfully form colonies even in hostile environments such as port facilities, air fields and associated structures. As examples, the recent incursions of the red imported fire ant in Australia (2001) and New Zealand (2001 and 2005) were each closely associated with a seaport or airport. For these reasons, regular detection surveys of points of entry are often implemented by quarantine agencies in order that these species are detected and eradicated early in the establishment phase.

The costs associated with eradicating a well-established ant incursion is closely related to the amount of land occupied by the new species. As an extreme example of this, the 2001 detection of

RIFA in Brisbane, covered over 60,000 acres of metropolitan Brisbane. To date this incursion has required an investment of over US\$400 million for eradication activities over the last 18 years^{**}. RIFA are still not eradicated and are indeed, spreading⁵⁷. In 2001, an incursion of the same species was detected in New Zealand ⁵⁸. Only spanning less than ¼ acre, this incursion was successfully eradicated in two years at minimal expense.

Regular (annual or more frequent) surveys of high risk areas within JBPHH is warranted in order to detect and eradicate invasive ants early in the invasion chronology. High risk sites at JBPHH include:

1. All areas where cargo is held, stored, or unstuffed (both at the airport and the sea port).
2. Staging areas and locations for repacking cargo, regardless of whether the cargo is trans-shipped or bound for a location in Hawai'i.
3. All land in the immediate vicinity of port structures, docks and adjacent to runways.

^{**} *As of 2018, red imported fire ants have not yet been eradicated from Brisbane and continue to spread.*

4.4 OTHER ACTIONS AT THE BORDER

4.4.1 Staging, consolidation and trans-shipping areas

Cargo destined for Pearl Harbor undergoes CBP clearance in accordance with DHS directives and instructions, when required. However, cargo and materials offloaded for staging or re-shipping also pose a biosecurity risk, regardless of the port of origin or the fact that they are only temporarily held in a holding area for reloading. These items may, or may not, be cleared by CBP depending on the circumstances of each shipment.

Unwanted animal or plant species attached to cargo can become dislodged and remain behind in the course of being offloaded, held, staged or reshipped. Insect pests, such as ants in particular, are able to easily relocate by this means. The risks associated with this can be reduced substantially by using designated holding areas that have been pre-treated with a residual pesticide ⁴⁸. Ports are busy places and it may not be possible to comply with a requirement to always use designated areas for staging and trans-shipping. However, any level of compliance will reduce these risks.

4.4.2 Inter-state personnel and materiel movements

There are many invasive species on CONUS that are absent from Hawai'i. One example is the red imported fire ant (*Solenopsis invicta*). The USDA administers a fire ant quarantine on CONUS which aims to limit or slow the spread of this species across the southern U.S. However, this quarantine only applies to agricultural produce and potted plants. Many southern U.S. ports and DoD facilities are within this quarantine.

There are few quarantine requirements when transporting goods from CONUS to Hawai'i. The HDOA requirements are limited to agricultural products and do not extend to vehicles or other materials⁵⁹. Vehicles and other materials that have been in contact with the ground also pose contamination risks. Most unwanted organisms will be closely associated with dirt and debris that has accumulated on and in these items, and when these items are relocated to Hawai'i, they potentially harbor invasive species.

4.4.3 Intra-state personnel and materiel movements

The transportation of personnel, materials and other items from JBPHH to neighbor islands or elsewhere on O'ahu, poses serious intra-state biosecurity concerns. Plant seeds, insects and pathogens are easily transported on infested cargo and especially on the clothing and footwear of personnel. While there may be no mandatory cleaning or other hygiene requirements, routine movements of personnel between islands are a potential pathway for pathogens insect pests and plant seeds. One example is the fungal agent for ROD which is easily transported with soil and organic material left in tents, clothing and footwear. This threat is made more serious because at least some personnel movements are between JBPHH and lands of natural resource significance.

Detailed standard operating procedures have been developed by the AFPMB⁶⁰ and Technical Guide 31 should be used as the basis of a broader hygiene requirement that includes inter-island activity. Adoption of the operating procedures in this guide across intrastate movements would significantly lower the risk of spreading invasive species between islands and to conservation and natural resource areas that the DoD may utilize for training and other purposes.

4.5 SUMMARY AND RECOMMENDATIONS

There are clear and detailed biosecurity instructions, policies and directives that apply to JBPHH. However, it has not been possible to determine whether these are being followed, and if so, how well. Comprehensive technical guides for a wide variety of pest management activities have been prepared by the AFPMB⁴⁷, but it is not clear if these guides are being used at JBPHH. One example of this is TG4, Disinsection of Military Aircraft²¹ which contains procedures for ensuring exotic insects in the cabins and holds are destroyed before take-off to the destination country. Without a clear knowledge of what activities are being implemented and which are not, it is difficult to recommend actions that may be required to address any gaps in biosecurity practices.

Table 4.1 Recommendations for strengthening the biosecurity system at JBPHH.

	Recommendations to strengthen biosecurity
4.a	Find, update and catalogue existing survey protocols for invasive species detection at the border.
4.b	Develop a survey work program for JBPHH that includes existing protocols and develop new protocols for species not currently covered.
4.0c	Provide instructions to operational staff that includes procedures at time of detection and contact details for appropriate NAVFAC HI or other personnel. Instructions include procedures for both inbound and outbound cargo and materials.
4.d	NAVFAC HI should consider whether a regular trapping program around loading/unloading facilities is warranted.
4.e	Review the Brown Tree Snake Interdiction Program to ensure all Hawai'i points of entry controlled by the Department of Defense are surveyed adequately, in both spatial and temporal contexts. This may indicate a need to expand the current survey areas.
4.f	Provide regular (annual or semi-annual) education and awareness material to operational staff. This information should include procedures at time of detection and contact details for appropriate NAVFAC HI or other personnel as well as biosecurity procedures for both inbound and outbound cargo and materials.
4.g	Provide detailed information to personnel deploying to JBPHH to ensure these species are not brought with deploying personnel or their families.
4.h	NAVFAC HI should expand and formalize the current bird strike reporting system to include any and all potential incidents involving bird strikes or the carriage of living avian fauna or parts

	thereof.
4.i	Annual or more frequent surveys of JBPHH for all invasive ant species using accepted protocols for survey and identification.
4.j	Protocols that encourage or mandate reporting of insects that are observed within key areas; including around airports and runways, loading and unloading facilities, designated staging areas and when packing or unpacking cargo.
4.k	Develop standard operating procedures for base personnel to follow in instances where a suspected exotic species is observed.
4.l	Create designated locations for holding staged or trans-shipped cargo and have these maintained in a pest free state by applying appropriate residual pesticide barriers.
4.m	Review current cleaning requirements and implement more rigorous cleaning requirements for vehicles where gaps exist.
4.n	Adoption of the AFPMB guide TG31 for cleaning of clothing and equipment used during movements between islands in Hawai'i.

5. POST-BORDER RESPONSE

“ Each Federal agency for which that agency’s actions may affect the introduction, establishment, or spread of invasive species shall, to the extent practicable and permitted by law,[and] subject to the availability of appropriations, and within administrative, budgetary, and jurisdictional limits, use relevant agency programs and authorities to ... 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.” Barack Obama, 2016¹¹

5.1 LAWS, REGULATIONS, ORDERS AND POLICIES SPECIFIC TO INCURSION RESPONSE AT JBPHH

DoD is obligated to prevent and manage the introduction of invasive species on DoD facilities in accordance with relevant laws and statutes listed in previous sections. The main approach recommended to fulfill these obligations is to reduce incursion risks through prevention and border actions, because these activities are widely held as the most cost-effective approach to biosecurity. However, it is inevitable that some invasive species will escape detection at these points in the logistics chain.

Additionally, Presidential Directive HSPD-5⁶¹ mandates that responses to disasters and other emergencies be structured using a single comprehensive approach to incident management as developed by DHS. Compliance with this directive ensures that all levels of government, as well as non-government agencies, are able to work together in a seamless response to domestic incident management, and combines the previously separate areas of crisis management and consequence management^{62 63}. Regardless of the magnitude of the emergency, any multi-jurisdictional response that involves or includes a federal agency must be managed within the National Response Framework (NRF)⁶³ using the National Incident Management System (NIMS)⁶². The five mission areas of the NRF are:

“Prevention: The capabilities necessary to avoid, prevent, or stop a threatened or actual act of terrorism. Within the context of national preparedness, the term “prevention” refers to preventing imminent threats.

Protection: The capabilities necessary to secure the homeland against acts of terrorism and manmade or natural disasters.

Mitigation: The capabilities necessary to reduce loss of life and property by lessening the impact of disasters.

Response: The capabilities necessary to save lives, protect property and the environment, and meet basic human needs after an incident has occurred.

Recovery: The capabilities necessary to assist communities affected by an incident to recover effectively.”⁶³

Four of the five NRF mission areas align with sections of the JBPHH biosecurity plan, namely

prevention (pre-border and pathway analyses), protection (border activities), mitigation and response (post border activities). Recovery plans are beyond the scope of this report. The structure of an operational response is based on the Incident Command System (ICS), a component of the NIMS⁶². Based on U.S. Navy command structures, the ICS was initially developed for wildfire responses in California in the 1970s⁶⁴. As such, the ICS structure should be familiar to many DoD personnel. ICS is a scalable and consistent command structure designed to coordinate responses where several organizations have jurisdiction or contribute personnel and resources. Any response arising from this initial detection should automatically conform to the NIMS structure

5.2 INCURSION PREPAREDNESS

The discovery of a new or unwanted organism may require responders to implement an immediate and rapid response that contains the organism to the smallest area practical and prevent impacts to the primary JBPHH mission. Some organisms have an ability to disperse quickly, and in doing so, containment costs will increase quickly, while the probability of a successful outcome will be reduced. The dispersal characteristics of the new organism, as well as the estimated environmental, economic and human impacts may not be known at the time of discovery. These factors will partly determine the urgency of any response. However, before these parameters are known, responders should proceed on the basis that the organism disperses quickly and impacts are severe. These assumptions require that responders are well prepared and able to act quickly on detection of an unwanted organism. Later, when subject-matter specialists are available to provide advice, it may be acceptable to plan more carefully and proceed at a slower pace.

In order to be able to respond appropriately, three key topics should be addressed and resolved prior to any detection. These are: (i) having a legal power to act, regardless of the circumstances; (ii) possession of control products, methods, equipment and trained operatives; and (iii) sufficient funds to commence containment activities.

5.2.1 Authority Having Jurisdiction

At the time of initial discovery of an unwanted organism, it may be unclear which agency has legislative jurisdiction over the site, the incident or organism in question. Often, jurisdiction is held by different agencies for different aspects of the response (for example, access to a site, authority to apply pesticides and power to allocate resources). Although both state and federal agencies may be involved in a response, the agency with jurisdiction will differ according to the pest species, and whether it is new to the U.S. or new to Hawai'i. In order to ensure that the authority having jurisdiction for each aspect of the incident is available and informed, all agencies with some legislative or mission authority should be involved in the response.

Organism is new to the United States

As a general rule, if an organism is new to the U.S. or is listed as an actionable organism, the DHS,

through CBP, has the legislative authority to act. Other actionable organisms include those with specific national quarantines or programs. Examples include the RIFA and the BTS, and these may have a different responsible agency, such as the USDA.

Organism is new to Hawai'i but present elsewhere in the U.S.

Organisms that are new to Hawai'i, or are listed as an actionable pest under state legislation, are the responsibility of the HDOA, and at times, other state agencies such as the Hawai'i Department of Land and Natural Resources.

Organism is new to O'ahu

The ever-changing distributions of target species within the State of Hawai'i adds a degree of complexity to invasive species management for JBPHH. In some cases, a pest species may be present on one or more islands, but absent from others. The HDOA regulates the movement of agricultural items between these islands in order to prevent the spread of pest species.

Transporting listed animal species⁴⁰ and some commodities²⁸ between islands in Hawai'i may contravene state laws^{13, 26}. This has important implications for the DoD as JBPHH is the hub through which many personnel and materiel movements to and from other islands originate and these movements have the potential to inadvertently spread invasive species between islands.

5.2.2 Registration and permits to apply pesticides

Pesticide use in the State of Hawai'i is administered by the U.S. Environmental Protection Agency (EPA) and the HDOA Pesticides Branch. All pesticides used in the U.S. must be registered by the EPA, while the HDOA regulates the use of federally registered pesticides in Hawai'i. There is substantial consultation and coordination between these two agencies; however, initial contact regarding pesticide use is with the HDOA Pesticides Branch.

Not all EPA registered pesticides are registered in Hawai'i, and it is possible that one of these unregistered pesticides may be needed to address incursions at JBPHH. It is also possible that a registered pesticide may need to be applied in a manner not listed on the label. In both cases, HDOA Pesticides Branch evaluates and issues state registration or special local need permits. The registration and permitting processes take some time to complete and this poses special problems in an emergency response where rapid action may be needed.

The presence of a facility-wide IPMP, including trained staff, availability of control products and application equipment, greatly decreases response times and substantially increases the efficacy of control actions. The facility pest management program is overseen by the AFPMB⁶⁵ which provides national oversight, policy support, technical guides⁴⁷, operations and research guidance for pest management on DoD installations⁶⁵. The pest management work program at JBPHH is implemented by the Public Works Department through the Installation Pest Management Coordinator and Installation Pest Controllers (both on-staff and contract), and the inclusion of this division in preparedness and response is essential.

5.2.3 Availability of funds and other resources

The fiscal and resource costs of a biosecurity response are highly variable and depend on factors that cannot be anticipated in advance or be incorporated in typical operating budgets. Funds may be required during one budget cycle and not needed for other budget cycles. Where possible, the costs associated with an initial response should be estimated, and an emergency or contingency fund to which these costs can be applied, needs to be identified in advance of a biosecurity event. Without adequate funds on hand, any response, such as initial containment and delimiting, may not be possible. Conversely, a clear understanding of what funds and resources will be available for management of an incursion greatly assists in developing a response that fits within likely resource allocation.

5.2.4 JBPHH Biosecurity Advisory Committee (BAC)

The Hawai'i Interagency Biosecurity Plan²⁴ recommends the formation of a statewide Biosecurity Emergency Response Task Force with the purpose of acting to coordinate and collaborate on Hawai'i biosecurity issues, including responses to incursions. Regardless of whether this committee is formed in the future, coordination and communication within and between agencies with biosecurity responsibilities at JBPHH will be improved by forming a Biosecurity Advisory Committee (BAC). However, it would be advantageous for the two committees to merge or coordinate on relevant issues.

The JBPHH BAC should be comprised of representatives from partner agencies and technical subject matter specialists. The committee has an advisory role with no formal authority. It serves three main functions.

The first is to communicate relevant information to agencies with a role, or an interest in biosecurity in Hawai'i, and to serve as a single point of communication regarding the incident. This ensures a single and consistent message is communicated with all agencies, and avoids confusion and the risk of conflicting versions of the incident from circulating. It also ensures the joint participation of all authority having jurisdiction whether they are national, state or local, and the liaison between these members and subject matter specialists.

Second, the make-up of the committee brings local expertise, involvement of authorities having jurisdiction, and subject matter specialists together in a forum where sound recommendations can be developed that have considered the technical, legislative and communication issues relating to each biosecurity breach. Consensus between members on issues minimizes the possibility of inter-agency conflict and the development of alternative courses of action by partner agencies.

Finally, resources from other agencies can be quickly allocated to the situation in ways that avoid duplication and gaps. This is especially important where a large response force needs to be mobilized or where specialized equipment and supplies may be needed at short notice.

Membership of the BAC should include appropriate representatives from the following agencies

and business groups:

Department of Defense:

Relevant JBPHH business groups including:

Pest Management^{††},
Public Relations/media^{ix},
JBPHH, Hawai'i and Pacific region environment programs^{ix},
Facility command^{ix}, logistics^{ix} and incident command^{ix}.

Authority having jurisdiction:

Department of Homeland Security (Customs and Border Protection)^{ix}

Hawai'i Department of Agriculture Plant Quarantine Branch^{ix}

USDA Animal and Plant Health Inspection Service (APHIS)^{ix}

Related state and federal agencies:

Department of Land and Natural Resources

U.S. Fish and Wildlife Service

Hawai'i Department of Agriculture Plant Pest Control Branch

U.S. Department of Forestry

Hawai'i Department of Forestry

Hawai'i Invasive Species Council^{ix}

O'ahu Invasive Species Committee

City and County of Honolulu

Other counties as appropriate

Subject matter specialists from state and federal agencies,

University of Hawai'i College of Tropical Agriculture and Human Resources

University of Hawai'i Pacific Cooperative Studies Unit

USDA

USGS

Additional members may be included as appropriate to the organism.

In any response that is likely to include more than one agency, DoD is mandated to abide by the Homeland Security Presidential Directive⁶¹ and utilize the National Response Framework⁶³ which includes using the organizational structure outlined in the NIMS⁶². Describing the likely structure of such a response is beyond the scope of this plan, but should include the following essential organizational components:

- Management and policy.
- Operational coordination.
- Finance and resource control.
- Liaison and communication.
- Technical advice.

^{††} *These are core committee members*

5.3 INITIAL DETECTION AND RESPONSE

A protocol for initial detection and response should contain the following elements:

- A reporting system that is clearly communicated to all facility staff and visitors.
- A process for investigating detections or sightings.
- Agreed lines of communication.
- A framework for decision-making.
- Development of a management plan.

5.3.1 Development of a reporting system

The initial detection of unwanted organisms in a complex structural environment, such as JBPHH, can be difficult and costly. Utilizing the “eyes and ears” of non-biosecurity personnel is an extremely efficient and effective means supplementing existing detection systems. Many biosecurity agencies worldwide encourage members of the public to participate in incursion prevention activities by reporting unusual organisms to biosecurity managers. This low-cost tactic, incorporated with the broader JBPHH detection program, has the potential to dramatically improve detection rates.

JBPHH has a large and varied workforce which includes military, logistics, maintenance and other support services for both naval and air operations in the Pacific region. Facility personnel tend to be highly trained, observant and competent, and as such, are valuable biosecurity detection assets. However, reporting structures and chains of command can be complex and inter-twined. Staff turnover is high, with constant military and civilian deployments and redeployments.

Under these circumstances, developing a consistent reporting structure for possible invasive species detections can be difficult, but very rewarding. Active planning and development of a sound communication plan will capitalize on these resources. This communication plan should complement the broader engagement plan developed for prevention activities. The first element of this communication plan is to ensure there is a consistent and accessible reporting system. As an example, the State of Hawai'i manages a citizen reporting system known as “643-pest”⁶⁶. This project operates as a central receiving point for the reporting of any suspicious organism statewide, and forwards those reports to the appropriate state agencies. An overarching feature is a single telephone number and website for any citizen report. All state agencies and NGO organizations with biosecurity responsibility promote the same central contact number in their outreach material. At times, this hotline receives calls from personnel at JBPHH. A similar methodology is recommended as appropriate for facility-wide purposes, and should be combined with a dedicated engagement strategy that raises general awareness of biosecurity issues by all facility personnel.

NAVFAC HI operates a service desk at JBPHH. The service desk utilizes a single call number (808-449-3100) for pest issues and other enquiries or requests for assistance. This number would be a good choice to use as the central information and reporting line. Service desks and call centers

often have pre-prepared answers to common questions and contact details to which callers can be directed. An information package, coupled with awareness and training, should be developed and provided to the service desk in order to streamline the reporting process. Such an information package should include sufficient information to assist operators to gather additional relevant information from callers, prioritizing enquiries, and include the contact details to which reports are to be directed.

5.3.2 Investigation protocol

Some reports of possible biosecurity breaches will be non-actionable, and others may demand an immediate response. In either case, a rapid assessment and identification of threats is needed to ensure appropriate actions are taken. A pre-determined protocol for the initial investigation and follow-up ensures that relevant information is collected and communicated to decision-makers to determine a course of action. This information should include an identification of the species that has been detected, a preliminary estimate of current distribution, whether and how the facility mission will be impacted and who is designated to follow-up. At this point, very little information might be available, and it is important to provide decision-makers with as much detail as can be found. The protocol for responding to a biosecurity breach is outlined in Figure 5.1. This table details the initial response actions needed to gather more information and the communication/reporting procedures that are to be followed.

5.3.3 Guidelines for decision-making

The decision on how to respond to an incursion will be based on many factors which include an estimate of potential severity of impacts, resources needed (fiscal and human resources), legislative requirements and an evaluation of feasibility of the proposed response. This decision is best made in the early stages of a response and modified as new information becomes available.

Once preliminary information has been gathered, an appropriate course of action must be developed. At this stage of the response, the Installation Environmental Program Director (IEPD), or delegate, will convene a meeting of the JBPHH BAC, and follow-up meetings as necessary. Committee members consider response options based on information available at the time, and recommend the option most suitable for the circumstances.

Response options range from doing nothing to attempting to eradicate the new organism. They form a continuum between these extremes and selecting the most appropriate course of action requires knowledge of the following key factors:

1. The cost of implementing control and mitigation actions, both now and in the future.
2. The feasibility and probability of successful implementation.
3. The costs of impacts in economic, ecological and human terms.
4. Potential impacts on the facility mission and operational readiness.
5. Availability of resources.

Figure 5.2 outlines a decision flowchart that is designed to allow the utilization of new information as it comes to hand to review and alter project objectives. It separates the range of options into four main streams: eradication, aggressive control, ongoing management and doing nothing. To do nothing is an action in itself and comes with costs which include the impacts caused by the new organism (now and in the future), the cost of implementation, the range and severity of impacts, and how the new organism might affect operational readiness and the primary mission of the facility. Eradication is a course of action that is planned and implemented regardless of budget. The budget for an eradication program is determined solely by what it will take to have a reasonable confidence in the outcome. It cannot be made to fit within a pre-determined budget.

There are two middle-ground alternatives which range from aggressive control to ongoing management. Aggressive control describes a response which aims to achieve a pre-determined end-state such as a maximum population size or level of acceptable impact. As with eradication, the objectives of aggressive control determine the budget. Ongoing management is an alternative course of action that aims to fit population management objectives into a pre-determined budget and involves methods that maximize pest and impact reduction for a given cost. For planning purposes, it is vital to understand the differences between these two alternatives.

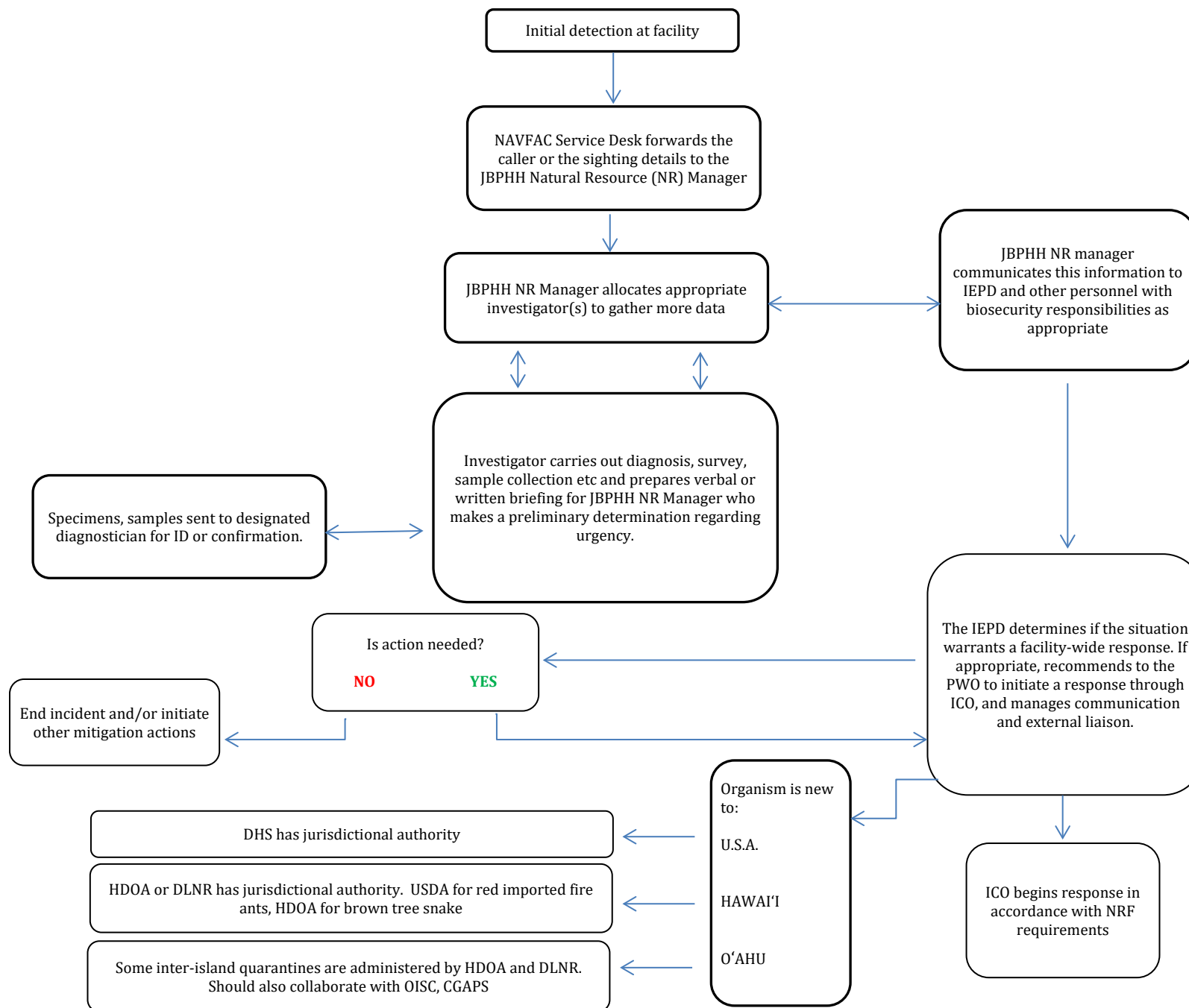


Figure 5.1 Process for initial response to suspected biosecurity breach.

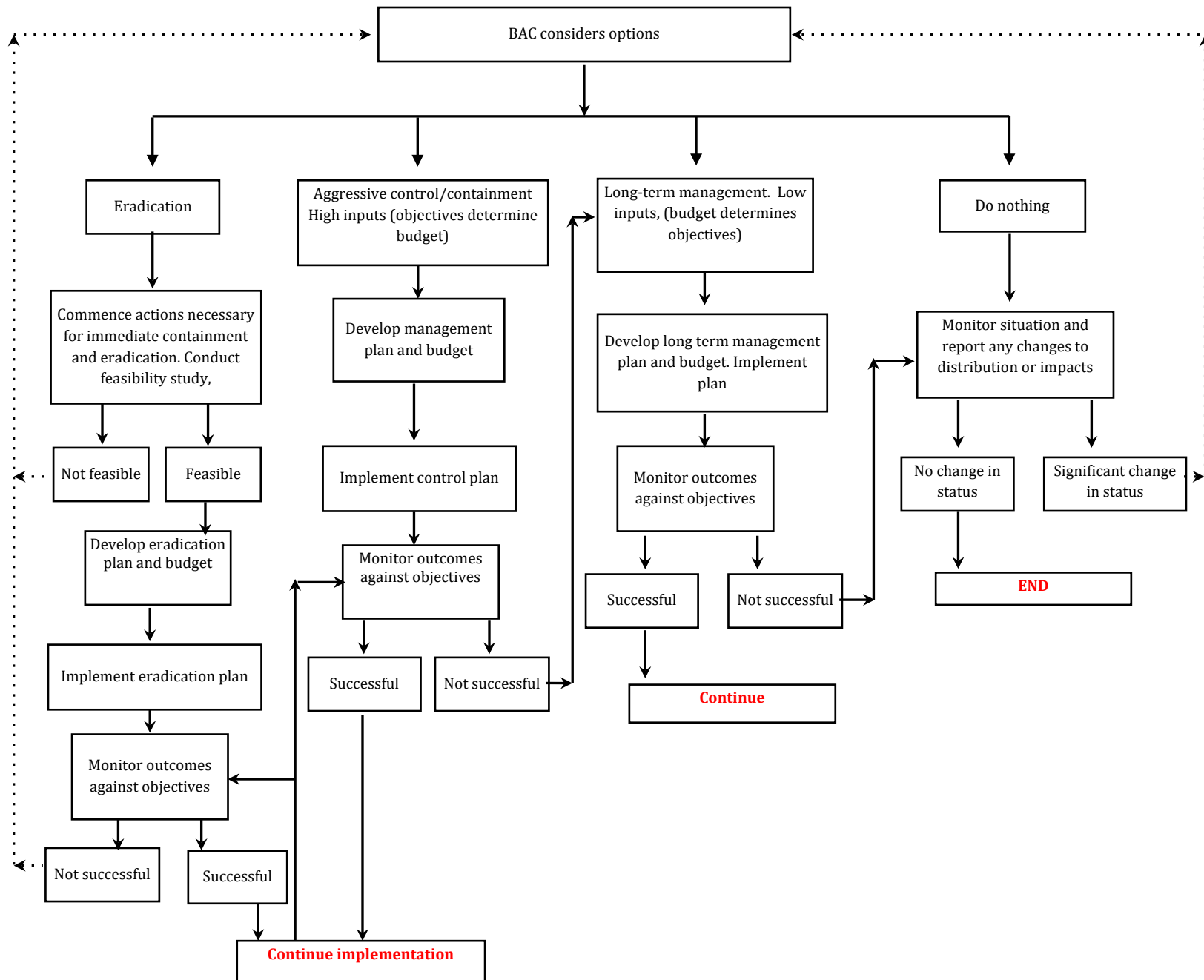


Figure 5.2: Process for initial decision-making by the Biosecurity Advisory Committee.

5.4 SUMMARY AND RECOMMENDATIONS

This section details a recommended approach for the preparation and response to the detection of potentially unwanted organisms discovered at JBPHH. These recommendations include:

	Recommendations to strengthen biosecurity preparedness
5.a	Identify, document and liaise with all authorities having jurisdiction for incursions new to the U.S., new to Hawai'i and new to O'ahu.
5.b	Ensure all control and surveillance supplies and the equipment necessary to apply them are readily available at the time they may be required.
5.c	Access to, and authority to utilize, emergency funds as required to address an emerging incursion threat.
5.d	Establish a DoD "biosecurity advisory committee" (BAC) comprised of representatives from relevant agencies to facilitate regular exchanges of information and communication on shared issues.
5.e	Develop a reporting system that utilizes all facility personnel as first detectors should be closely synchronized with the pre-border outreach strategy.
5.f	Formalize and implement a process for investigating and assessing new detections which includes provision of relevant information to the NAVFAC Help Desk.
5.g	Document agreed lines of communication during an initial response. Communicate these lines to all personnel.
5.h	The BAC should use a logical decision-making process that considers the feasibility and likely outcomes of all management options and communicate those recommendations to the IEPD.
5.i	Progression of a multi-agency response should be structured within the National Response Framework, including the National Incident Management System.

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6. DISCUSSION AND RECOMMENDATIONS

Each year, an average of 89 new, non-native species are introduced to the State of Hawai'i. This is orders of magnitude greater than any other U.S. state². These species have the potential to cause irreparable harm to the social, environmental and economic wellbeing of the state. Some are especially harmful. The CRB, LFA and ROD for example, threaten the very fabric of the Hawaiian environment and the welfare of its inhabitants. DoD activities in Hawai'i have the potential to contribute to this crisis through the introduction of invasive species new to the U.S. or the State, and facilitating the spread of both new and existing invasive species between the islands of Hawai'i.

The DoD is committed to preventing the introduction of invasive species, to detect and rapidly respond to new introductions and to control invasive species on the 25 million acres of land in its control³. Federal laws, Executive Orders and DoD policy all mandate the careful stewardship of lands managed by DoD as well as preventing the introduction and spread of invasive species. The Regional Biosecurity Plan for Micronesia and Hawai'i as well as the Hawai'i Interagency Biosecurity Plan provide an over-arching biosecurity policy framework within which DoD operates at JBPHH. Biosecurity and stewardship procedures for JBPHH are detailed in the facility Integrated Pest Management Plan (IPMP) and the Integrated Natural Resource Program (INRMP). This biosecurity plan is a sub-plan of the INRMP and a requirement under the Sikes Act.

JBPHH, is the *de facto* hub for the transportation of DoD personnel, supplies and materiel into Hawai'i from foreign locations, from elsewhere in the U.S. or its territories; and outward to support military activities throughout Hawai'i and elsewhere. The central location of JBPHH in the logistics chain provides an unparalleled opportunity for DoD to significantly improve biosecurity outcomes for the state. While jurisdiction for managing biosecurity risks at the border is vested with other agencies, there are additional procedures that can be implemented elsewhere in the logistics chain.

The movement of personnel and military supplies from foreign locations to Hawai'i potentially facilitates the entry of non-native species that travel as hitchhikers in general cargo or associated with specific commodities. Military movements from locations within the U.S. to JBPHH, likewise, are potential pathways for the entry of non-native species new to Hawai'i. Once in Hawai'i, some of these personnel and supplies are dispersed throughout the state to support other DoD facilities and programs. This provides more opportunities for invasive species to be relocated to other islands in the state (and to O'ahu on return). Further, movement of personnel, equipment and supplies for routine DoD activities within Hawai'i are also often routed through JBPHH, in preference to direct movements between islands (see Figure 6.1).

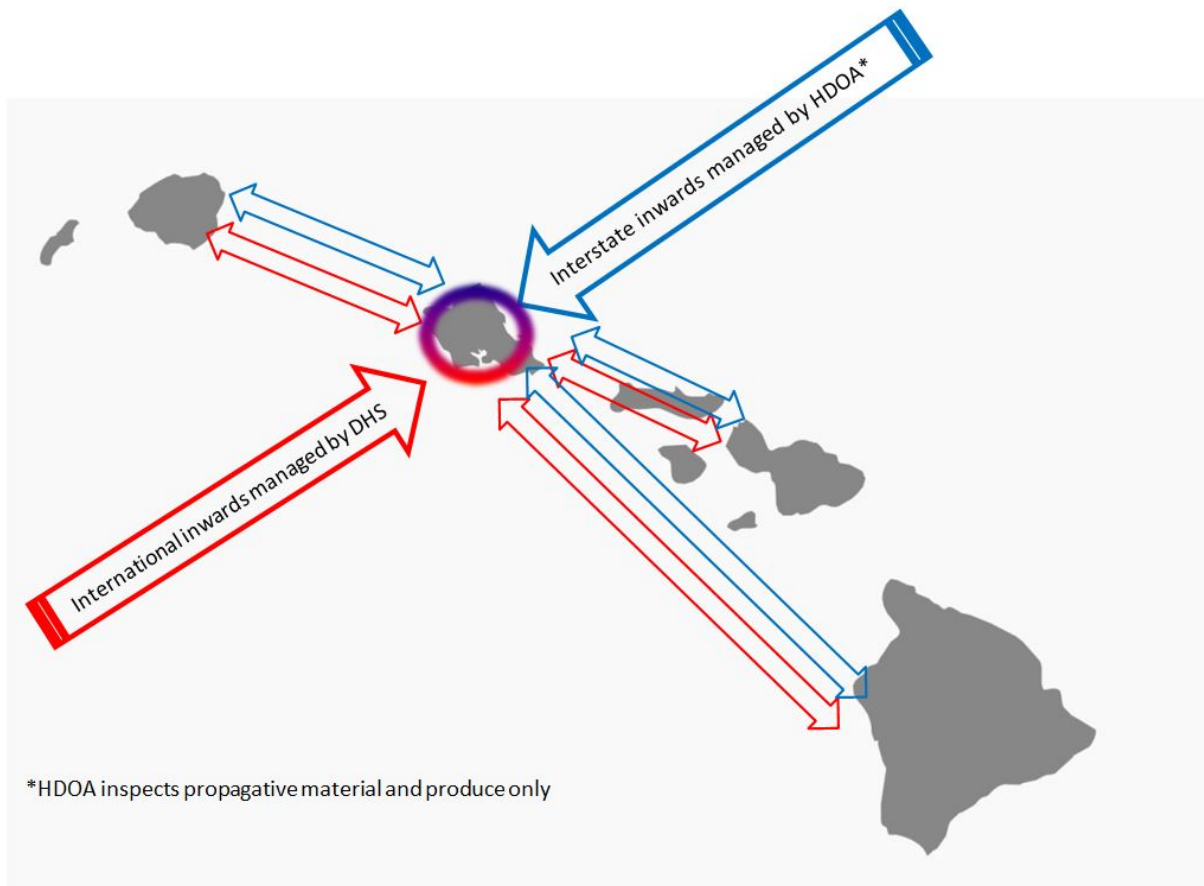


Figure 6.1: Flow of cargo and personnel arriving at JBPHH from international and interstate sources before moving to and from neighbor islands in the State. Red arrows – foreign, blue arrows – domestic.

The development of a biosecurity plan for JBPHH is a recommendation of the facility INRMP (rec 13, p9-5)¹⁴ and could be considered as a sub-plan of that document. Both plans are relevant to the JBPHH facility and also relate to the Regional Biosecurity Plan for Micronesia and Hawai'i. The regional plan contains some recommendations relevant to JBPHH²³. The Hawai'i Interagency Biosecurity Plan²⁴ also contains a number of recommendations relevant to DoD and JBPHH specifically. Table 6.1 shows how the recommendations in this plan relate to the Regional Biosecurity Plan for Micronesia and Hawai'i; and the Hawai'i Interagency Biosecurity Plan.

Table 6.1: Summary of JBPHH Biosecurity Plan recommendations and relationship to the Regional Biosecurity Plan for Micronesia and Hawai‘i and the Hawai‘i Interagency Biosecurity Plan. Critical recommendations are highlighted.

	Recommendation	Regional Biosecurity Plan for Micronesia and Hawai‘i Appendix M²³ Action Items and Recommendations. Superscript numbers in this column indicate discrete Action Items from the Regional Biosecurity Plan for Micronesia and Hawai‘i Appendix M.	Hawai‘i Interagency Biosecurity Plan²⁴
3.a	Review JBPHH rules, practices and procedures to ensure they comply with relevant Executive Orders ⁹⁻¹¹ and DoD policies contained in Defense Transportation Regulation Part V ⁴⁻⁵ .	Revise and update military guidelines and SOPs for biosecurity. In some cases, the military uses outdated guidance with inaccurate information. For example, the OPNAVINST 6210.2 lists only the States, District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands as the U.S., notably excluding the CNMI and American Samoa (7 CFR § 330.400[a] and 9 CFR § 94.5[a]). ^{AI10} Ensure that appropriate biosecurity policies and procedures such as HACCP are in place and enforced. ^{AI27}	-
3.b	Mandatory adoption of TG31⁶⁰ for all materiels, vehicles, equipment and personal items arriving or being transshipped through JBPHH will dramatically reduce the risks of spreading invasive species and comply with Executive orders 13112¹⁰ and 13751¹¹ as well as the Defense Transportation Regulation Part V⁵.	Action Item 10 Construction and other commercial equipment must be inspected, cleaned, and washed down prior to arrival at the port of entry. Inspection and decontamination as needed at port of entry. Tracked vehicles can be cleaned on shore only if they can be reloaded without recontamination of the treads; otherwise they should be cleaned on the ship’s well-deck. They should be cleaned to USDA-APHIS standards (USDA-APHIS-PPQ Treatment Manual 2008) prior to shipment from the port of departure. Vehicles may be cleaned at the port of entry provided wastewater soil is collected and drained fully into an approved collection system. ^{AI23} Military aircraft and other military vehicles arriving as maritime cargo should be inspected, cleaned, and washed down at a retrograde wash facility before entry. Inspection and decontamination at port of entry as needed. Wash down procedures for military vehicles should target soil, plants, insects, and other wildlife. Tracked vehicles can be cleaned on shore only if they can be reloaded without recontamination of the treads; otherwise they should be cleaned on the ship’s well-deck. They should be cleaned to USDA-APHIS standards (USDA-APHIS-PPQ Treatment Manual 2008) prior to shipment from the port of departure. Vehicles may be cleaned at the port of entry provided wastewater soil is collected and drained fully into an approved collection system. ^{AI25}	BorTifs2.2
3.c	Consideration be given to implementing a system similar to the New Zealand / Australian sea container hygiene system for general cargo and containerized items.	Inspect and clean all incoming containers, conveyances and construction materials that arrive through DoD controlled ports of entry with soil and/or exotic plant and animal pests including materials previously treated or cleaned if re-contaminated after treatment. ^{AI29} Capacity training on sea container hygiene and the development of SOPs	PrePol2.1

	Recommendation	Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M²³ Action Items and Recommendations. Superscript numbers in this column indicate discrete Action Items from the Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M.	Hawai'i Interagency Biosecurity Plan²⁴
		regarding container hygiene would support better compliance with acceptable standards such as where to place containers and preventing pests from entering or being stuck to the outside of containers prior to shipping. ^{AI40}	
3.d	Review existing BTS prevention program and develop a similar pre-border protocol for CRB. Strengthen on-shore survey trapping and interception activities for these species at JBPHH to include intensive trapping at both sea port and airport cargo areas.	Increase efforts to eradicate targeted IAS. Improving this ability should be a long term commitment. Species targeted for eradication should be identified in each facilities IAS management plan. ^{AI66}	-
3.e	Develop a pre-border prevention program for the red imported fire ant to be implemented at applicable source locations for cargo shipments to Hawai'i. Strengthen on-shore survey trapping and interception activities for this species at JBPHH, including include regular (annual or more frequent) surveys at both sea port and airport cargo areas.	Support the establishment of a biosecurity pre-clearance program in Okinawa, Japan for materials associated with the relocation departing Okinawa for Guam, Hawaii, and the CNMI. ^{AI41} Biosecurity emphasis should be directed towards audited off-shore hygiene systems such as those utilized very successfully in Australia and New Zealand. As an example, all large equipment such as construction and military items intended for importation should be cleaned and inspected for IAS prior to loading. Treat (clean) if necessary immediately prior to shipping. ^{AI46}	PrePol2.1
3.f	Provide transferees to JBPHH with clear information regarding the importance of invasive species and their impacts to Hawai'i ecosystems and economy. Include instructions for cleaning and disinfestation of household items and personal possessions.	Enhance training for military personnel and their dependents about phytosanitary and general sanitary regulations and the risks of sending or receiving agricultural and wildlife materials in the mail. ^{AI60} Develop appropriate, comprehensive education and awareness programs within DoD for biosecurity including IAS prevention. This should cover military personnel and their families as well as contracted workers and their dependents. Such programs shall be extended into DoD schools. ^{AI69} Support development of posters, brochures and other print media to support invasive species awareness campaigns. ^{AI71} Implement a targeted outreach program for DoD installations in Micronesia and Hawaii. Ensure program addresses active duty and civilian workforce, and includes specific guidelines on the methods known to minimize species transfers associated with small boats, jet skis, other water sports gear, and diving gear. In addition to providing guidance on marine related actions, ensure the program also addresses guidelines to follow as it applies to terrestrial items of interest, such as the movement of household goods, cars, and other pack out items. ^{AI72}	-

	Recommendation	Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M²³ Action Items and Recommendations. Superscript numbers in this column indicate discrete Action Items from the Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M.	Hawai'i Interagency Biosecurity Plan²⁴
4.a	Find, update and catalogue existing survey protocols for invasive species detection at the border.	All jurisdictions should develop well thought out plans for response to incursions of IAS. In areas where DoD has facilities or otherwise operates, DoD should work with local authorities to insure that DoD actions and activities are adequately covered response planning. ^{AI20}	BorPro1.6 PosPro4.4
4.b	Develop a survey work program for JBPHH that includes existing protocols and develop new protocols for species not currently covered.	Action Item 20	BorPro1.6
4.0c	Provide instructions to operational staff that includes procedures at time of detection and contact details for appropriate NAVFAC or other personnel. Instructions include procedures for both inbound and outbound cargo and materials.	Action Items 69, 71, 72,	BorTifs2.2 PosPro1.4
4.d	NAVFAC should consider whether a regular trapping program around loading/unloading facilities is warranted.	INRMPs and NMRPs (JRM, NRH, KWAJ, Wake, Palau) shall depict IAS monitoring and surveillance, detection, rapid response actions for all taxa to ensure biosecurity efforts are planned and funding is requested. ^{AI1}	-
4.e	Review the BTS interdiction program to ensure all Hawai'i points of entry controlled by the DoD are surveyed adequately, in both spatial and temporal contexts. This may indicate a need to expand the current survey areas.	Finalize and utilize the Joint Region Marianas Instruction: BTS control and interdiction. ^{AI13} Action Item 66	-
4.f	Provide regular (annual or semi-annual) education and awareness material to operational staff. This information should include procedures at time of detection and contact details for appropriate NAVFAC or other personnel as well as biosecurity procedures for both inbound and outbound cargo and materials.	Action items 60, 69, 72	-
4.g	Provide detailed information to personnel deploying to JBPHH to ensure these species are not brought with deploying personnel or their families.	Action Items 60, 69, 72	-
4.h	NAVFAC should expand and formalize the current bird strike reporting system to include any and all potential incidents involving bird strikes or the carriage of living avian fauna or parts thereof.	Action Item 66	-

	Recommendation	Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M²³ Action Items and Recommendations. Superscript numbers in this column indicate discrete Action Items from the Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M.	Hawai'i Interagency Biosecurity Plan²⁴
4.i	Annual or more frequent surveys of JBPHH for all invasive ant species using accepted protocols for survey and identification.	Recommendation: Support regional biosecurity and invasive species control efforts.	-
4.j	Protocols that encourage or mandate reporting of insects that are observed within key areas; including around airports and runways, loading and unloading facilities, designated staging areas and when packing or unpacking cargo.	Action Item 72	-
4.k	Develop standard operating procedures for base personnel to follow in instances where a suspected exotic species is observed.	Action Item 72	PosPro1.6 PosPro4.4
4.l	Create designated locations for holding staged or trans-shipped cargo and have these maintained in a pest free state by applying appropriate residual pesticide barriers.	Establish appropriate decontamination sites for cleaning both military and civilian equipment associated with military activities. ^{AI28} All departing vehicles, equipment and materials should be properly inspected, cleaned, and washed at laydown area prior to departure. Subject to wash down and canine inspection requirements, vehicles should be loaded on to transport vessels for immediate transport. ^{AI38} Develop cleaning facilities (wash racks, etc.) at all DoD installations where warranted and provide appropriate training for military personnel to utilize these facilities. ^{AI68}	-
4.m	Review current cleaning requirements and implement more rigorous cleaning requirements for vehicles where gaps exist.	Ensure JRM/NVH Biosecurity Instruction addresses proper cleaning of equipment and materials prior to moving between sites within a jurisdiction (example: movement of vehicles between training sites and storage facilities within the state of Hawaii). ^{AI65} Action Item 68	-
4.n	Adoption of the AFPMB Technical Guide 31 for cleaning of clothing and equipment used during movements between islands in Hawai'i.	Revise and update military guidelines and SOPs for biosecurity. In some cases, the military uses outdated guidance with inaccurate information. For example, the OPNAVINST 6210.2 lists only the States, District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands as the U.S., notably excluding the CNMI and American Samoa (7 CFR § 330.400[a] and 9 CFR § 94.5[a]). ^{AI10} Action Item 65	PosPol1.3

	Recommendation	Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M²³ Action Items and Recommendations. Superscript numbers in this column indicate discrete Action Items from the Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M.	Hawai'i Interagency Biosecurity Plan²⁴
5.a	Identify, document and liaise with all authorities having jurisdiction for incursions new to the U.S., new to Hawai'i and new to O'ahu.	<p>Establish agreements (MOUs) between DoD and local agencies tasked with IAS control and management in specific jurisdictions where DoD operates. If not already in place, it should become SOP for DoD and specific jurisdictions to communicate and work in tandem to ensure appropriate biosecurity mechanisms are in place for all DoD activities related to individual jurisdictions. Activities covered by the MOU should include but not be limited to the facilitation of response planning, identification of command structure, and support of response actions to biosecurity threats posed by DoD activities. ^{AI3}</p> <p>Continue to improve partnering with civilian agencies (in each location where DoD has facilities) in regards to biosecurity. The military should have at least one invasive species biologist, in addition to a supporting pest control shop or equivalent contract team at each DoD facility working in conjunction with local authorities to monitor for pests, to conduct biosecurity inspections, to respond to incursions, and to implement management efforts as needed. Improvements to existing systems, communication, and partnering with local civilian agencies should continue to be advanced. ^{AI5}</p>	PosPol1.3
5.b	Ensure all control and surveillance supplies and the equipment necessary to apply them are readily available at the time they may be required.		-
5.c	Access to, and authority to utilize, emergency funds as required to address an emerging incursion threat.		-
5.d	Establish a DoD "biosecurity advisory committee" (BAC) comprised of representatives from relevant agencies to facilitate regular exchanges of information and communication on shared issues.	Action Item 3	BorPro1.4 BorPro3.1 BorPro3.2
5.e	Develop a reporting system that utilizes all facility personnel as first detectors should be closely synchronized with the pre-border outreach strategy.	Recommendations: Improve border security. Ensure long-term support for biosecurity efforts within the region.	-
5.f	Formalize and implement a process for investigating and assessing new detections which includes provision of relevant information to the NAVFAC Help Desk.	Recommendation: Improve facilities IAS management.	-
5.g	Document agreed lines of communication during an initial	Recommendations:	-

	Recommendation	Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M²³ Action Items and Recommendations. Superscript numbers in this column indicate discrete Action Items from the Regional Biosecurity Plan for Micronesia and Hawai'i Appendix M.	Hawai'i Interagency Biosecurity Plan²⁴
	response. Communicate these lines to all personnel.	Improve facilities IAS management. Improve awareness of biosecurity and invasive species.	
5.h	The BAC should use a logical decision-making process that considers the feasibility and likely outcomes of all management options and communicate those recommendations to the Installation Environmental Program Director (IEPD).	Recommendations: Improve communication, facilitation, and joint biosecurity activities with civilian counterparts. Support improvement to biosecurity elements of partnering militaries. Improve border security. Improve pre-departure and pre-arrival biosecurity.	-
5.i	Progression of a multi-agency response should be structured within the National Response Framework, including the National Incident Management System.	Recommendation: Improve border security.	-

6.1 PRE-BORDER RISK REDUCTION

Pre-border risk reduction tactics aim to reduce the amount of contamination in, or on, incoming cargo and personnel. This can be achieved at JBPHH by facilitating off-shore hygiene systems, and increasing the level of awareness for new deployees.

Hygiene and cleaning systems conducted at the source points rather than arrival points can be more effective at reducing the rate of invasive species introductions because net slippage is reduced. JBPHH has some control over arriving cargo and personnel and systems similar to the New Zealand off-shore hygiene systems could be implemented with the cooperation of source points, whether these are of foreign or domestic origin. Preclearance activities make up part of the U.S. Customs and Border Protection biosecurity system for the movement of materials and personnel from foreign locations⁴. These systems could be expanded if so directed by DoD, especially for items arriving from interstate ports. These shipments are potentially contaminated with invasive species already in the continental U.S. but not in Hawai'i and thus less likely to draw the attention of facility personnel. Current standard operating procedures, guides and instructions for international shipments^{4, 5, 47} could be expanded to include cargo from U.S. ports.

Most importantly, training and awareness programs for all facility personnel are an essential element of any prevention strategy and these should start prior to personnel arriving at a new posting. There is an ongoing turnover of military and civilian personnel at JBPHH, some bringing family and household belongings from their previous posting CONUS. Not all will be aware of the biosecurity considerations unique to Hawai'i, or that pests they have long considered to be common are actually absent from the State. As a consequence, household belongings are not always checked to remove these common pests prior to transport. Items such as gardening tools, lawnmowers, recreational vehicles, boats and associated equipment can harbor both aquatic and terrestrial pest species that are not currently present in Hawai'i. When coupled with a facility-wide ethos that emphasizes the importance of biosecurity, an increase in awareness is likely to result in a corresponding decrease in the entry of new pests.

6.2 SURVEY, MONITORING AND REPORTING

Although jurisdiction for border biosecurity is vested with other agencies, there are additional actions that can further support biosecurity measures at the border. The two most valuable of these are early detection surveys and promoting an ethos of biosecurity awareness among facility staff.

New invasive species are often first detected at points of entry and exit after being dislodged from cargo or escaping during devanning. At this early stage of the invasion process, the new organisms are often not well established and more vulnerable to efforts to contain or destroy them. Eradicating these species before they spread or become entrenched is more cost effective than

attempting to contain or control a larger population or wider distribution of the same pest. Currently, early detection activities are not coordinated and some operate independently from each other. A comprehensive plan for regular surveys of the facility for known and unknown threat species will substantially reduce these risks. This can be achieved with a program dedicated to coordinating these surveys and implementing additional survey activities to ensure any gaps in the early detection system can be identified and addressed.

The role of first detectors, (personnel at the facility engaged in handling cargo or other related tasks not directly related to biosecurity) cannot be over emphasized. JBPHH is comprised of 21,090 acres (8,535 hectares) of land and 40,199 acres (16,268 hectares) of water. Early detection surveys mostly focus on defined areas where risks are deemed to be highest. However, invasive species can potentially be found anywhere on the facility. Personnel engaged in non-biosecurity related activities are extremely valuable as first detectors because they are often the first to encounter these species whilst undertaking other routine activities. These sightings are likely to go unreported unless those personnel have the knowledge and awareness of the importance of these observations, and a means of communicating suspect incursions to responsible persons.

Biosecurity must be promoted as an important component of the overall mission, not simply an add-on consideration. Awareness, training and reporting need to be standardized and include clear and simple messaging. The use of focus species (one representative species from each representing a group of similar species) as outlined in earlier sections will help to ensure that key messages are kept clear and easily understood. However, success is predicated on a facility wide ethos that values biosecurity as a core part of the mission. Without the full support of management at all levels, both military and civilian, it is unlikely that any attempts at increasing awareness and cooperation will be effective.

6.3 INTRASTATE BIOSECURITY

Implementing international biosecurity practices for intrastate movements will prevent many invasive species from establishing on neighbor islands. Currently there is no overarching biosecurity program that prevents the movement of invasive species between islands^{##}. Conventional biosecurity systems, which depend largely on inspection and interception of invasive species at points of entry, may be costly and difficult to implement because each island has multiple points of entry and some military movements occur in remote areas. Some of these activities occur in or near to protected areas which makes this risk especially important. However, the central role that JBPHH fulfils for intrastate military movements makes it an excellent location for

^{##} HDOA is responsible for regulating the movement of propagative material and agricultural produce.

implementing a broader intrastate risk reduction strategy that includes a requirement for preparing and cleaning personnel, equipment and gear prior to movement.

Standard operating procedures currently used for preparing equipment and gear for movement from non-CONUS locations to CONUS^{4, 5, 20, 21, 46, 47, 60} could also be used for intrastate movements. A direction to use these same SOPs before movement to other locations and prior to their return to JBPHH has the potential to prevent the spread of invasive species without a need for inspection or interception. The use of existing standard operating procedures will reduce confusion and training requirements. SOPs developed by the Armed Services Pest Management Board⁶⁰ cover most if not all situations likely to be encountered at JBPHH.

6.4 INCURSION PREPAREDNESS AND RESPONSE

A robust plan outlining the appropriate response and correct lines of communication for responding to a newly detected invasive organism is essential for a rapid and coordinated response. Additionally, sub plans for specific species or species groups help to prepare personnel for responding to specific threats and provide a reference for supply and equipment needs in advance of an incursion.

Response to the detection of an invasive species is complicated by agency jurisdictions, a requirement to adopt a pre-specified management system and coordination between and within agencies. To this end, the establishment of an advisory panel comprised of representatives from federal, local and state governments, invasive species agencies and other relevant bodies can do much to streamline responses and achieve desired outcomes. Both the Hawai'i Interagency Biosecurity Plan and the Regional Biosecurity Plan for Micronesia and Hawai'i recommend the formation of similar committees to promote a cooperative approach to mitigation, resources and information at regional and state levels. Establishing multiple committees that each attempt to coordinate aspects of invasive species management in Hawai'i may be counter-productive and it is more logical for DoD and related agencies to coordinate in the formation of a single over-arching technical advisory body.

The prime purpose of the JBPHH biosecurity advisory committee is to guide the initial response, provide a channel of communication, and evaluate technical aspects of the response. The BAC, after exploring the technical data, provides decision makers with the best technical information with which to make a decision on how to proceed. Key initial considerations include:

- Is there an effective available treatment, method or therapy for destroying the target organism?
- Is it technically feasible to eradicate the target organism given its known distribution and other

factors^{§§}?

- What methodology is proposed and what inputs (human and capital) will be needed?
- Based on technical data, is eradication feasible and if not, what type of response is recommended?
- What is the probability of successful eradication?
- What is the cost of failure or inaction in the environmental, social and economic terms?
- What method will be used to validate whether or when eradication is achieved or targets met?

The flow chart in Figure 5.2 shows how these factors might be considered by the committee but invariably the decision on whether to proceed as recommended (or how) will be made elsewhere in the chain of command by the appropriate personnel. Decision makers should consider the following non-technical factors:

- What is the estimated cost of eradication compared with other management options?
- Are there externalities or other impediments that would compromise the response or the facility mission?
- Is there a source of funds and should those funds be expended on this response?
- Are required human resources available?
- How does each control option (see Figure 5.2) impact the mission of the facility and/or broader regional mission; both positive and negative?
- Which agency will lead the response?

6.5 CONCLUSIONS

The current biosecurity system at JBPHH is managed and implemented by U.S. Customs and Border Protection (international) and the Hawai'i Department of Agriculture (domestic) in accordance with the laws, policies and procedures of their respective agencies, and do not differ substantially from those at civilian airports and seaports. However, in order to comply with the standard of care required by laws and directives, a more comprehensive suite of actions are needed. For this to succeed, JBPHH personnel, whether military or civilian, active duty or logistics, management or tenant commands all need to contribute. The recommendations of this plan are intended to supplement existing systems by identifying opportunities to improve biosecurity outcomes in areas not currently addressed by existing systems.

Improving biosecurity practices at this facility presents the difficult operational challenge of optimizing outcomes with finite resources. Central to this plan are four central themes without

^{§§} Budgetary factors are not used to determine technical feasibility.

which, additional efforts are unlikely to succeed:

- Promoting a culture of biosecurity as a shared responsibility,
- Provision of training, awareness and the concept of personnel as first detectors,
- Developing an effective communication system for information and reporting,
- Establishment of a technical advisory committee.

6.5.1 Promoting biosecurity as a shared responsibility

JBPHH is a large and diverse facility with numerous military, civilian and tenant command structures. The complexity of these interacting systems can interfere with the development of a shared culture, and work ethos. In order for any facility-wide biosecurity system to be effective, the concept of preventing invasive species needs to be an integral part of the facility ethos and must permeate through all command structures and tasks. Without a conscious effort on the part of all management structures, incorporating biosecurity-related tasks and values into daily activities becomes difficult if not impossible. Therefore the implementation of any plan to strengthen biosecurity needs to begin with the promotion of these shared values and responsibilities and this requires all command structures to “buy in” to this concept.

6.5.2 Provision of training and awareness

Awareness of biosecurity issues should start before deployment, especially for personnel deploying from CONUS (see sec 6.1). Reaching these personnel before they arrive begins the process of changing values and behavior; and encourages personnel to check and clean high risk items for invasive species before packaging these for transport to Hawai‘i. Once arrived, these personnel should attend regular awareness sessions that reinforces these values and builds on their knowledge of invasive species and their impacts. With the support of the various command structures at the facility, all personnel can be called on to look out for suspect new invasive species and report these to the relevant office.

6.5.3 Develop an effective communication system

The person who observes a suspect invasive species needs to know who to call and what to do. This requires an effective communication system which allows the free flow of information up the chain of command, instructions down to subordinate staff and collaboration between command structures. For example, logistics personnel need to know to which office they should report suspect biosecurity breaches; groups returning from inter-island activities need to know which SOPs apply before their departure and return; and who to ask if they are not sure. A well-defined communication system is essential even for simple management structures and even more important where multiple agencies manage personnel in the same location. The use of the NAVFAC Help Desk, as recommended earlier, is the most logical hub of this communication system, and phone staff should be able to immediately direct a call to the correct office and know what basic information should be collected at the time of a report.

6.5.4 Establishment of a technical advisory committee

Rapid actions and decisive directions early in the response stages increase the odds of success dramatically. A committee comprised of representative personnel from across the facility, the various command structures, agencies with jurisdiction, resources, or a shared interest and technical experts as needed will greatly facilitate positive biosecurity outcomes. There are few opportunities to remove a new invasive species once it is detected and a rapid response is more likely to achieve positive and cost effective outcomes.

Biosecurity is a shared responsibility. Developing an effective and robust biosecurity system for JBPHH will take time, effort and resources. Most importantly, it requires all personnel, regardless of their duties or rank, to actively participate in addressing these challenges.

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J-14 JBPHH Greenwaste Policy

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DEPARTMENT OF THE NAVY
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11000
JB00/Ser 818
29 Oct 18


From: Commander, Joint Base Pearl Harbor-Hickam


Subj: JOINT BASE PEARL HARBOR-HICKAM GREENWASTE POLICY

Encl: (1) Map for Greenwaste Disposal

1. All greenwaste cleared or generated on any Joint Base Pearl Harbor-Hickam (JBPHH) property (to include all outlying annexes and properties) must remain on JBPHH property. Follow below specifications regarding drop-off site as well as whether or not greenwaste can be chipped or left whole. Greenwaste generated on JBPHH cannot be taken to other non-JBPHH work site(s). Additionally, no inter-mixing of greenwaste from any non-JBPHH source is allowed. If any life stage of Coconut Rhinoceros Beetle (CRB) or suspected CRB is found, stop greenwaste clearing and call Hawaii Department of Agriculture Pest Hotline at 808-643-PEST (7378).

2. Zones for Whole vs. Chipped Greenwaste - Enclosure (1).

a.  WHOLE (includes Hickam, Pearl Harbor Waterfront and Shipyard, Navy Marine Golf Course, Navy Makalapa area, Navy Moanalua area, McGrew Point and Ford Island). All greenwaste generated in this zone must be kept whole and delivered within 24 hours to the Fire Training Area (FTA). See FTA location on map. During 24-hour period, material must be contained using an approved cover/tarp. No stockpiling/staging of any form of greenwaste allowed. No chipping in this zone allowed. Once cleared, no form of greenwaste can be left on the ground. Following is stump grinding protocol. All trees (to include palms) should be cut in 3-foot sections with fronds/small branches left whole. Oversized trunks may need a waiver.

b.  CHIP (includes: Pearl City Peninsula, Waipio Peninsula, West Loch, Lualualei, Barber's Point Golf Course/Kalaeloa and NCTAMS/Wahiawa Annex). All greenwaste generated in this zone must be chipped and transported to the Bio-Solid Treatment Facility (BTF) within 24 hours. See map for BTF location. If 24-hour period includes overnight, material must stay on JBPHH and in a fully enclosed container/vehicle with immediate next-day delivery to BTF. During transport to BTF, if vehicle is not fully enclosed, vehicle must use an approved cover/tarp to cover an open top/back truck bed during transport. No stockpiling or staging of any form of greenwaste is allowed. Once cleared, no form of greenwaste can be left on the ground. Stump grinding protocol is defined below.

3. Waivers to Policy.

a. Any waiver to the above policy must be approved via waiver application point of contact. Waivers may be granted that allow for changes to the form of greenwaste, i.e., chipped versus whole or to the specific drop-off location that can be used. No JBPHH greenwaste can go to off-site treatment facilities (HECO and/or Hawaiian Earth Products) unless advanced approval is granted via waiver application.

Subj: JOINT BASE PEARL HARBOR-HICKAM GREENWASTE POLICY

b. If no waiver is granted, then above guidelines must be followed.

4. Stump grinding: All stump grinding on JBPHH (including all outlying properties and annexes) shall follow contract specific guidance in addition to grind stump 12-18 inches down. Ground material will be delivered to an approved composting facility within 24 hours. Stump hole will be filled with topsoil and covered with sod.



S. R. KING
By direction

FOR INQUIRIES REGARDING GREENWASTE POLICY/WAIVER APPLICATION, CONTACT:

CORRINA CARNES (808) 291-9053 OR CORRINA.CARNES.CTR@NAVY.MIL

FIRE TRAINING AREA (FTA) AND BIO-SOLID TREATMENT FACILITY (BTF) CONTACTS:

LONNIE FELISE (808) 347-2645

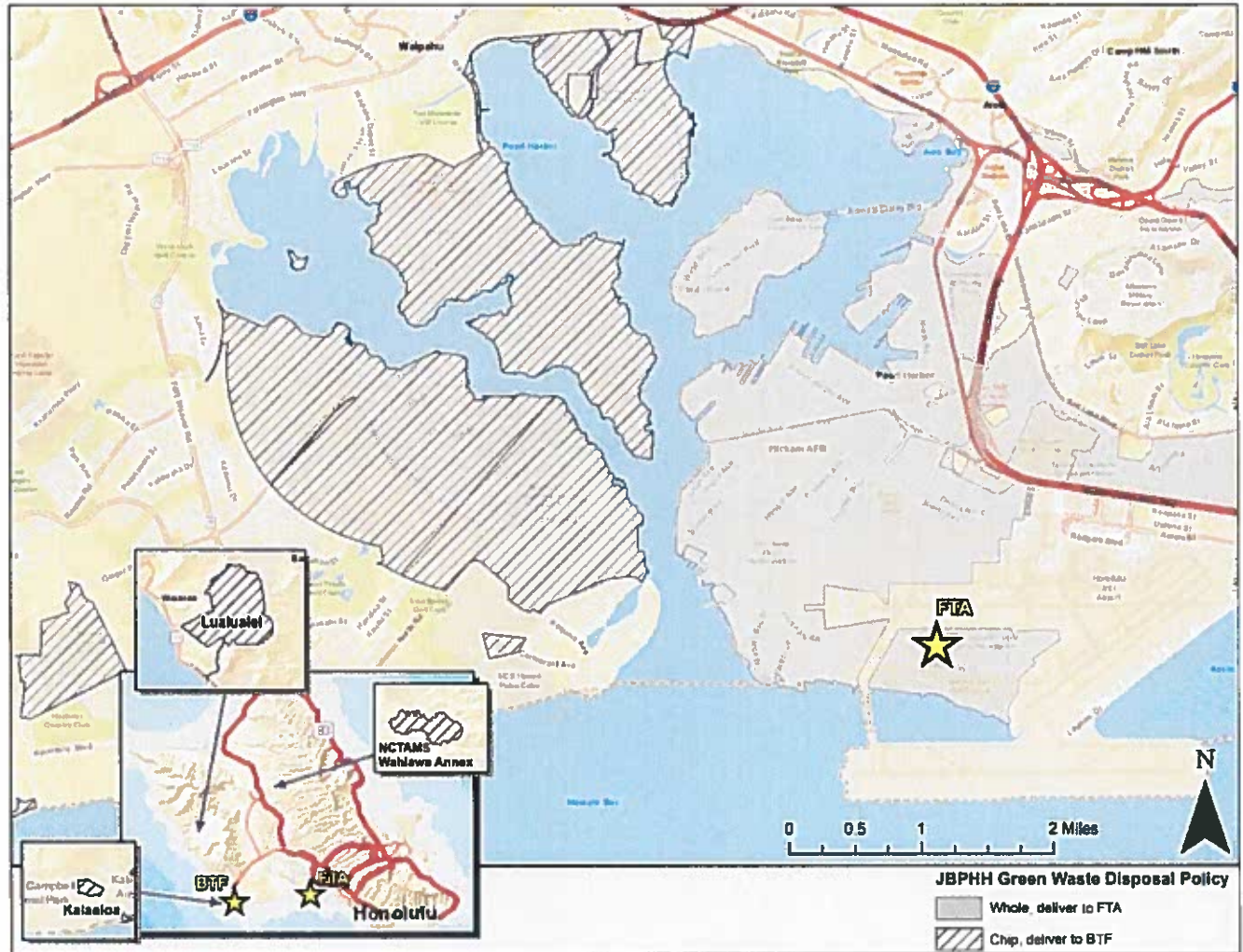
OR

ED DURLAO (808)-347-2639

LONNIE.FELISE@NAVY.MIL

EDWIN.DURLAO@NAVY.MIL

NOTE: BTF CAN RECEIVE NON-NAVY DOD CHIPPED GREENWASTE ON A CASE BY CASE BASIS. CONTACT BTF POC FOR APPROVAL



BTF

BIO-SOLID TREATMENT FACILITY @ BARBER'S POINT

2187 LAKE CHAMPLAIN ST.

KAPOLEI, HI 96707



FTA

FIRE TRAINING AREA @ HICKAM

WORCHESTER DRIVE

(ACROSS STREET FROM MAMALA BAY
GOLF COURSE)

Enclosure (1)

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J-15 JBPHHINST 5510.4 Fishing Instruction

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JOINT BASE PEARL HARBOR-HICKAM INSTRUCTION

SUBJ: JOINT BASE PEARL HARBOR-HICKAM REGULATIONS FOR RECREATIONAL FISHING

REF:

- A. JBPHHINST 5560.1A TRAFFIC REGULATIONS
- B. JBPHHINST 5510.3 SEA AREA ENTRY REGULATIONS FOR RECREATION
- C. SIKES ACT 16 USC 670a-670o, 74 Stat. 1052, as amended, Public Law 86-797
- D. ENDANGERED SPECIES ACT OF 1973 (16 U.S.C. 1533)
- E. DODI 1015.10 MILITARY MORALE, WELFARE, AND RECREATION (MWR) PROGRAMS
- F. JBPHHINST 5510.1B BASE ACCESS
- G. JBPHHINST 5560.2 PARKING REGULATIONS
- H. MARINE MAMMAL PROTECTION ACT (MMPA) 16 U.S.C. §§1361-1383b, 1401-1406, 1411-1421h
- I. DoDI 5525.17 DOD CONSERVATION LAW ENFORCEMENT PROGRAM
- J. DoDI 4715.3 NATURAL RESOURCES CONSERVATION PROGRAM
- K. SECNAV M 5210.1 RECORDS MANAGEMENT PROGRAM
- L. OPNAVINST 5215.17A NAVY DIRECTIVES MANAGEMENT PROGRAM MANUAL

ENCLOSURES:

(1) RECREATIONAL FISHING SIGN GUIDE

1. Purpose. This instruction sets forth the regulations, terms, conditions and provisions regarding recreational fishing aboard Joint Base Pearl Harbor-Hickam (JBPHH). To ensure consistency, regulations regarding fishing are established to ensure safety of personnel and conservation of natural resources aboard JBPHH.
2. Cancellation. This instruction reissues and renames enclosure (6) of JBPHHINST 5510.3 to establish policy and assign responsibilities for recreational fishing compliance with applicable federal, state and local statutory and regulatory requirements, for the integrated management of natural resources including lands, waters, coastal, and near-shore areas managed and/or controlled by the Department of Defense at JBPHH.
3. Background. In 1998, the State of Hawaii Department of Health issued a health advisory stating that fish and shellfish from Pearl Harbor should not be eaten because the fish and shellfish may contain chemicals that can be hazardous based on the animals' uptake of pollutants and contaminants. As of 2022, the

advisory remains in effect. Fishing in the Pearl Harbor Naval Defensive Sea Area (PHNDSA) and from the shorelines surrounding the PHNDSA is authorized only in certain areas and only on a catch-and-release, zero bag limit, utilizing pole and line gear. JBPHH Security Forces are responsible for patrolling and enforcing the requirements in applicable recreational fishing instructions as well as enforcing state and federal regulations applicable to fishing on JBPHH.

4. Definitions.

- a. Catch-and-release. The practice of fishing which involves the release of caught fish alive.
- b. Zero bag limit. Means you may not retain any fish, but take with immediate release is still legal.
- c. Take. The hunt, pursuit, catch, capture or killing of a fish or the attempt to hunt, pursue, catch, capture or kill a fish.
- d. Pole and line. Fishing gear consisting of a fishing pole, reel, and fishing line with a baited hook or artificial tackle.

5. Policy. Recreational fishing within the PHNDSA and from the JBPHH shoreline is authorized in designated areas only as pole and line fishing on a catch and release basis. Spearfishing, crabbing or net fishing is not allowed. Authorized fishing areas shown in Figure 1 are designated by signs in enclosure (1). Compliance with reference (F) is required for entry to Ford Island and shoreline areas within the fenced portions of JBPHH.

- a. This instruction shall not be misconstrued to permit any violation of federal or state laws or regulations.
- b. The provisions herein are applicable to the taking of all forms of marine life, including crustaceans (crabs) from the waters of Pearl Harbor.
- c. Scientific research activity. Nothing in this instruction is intended to authorize, inhibit or prevent any scientific research activity conducted by a scientific organization or educational institution. Persons planning to conduct scientific research activities on board JBPHH are encouraged to submit to the NAVFAC Hawaii Natural Resources Manager, 60 days or as soon as practicable prior to its start, a

scientific research plan for each scientific activity. Appropriate applications can be attained from the NAVFAC Hawaii Natural Resources Branch.

- d. Exempted fishing- The JBPHH Commanding Officer may authorize, for limited testing, public display, data collection, exploratory fishing, compensation fishing, conservation engineering, health and safety surveys, environmental cleanup, and/or hazard removal purposes, the target or incidental harvest of species managed under an INRMP (Integrated Natural Resources Management Plan) or fishery regulations that would otherwise be prohibited. Appropriate applications can be attained from the NAVFAC Hawaii Natural Resources Branch.
6. Discussion. Entry into any designated fishing area that requires entry onto JBPHH property requires that access first be authorized in accordance with JBPHH access instructions. (Ref. F) Entry will be subject to all Force Protection Conditions.
- a. The following are designated as authorized recreational fishing areas within JBPHH.

- (1) General Public Fishing Areas (defined in yellow in Figure 1.)

Middle Loch: The shoreline bordering Pearl Harbor Bike Path from Waipio Point Access Rd. Bridge to the bridge over Waiawa Rd. stream runoff, West of Waiawa Wildlife Refuge.

East Loch: The shoreline bordering Hawaiian Electric Company (HECO) to Kalauao Stream Bridge.

Aiea Bay State Recreation Area: The Shoreline bordering Aiea Bay State Recreation Area.

West Loch Shoreline Park: The shoreline bordering West Loch shoreline park managed by Honolulu City and County Department of Parks and Recreation.

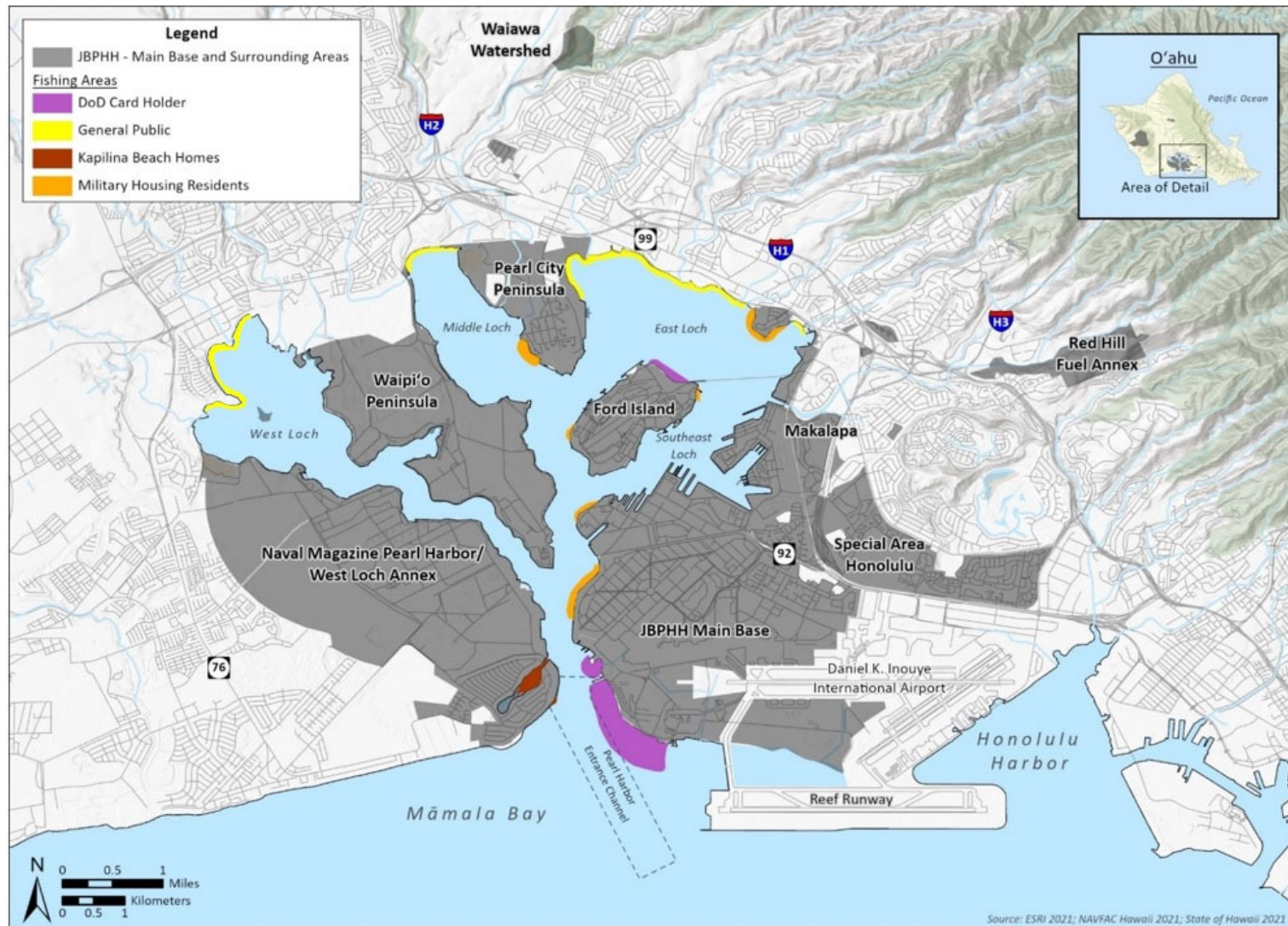


Figure 1 General Public Access Fishing Areas

- (2) Military Housing Residents Fishing Areas (defined in orange in Figure 1.) Fishing is restricted to the residents of JBPHH and their authorized guests.

Pearl City Peninsula: The west side shoreline from south of the pier at the end of Lanakila Ave. to the end of Coral Ave.

McGrew Pt.: The Shoreline bordering McGrew Point residential property.

Quarter K Housing, Ford Island: Fishing is restricted to the residents of Quarter K and their authorized guests.

Hospital Point: Hospital Point Housing including Charlie Landing. This area is restricted to the residents of Hospital Point Housing and their authorized guests.

Hickam Housing: The shoreline along the eastern bank of the channel entrance from the cross streets of Lake Erie St. and 6th Ave., bordering the Hickam Bike path to Alpha 7 Landing. Those persons engaged in fishing must leave the shore as directed by JBPHH security personnel during Navy vessel operations or training, which require that the area be clear.

- (3) DOD Card Holder Fishing Areas (defined in purple in Figure 1)

North Ford Island: The area on north side of Navy Lodge and adjacent to the dog park west of the bridge along the shoreline to the north shoal adjacent to Foxtrot 13 pier.

Hickam Coastline: Fishing is allowed between the Foster Point boat docks (next to the Hickam Harbor) along the shoreline to the western fence line of the NAVFAC Hawaii Wastewater Treatment Plant (WWTP). Fishing is not authorized on the pier located behind the NAVFAC Hawaii WWTP. Fishing is authorized along the Alpha Dock 7 and adjacent parking lot. Shore fishing is also permitted in the shoreline area adjacent to the Historic Fort Kamehameha housing area. Those persons engaged in fishing must leave the shore as directed by JBPHH security personnel during Navy vessel operations or training, which require that the area be clear. Fishing along the Channel Display area and north is not authorized. **Do not enter the**

JBPHH channel.

- (4) Kapilina Housing Fishing Areas (defined in red in Figure 1.)

Recreational fishing from the Kapilina Housing (formerly Iroquois Point Housing) is similarly on a catch and release, pole and line shore-based fishing only. The general public may fish alongside the south end of the Iroquois Point lagoon, from the shore area in the northeast where the lagoon opens to the channel, and on the south ocean side in the area where the canoes are located. See JBPHH 5510.3 for further regulations regarding fishing from this site.

7. Fishing Rules & Restrictions

- a. All those who utilize authorized fishing locations must conduct themselves in a courteous and environmentally protective manner. No one accessing the shore for fishing may cross an area being used as a residence, driveway or landscaped area. Smoking is discouraged. All trash, including derelict/used fishing line, shall be removed by the person fishing at the site. People fishing are encouraged to maintain the site and remove litter left by others.
- b. No Personally Owned Leisure Craft (POLC) is to be launched from any shoreline other than as indicated in reference B. No POLC shall anchor in Pearl Harbor waters in an area that will cause damage to coral reef structures.
- c. Only the shallow waters fronting the Fort Kamehameha Beach historic housing area also known as Ahua Reef may be entered on foot for pole and line fishing. Standing in the water is not allowed in other locations.
- d. Fishing from the Ships in Pearl Harbor. Commanding Officers of Ships moored at berths outside the Naval Shipyard may authorize crewmembers to fish from their own ship's decks.
- e. Use of pole and line is the only fishing method authorized throughout JBPHH. Subsurface fishing (spearfishing) is not authorized on JBPHH. **Use of nets or traps is also prohibited.**

- f. Those under 10 years old must be accompanied by a parent or guardian.
- g. All guests must be accompanied by personnel maintaining current DOD identification and guests must be accompanied by their host at all times while on JBPHH property (Reference F).

8. Fishing Safety

- a. Fishing is authorized in designated areas provided it does not interfere or endanger persons involved in other recreational activities. Possession or use of explosives, poisons, drugs, chemicals, electrical devices, or any unlawful fishing items is prohibited. Persons engaging in fishing will not interfere with or interrupt the activities of others engaging in recreational activities and/or military functions, i.e., picnicking, swimming, sunbathing and/or surfing. Fishing in any areas not specified by this supplement is prohibited. Vehicles shall be parked in authorized areas. Overnight camping or parking is not permitted in fishing areas on JBPHH. Violators are subject to JBPHH Security Forces apprehension and revocation of fishing privileges as well as enforcement of state and local laws as applicable.
- b. Fishing is authorized for Active Duty Military/Dependents, DoD/installation civilian employees/dependents and retired Armed Forces personnel/dependents with proper ID. Recreational Fishing is not authorized for JBPHH Contractors or temporary visitor pass holders unless they are sponsored by personnel with authorization to fish as listed above.
- c. Recreational fishing is allowed for all types of fish, but shall follow catch and release, zero bag, requirements.

9. Fishing Closures

- a. Fishing on JBPHH is subject to closure at any time for numerous reasons including but not limited to; military training requirements, protected species protections, by order of the Joint Base Commander, special events, significant trash and debris on site, etc.
- b. In accordance with references D and H, protected species closures are to ensure that Hawaiian monk seals and sea

turtles have appropriate rest areas and nesting areas without harassment or harm from human based activities. If a Hawaiian monk seal is sighted on lands or waters of JBPHH, all fishing activity in the area will be secured during the duration of the marine mammals' stay and will continue to be secured up to 24 hours after the last sighting of the animal. If a sea turtle nest is discovered on JBPHH lands fishing and shore based activities will be secured indefinitely until the hatchlings depart the nest and no other nest sites are found to be active. Flags and appropriate signs will indicate these conditions.

10. Records Management

- a. Records created as a result of this instruction, regardless of media and format, must be managed per Secretary of the Navy Manual 5210.1 of January 2019 (Reference K).

11. Review and Effective Date

- a. Per OPNAVIST 5215.17A (Reference J), JBPHH will review this instruction annually on the anniversary of its effective date to ensure applicability, currency, and consistency with Federal, DoD, SECNAV, and Navy policy and statutory authority using OPNAV 5215/40, Review of Instruction. This instruction will be in effect for 10 years, unless revised or cancelled in the interim and will be reissued by the 10-year anniversary date if it is still required, unless it meets one of the exceptions in OPNAVIST 5215.17A, paragraph 9. Otherwise, if the instruction is no longer required, it will be processed for cancellation as soon as the need for cancellation is known, following the guidance in OPNAV Manual 5215.1 dated May 2016.

Distribution:

https://www.cnmc.navy.mil/regions/cnrh/installations/jb_pearl_harbor_hickam/about/jbphh-instructions.html

ENCLOSURE 1 Fishing Signage:



Warning sign



Polluted Water



No Fishing



Off Limits Sign



Catch and Release sign



Prohibited Activities



No Fishing



Authorized Fishing Area

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**J-16 JBPHHINST 5510.3 Pearl Harbor Naval Defensive
Sea Area Entry Regulations**

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DEPARTMENT OF THE NAVY
JOINT BASE PEARL HARBOR-HICKAM
850 TICONDEROGA ST STE 100
JBPHH HI 96860-5102

JBPHHINST 5510.3
JB3
25 Jul 16

JOINT BASE PEARL HARBOR-HICKAM INSTRUCTION 5510.3

Subj : PEARL HARBOR NAVAL DEFENSIVE SEA AREA ENTRY REGULATIONS
FOR RECREATION

Ref: (a) OPNAVINST 5500.11E
(b) COMNAVREGHIINST 5500.5L
(c) COMNAVREGHIINST 5510.18D
(d) COMNAVREGHIINST 5510.23A
(e) JBPHHINST 5560.1

Encl: (1) Joint Base Pearl Harbor-Hickam (JBPHH) Watercraft
Permit Regulation
(2) Rainbow Bay Marina Recreation Area (RBMA) and Hickam
Marina Recreation Area (HMRA) Morale Welfare and
Recreation Operations
(3) Iroquois Point Marina Regulation (IPM)
(4) Allowed Uses within Area Fronting the
Former Iroquois Point Family Housing Area (IPFHA)
(5) Kayak Commuting Operations
(6) Recreational Fishing

1. Purpose. This instruction sets forth the regulations, terms, conditions and provisions under which recreational activities, including the entry of personally owned leisure craft (POLC), may occur within the Joint Base Pearl Harbor-Hickam Pearl Harbor Naval Defensive Sea Area (PHNDSA). This instruction amplifies references (a) through (e).

2. Discussion. The security of ships, submarines, forces and facilities at Joint Base Pearl Harbor-Hickam (JBPHH) during the various Force Protection Conditions (FPCONS) is the primary reason for restrictions on the use of POLC for recreational purposes within the PHNDSA. To ensure consistency, regulations regarding fishing and other recreational activities, including the rental of watercraft from JBPHH Moral Welfare and Recreation (MWR), are included in this instruction. JBPHH Security Forces are tasked with patrolling and controlling the PHNDSA.

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3. Operation of Personally Owned Leisure Craft

a. POLC refers to all watercraft in personal use, including, but not limited to, motorized and non-motorized boats of all types, jet skis, canoes, surfboards, paddle boards and kayaks, including watercraft rented from JBPHH MWR facilities. A motorized POLC is a subset of POLC's and includes fishing boats and sailboats with motors, but does not include jet skis and similar personal watercraft because they are not allowed within the PHNDSA.

b. Every person operating a POLC within the PHNDSA is to have in their possession a government-issued photo identification card which will be presented to JBPHH Security Forces personnel upon request.

c. No POLC may enter the PHNDSA without:

(1) Current registration with the State of Hawaii (except kayaks, surfboards, paddle boards etc...)

(2) A JBPHH watercraft permit provided in accordance with enclosure (1).

(3) Permission to move from the JBPHH Harbor Control Tower prior to movement. Requests to move shall be made by contacting the Harbor Control Tower.

d. Kayaks for Commuting. Those with access to JBPHH in accordance with reference (e) may be authorized in accordance with enclosure (5) to use a kayak to commute across the channel only in the lane between Lima Landing and Bishop Point Boat Ramp (A-7) as shown on Attachment A to enclosure (5). Kayaks used for commuting are subject to the watercraft permit requirements of enclosure (1).

4. General Conditions for POLC Use within the PHNDSA

a. Operators of POLC's within the PHNDSA shall strictly adhere to this instruction. Non-compliance may result in revocation of the JBPHH watercraft permit, exclusion from the PHNDSA, and military, civil and federal prosecution. All operators of POLC are required to have a current watercraft permit issued in accordance with enclosure (1) and shall

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surrender such permit upon demand by JBPHH Security Forces personnel or members of Port Operations.

b. When a JBPHH Security Forces patrol boat approaches a POLC within the PHNDSA, all personnel aboard shall make themselves visible, reporting topside if the POLC has a lower deck. All personnel over the age of 18 shall have in their possession a government-issued photo identification card which shall be made available to any JBPHH Security Forces personnel for examination upon request. If applicable, the POLC's registration and JBPHH watercraft permit will also be provided for examination upon request.

c. No POLC may enter South Channel, West Loch Channel or Middle Loch. Any POLC observed in any of these areas will have their watercraft permit immediately revoked and the operator and POLC will be escorted to shore or out of the PHNDSA.

d. All POLCs operating within or transiting the PHNDSA will remain clear of all other vessel traffic. All POLCs transiting the NDSA will do so directly and expeditiously.

e. POLCs with valid permits may enter RBMRA or HMRA for fueling and/or maintenance upon receiving permission from JBPHH Harbor Control. All such movements are restricted to daylight hours.

5. Communications. All POLCs with the exception of kayaks will monitor VHF channel 69 and check in and out with Harbor Control prior to departing berth and, if applicable, when the POLC arrives at the main channel Buoys one and two. No motorized POLC will be allowed to move within the PHNDSA without the ability to transmit and receive on VHF channel 69.

6. Fishing. In 1998, the State of Hawaii Department of Health issued an advisory stating that fish and shellfish from Pearl Harbor should not be eaten because the fish and shellfish may contain chemicals that can be hazardous based on the animals' uptake of pollutants and contaminants. As of 2012, the advisory remains in effect. Fishing in the PHNDSA and from the shorelines surrounding the PHNDSA is authorized only in certain areas and only on a catch-and-release, pole and line basis. Spear-fishing and net fishing are not allowed. Compliance with reference (e) is required for entry to Ford Island and shoreline

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areas within the fenced portions of JBPHH. Additional details are found in enclosures (4) and (6).

7. Authorized NDSA Movement Hours

a. FPCON Alpha

(1) All motorized POLC operators must contact Harbor Control via VHF channel 69 and request permission to enter or exit the harbor prior to doing so. When calling, the POLC operator shall provide the following information:

(a) Operator's name

(b) Valid watercraft permit number

(c) Number of passengers onboard

(2) Movement within the PHNDSA may be restricted or suspended with little or no notice as harbor operations dictate.

b. FPCON Bravo

(1) Harbor ingress/egress is restricted to the hours of 0600 to sunset.

(2) All POLC owners must request permission to move from Port Operations at least **24 hours in advance**, by calling and providing the following information:

(a) Operator's name

(b) Requested exit and return time and date

(c) Number of passengers onboard

(d) Valid watercraft permit number

*Kayaks are prohibited to transit from sunset to 0500.

(3) If approved, each POLC owner shall again contact the Harbor Control via VHF channel 69 and request permission to enter or exit the harbor prior to getting underway.

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(4) All vessel movement (POLCs and kayaks) within the PHNDSA may be restricted or suspended with little or no notice as dictated by JBPHH Port Operations.

c. FPCON Charlie and Delta

(1) No POLC movement is authorized from any location including RBMRA, HMRA, IPM and IPFHA. This includes all MWR rental craft and boating skills program movements.

8. Records Management. Records created as a result of this instruction, regardless of media and format, shall be managed per SECNAV Manual 5210.1 of November 2007.

A handwritten signature in black ink, appearing to be 'R. Smith', written in a cursive style.

R. SMITH

Distribution:
JB3

Website:
<https://g2.cnmc.navy.mil/tscnrh/JOINTBASEPEARLHARBOR-HICKAMHI/JBPHH%20Instructions/Forms/Instructions.aspx>

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JBPHH WATERCRAFT PERMIT REGULATION

1. The owner of each POLC wishing to enter the Pearl Harbor Naval Defensive Sea Area (PHNDSA), including any kayak owner wishing to commute by transiting the harbor channel, is required to obtain a permit from JBPHH Port Operations, Building 150, Room 114. Permits may be issued to active duty members, active reservists, retired armed forces personnel and DoD civilian employees. If a Personally Owned Leisure Craft (POLC) is registered with the State of Hawaii, the Joint Base Pearl Harbor-Hickam (JBPHH) permit will be valid until the expiration date of the State of Hawaii registration, or for one year, whichever is greater.

2. Permits are not issued to jet skis and similar personal watercraft because they are not to be used in the PHNDSA.

3. Permits are issued between the hours of 0730 to 1530, Monday through Friday after presentation of the following for POLC's other than kayaks:

a. A current Uniformed Services Identification Card, Department of Defense (DOD) or US Coast Guard issued identification card proving that the person is an active duty member, active reservist, retired armed forces personnel or a DoD civilian employee. Active Reserve personnel must show proof of drill status prior to receiving a permit.

b. A current U.S. Coast Guard Auxiliary Courtesy Vessel Inspection. The nearest Coast Guard Auxiliary Examiner can be found online at www.safetyseal.net/GetVSC/.

c. A State of Hawaii Boat Registration. This can be obtained by submitting an application with the State of Hawaii Department of Transportation, Harbors Division via <http://hawaii.gov/dlnr/dbor/>

d. Proof of the following minimum insurance coverage: \$10,000 for bodily injury to or death of one person, subject to the total coverage in any one accident of \$20,000 for bodily injury to or death of more than one person and \$5,000 for property damage.

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4. Kayak owners wishing to transit the harbor are required to present appropriate identification as indicated above in 3.a. and a description of the kayak (name (if any), color, make, model, number of seats. Those wishing to use kayaks in the PHNDSA may see enclosure (5) for additional information regarding the use of kayaks for commuting, and enclosures (2) and (4) for additional information regarding kayaking in other locale areas within the PHNDSA.

5. The JBPHH watercraft permit must be onboard the POLC at all times and shall be made available for inspection when required by JBPHH Security Forces personnel.

6. The registered JBPHH permit holder or an immediate family member must be onboard the POLC during any movement within the PHNDSA.

7. The permit is issued with a serialized number. The original permit will be maintained with the JBPHH Port Operations Harbor Master, Building 150, Room 114, and logged in the harbor database. No movements for any POLC will be authorized prior to the permit being entered into the database. No movements will be made after a permit expires, until the permit is renewed and reentered into the database.

For kayaks, the serialized permit number shall be tagged or marked(e.g. Sharpie, engraved) on the stern of the vessel to aid in owner identification. Owner will provide a picture of the kayak showing the permit number affixed to Port Operations. See attachment C to Enclosure (5). Any evidence of alteration or improper use of a permit will result in immediate revocation of the permit. At no time may a permit be transferred from one POLC to another. A permit is no longer valid if ownership of the POLC has changed. A permit should be returned to the Harbor Master prior to transfer.

9. No POLC shall be abandoned within the PHNDSA. Kayaks shall not be left unused for 30 days or longer at either Alpha or Lima Landing. Any kayaks left unused for 30 days or longer may be considered abandoned. If a kayak is determined to be abandoned, it may be removed at the discretion of JBPHH Port Operations and/or Security Department(s). Prior to removal, JBPHH Port Operations will make every effort to contact the permitted owner prior to removal.

JBPHHINST 5510.3

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10. Kayaks parked in unauthorized areas or fire lanes will be confiscated by Security. Kayaks not claimed within 30 days will be considered abandoned per paragraph 9.

JBPHHINST 5510.3
25 Jul 16

RAINBOW BAY MARINA RECREATION AREA AND HICKAM MARINA RECREATION
AREA MORAL WELFARE AND RECREATION OPERATIONS

1. The JBPHH MWR department is authorized to operate an instructional boating skills program at Rainbow Bay Marina Recreation Area (RBMRA) and Hickam Marina Recreation Area (HMRA). The JBPHH MWR program also rents watercraft to those with access to JBPHH. No jet skis or similar personal watercraft are authorized for use in the Pearl Harbor Naval Defensive Sea Area (PHNDSA) including RBMRA and HMRA. MWR rental watercrafts are subject to the following:

a. MWR rental watercraft (such as sailboats, kayaks and canoes) are restricted to operations between 0600 to sunset, Monday through Sunday and within the confines of the RBMRA or HMRA.

b. Each renter must be checked out with an MWR instructor as qualified to operate the watercraft issued to them.

c. Each renter must maintain qualifications by renting/operating the watercraft within a 12 month period.

d. No watercraft may approach or transit underneath the Ford Island Bridge at any time.

e. Renters/Operators of Rhodes 19 rental craft may transit to or from IPM or from RBMRA only if they meet all the requirements of this instruction, and complete the Open Ocean Checkout qualifications and complete the VHF radio course. Operators of other rental craft are not authorized to depart the RBMRA and enter into Pearl Harbor or cross the channel at any time.

f. Watercraft rented at HMRA are not to enter Pearl Harbor or cross the channel at any time. They are to remain east of the entrance channel or proceed to the ocean.

2. An MWR member will continuously monitor MWR operations within the HMRA and RBMRA portions of the PHNDSA and will immediately dispatch a chase boat to assist operators in need of assistance or to direct the operator's return to the RBMRA or the HMRA as appropriate.

Enclosure (2)

3. MWR instructional classes to include sailing, kayaking and canoeing are restricted to operations from 0600 to sunset Monday through Sunday for operations within the confines of the marina recreation areas. The following will apply:

a. Each class will be accompanied by an MWR instructor operating a small boat to continuously supervise the students at all times.

b. Students or instructors will not approach or transit underneath the Ford Island Bridge at any time.

c. An MWR staff member will contact Harbor Control at the conclusion of each day to confirm that all students have returned to the harbor.

4. MWR may offer special events involving group kayaking or canoeing which shall be approved by the JBPHH CSO via the Command Action Group (CAG).

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IROQUOIS POINT MARINA (IPM) REGULATIONS

1. Requirements for civilian personnel who desire to berth or moor their Personally Owned Leisure Crafts (POLC's) at the Iroquois Point Marina (IPM) are contained on the following pages, and include requirements for annual background checks for all registered boat owners/operators.

2. In addition to requirements detailed in the following pages as to POLCs berthed at IPM, the following sets forth the agreement between the Navy and the Navy's lessee of the property at Iroquois Point, as of this writing, Ford Island Housing, LLC.

3. The Navy's lessee shall be responsible for maintaining accurate records, documents and correspondence pertaining to all registered POLC's at Iroquois Point Marina and POLC owners. The Navy's lessee shall:

a. Maintain vessel owner files containing copies of all documents pertaining to vessel registration, safety requirements, insurance documents, background checks and signed copies of the Iroquois Point Marina Regulations.

b. Provide the Joint Base Pearl Harbor-Hickam (JBPHH) Harbor Security and Port Operations Departments with a monthly report containing:

(1) Alphabetical listing of all registered vessel owners, including a listing of immediate family members authorized by the owner to operate the vessel, (specifically indicating additions/deletions from the previous month's report).

(2) Dates registration, safety checks and background checks will expire (specifically indicating any expired documents) .

(3) Copies of correspondence to registered owners indicating upcoming expiration dates and direction to renew requirements prior to expiration.

4. Members of the JBPHH Security Forces may examine all records/files at any time without notice.

5. Civilian personnel who berth or moor a motorized Privately Owned Leisure Craft (POLC) at the IPM, may transit to/from the marina between buoys one and two and Iroquois Point Lagoon only, provided they meet and maintain the conditions of this instruction including a satisfactory annual background check. See Attachment A of this enclosure. Specifically:

a. All civilian POLC owners must register their vessels in accordance with this instruction, obtain and maintain the required JBPHH watercraft permit and surrender such permit immediately if requested to do so by JBPHH security personnel.

b. All civilian POLC owners must request and receive permission from the Harbor Control Tower to depart the lagoon. Additionally, POLC owners must request and receive permission from the Harbor Control Tower when approaching the Pearl Harbor Channel, in the vicinity of Buoy one. POLC owners shall not enter the Pearl Harbor Naval Defensive Sea Area without receiving authorization from the Harbor Control Tower.

(1) Movement within Pearl Harbor for civilian POLC owners/operators is restricted to the following:

(a) After receiving permission from the Harbor Control Tower to depart Iroquois Point Lagoon, departing vessels must turn to starboard immediately upon reaching navigable waters and exit Pearl Harbor via the most direct route.

(b) After receiving permission from the Harbor Control Tower to enter Pearl Harbor enroute back to the Iroquois Point Lagoon, returning vessels will proceed directly to the lagoon.

NOTE: AT NO TIME WILL CIVILIAN POLCs, WHETHER LEAVING OR RETURNING TO THE LAGOON, PROCEED NORTH PAST THE ENTRANCE TO IROQUOIS POINT LAGOON. OFFENDERS MAY BE SUBJECT TO CIVIL PROSECUTION, HAVE THEIR VESSELS IMPOUNDED AND BE DIRECTED TO PERMANENTLY REMOVE THEIR VESSELS FROM THE IROQUOIS POINT LAGOON AT THEIR OWN EXPENSE. ADDITIONALLY, THE UNITED STATES NAVY WILL NOT BE LIABLE FOR ANY EXPENSES INCURRED IF AN OWNER LOSES HIS/HER PRIVILEGE TO OPERATE, MOOR OR OTHERWISE MAINTAIN THEIR VESSEL IN THE LAGOON, AS A RESULT OF VIOLATING OR DISREGARDING THE PROVISIONS OF THIS INSTRUCTION.

25 Jul 16

c. POLC's owned by civilians will be equipped with a VHF Radio. At all times within Pearl Harbor, POLC operators will monitor VHF Radio Channel 69 (primary) or 16 (secondary) for contact with Pearl Harbor Harbor control.

d. All civilian POLC owners who desire to operate their vessels within the parameters of this instruction will complete and submit the enclosed "Authorization to Conduct Background Investigations" form, accompanied by the appropriate fees, in accordance with the instructions contained on the form. Copies of the "Authorization to Conduct Background Investigations" form are available from the rental office of the Navy's lessee.

e. All POLC owners/operators must understand that, due to security concerns, JBPHH may direct that all POLC movement within the harbor and/or lagoon be terminated without advanced notice. POLC owners/operators who are underway at the time such movement is terminated may be responsible for berthing their vessel elsewhere until the harbor/lagoon are opened again.

f. All civilian POLC owners will also sign and date below where indicated, acknowledging that they have read this instruction in its entirety and that they agree to abide by all regulations herein. This form, along with the background check and vessel registration/permit forms must be updated on an annual basis.

Printed Name

Telephone

Signature

Date

JBPHHINST 5510.3
25 Jul 16

COMMANDER, JOINT BASE PEARL HARBOR-HICKAM
IROQUOIS POINT MARINA TENANT
AUTHORIZATION TO CONDUCT BACKGROUND INVESTIGATION

In accordance with the Privacy Act of 1974, I have been provided with a copy of a statement advising me that certain information is required to assist JBPHH in making a security determination concerning me and that the execution of this form is voluntary. Disclosure of requested information is voluntary, but failure to complete the form below will result in the denial of harbor access.

I hereby authorize and consent to the release of information and records bearing on my personal history, arrests and convictions, if any, to background investigation and/or criminal justice agencies and their subsidiaries, affiliates, officers, agents and employees, as well as the Commander, JBPHH Security Department and its precincts. The information will be used for the sole purpose of determining my eligibility to transit the waters of Pearl Harbor in my registered, privately owned leisure craft while a resident of the Kapilina Beach Homes in Ewa Beach, HI.

This authorization is valid for one year from issue. Upon request, a copy of this signed statement may be furnished to the criminal justice agency or other such person duly as described above requesting such information.

Complete Application on Following Page

Attachment A to
Enclosure (3)

AUTHORIZATION TO CONDUCT BACKGROUND INVESTIGATION

There is a \$35.00 nonrefundable charge for the background check, payable in check, cash, or credit card. Make checks payable to the MWR Fund for the full amount.

Print Name:

Last First Middle Name

Phone - Home: _____ Work: _____ Cell: _____

Signature: _____ Date: _____

Date of Birth: _____ Place of Birth: _____

Note: ALL APPLICANTS MUST BE U.S. CITIZENS

Print Former Name if name changed:

Current Street Address:

City: _____ State: _____ Zip Code: _____

List previous residences (going back 2 years only)

(1) Street Address:

City: _____ State: _____ Zip Code: _____

(2) Street Address:

City: _____ State: _____ Zip Code: _____

Do not write below this line. For Official Use Only

ITT: Payment Amount: _____ Date Payment Received: _____

**ALLOWED USES WITHIN THE AREA FRONTING THE FORMER IROQUOIS POINT
FAMILY HOUSING AREA**

1. This section identifies the allowed and prohibited uses of the submerged lands and waters in the area depicted in Attachment A of this enclosure and identified as the "Area Fronting the Former Iroquois Point Family Housing Area" (IPFHA). It is described as a portion of the Pearl Harbor Naval Defensive Sea Area, bounded by the following coordinates, from the shoreline landward of Buoy seven, 320° for 430 feet, then 0° for 5483 feet, then 90° for 1580 feet, then 146° for 4200 feet back to the shoreline.

2. The former IPFHA is presently leased by the Navy to Ford Island Housing, LLC. This regulation remains applicable to any successor lessee.

3. The area depicted in Attachment A is authorized by JBPHH to be added to the area available for use by the Navy's lessee of the former IPFHA. There are T-shaped breakwater jetties that protrude just off the beach.

a. No person may enter the water from these breakwater structures.

b. No activities, including but not limited to fishing or collecting via nets, diving, or launching of watercraft, are authorized from these structures given the occasional presence of protected marine species in these waters and the structures' extension into the Pearl Harbor Naval Defensive Sea Area (PHNDSA).

4. Unless directly contrary language is provided in this enclosure, all other existing regulations remain applicable, including but not limited to any restrictions related to changes in force protection levels which could require suspension of this access for reasons of security.

5. Authorized activities: Those persons who have accessed this portion of the PHNDSA by first entering and crossing through the former IPFHA may, at their own risk, in addition to walking the beach, engage in: swimming, kayaking, surfing, canoeing,

snorkeling, and paddle-boarding. Shore-based pole and line fishing on a catch and release basis is authorized from limited shore areas at limited times designated by the lessee. Any non-motorized POLC (surfboard, kayak, canoe) launched from the IPFHA is to remain within the area described in Attachment A and not cross the entrance channel.

6. Prohibited activities. No one entering the PHNDSA from the former IPFHA may engage in: spear-fishing, fishing by use of nets, launching or using any motorized POLC including jet skis, using SCUBA equipment, or any activity that could disturb the ocean floor.

7. Personnel and vehicles accessing the former IPFHA are not subject to the entry regulations for JBPHH, references (d) and (e). However anyone age 18 or older who enters the PHNDSA from the former IPFHA must possess a valid government issued photo identification card, except swimmers between the T-groins or who remain within the first 100 yards of the shoreline. The government issued photo identification card must be presented to JBPHH Security Forces personnel for inspection if requested.

8. Fishing. Enclosure (6) applies in the area depicted in Attachment A, except as indicated in this enclosure.

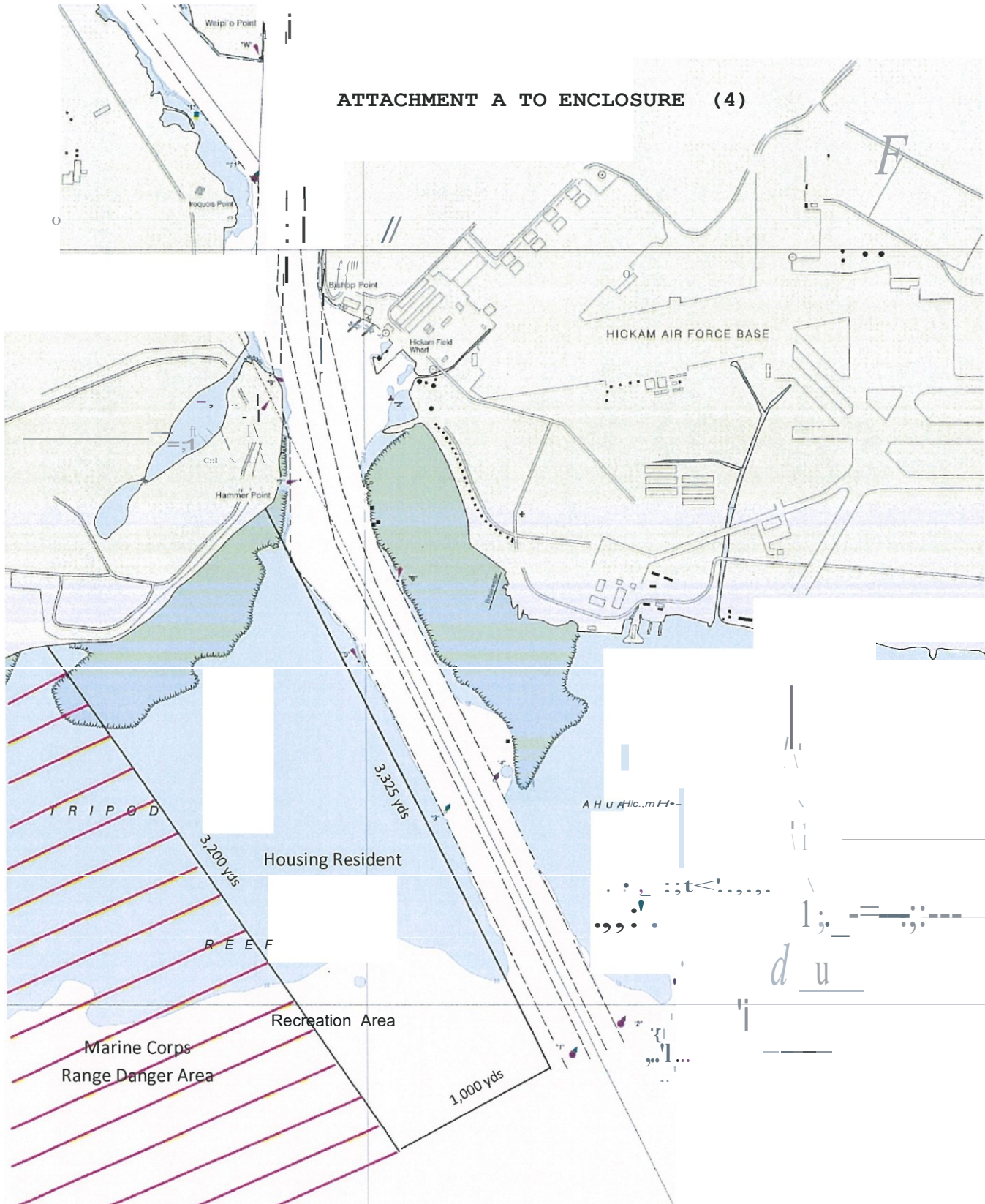
a. Given the occasional presence in these waters of endangered marine species such as the Hawaiian monk seal and sea turtles, and the State of Hawaii Department of Health advisory against consuming anything taken from Pearl Harbor, only catch and release pole and line shore-based fishing, from limited areas at limited times designated by the lessee, is authorized. No other forms of collecting or harvesting are authorized.

b. No fishing in any manner, including the casting of nets or pole and line fishing, is authorized from the rock jetties.



JBP HHINST 5510.3
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ATTACHMENT A TO ENCLOSURE (4)



JBPHHINST 5510.3
25 Jul 16



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KAYAK COMMUTING OPERATIONS

1. In addition to enclosure (1), the following applies to kayak operators seeking to transit the harbor for commuting purposes. It does not apply to MWR-sponsored kayak events detailed in enclosure (2). It does not apply to kayaks operated for recreational purposes in the Hickam Marina Recreation Area (HMRA), the Rainbow Bay Marina Recreation Area (RBMRA), the Iroquois Point Marina (IPM) or the area fronting the former Iroquois Point Family Housing Area (IPFHA). See enclosures (2) and (4).

2. The operation of kayaks within the PHNDSA for commuting shall be in accordance with the following:

a. Due to the low profile of kayaks in the water and in an effort to minimize the chances of collision with other craft, kayak operators must contact Harbor Control prior to getting underway by calling Harbor Control. Kayak operators shall again call Harbor Control upon completion of transit. No movement will take place without Harbor Control approval.

b. Kayak transiting shall only be between the hours of 0500 and 1900, which ever time is later.

c. Movement will only be approved during FPCON Alpha. In FPCON Bravo, kayaks movement will be at the discretion of JBPHH Port Operations. In all other FPCONs, kayakers are prohibited from transiting.

d. Only permitted personnel are authorized to transit between the kayak landings (Lima Landing and Alpha 7 Landing) . Permit must be on transiting personnel at all times.

e. Kayak commuting is restricted to the kayak transit lane shown in Attachment A to this enclosure. Operators shall not deviate from this transit lane.

f. All kayakers are required to wear a US Coast Guard approved floatation device during transit.

g. In accordance with rules of navigation, during hours of darkness, commuting kayakers shall display a bright white light

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e.g. an electric torch, high powered flashlight, or a lighted lantern to prevent a collision during transit across channel.

h. Kayaks shall not launch or land at any location other than the Lima Landing boat ramp and the Alpha 7 Landing.

i. All kayaks used for commuting will be stowed in or next to the kayak racks provided adjacent to Lima Landing and Alpha 7 Landing as shown in attachment B to enclosure (5).

j. Kayaks used to transit the harbor for commuting purposes must be clearly marked with their JBP HH permit number. The permit number shall be displayed on the bow, or forward half, of each side of the kayak, read from left to right, and in a position to be distinctly visible. The letters and numbers must be of a plain block design, and of a color that will provide maximum contrast to the background (light numbers on a dark hull or vice versa).

k. Bicycles for kayakers shall be secured and locked in the bicycle racks provided at Lima Landing and Alpha 7 Landing as shown in attachment B to this enclosure. Bicycles are prohibited within the MDSU/NAVSEA compound.

l. Personally owned vehicles (POVs) for kayakers are prohibited within the MDSU/NAVSEA compound. POV operators shall adhere to the requirements of reference (f).

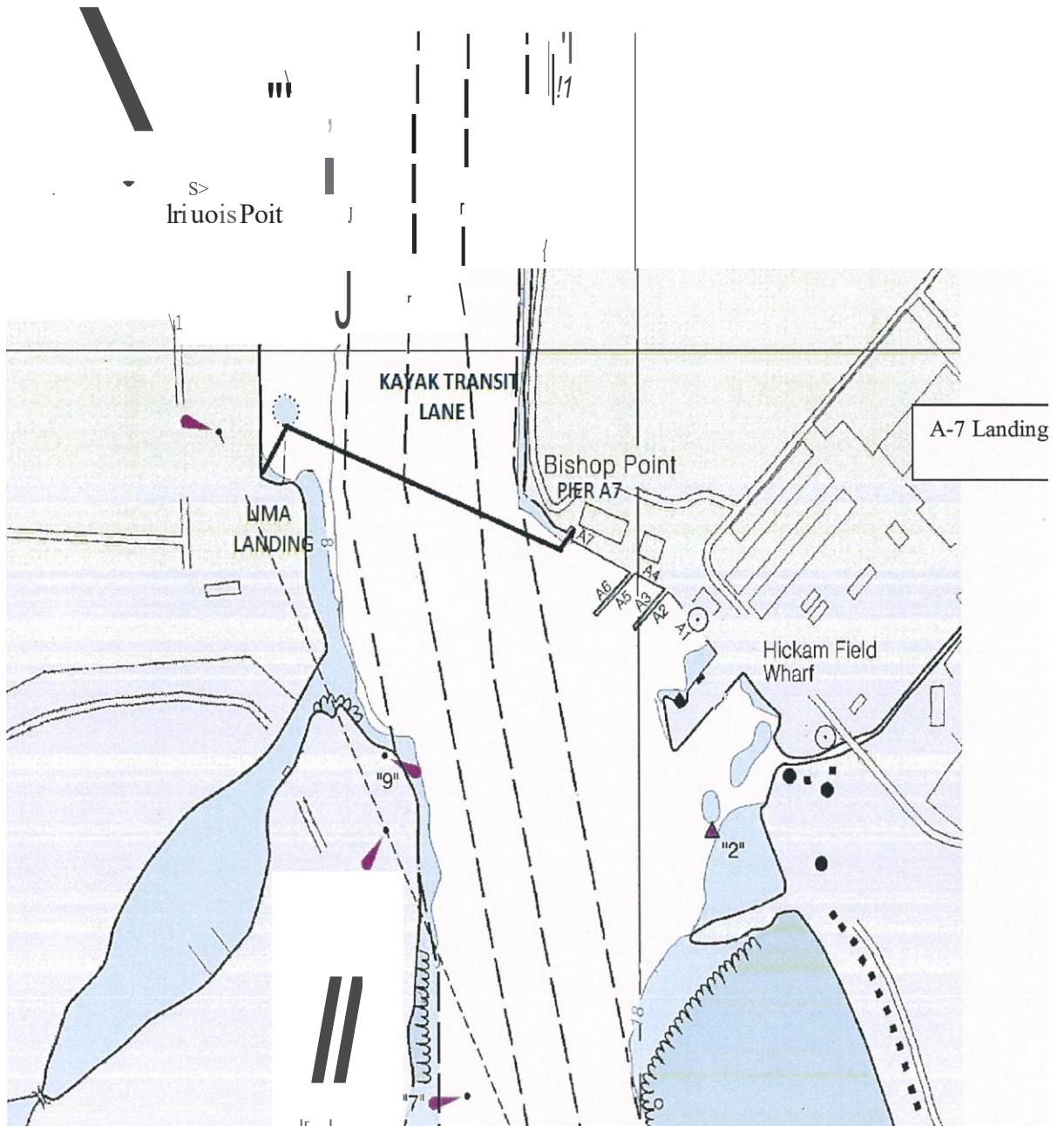
m. Failure to adhere to these policies may result in the confiscation/removal of the kayak, towing of the POV, removal of the bicycle, issuance of a citation, escort from the installation, and revocation of kayak permit as appropriate and applicable to the violation(s).

n. During Tropical Cyclone Conditions of Readiness (TCCOR) four, kayaks must be removed from Lima Landing and Alpha 7 Landing areas. No overnight storage of kayaks at Lima Landing or Alpha 7 Landing is authorized. During TCCOR three or higher, kayak lanes will be secured and all kayaks are to be removed by the permitted owner.

o. Violation of any of the above rules or procedures may result in the suspension or revocation of PLOC permit.

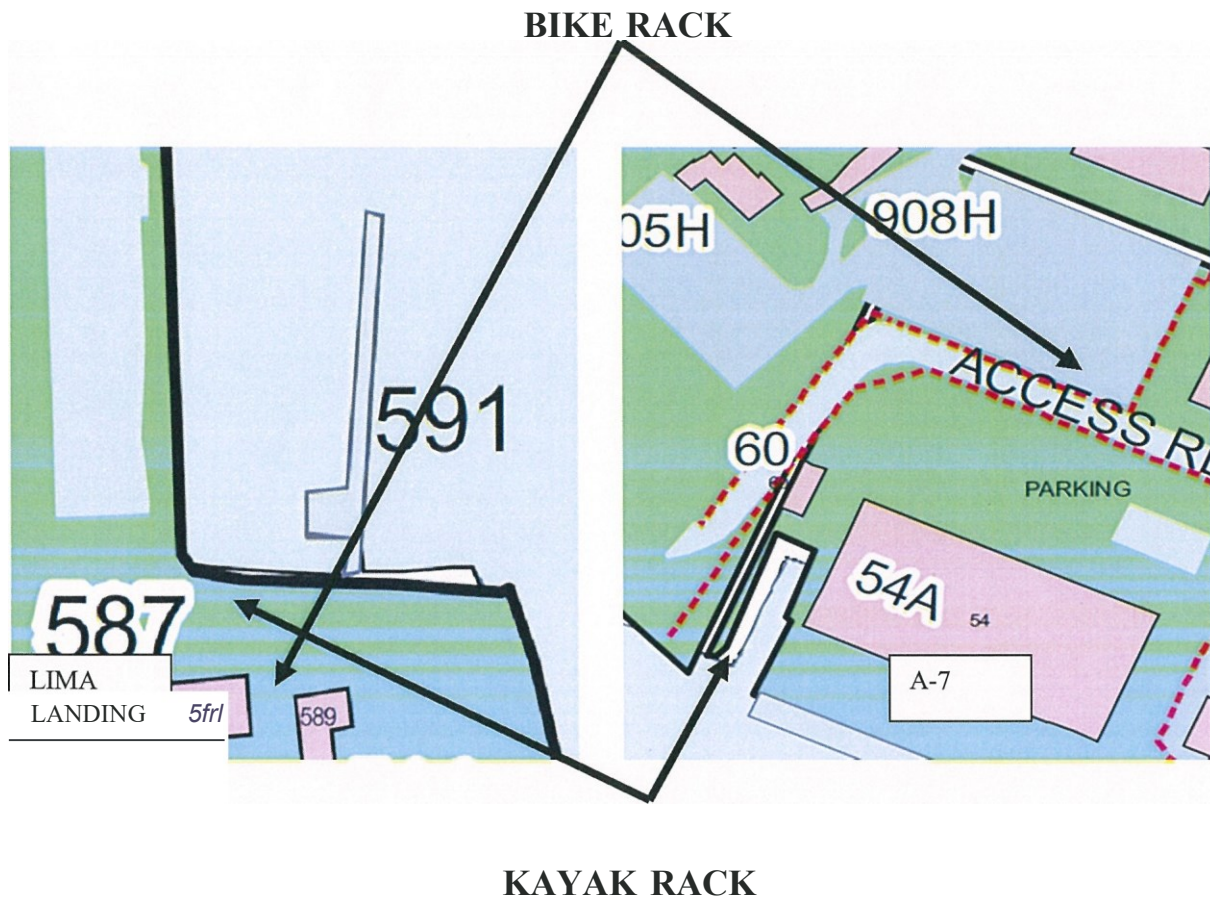
ATTACHMENT A TO ENCLOSURE (5)

KAYAK TRANSIT LANE



ATTACHMENT B TO ENCLOSURE (5)

Bike and Kayak Racks



JBP HHINST 5510.3
25 Jul 16



RECREATIONAL FISHING

1. Recreational fishing within the PHNDSA and from the Pearl Harbor shore line is allowed only in designated areas as pole and line fishing on a catch and release basis. No spear fishing or use of nets is allowed.

a. This instruction shall not be misconstrued to permit any violation of Federal or State Laws or regulations.

b. The provisions herein are applicable to the taking of all forms of marine life, including crustaceans (crabs) from the waters of Pearl Harbor.

c. In 1998, the State of Hawaii Department of Health issued an advisory not to eat any fish or shell fish from Pearl Harbor. The advisory remains in effect as of 2012. Due to this advisory, only pole and line fishing is allowed and only on a catch and release basis.

2. Designated Fishing Areas. Entry into any designated fishing area that requires entry onto JBPHH property requires that access first be authorized in accordance with JBPHH access instructions. Entry will be subject to all Force Protection Conditions.

a. The following are designated areas within Pearl Harbor as depicted in Attachment A.

(1) Area 1, Quarters K Pier, Ford Island. Fishing is restricted to the residents of Quarters K and their authorized guests.

(2) Area 2, East Loch. North of Ford Island Bridge from Aiea Bay extending to Waiau Bank.

(3) Area 3 Middle Loch. The area bordering the west side of Pearl City Peninsula extending to the northwest corner of Inactive Ships.

(4) Areas 4A and 4B, Ford Island. Area 4A is from the golf course shoreline to the north shoal adjacent to Foxtrot 13

Pier. Area 4B location is on the northwest portion of Ford Island, between the seaplane ramp and the small boat dock.

(5) Area 5 Hospital Point. Hospital Point Housing including Charlie Landing. This area is restricted to the residents of Hospital Point Housing and their authorized guests.

(6) Area 6 Aloha Aina Shoreline

a. Shoreline along the eastern bank of the channel entrance from the Degaussing Station to Hickam Marina Recreation Area. Those persons engaged in fishing must leave the shore as directed by JBPHH security personnel during Navy vessel operations or training which requires that the area be clear. Fishing is allowed between the Foster Point boat dock (next to the Hawaii Air National Guard parking area) and to the eastern side of the Alpha Docks along the parking lot to 30 feet westward of the Sewage Treatment Plant. Shore fishing is also permitted at the area adjacent to the former Fort Kamehameha housing area.

b. Fishing from ships in Pearl Harbor. Commanding Officers of ships moored at berths outside the Naval Shipyard may authorize crewmembers to fish from their own ship's decks.

3. Fishing Rules & Restrictions

a. All those who utilize authorized fishing locations must conduct themselves in a courteous and environmentally protective manner. No one accessing the shore for fishing may cross an area being used as a residence, driveway or landscaped area. Smoking is discouraged. All trash, including all cigarette butts, shall be removed by the person fishing the site. People fishing are encouraged to maintain the site and remove litter left by others.

b. No POLC is to be launched from any shoreline other than as indicated in the main instruction.

c. Only the shallow waters fronting Fort Kamehameha housing area known as Ahua Reef may be entered on foot for pole and line fishing. Standing in the water is not allowed in other locations.

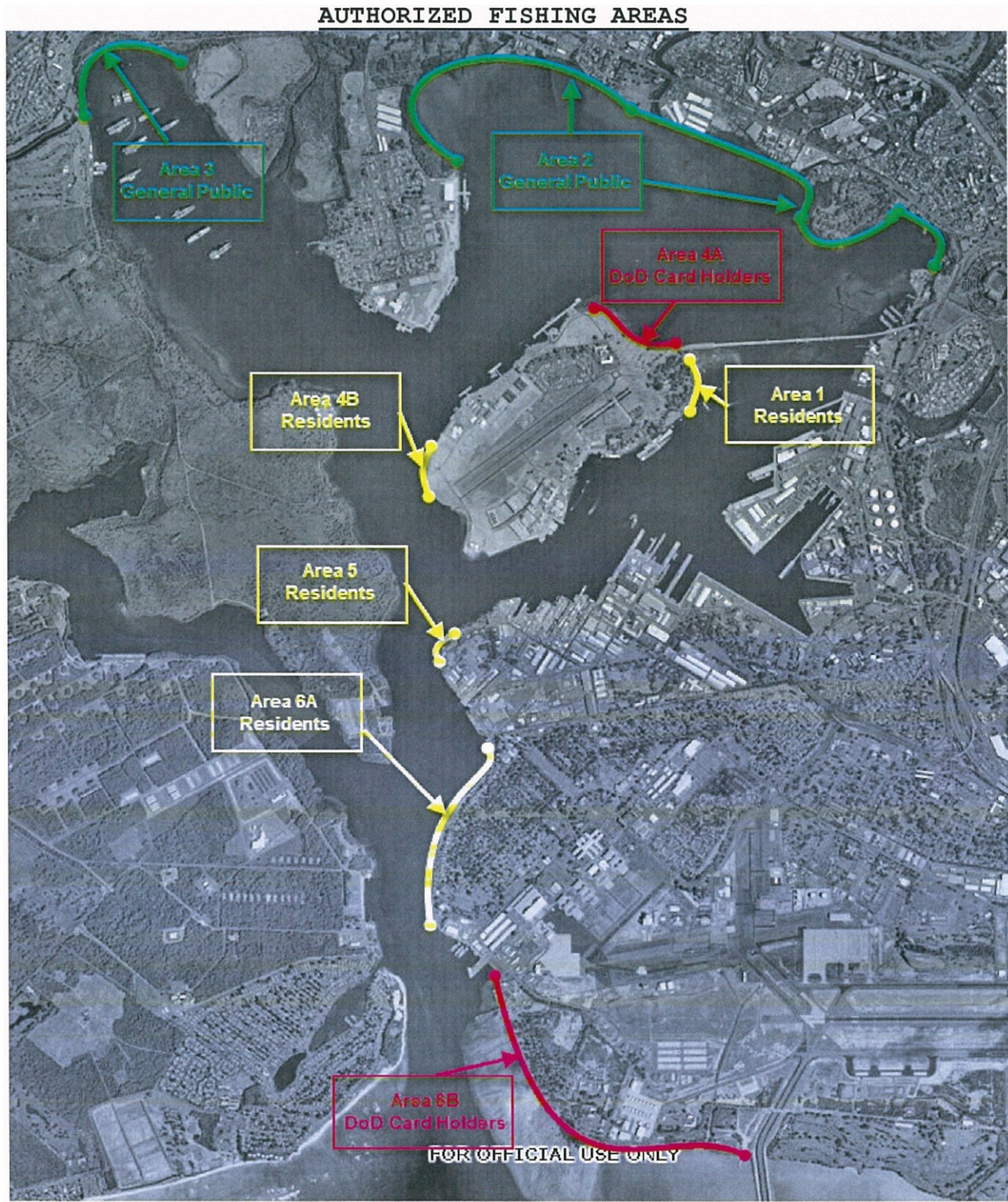
d. Use of pole and line is the only fishing method authorized. No spear fishing or use of nets is allowed.

e. Those under ten years old must be accompanied by a parent or guardian.

f. In accordance with reference (e), all guests must be accompanied by personnel maintaining current DoD identification and guests must be accompanied by their host at all times while on Navy property.

g. Recreational fishing from the former Iroquois Point Family Housing Area is similarly on a catch and release, pole and line basis only. See enclosure (4) for further regulations regarding fishing from this site.

ATTACHMENT A TO ENCLOSURE (6)



J-17 COMNAVREGHIINST 5090.9 Lighting for Seabird Fledging Season

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DEPARTMENT OF THE NAVY

COMMANDER
NAVY REGION HAWAII
850 TICONDEROGA ST STE 110
PEARL HARBOR HI 96860-5101

COMNAVREGHIINST 5090.9

N4

9 Jan 2017

COMNAVREG HAWAII INSTRUCTION 5090.9

From: Commander, Navy Region Hawaii

Subj: LIGHTING FOR SEABIRD FLEDGING SEASON

Ref: (a) OPNAVINST 5090.1D
(b) Unified Facilities Criteria Interior and Exterior Lighting Systems and Control,
UFC 3-530-01 of 1 April 2015
(c) PMRFNOTE 10570

1. Purpose

a. To affirmatively demonstrate the Navy's continuing commitment to protection of Hawaii's natural and cultural resources, Navy Region Hawaii (NRH) continuously seeks ways to modify its actions to limit effects on the natural environment. This instruction encourages actions at each installation and by each installation tenant or user that may reduce the effects of our installations on threatened, endangered, or migratory seabirds that take to the air or fledge during nights around the new moon and are disoriented by man-made night lighting.

b. Per reference (c), chapter 12, this instruction sets forth NRH's policy regarding night lighting that may affect threatened, endangered, or migratory species. Night lighting around the nights of the new moon from mid-September to mid-December must be controlled to limit disorientation of these birds. Exterior lighting fixtures must follow the designs provided in reference (b) to avoid or minimize the potential for disorientation of night-flying seabirds.

2. Cancellation. COMNAVREGHIINST 5090.8.

3. Action and Responsibilities

a. Installation Commanding Officers. Taking into consideration safety, security and anti-terrorism/force protection requirements, installation commanding officers are directed to take all reasonable actions within their control to reduce potential effects on Hawaii's night-flying seabirds. Reference (c) is an example of actions installations may take to address night lighting during the seabird fledging season. This is an "all hands" effort. In addition, to reduce the potential for harm to a disoriented bird, anyone who sees a bird flying around a light needs to know to step forward and immediately seek to extinguish that light until the bird moves along.

b. Installation tenants and users are similarly subject to this policy and must modify their actions prior to each new moon between September and December.


9 Jan 2017

c. Any person designing exterior lighting must follow the designs provided in reference (b) which protect the night sky, avoid dis-orientation of birds and other wildlife, and reduce electrical consumption. Assistance can be provided by the NRH energy team within the N4 department.

d. Assistance with natural and cultural resource management matters may be obtained through the NRH N4 department.

4. Records Management. Records created as a result of this instruction, regardless of media and format, must be managed per Secretary of the Navy Manual 5210.1 of January 2012.

5. Review and Effective Date. Per OPNAVINST 5215.17A, Facilities and Environmental (N4) will review this instruction annually on the anniversary of its effective date to ensure applicability, currency, and consistency with Federal, DoD, SECNAV, and Navy policy and statutory authority using OPNAV 5215/40 Review of Instruction. This instruction will automatically expire 5 years after effective date unless reissued or canceled prior to the 5-year anniversary date, or an extension has been granted.



J. W. JENKS
By direction

Distribution:

Electronic only, via NRH Directive Website

<https://g2.cnrc.navy.mil/CNRH/SitePages/Home.aspx>

Appendix K
Key Biological Reference Documents for Lualualei Annex

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K-1 Lualualei Annex Flora Species

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Appendix K-1
Lualualei Annex
Species List – Flora

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Occurrence</i>	<i>Reference</i>
Acanthaceae	<i>Asystasia gangetica</i>	Chinese violet	-	-	-	Potentially	CNRH, 2001
Amaranthaceae	<i>Achyranthes aspera</i>	devil's horsewhip	-	-	-	Confirmed	CNRH, 2004
Amaranthaceae	<i>Alternanthera pungens</i>	khaki weed	-	-	-	Potentially	CNRH, 2001
Amaranthaceae	<i>Amaranthus spinosus</i>	spiny amaranth	-	-	-	Confirmed	CNRH, 2004
Amaranthaceae	<i>Amaranthus viridis</i>	slender amaranth	-	-	-	Potentially	CNRH, 2001
Amaranthaceae	<i>Charpentiera obovata</i>	broadleaf papala	pāpala	-	E	Confirmed	CNRH, 2004
Amaranthaceae	<i>Charpentiera tomentosa</i>	Waianae Range papala	pāpala	-	E	Confirmed	CNRH, 2004
Amaranthaceae	<i>Nototrichium humile</i>	Ka'ala rockwort	kulu'ī	FE, SE	E	Confirmed	CNRH, 2004
Anacardiaceae	<i>Mangifera indica</i>	mango	manakō	-	-	Confirmed	CNRH, 2004
Anacardiaceae	<i>Schinus terebinthifolius</i>	Christmas berry	wilelaiki	-	I	Confirmed	DON, 2021
Apiaceae	<i>Centella asiatica</i>	Asiatic pennywort	pohe kula	-	-	Confirmed	CNRH, 2004
Apiaceae	<i>Cryptotaenia canadensis</i>	honeysort	-	-	-	Potentially	CNRH, 2001
Apiaceae	<i>Cyclospermum leptophyllum</i>	fir-leaved celery	-	-	-	Confirmed	CNRH, 2004
Apiaceae	<i>Hydrocotyle sibthorpioides</i>	lawn marsh pennywort	-	-	-	Potentially	CNRH, 2001
Apiaceae	<i>Spermolepis hawaiiensis</i>	Hawai'i scaleseed	-	FE, SE	E	Confirmed	CNRH, 2004
Apocynaceae	<i>Alyxia stellata</i>	-	maile	-	E	Confirmed	DON, 2021
Apocynaceae	<i>Pteralyxia macrocarpa</i>	-	Kaulu	SSC	E	Potential	DON, 2021
Apocynaceae	<i>Rauvolfia sandwicensis</i>	devil's pepper	hao	-	E	Confirmed	DON, 2021
Aquifoliaceae	<i>Ilex anomala</i>	Hawai'i holly	kāwa'u	-	E	Confirmed	CNRH, 2004
Araceae	<i>Alocasia macrorrhizos</i>	giant taro	'ape	-	-	Potentially	CNRH, 2001
Araceae	<i>Colocasia esculenta</i>	taro	-	-	-	Potentially	NAVFAC PAC, 1998
Araceae	<i>Epipremnum pinnatum</i>	pothos	-	-	-	Potentially	CNRH, 2001
Araliaceae	<i>Cheirodendron trigynum subsp. trigynum</i>	olapa	'ōlapalapa	-	E	Confirmed	CNRH, 2004
Araliaceae	<i>Polyscias sandwicensis</i>	-	'ohe makai, 'ohe kukulu'ae'o, 'ohe-o-kai	-	E	Confirmed	CNRH, 2004
Araliaceae	<i>Schefflera actinophylla</i>	octopus tree	-	-	-	Confirmed	CNRH, 2004
Araliaceae	<i>Tetraplasandra oahuensis</i>	-	'ōhe mauka	-	E	Confirmed	CNRH, 2004
Araucariaceae	<i>Araucaria columnaris</i>	Cook Island pine	-	-	-	Confirmed	CNRH, 2004
Aristolochiaceae	<i>Aristolochia littoralis</i>	calico flower	-	-	-	Confirmed	DON, 2021
Asclepiadaceae	<i>Asclepias curassavica</i>	butterfly weed	laulele	-	-	Confirmed	CNRH, 2004
Asclepiadaceae	<i>Stapelia gigantea</i>	Zulu giant	-	-	-	Confirmed	CNRH, 2004
Asparagaceae	<i>Agave sisalana</i>	sisal hemp	-	-	-	Confirmed	CNRH, 2004

Category: E = endemic; I = invasive; - = no data.

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; SSC = Species of Special Concern; - = no data.

Appendix K-1
Lualualei Annex
Species List – Flora

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Occurrence</i>	<i>Reference</i>
Asparagaceae	<i>Chrysodracon forbesii</i>	hala pepe	-	FE, SE	E	Confirmed	DON, 2021
Asparagaceae	<i>Cordyline fruticosa</i>	-	ti, kī	-	-	Confirmed	DON, 2021
Asparagaceae	<i>Furcraea foetida</i>	Mauritius hemp	-	-	-	Potentially	CNRH, 2001
Aspleniaceae	<i>Asplenium acuminatum</i>	tapertip spleenwort	-	-	E	Confirmed	CNRH, 2004
Aspleniaceae	<i>Asplenium aethiopicum</i>	-	Egyptian spleenwort	-	N	Confirmed	CNRH, 2004
Aspleniaceae	<i>Asplenium contiguum</i>	forest spleenwort	-	-	E	Confirmed	CNRH, 2004
Aspleniaceae	<i>Asplenium dielfalcatum</i>	sickle island spleenwort	-	FE, SE	N	Potential	DON, 2021
Aspleniaceae	<i>Asplenium horridum</i>	-	‘alae	-	N	Confirmed	CNRH, 2004
Aspleniaceae	<i>Asplenium macraei</i>	-	-	-	E	Confirmed	CNRH, 2004
Aspleniaceae	<i>Asplenium nidus</i>	Hawai‘i bird's nest fern	‘ekaha	-	N	Confirmed	CNRH, 2004
Aspleniaceae	<i>Asplenium unisorum</i>	singlesorus island spleenwort	-	FE, SE	E	Confirmed	CNRH, 2004
Aspleniaceae	<i>Asplenium adiantum-nigrum</i>	-	‘iwa‘iwa	-	N	Confirmed	CNRH, 2004
Asteraceae	<i>Ageratina adenophora</i>	sticky snakeroot	Maui pāmakani	-	-	Confirmed	DON, 2021
Asteraceae	<i>Ageratina riparia</i>	spreading snakeroot	Hāmākua pāmakani	-	-	Confirmed	DON, 2021
Asteraceae	<i>Ageratum conyzoides</i>	tropical whiteweed	maile hohono	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Artemisia australis</i>	O‘ahu wormwood	hinahina kuahiwi	-	E	Confirmed	DON, 2021
Asteraceae	<i>Bidens cervicata</i>	Kaua‘i beggarticks	kō‘oko‘olau, kōko‘olau	-	E	Confirmed	CNRH, 2004
Asteraceae	<i>Bidens cynapiifolia</i>	Spanish needle	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Bidens pilosa</i>	common beggarticks	kī	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Bidens torta</i>	corkscrew beggarticks	kō‘oko‘olau	-	E	Confirmed	CNRH, 2004
Asteraceae	<i>Conyza bonariensis</i>	hairy horseweed	ilioha	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Conyza canadensis</i>	Canadian horseweed	-	-	-	Confirmed	DON, 2021
Asteraceae	<i>Crassocephalum crepidioides</i>	redflower ragleaf	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Cyanthillium cinereum</i>	little ironwood	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Dubautia sherffiana</i>	-	-	SSC	N	Potential	DON, 2021
Asteraceae	<i>Dubautia plantaginea</i> <i>su bsp. plantaginea</i>	-	na‘ena‘e	-	E	Confirmed	CNRH, 2004
Asteraceae	<i>Emilia fosbergii</i>	Flora's paintbrush	pualele	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Emilia sonchifolia</i>	Flora's paintbrush	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Erechtites hieraciifolius</i>	American burnweed	-	-	-	Potentially	CNRH, 2001
Asteraceae	<i>Erechtites valerianifolia</i>	fireweed	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Erigeron karvinskianus</i>	daisy fleabane	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Galinsoga parviflora</i>	-	-	-	-	Confirmed	CNRH, 2004

Category: E = endemic; N = native; - = no data.

Regulatory Status: FE= federally listed endangered; SGCN= species of greatest conservation need; SSC = Species of Special Concern; - = no data.

Appendix K-1
Lualualei Annex
Species List – Flora

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Occurrence</i>	<i>Reference</i>
Asteraceae	<i>Gamochaeta purpurea</i>	purple cudweed	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Hypochaeris radicata</i>	hairy cat's ear	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Lactuca serriola</i>	prickly lettuce	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Lipochaeta lobata</i> var. <i>leptophylla</i>	-	nehe	FE, SE	E	Confirmed	CNRH, 2004
Asteraceae	<i>Melanthera tenuis</i>	-	nehe	SSC	E	Confirmed	CNRH, 2004
Asteraceae	<i>Montanoa hibiscifolia</i>	tree daisy	-	-	-	Confirmed	DON, 2021
Asteraceae	<i>Neurolaena lobata</i>	sourbush	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Pluchea carolinensis</i>	sourbush	-	-	-	Potentially	CNRH, 2001
Asteraceae	<i>Pluchea indica</i>	Indian fleabane	-	-	-	Potentially	CNRH, 2001
Asteraceae	<i>Sonchus oleraceus</i>	sow thistle	pualele	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Sphagneticola triloba</i>	Bay Biscayne creeping-oxeye	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Synedrella nodiflora</i>	nodeweed	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Tetramolopium filiforme</i> var. <i>filiforme</i>	ridgetop tetramolopium	-	FE, SE	-	Confirmed	CNRH, 2004
Asteraceae	<i>Tetramolopium lepidotum</i> subsp. <i>lepidotum</i>	Wai'anae Range retramolopium	-	FE, SE	E	Potential	DON, 2021
Asteraceae	<i>Tridax procumbens</i>	coat buttons	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Verbesina encelioides</i>	golden crown-beard	-	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Xanthium strumarium</i>	cocklebur	kikānia	-	-	Confirmed	CNRH, 2004
Asteraceae	<i>Youngia japonica</i>	Oriental hawksbeard	-	-	-	Confirmed	CNRH, 2004
Basellaceae	<i>Anredera cordifolia</i>	madeira vine	'uala hūpē	-	-	Confirmed	CNRH, 2004
Bignoniaceae	<i>Spathodea campanulata</i>	African tulip tree	-	-	-	Confirmed	CNRH, 2004
Bignoniaceae	<i>Tecoma castanifolia</i>	-	-	-	-	Confirmed	CNRH, 2004
Blechnaceae	<i>Blechnum appendiculatum</i>	palm fern	-	-	-	Confirmed	DON, 2021
Blechnaceae	<i>Blechnum occidentale</i>	hammock fern	-	-	-	Confirmed	CNRH, 2004
Blechnaceae	<i>Doodia kunthiana</i>	Kunth's hacksaw fern	'okupukupu lau'ī'ī	-	E	Confirmed	CNRH, 2004
Blechnaceae	<i>Sadleria cyatheoides</i>	amaumau fern	'ama'u	-	E	Confirmed	CNRH, 2004
Brassicaceae	<i>Lepidium arbuscula</i>	Waianae Range pepperwort	'ānaunau, naunau, kūnānā	FE, SE	E	Confirmed	CNRH, 2004
Brassicaceae	<i>Lepidium didymum</i>	lesser swinecress	-	-	-	Confirmed	CNRH, 2004
Cactaceae	<i>Opuntia ficus-indica</i>	prickly pear	pānini	-	-	Confirmed	CNRH, 2004
Campanulaceae	<i>Cyanea calycina</i>	Wai'anae Range rollandia	Haha	FE, SE	E	Potential	DON, 2021
Campanulaceae	<i>Cyanea membranacea</i>	papery cyanea	Haha	SSC	N	Potential	DON, 2021

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<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Occurrence</i>	<i>Reference</i>
Campanulaceae	<i>Lobelia niihauensis</i>	-	‘ōhā, hāhā, ‘ōhā wai	FE, SE	E	Confirmed	CNRH, 2004
Campanulaceae	<i>Lobelia yuccoides</i>	-	pānaunau	SGCN	E	Confirmed	CNRH, 2004
Capparaceae	<i>Gynandropsis gynandra</i>	spiderwisp	-	-	-	Potentially	CNRH, 2001
Caryophyllaceae	<i>Cerastium fontanum ssp. vulgare</i>	mouse-ear chickweed	-	-	-	Confirmed	CNRH, 2004
Caryophyllaceae	<i>Drymaria cordata</i>	chickweed	pipili, pilipili	-	-	Confirmed	CNRH, 2004
Caryophyllaceae	<i>Schiedea ligustrina</i>	privetleaf schiedea	Ma ‘oli ‘oli	SSC	E	Potential	CNRH, 2004
Caryophyllaceae	<i>Schiedea mannii</i>	ridgetop schiedea	-	-	E	Confirmed	CNRH, 2004
Caryophyllaceae	<i>Schiedea hookeri</i>	sprawling schiedea	-	FE, SE	E	Confirmed	DON, 2021
Caryophyllaceae	<i>Schiedea pentandra</i>	hairy schiedea	-	SGCN	E	Confirmed	CNRH, 2004
Caryophyllaceae	<i>Silene perlmannii</i>	cliff-face catchfly	-	FE, SE	E	Potential	DON, 2021
Caryophyllaceae	<i>Stellaria media</i>	common chickweed	-	-	-	Confirmed	CNRH, 2004
Casuarinaceae	<i>Casuarina equisetifolia</i>	ironwood	paina	-	-	Confirmed	CNRH, 2004
Chenopodiaceae	<i>Atriplex semibaccata</i>	Australian saltbush	-	-	-	Potentially	CNRH, 2001
Chenopodiaceae	<i>Chenopodium album</i>	lamb’s quarters	-	-	-	Potentially	CNRH, 2001
Chenopodiaceae	<i>Chenopodium murale</i>	goosefoot	-	-	-	Confirmed	CNRH, 2004
Chenopodiaceae	<i>Chenopodium oahuense</i>	-	‘āheahea, ‘āweoweo	-	E	Confirmed	CNRH, 2004
Cibotiaceae	<i>Cibotium chamissoi</i>	Chamisso’s manfern	hāpu‘u	-	E	Confirmed	CNRH, 2004
Commelinaceae	<i>Commelina benghalensis</i>	Benghal dayflower	-	-	-	Confirmed	CNRH, 2004
Commelinaceae	<i>Commelina diffusa</i>	spreading dayflower	honohono	-	-	Confirmed	CNRH, 2004
Convolvulaceae	<i>Bonamia menziesii</i>	-	-	FE, SE	E	Confirmed	CNRH, 2004
Convolvulaceae	<i>Ipomoea alba</i>	moon flower	koali pehu	-	-	Confirmed	CNRH, 2004
Convolvulaceae	<i>Ipomoea cairica</i>	ivy-leaved morning glory	koali ‘ai	-	-	Confirmed	CNRH, 2004
Convolvulaceae	<i>Ipomoea indica</i>	blue morning-glory	koali ‘awa	-	N	Confirmed	CNRH, 2004
Convolvulaceae	<i>Ipomoea obscura</i>	obscure morning-glory	-	-	-	Confirmed	CNRH, 2004
Convolvulaceae	<i>Jacquemontia ovalifolia</i>	oval-leaf clustervine	pā‘ūohi‘iaka	-	N	Potentially	CNRH, 2001
Convolvulaceae	<i>Merremia aegyptia</i>	hairy merremia	-	-	-	Confirmed	CNRH, 2004
Crassulaceae	<i>Kalanchoe pinnata</i>	air plant	‘oliwa kū kahakai	-	-	Confirmed	CNRH, 2004
Cucurbitaceae	<i>Coccinia grandis</i>	scarlet-fruited gourd	-	-	-	Confirmed	CNRH, 2004
Cucurbitaceae	<i>Cucumis dipsaceus</i>	teasel gourd	-	-	-	Confirmed	CNRH, 2004
Cucurbitaceae	<i>Momordica charantia</i>	balsam pear	-	-	-	Confirmed	CNRH, 2004
Cucurbitaceae	<i>Sicyos pachycarpus</i>	paha	‘ānunu, kūpala	-	E	Confirmed	CNRH, 2004
Cyatheaaceae	<i>Cyathea cooperi</i>	Australian tree fern	-	-	-	Confirmed	CNRH, 2004
Cyperaceae	<i>Carex meyenii</i>	Meyen's sedge	-	-	N	Confirmed	DON, 2021
Cyperaceae	<i>Carex wahuensis</i>	O‘ahu sedge	-	-	E	Confirmed	DON, 2021
Cyperaceae	<i>Cyperus cyperinus</i>	-	-	-	N	Confirmed	CNRH, 2004

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Cyperaceae	<i>Cyperus gracilis</i>	slimjim flatsedge	mau'u hunehune	-	-	Confirmed	DON, 2021
Cyperaceae	<i>Cyperus haspan</i>	haspan flatsedge	-	-	E	Confirmed	CNRH, 2004
Cyperaceae	<i>Cyperus hillebrandii</i> var. <i>hillebrandii</i>	-	-	-	E	Confirmed	CNRH, 2004
Cyperaceae	<i>Cyperus involucratus</i>	umbrella sedge	ahu'awa haole	-	-	Potentially	CNRH, 2001
Cyperaceae	<i>Cyperus phleoides</i> var. <i>phleoides</i>	-	-	-	E	Potentially	CNRH, 2001
Cyperaceae	<i>Cyperus rotundus</i>	nut grass	kili'o'opu	-	-	Confirmed	CNRH, 2004
Cyperaceae	<i>Cyperus trachysanthos</i>	sticky flatsedge	pu'uka'a	FE, SE	E	Confirmed	NAVFAC HI, 2011
Cyperaceae	<i>Kyllinga brevifolia</i>	shortleaf spikesedge	kili'o'opu	-	-	Confirmed	CNRH, 2004
Cyperaceae	<i>Kyllinga nemoralis</i>	whitehead spikesedge	kili'o'opu	-	-	Confirmed	CNRH, 2004
Dennstaedtiaceae	<i>Microlepia speluncae</i>	limpleaf fern	palapalai	-	N	Confirmed	CNRH, 2004
Dennstaedtiaceae	<i>Microlepia strigosa</i>	-	palapalai	-	N	Confirmed	DON, 2021
Dennstaedtiaceae	<i>Microlepia x adulterina</i>	-	palapalai	-	E	Confirmed	CNRH, 2004
Dennstaedtiaceae	<i>Pteridium aquilinum</i> subsp. <i>decompositum</i>	decomposition brackenfern	kilau	-	E	Confirmed	CNRH, 2004
Dipentodontaceae	<i>Perrottetia sandwicensis</i>	-	olomea	-	E	Confirmed	CNRH, 2004
Dryopteridaceae	<i>Cyrtomium caryotideum</i>	netvein hollyfern	ka'ape'ape	-	N	Confirmed	CNRH, 2004
Dryopteridaceae	<i>Cyrtomium falcatum</i>	-	-	-	E	Confirmed	CNRH, 2004
Dryopteridaceae	<i>Dryopteris sandwicensis</i>	-	-	-	E	Confirmed	CNRH, 2004
Dryopteridaceae	<i>Dryopteris fuscoatra</i>	crowned woodfern	-	-	E	Confirmed	CNRH, 2004
Dryopteridaceae	<i>Dryopteris glabra</i> var. <i>nuda</i>	kilaw	-	-	E	Confirmed	CNRH, 2004
Dryopteridaceae	<i>Dryopteris unidentata</i>	onetooth woodfern	'akole	-	E	Potentially	CNRH, 2001
Dryopteridaceae	<i>Elaphoglossum aemulum</i>	-	-	-	E	Confirmed	CNRH, 2004
Dryopteridaceae	<i>Elaphoglossum alatum</i>	-	-	-	E	Confirmed	CNRH, 2004
Dryopteridaceae	<i>Elaphoglossum crassifolium</i>	-	-	-	E	Confirmed	CNRH, 2004
Dryopteridaceae	<i>Elaphoglossum paleaceum</i>	-	makue	-	E	Confirmed	CNRH, 2004
Ebenaceae	<i>Diospyros hillebrandii</i>	-	lama, ēlama	-	E	Confirmed	CNRH, 2004
Ebenaceae	<i>Diospyros sandwicensis</i>	-	lama, ēlama	-	E	Confirmed	DON, 2021
Elaeocarpaceae	<i>Elaeocarpus bifidus</i>	-	kalia	-	E	Confirmed	CNRH, 2004

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Ericaceae	<i>Leptecophylla tameiameia</i>	-	pūkiawe	-	N	Confirmed	CNRH, 2004
Ericaceae	<i>Vaccinium dentatum</i>	-	‘ōhelo	-	E	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Aleurites moluccanus</i>	candlenut	kukui	-	-	Confirmed	DON, 2021
Euphorbiaceae	<i>Claoxylon sandwicense</i>	-	po‘olā	-	E	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Euphorbia hirta</i>	hairy spurge	koko kahiki	-	-	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Euphorbia hypericifolia</i>	graceful sandmat	-	-	-	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Euphorbia kuwaleana</i>	-	kōkōmālei, ‘akoko	FE, SE	E	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Euphorbia prostrata</i>	ground spurge	-	-	-	Potentially	CNRH, 2001
Euphorbiaceae	<i>Euphorbia celastroides</i>	-	‘ekoko	-	E	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Euphorbia multiformis</i> var. <i>microphylla</i>	variable sandmat	kōkōmālei, ‘akoko	-	E	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Euphorbia multiformis</i> var. <i>multiformis</i>	variable sandmat	kōkōmālei, ‘akoko	-	E	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Flueggea neowawraea</i>	bushweed	mēhamehame	FE, SE	E	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Macaranga mappia</i>	pengua	-	-	-	Potentially	CNRH, 2001
Euphorbiaceae	<i>Mallotus philippensis</i>	kamala tree	-	-	-	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Phyllanthus debilis</i>	phyllanthus weed	niruri	-	-	Potentially	CNRH, 2001
Euphorbiaceae	<i>Phyllanthus distichus</i>	-	pāmakani mähū	-	E	Confirmed	CNRH, 2004
Euphorbiaceae	<i>Ricinus communis</i>	castor bean	pā‘aila, kolī	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Acacia confusa</i>	Formosan koa	-	-	-	Confirmed	DON, 2021
Fabaceae	<i>Acacia koa</i>	-	koa	-	E	Confirmed	CNRH, 2004
Fabaceae	<i>Caesalpinia major</i>	yellow nickers	kākalaioa	-	N	Confirmed	DON, 2021
Fabaceae	<i>Canavalia galeata</i>	-	‘āwikiwiki, puakauhi	-	E	Confirmed	CNRH, 2004
Fabaceae	<i>Chamaecrista nictitans</i> var. <i>glabrata</i>	partridge pea	laukī	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Crotalaria incana</i>	shakeshake	-	-	-	Potentially	CNRH, 2001
Fabaceae	<i>Crotalaria pallida</i>	smooth rattlepod	-	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Desmanthus virgatus</i>	slender mimosa	-	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Desmodium incanum</i>	tickclover	ka‘imi	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Desmodium sandwicense</i>	spanish clover	pua pilipili	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Erythrina sandwicensis</i>	-	wiliwili	-	E	Confirmed	CNRH, 2004
Fabaceae	<i>Falcataria moluccana</i>	peacock’s plume	-	-	I	Confirmed	CNRH, 2004
Fabaceae	<i>Guilandina bonduc</i>	gray nickers	kākalaioa	-	N	Confirmed	CNRH, 2004

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Fabaceae	<i>Indigofera spicata</i>	creeping indigo	-	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Indigofera suffruticosa</i>	indigo	-	-	-	Confirmed	DON, 2021
Fabaceae	<i>Leucaena leucocephala</i>	koa haole	ēkoa	-	-	Confirmed	DON, 2021
Fabaceae	<i>Macroptilium lathyroides</i>	cow pea	-	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Medicago minima</i>	little bur-clover	-	-	-	Potentially	CNRH, 2001
Fabaceae	<i>Mimosa pudica</i>	shameplant	-	-	-	Potentially	CNRH, 2001
Fabaceae	<i>Neonotonia wightii</i>	perennial soybean	-	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Peltophorum pterocarpum</i>	-	-	-	-	Potentially	NAVFAC PAC, 1998
Fabaceae	<i>Plectranthus parviflorus</i>	little spurflower	‘ala‘ala wai nui wahine	-	N	Confirmed	DON, 2021
Fabaceae	<i>Prosopis pallida</i>	common kiawe, mesquite	kiawe	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Samanea saman</i>	monkeypod	-	-	-	Potentially	CNRH, 2001
Fabaceae	<i>Senna pendula</i> var. <i>advena</i>	valamuerto	-	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Tephrosia purpurea</i>	-	‘auhuhu, hola	-	-	Confirmed	CNRH, 2004
Fabaceae	<i>Vachellia farnesiana</i> var. <i>farnesiana</i>	sweet acacia	klu, kolū	-	-	Confirmed	CNRH, 2004
Gentianaceae	<i>Centaurium erythraea</i>	European centaury	-	-	-	Confirmed	CNRH, 2004
Gesneriaceae	<i>Cyrtandra waianaeensis</i>	Waianaeuka cyrtandra	-	-	E	Confirmed	CNRH, 2004
Gleicheniaceae	<i>Dicranopteris linearis</i>	Old World forkedfern	uluhe	-	N	Confirmed	CNRH, 2004
Goodeniaceae	<i>Scaevola gaudichaudiana</i>	-	naupaka kuahiwi	-	E	Confirmed	CNRH, 2004
Heliotropaceae	<i>Euploca procumbens</i>	fourspike heliotrope	-	-	-	Confirmed	CNRH, 2004
Hydrangeaceae	<i>Broussaisia arguta</i>	-	pū‘ahanui, kanawao	-	E	Confirmed	CNRH, 2004
Hymenophyllaceae	<i>Crepidomanes minutum</i>	tiny bristle fern	-	-	N	Confirmed	CNRH, 2004
Hymenophyllaceae	<i>Vandenboschia davallioides</i>	-	-	-	E	Confirmed	CNRH, 2004
Joinvilleaceae	<i>Joinvillea ascendens</i> subsp. <i>ascendens</i>	-	‘Ohe	FE, SE	E	Potential	DON, 2021
Juncaceae	<i>Luzula hawaiiensis</i> var. <i>oahuensis</i>	wood rush	-	-	E	Confirmed	CNRH, 2004
Lamiaceae	<i>Hyptis pectinata</i>	comb hyptis	-	-	-	Confirmed	CNRH, 2004
Lamiaceae	<i>Leonotis nepetifolia</i>	lion's ear	-	-	-	Confirmed	CNRH, 2004

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Lamiaceae	<i>Ocimum gratissimum</i>	African basil	-	-	-	Confirmed	CNRH, 2004

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Lamiaceae	<i>Plectranthus parviflorus</i>	-	‘ala‘ala wai nui	-	-	Confirmed	CNRH, 2004
Lamiaceae	<i>Salvia coccinea</i>	scarlet sage	-	-	-	Confirmed	DON, 2021
Lamiaceae	<i>Salvia occidentalis</i>	West Indian safe	-	-	-	Confirmed	CNRH, 2004
Lamiaceae	<i>Stachys arvensis</i>	staggerweed	-	-	-	Confirmed	CNRH, 2004
Lamiaceae	<i>Stenogyne kaalae</i>	Ka‘ala stenogyne	-	-	E	Confirmed	CNRH, 2004
Liliaceae	<i>Dianella sandwicensis</i>	-	‘uki‘uki	-	N	Confirmed	CNRH, 2004
Lindsaeaceae	<i>Odontosoria chinensis</i>	Chinese creepingfern	pala‘a	-	N	Confirmed	CNRH, 2004
Loganiaceae	<i>Labordia kaalae</i>	-	kāmakahala	SSC	E	Confirmed	CNRH, 2004
Lomariopsidaceae	<i>Nephrolepis brownii</i>	Asian swordfern	kupukupu, ni‘ani‘au	-	I	Confirmed	CNRH, 2004
Lomariopsidaceae	<i>Nephrolepis exaltata</i> <i>subsp. hawaiiensis</i>	common swordfern	‘ōkupukupu, ni‘ani‘au	-	E	Confirmed	CNRH, 2004
Lythraceae	<i>Ammannia coccinea</i>	toothcup	-	-	-	Confirmed	CNRH, 2004
Lythraceae	<i>Cuphea carthagenensis</i>	Columbian waxweed	puakamoli	-	-	Potentially	CNRH, 2001
Lythraceae	<i>Lythrum maritimum</i>	-	pūkāmole	-	N	Confirmed	CNRH, 2004
Malvaceae	<i>Abutilon grandifolium</i>	hairy Indian mallow	-	-	-	Confirmed	DON, 2021
Malvaceae	<i>Abutilon incanum</i>	hoary abutilon	ma‘o	-	N	Confirmed	CNRH, 2004
Malvaceae	<i>Abutilon menziesii</i>	-	ko‘oloo‘ula	FE, SE	E	Confirmed	NAVFAC HI, 2011
Malvaceae	<i>Abutilon sandwicense</i>	-	-	FE, SE	E	Confirmed	CNRH, 2004
Malvaceae	<i>Gossypium hirsutum</i>	upland cotton	-	-	-	Potentially	CNRH, 2001
Malvaceae	<i>Hibiscus arnottianus</i>	white rosemallow	koki‘o ke‘o ke‘o	-	E	Confirmed	CNRH, 2004
Malvaceae	<i>Malva parviflora</i>	cheese weed	-	-	-	Confirmed	CNRH, 2004
Malvaceae	<i>Malvastrum coromandelianum</i>	false mallow	-	-	E	Confirmed	CNRH, 2004
Malvaceae	<i>Sida fallax</i>	yellow ‘ilima	‘ilima	-	N	Confirmed	CNRH, 2004
Malvaceae	<i>Sida rhombifolia</i>	arrowleaf sida	-	-	-	Confirmed	DON, 2021
Malvaceae	<i>Sida spinosa</i>	prickly sida	-	-	-	Confirmed	CNRH, 2004
Malvaceae	<i>Talipariti tiliaceum</i>	-	hau	-	N	Confirmed	CNRH, 2004
Malvaceae	<i>Waltheria indica</i>	malva blanca	‘uhaloa	-	N	Confirmed	CNRH, 2004
Marsilaceae	<i>Marsilea villosa</i>	villous watercress	‘ihi lā‘au	FE, SE	E	Confirmed	CNRH, 2004
Melastomaceae	<i>Clidemia hirta</i>	Koster’s curse	-	-	-	Confirmed	CNRH, 2004
Meliaceae	<i>Melia azedarach</i>	chinaberry	-	-	-	Confirmed	CNRH, 2004
Meliaceae	<i>Swietenia macrophylla</i>	broad-leafed mahogany	-	-	-	Confirmed	CNRH, 2004
Meliaceae	<i>Toona ciliata</i>	Australian red cedar	-	-	-	Confirmed	DON, 2021
Menispermaceae	<i>Cocculus orbiculatus</i>	queen coralbead	-	-	N	Confirmed	DON, 2021
Moraceae	<i>Ficus macrophylla</i>	Moreton Bay fig	-	-	-	Confirmed	DON, 2021

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Appendix K-1
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<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Occurrence</i>	<i>Reference</i>
Moraceae	<i>Ficus microcarpa</i>	Chinese banyan	-	-	-	Confirmed	CNRH, 2004
Moraceae	<i>Streblus pendulinus</i>	Hawai'i roughbush	a'ia'i	-	N	Confirmed	CNRH, 2004
Musaceae	<i>Musa x paradisiaca</i>	plantain, banana	mai'a	-	-	Confirmed	CNRH, 2004
Myoporaceae	<i>Myoporum sandwicense</i>	false sandalwood	naio	-	N	Confirmed	CNRH, 2004
Myricaceae	<i>Morella faya</i>	firetree	-	-	-	Confirmed	CNRH, 2004
Myrsinaceae	<i>Myrsine lanaiensis</i>	kōlea	Lāna'i colicwood	-	E	Confirmed	CNRH, 2004
Myrsinaceae	<i>Myrsine lessertiana</i>	kōlea lau nui	-	-	E	Confirmed	CNRH, 2004
Myrsinaceae	<i>Myrsine sandwicensis</i>	kōlea lau li'i	-	-	E	Confirmed	CNRH, 2004
Myrtaceae	<i>Eucalyptus robusta</i>	swamp mahogany	-	-	-	Confirmed	CNRH, 2004
Myrtaceae	<i>Eugenia reinwardtiana</i>	mountain stopper	nīoi	-	N	Confirmed	DON, 2021
Myrtaceae	<i>Melaleuca quinquenervia</i>	paperbark	-	-	-	Confirmed	CNRH, 2004
Myrtaceae	<i>Metrosideros polymorpha</i>	ohia	'ōhi'ā lehua	-	E	Confirmed	CNRH, 2004
Myrtaceae	<i>Metrosideros polymorpha</i> var. <i>glaberrima</i>	ohia	'ōhi'ā lehua	-	E	Confirmed	CNRH, 2004
Myrtaceae	<i>Metrosideros polymorpha</i> var. <i>incana</i>	ohia	'ōhi'ā lehua	-	E	Confirmed	CNRH, 2004
Myrtaceae	<i>Metrosideros polymorpha</i> var. <i>polymorpha</i>	ohia	'ōhi'ā lehua	-	E	Confirmed	CNRH, 2004
Myrtaceae	<i>Psidium cattleianum</i>	strawberry guava	waiawī	-	I	Confirmed	CNRH, 2004
Myrtaceae	<i>Psidium guajava</i>	common guava	kuawa	-	-	Confirmed	DON, 2021
Myrtaceae	<i>Syzygium cumini</i>	Java plum	-	-	-	Confirmed	CNRH, 2004
Myrtaceae	<i>Syzygium jambos</i>	rose apple	-	-	-	Confirmed	CNRH, 2004
Myrtaceae	<i>Syzygium sandwicense</i>	-	'ōhi'a hā	-	E	Confirmed	CNRH, 2004
Nyctaginaceae	<i>Boerhavia coccinea</i>	false alena	-	-	-	Confirmed	CNRH, 2004
Nyctaginaceae	<i>Boerhavia repens</i>	-	alena	-	N	Confirmed	CNRH, 2004
Nyctaginaceae	<i>Pisonia brunoniana</i>	Australasian catchbirdtree	pāpala kēpau	-	N	Confirmed	CNRH, 2004
Nyctaginaceae	<i>Pisonia sandwicensis</i>	-	pāpala kēpau, āulu	-	E	Confirmed	DON, 2021
Nyctaginaceae	<i>Pisonia umbellifera</i>	umbrella catchbirdtree	pāpala kēpau	-	E	Confirmed	CNRH, 2004
Oleaceae	<i>Fraxinus uhdei</i>	tropical ash	-	-	-	Confirmed	CNRH, 2004
Oleaceae	<i>Nestegis sandwicensis</i>	Hawai'i olive	olopua, pua	-	E	Confirmed	DON, 2021
Onagraceae	<i>Ludwigia octovalvis</i>	primrose willow	kāmole	-	-	Confirmed	CNRH, 2004

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Orchidaceae	<i>Epidendrum x obrienianum</i>	scarlet orchid	-	-	-	Confirmed	CNRH, 2004
Orchidaceae	<i>Spathoglottis plicata</i>	Malayan ground orchid	-	-	-	Confirmed	CNRH, 2004
Oxalidaceae	<i>Oxalis corniculata</i>	yellow wood sorrel	‘ihi‘ai, ‘ihi mākole	-	-	Confirmed	CNRH, 2004
Pandanaceae	<i>Freycinetia arborea</i>	-	‘ie‘ie	-	N	Confirmed	CNRH, 2004
Passifloraceae	<i>Passiflora edulis</i>	passionflower	liliko‘i	-	-	Confirmed	DON, 2021
Passifloraceae	<i>Passiflora foetida</i>	scarletfruit passionflower	-	-	-	Potentially	CNRH, 2001
Passifloraceae	<i>Passiflora suberosa</i>	wild passionfruit	huehue haole	-	-	Confirmed	DON, 2021
Phyllanthaceae	<i>Antidesma platyphyllum</i> var. <i>platyphyllum</i>	-	ha‘ā, hame, mehame	-	E	Confirmed	CNRH, 2004
Phyllanthaceae	<i>Antidesma pulvinatum</i>	-	hame	-	E	Confirmed	DON, 2021
Phytolaccaceae	<i>Phytolacca octandra</i>	southern pokeberry	-	-	-	Confirmed	CNRH, 2004
Phytolaccaceae	<i>Rivina humilis</i>	coral berry	-	-	-	Confirmed	DON, 2021
Piperaceae	<i>Peperomia blanda</i>	arid land peperomia	‘ala‘ala wai nui	-	N	Confirmed	DON, 2021
Piperaceae	<i>Peperomia humilis</i>	Polynesian peperomia	‘ala‘ala wai nui	-	-	Confirmed	CNRH, 2004
Piperaceae	<i>Peperomia latifolia</i>	Hawai‘i peperomia	‘ala‘ala wai nui	-	E	Confirmed	CNRH, 2004
Piperaceae	<i>Peperomia membranacea</i>	woodland peperomia	‘ala‘ala wai nui	-	E	Confirmed	CNRH, 2004
Piperaceae	<i>Peperomia sandwicensis</i>	singlespike peperomia	‘ala‘ala wai nui	-	E	Confirmed	CNRH, 2004
Piperaceae	<i>Peperomia tetraphylla</i>	acorn peperomia	‘ala‘ala wai nui	-	N	Confirmed	DON, 2021
Pittosporaceae	<i>Pittosporum confertiflorum</i>	-	hō‘awa	-	E	Confirmed	CNRH, 2004
Pittosporaceae	<i>Pittosporum glabrum</i>	-	hō‘awa	-	E	Confirmed	CNRH, 2004
Plantaginaceae	<i>Plantago major</i>	broadleaf plantain	laukahi	-	-	Confirmed	CNRH, 2004
Plantaginaceae	<i>Plantago princeps</i> var. <i>princeps</i>	-	Ale	FE, SE	E	Confirmed	DON, 2021
Plumbaginaceae	<i>Plumbago zeylanica</i>	wild leadwort	‘ilie‘e	-	N	Confirmed	DON, 2021
Poaceae	<i>Aira caryophyllea</i>	silver hairgrass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Andropogon virginicus</i>	broomsedge	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Axonopus compressus</i>	broadleaf carpet grass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Bothriochloa pertusa</i>	pitted beardgrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Bromus hordeaceus</i>	soft chess	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Cenchrus ciliaris</i>	buffelgrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Cenchrus echinatus</i>	southern sandbur	-	-	-	Confirmed	CNRH, 2004

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Poaceae	<i>Cenchrus polystachios</i>	feathery pennisetum	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Cenchrus purpureus</i>	elephant grass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Chloris barbata</i>	swollen fingergrass	mau'u lei	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Chloris divaricata</i>	spreading windmill grass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Chloris radiata</i>	radiate fingergrass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Chloris virgata</i>	feather fingergrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Chrysopogon aciculatus</i>	golden beardgrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Cynodon dactylon</i>	Bermuda grass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Dactyloctenium aegyptium</i>	crowfoot grass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Digitaria ciliaris</i>	Henry's crabgrass	-	-	-	Confirmed	DON, 2021
Poaceae	<i>Digitaria insularis</i>	sourgrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Dissochondrus biflorus</i>	galse bristlegrass	-	SSC	E	Potential	DON, 2021
Poaceae	<i>Echinochloa crus-galli</i> var. <i>crus-galli</i>	large barnyard grass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Ehrharta stipoides</i>	meadow ricegrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Eleusine indica</i>	goosegrass	manienie ali'i	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Eragrostis cilianensis</i>	stink grass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Eragrostis grandis</i>	large Hawai'i lovegrass	kāwelu	-	E	Confirmed	CNRH, 2004
Poaceae	<i>Eragrostis pectinacea</i>	tufted lovegrass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Eragrostis tenella</i>	Japanese lovegrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Heteropogon contortus</i>	tanglehead	pili	-	N	Confirmed	CNRH, 2004
Poaceae	<i>Lachnagrostis filiformis</i>	-	he'upueo	-	N	Confirmed	CNRH, 2004
Poaceae	<i>Leptochloa fusca</i> subsp. <i>uninervia</i>	sprangletop	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Megathyrsus maximus</i>	Guinea grass	-	-	-	Confirmed	DON, 2021
Poaceae	<i>Melinis minutiflora</i>	molasses grass	-	-	-	Confirmed	DON, 2021
Poaceae	<i>Melinis repens</i>	rose natal grass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Oplismenus hirtellus</i>	basket grass	-	-	-	Confirmed	DON, 2021
Poaceae	<i>Panicum beecheyi</i>	rock panicgrass	-	-	E	Confirmed	CNRH, 2004
Poaceae	<i>Panicum nephelophilum</i>	-	konakona	-	E	Confirmed	CNRH, 2004
Poaceae	<i>Paspalum conjugatum</i>	Hilo grass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Paspalum fimbriatum</i>	Panama grass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Paspalum scrobiculatum</i>	ricegrass	mau'u laiki	-	N	Confirmed	CNRH, 2004

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Poaceae	<i>Sacciolepis indica</i>	Glenwood grass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Setaria parviflora</i>	yellow bristlegrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Setaria verticillata</i>	bristly foxtail	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Sorghum halepense</i>	Johnson grass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Sporobolus diandrus</i>	Indian dropseed	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Sporobolus indicus</i>	smutgrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Urochloa mutica</i>	paragrass	-	-	-	Potentially	CNRH, 2001
Poaceae	<i>Urochloa plantaginea</i>	creeping signalgrass	-	-	-	Confirmed	CNRH, 2004
Poaceae	<i>Vulpia bromoides</i>	brome fescue	-	-	-	Confirmed	CNRH, 2004
Polygonaceae	<i>Antigonon leptopus</i>	Mexican creeper	-	-	-	Potentially	CNRH, 2001
Polygonaceae	<i>Rumex albens</i>	O'ahu dock	hu'ahu'akō	-	E	Confirmed	CNRH, 2004
Polypodiaceae	<i>Adenophorus tamariscinus</i>	-	wahini noho mauna	-	E	Confirmed	CNRH, 2004
Polypodiaceae	<i>Adenophorus tenellus</i>	-	kolokolo	-	E	Confirmed	CNRH, 2004
Polypodiaceae	<i>Lepisorus thunbergianus</i>	weeping fern	'ekaha 'ākōlea, pākahakaha	-	N	Confirmed	DON, 2021
Polypodiaceae	<i>Phlebodium aureum</i>	golden polypody	laua'e haole	-	-	Confirmed	CNRH, 2004
Polypodiaceae	<i>Phymatosorus scolopendria</i>	monarch fern	laua'e	-	-	Confirmed	CNRH, 2004
Polypodiaceae	<i>Polypodium pellucidum</i>	dotted polypody	'ae	-	E	Confirmed	CNRH, 2004
Portulacaceae	<i>Portulaca oleracea</i>	pigweed	'ihi	-	-	Confirmed	CNRH, 2004
Portulacaceae	<i>Portulaca pilosa</i>	pigweed	'ihi	-	-	Confirmed	CNRH, 2004
Primulaceae	<i>Anagallis arvensis</i>	scarlet pimpernel	-	-	-	Potentially	CNRH, 2001
Primulaceae	<i>Lysimachia hillebrandii</i>	-	puahekili	-	E	Confirmed	CNRH, 2004
Proteaceae	<i>Grevillea robusta</i>	silk oak	-	-	-	Confirmed	DON, 2021
Psilotaceae	<i>Psilotum nudum</i>	whisk fern	moa	-	N	Confirmed	DON, 2021
Pteridaceae	<i>Adiantum hispidulum</i>	rough maidenhair fern	-	-	-	Confirmed	CNRH, 2004
Pteridaceae	<i>Adiantum raddianum</i>	delta maidenhair	-	-	-	Confirmed	CNRH, 2004
Pteridaceae	<i>Cheilanthes viridis</i>	green cliffbrake	-	-	-	Confirmed	DON, 2021
Pteridaceae	<i>Doryopteris decipiens</i>	-	kumuniu	-	E	Confirmed	DON, 2021
Pteridaceae	<i>Dryopteris scottii</i>	-	kumuniu	-	E	Confirmed	CNRH, 2004
Pteridaceae	<i>Pteris cretica</i>	Cretan brake	-	-	E	Confirmed	CNRH, 2004
Pteridaceae	<i>Pteris irregularis</i>	zigzag brake	'ahewa	-	E	Confirmed	CNRH, 2004
Pteridaceae	<i>Pteris x hillebrandii</i>	Hillebrand's brake	-	-	E	Potentially	CNRH, 2001
Rosaceae	<i>Osteomeles anthyllidifolia</i>	Hawai'i hawthorn	'ūlei	-	N	Confirmed	CNRH, 2004

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Rosaceae	<i>Rubus rosifolius</i>	thimbleberry	ola'a	-	-	Confirmed	CNRH, 2004
Rubiaceae	<i>Bobea brevipes</i>	-	'ahakea lau li'i, 'akupa	SGCN	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Bobea elatior</i>	-	'ahakea lau nui	SGCN	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Bobea sandwicensis</i>	Hawai'i dogwood	'ahakea	SSC	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Coprosma foliosa</i>	forest mirrorplant	pilo	-	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Coprosma longifolia</i>	O'ahu mirrorplant	pilo	-	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Hedyotis centranthoides</i>	-	-	-	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Hedyotis schlechtendahlia</i> var. <i>schlechtendahlia</i>	-	-	-	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Kadua affinis</i>	-	-	-	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Kadua parvula</i>	-	-	FE, SE	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Kadua acuminata</i>	-	au	-	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Psychotria hathewayi</i> var. <i>hathewayi</i>	Waianae Range wild coffee	kōpiko, 'ōpiko	-	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Psychotria mariniana</i>	forest wild coffee	kōpiko, 'ōpiko	-	E	Confirmed	CNRH, 2004
Rubiaceae	<i>Psydrax odorata</i>	-	alahe'e	-	N	Confirmed	DON, 2021
Rutaceae	<i>Melicope christophersenii</i>	Wai'anae Range melicope	Alani	FE, SE	E	Confirmed	DON, 2021
Rutaceae	<i>Melicope clusiifolia</i>	-	kūkaemoa, 'alani	-	E	Confirmed	CNRH, 2004
Rutaceae	<i>Melicope pallida</i>	pale melicope	Alani	FE, SE	E	Offsite, within 5 miles	DON, 2021
Rutaceae	<i>Melicope peduncularis</i>	boxfruit alani	'alani	-	E	Confirmed	CNRH, 2004
Rutaceae	<i>Melicope (Platydesma) cornuta</i> var. <i>decurrens</i>	-	-	FE, SE	N	Confirmed	DON, 2021
Rutaceae	<i>Melicope saint-johnii</i>	St. John's melicope	Alani	FE, SE	E	Offsite, within 5 miles	DON, 2021
Rutaceae	<i>Zanthoxylum dipetalum</i>	-	kāwa'u	-	E	Confirmed	CNRH, 2004
Rutaceae	<i>Zanthoxylum oahuense</i>	-	-	-	E	Potentially	NAVFAC PAC, 1998
Salicaceae	<i>Xylosma hawaiiensis</i>	Hawai'i brushholly	maua	-	E	Confirmed	CNRH, 2004
Santalaceae	<i>Santalum ellipticum</i>	sandalwood	'iliahialo'e	-	E	Confirmed	CNRH, 2004
Sapindaceae	<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	Hawai'i alectryon	māhoe	FE, SE	E	Confirmed	CNRH, 2004
Sapindaceae	<i>Dodonaea viscosa</i>	hopbush	'a'ali'i	-	N	Confirmed	DON, 2021
Sapindaceae	<i>Sapindus oahuensis</i>	-	lonomea, āulu	-	E	Confirmed	DON, 2021

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Sapotaceae	<i>Chrysophyllum oliviforme</i>	satinleaf, caimitillo	-	-	-	Confirmed	CNRH, 2004
Sapotaceae	<i>Pouteria sandwicensis</i>	-	‘ala‘a	-	E	Confirmed	CNRH, 2004
Sapotaceae	<i>Sideroxylon persimile</i>	bully tree	-	-	-	Confirmed	DON, 2021
Scrophulariaceae	<i>Buddleja asiatica</i>	dog tail	-	-	-	Confirmed	CNRH, 2004
Selaginellaceae	<i>Selaginella arbuscula</i>	lepelepe a moa	-	-	E	Confirmed	CNRH, 2004
Smilacaceae	<i>Smilax melastomifolia</i>	-	hoi kuahiwi	-	E	Confirmed	CNRH, 2004
Solanaceae	<i>Capsicum annuum</i> var. <i>annuum</i>	cayenne pepper	-	-	-	Potentially	CNRH, 2001
Solanaceae	<i>Datura stramonium</i>	jimsonweed	-	-	-	Confirmed	CNRH, 2004
Solanaceae	<i>Nicandra physalodes</i>	apple of Peru	-	-	-	Confirmed	CNRH, 2004
Solanaceae	<i>Nicotiana glauca</i>	tree tobacco	-	-	-	Confirmed	CNRH, 2004
Solanaceae	<i>Physalis peruviana</i>	cape gooseberry	pohā	-	-	Confirmed	CNRH, 2004
Solanaceae	<i>Solanum americanum</i>	glossy nightshade	pōpolo	-	N	Confirmed	CNRH, 2004
Solanaceae	<i>Solanum pimpinellifolium</i>	currant tomato	-	-	-	Confirmed	CNRH, 2004
Solanaceae	<i>Solanum seaforthianum</i>	Brazilian nightshade	-	-	-	Confirmed	CNRH, 2004
Tectariaceae	<i>Tectaria gaudichaudii</i>	Gaudichaud's halberd fern	‘iwa‘iwa lau nui	-	E	Confirmed	CNRH, 2004
Tectariaceae	<i>Tectaria cicutaria</i>	button fern	‘iwa ‘iwa lau nui	-	E	Potentially	CNRH, 2001
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	parasitic maiden fern	-	-	-	Confirmed	DON, 2021
Thelypteridaceae	<i>Cyclosorus hudsonianus</i>	-	-	-	E	Confirmed	CNRH, 2004
Thelypteridaceae	<i>Macrothelypteris torresiana</i>	-	-	-	-	Confirmed	CNRH, 2004
Thymelaeaceae	<i>Wikstroemia oahuensis</i>	O‘ahu false ohelo	‘ākia	-	E	Confirmed	CNRH, 2004
Tiliaceae	<i>Heliocarpus americanus</i>	white moho	moho	-	-	Confirmed	CNRH, 2004
Tiliaceae	<i>Triumfetta semitriloba</i>	Sacramento burr	-	-	-	Confirmed	DON, 2021
Urticaceae	<i>Boehmeria grandis</i>	Hawai‘i false nettle	-	-	E	Confirmed	CNRH, 2004
Urticaceae	<i>Cecropia obtusifolia</i>	guarumo	-	-	-	Potentially	CNRH, 2001
Urticaceae	<i>Neraudia melastomifolia</i>	angularfruit maoloa	ma‘aloa, ma‘oloa, ‘oloa	SSC	E	Confirmed	CNRH, 2004
Urticaceae	<i>Neraudia angulate</i> var. <i>angulata</i>	-	ma‘aloa, ma‘oloa, ‘oloa	FE, SE	E	Confirmed	CNRH, 2004
Urticaceae	<i>Pilea peploides</i>	Pacific island clearweed	-	-	N	Confirmed	CNRH, 2004
Urticaceae	<i>Pipturus albidus</i>	Waimea pipturus	māmaki	-	E	Confirmed	CNRH, 2004
Urticaceae	<i>Urera glabra</i>	-	hōpue, ōpuhe	-	E	Confirmed	CNRH, 2004
Urticaceae	<i>Urera kaalae</i>	-	Ōpuhe	FE, SE	E	Offsite, within 5 miles	DON, 2021

Appendix K-1
Lualualei Annex
Species List – Flora

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Occurrence</i>	<i>Reference</i>
Verbenaceae	<i>Lantana camara</i>	lantana	-	-	-	Confirmed	DON, 2021
Verbenaceae	<i>Stachytarpheta dichotoma</i>	-	oī	-	-	Confirmed	CNRH, 2004
Verbenaceae	<i>Stachytarpheta jamaicensis</i>	Jamaica vervain	oī	-	-	Confirmed	CNRH, 2004
Verbenaceae	<i>Verbena litoralis</i>	seashore vervain	ha'ōwī, ha'uoi, oī	-	-	Confirmed	CNRH, 2004
Violaceae	<i>Viola chamissoniana subsp. chamissoniana</i>	-	'olopū, pāmakani	FE, SE	E	Confirmed	CNRH, 2004
Violaceae	<i>Viola chamissoniana subsp. trachelifolia</i>	-	'olopū, pāmakani	-	E	Confirmed	CNRH, 2004
Viscaceae	<i>Korthalsella cylindrica</i>	Hawai'i korthal mistletoe	hulumoa, kaumahana	-	E	Confirmed	CNRH, 2004
Woodsiaceae	<i>Deparia fenziiana</i>	Fenzi's false spleenwort	-	-	E	Potentially	CNRH, 2001
Woodsiaceae	<i>Deparia petersenii</i>	Japanese false spleenwort	-	-	-	Potentially	CNRH, 2001
Woodsiaceae	<i>Diplazium sandwichianum</i>	Hawai'i twinsorus fern	ho'i'o, pohole	-	E	Confirmed	CNRH, 2004
Xanthorrhoeaceae	<i>Aloe vera</i>	aloe	-	-	-	Potentially	CNRH, 2001

Notes: E = endemic; N = native; I = invasive; - = no data; FE= federally listed endangered; SE = state listed endangered; SGCN = species of greatest conservation need; CNRH = Commander, Navy Region Hawai'i; DON = Department of the Navy; NAVFAC PAC = Naval Facilities Engineering Command, Pacific.

Rules: (1) If a species is native, it is classified as non-invasive.
(2) Invasive species list obtained from Hawaii Invasive Species Council at: <https://dlnr.hawaii.gov/hisc/>
(3) For species not listed in Integrated Taxonomic Information System, refer to: <http://www.worldfloraonline.org/>
(4) Native status removed for species not listed on U.S. Department of Agriculture as native to Hawai'i: <https://plants.usda.gov/>

Appendix K-1
Lualualei Annex
Species List – Flora



Appendix 1 References

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K-2 Lualualei Annex ESA-Listed Flora Descriptions

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Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

<i>Hawaiian Name</i>	<i>Photograph/Latin Binomial</i>	<i>Common Name</i>	<i>Comments</i>
Status: Federally listed ESA Species (Endangered)			
ko'oloa'ula	 <p>Photo 5-1: <i>Abutilon menziesii</i></p>	NCN	<p><i>Abutilon menziesii</i> (Photo 5-1) is a diffusely branched shrub in the mallow family that grows up to 4 to 7 feet (2 to 3 meters) with light green, heart-shaped leaves with serrated edges. When in bloom, <i>Abutilon menziesii</i> produces small (0.8 to 1.6 inches [2 to 4 centimeters{cm}]) flowers that hang upside down. The color of the flowers differs from population to population from maroon to pale yellow and red. The flowers of the plant at NRTF Lualualei are pale yellow on the inside and red on the outside edges of the petals. The habitat for the <i>Abutilon menziesii</i> includes dry coastal and lowland areas. The plants at Lualualei are the only wild <i>Abutilon menziesii</i> plant discovered thus far on O'ahu aside from plants in the 'Ewa Plains area, and its genetic material may be important for the conservation of the O'ahu population of the species. <i>Abutilon menziesii</i> occurs in one population within NRTF Lualualei and two in NAVMAG PH Lualualei. All individuals have been tagged. One population has been monitored for years and the other two populations were first observed in 2005. All three populations are found in sparse kiawe forest, with buffelgrass as the predominant ground cover. They generally seed throughout the year.</p>
Not available	 <p>Photo 5-2: <i>Abutilon sandwicense</i></p>	NCN	<p><i>Abutilon sandwicense</i> (Photo 5-2) is a member of the mallow family. Endemic to dry forests of Wai'anae Mountains, this shrub is 5 to 20 feet (1.5 to 6.0 meters) tall. Its leaves are heart-shaped and 3 to 9 inches (8 to 22 cm) long. The flowers are solitary in the leaf axils and pendulous. The narrow petals of the flower are green to reddish brown and 1.5 to 2 inches (4 to 5 cm) long. Its fruit is vase-like and 0.7 to 1 inch (17 to 25 millimeters [mm]) long. Individuals were observed at Mikiula and Hālonā Sites in 2004.</p>



Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
ala'alahua, māhoe	 <p>Photo 5-3: <i>Alectryon macrococcus</i> var. <i>macrococcus</i></p>	Hawai'i Alectryon	<p><i>Alectryon macrococcus</i> var. <i>macrococcus</i> (Photo 5-3) is a member of the soapberry family. Endemic. <i>A. macrococcus</i> var. <i>macrococcus</i> is a tree 10 to 37 feet (3 to 11 meters) tall. Its compound leaves are 8 to 22 inches (20 to 55 cm) long, with two to five pairs of leaflets. Its small flowers are either perfect (containing both male and female parts) or staminate (containing only male parts) and born in panicles up to 12 inches (30 cm) long. The fruit is sub-globose, and 1 to 3 inches (2.5 to 7.0 cm) in diameter. The flesh of the fruit is scarlet and is enclosed within a hard rind. A tree was observed at Pu'u Kaua in 2004; trees were observed at Pu'u Hāpapa in 1994 (within NAVMAG PH Lualualei) but not in 2004.</p>
Not available	 <p>Photo 5-4: <i>Asplenium dielfalcatum</i></p>	sickle island spleenwort	<p><i>Asplenium dielfalcatum</i> is a member of the Spleenwort family. This fern is endemic to the island of Oahu and grows in loamy soil in mesic forests from 1,300 to 3,280 feet (400 to 1,000 meters). Fronds are one pinnate and narrowly lanceolate, pale tan to dark brown and typically 1 to 5.5 inches (2.5 to 14 cm) long. Sori are usually single, short and separate, rarely fused. This species has not been recorded within PH LLL but has been observed just outside LLL boundaries and has a fair chance of occurring on DON property.</p>


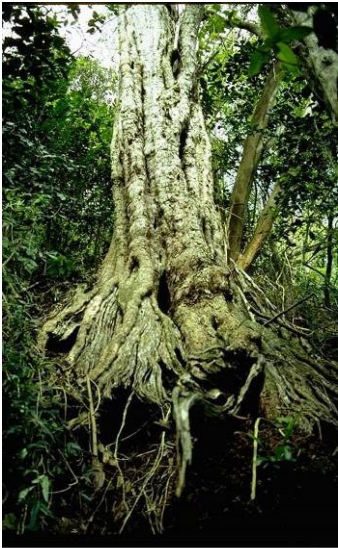
Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
Not available	 <p>Photo 5-5: <i>Asplenium unisorum</i></p>	singlesorus island spleenwort	<p><i>Asplenium unisorum</i> (Photo 5-7) is a member of the spleenwort family. Endemic to the southern Wai‘anae Mountains. Grows in mesic grasslands, shrublands, or forests. <i>Asplenium unisorum</i> grows from a slender, erect rhizome 0.20 to 1.8 inches (0.5 to 3.0 cm) tall and 0.16 to 0.40 inch (0.4 to 1.0 cm) in diameter. The stipes are black and shiny. The rhizome and stipe bases are clothed with small jet-black scales. The fronds have 20 to 35 pairs of pinnae, and are linear, gradually narrowing towards the apex. The pinnae are usually strongly asymmetrical in outline. A single marginal sorus runs along the anterior edge of each pinna.</p> <p>Solitary individual plants were noted at the Wai‘anae summit ridge between Pōhākea Pass and Palikea in Hālonā (within NAVMAG PH Lualualei).</p>
Not available	 <p>Photo 5-6: <i>Bonamia menziesii</i></p>	NCN	<p><i>Bonamia menziesii</i> (Photo 5-4) is a member of the morning glory family. Endemic to dry to mesic forests, rarely wet forests. <i>Bonamia menziesii</i> is a vine with twinning stems up to 33 to 49 feet (10 to 15 meters) long. The leaves are oblong-elliptic, ovate to rarely orbicular, and 1 to 4 inches (3 to 9 cm) long and 0.4 to 1.6 inches (1 to 4 cm) wide. The upper surface of the leaves may be smooth or covered with short wooly hairs, while the lower surface is almost always densely covered with yellowish-brown hairs. The flowers are solitary or sometimes cymes. The corollas are white to greenish-white and are 0.8 to 0.9 inch (20 to 25 mm) long and 0.6 to 0.8 inch (15 to 20 mm) wide. Plants were observed at Mikiula site (within NAVMAG PH Lualualei) in 2002 and 2003 by DON staff.</p>



Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

<i>Hawaiian Name</i>	<i>Photograph/Latin Binomial</i>	<i>Common Name</i>	<i>Comments</i>
hala pepe	 <p>Photo 5-7: <i>Chrysodracon forbesii</i></p>	Forbes' hala pepe	Hala pepe (Photo 5-7) is a member of the agave family. Endemic primarily to the Wai'anae Mountains. Occurs in dry to mesic forests from 803 to 2,903 feet (245 to 885 meters). <i>Chrysodracon forbesii</i> is a tree 10 to 23 feet (3 to 7 meters) tall and usually sparingly branched. The leaves are 9 to 15 inches (24 to 37 cm) long and 0.2 to .47 inch (0.5 to 1.2 cm) wide. The panicles are about 6 to 14 inches (15 to 35 cm) long, bearing greenish-yellow flowers 2.1 to 2.3 inches (52 to 60 mm) long. The berries are red and about 0.40 to 0.43 inch (10 to 11 mm) long. One individual is along the trail to the Mikilua management area within NAVMAG PH Lualualei.
'akoko, koko, ēkoko, kōkōmālei	 <p>Photo 5-8: <i>Euphorbia kuwaleana</i></p>	NCN	The endangered 'akoko (Photo 5-5) is a member of the spurge family. Endemic, primarily to Lualualei-Wai'anae Kai. Found on dry to mesic ridges and cliffs. <i>Euphorbia kuwaleana</i> is a shrub that grows 0.7 to 3.0 feet (0.2 to 0.9 meters) tall. The oppositely arranged leaves are 0.4 to 0.9 inches (11 to 25 mm) long and 0.3 to 0.6 inch (8 to 15 mm) wide and are ovate or rarely orbicular. The flowers are borne in cyathia (a specialized inflorescence) arranged singly in the leaf axils or rarely at the tips of branches. The size and shape of the capsules are not known. In 2004, plants on Kaua'ōpu'u (within NAVMAG PH Lualualei) appeared to be less common than in 1994. Some plants appeared to be defoliated by caterpillars. A fire occurred in this area in 2004.



Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
pu'uka'a	 <p>Photo 5-9: <i>Cyperus trachysanthos</i></p>	sticky flatsedge	<p>Pu'uka'a (Photo 5-9) is dispersed in three small populations within antenna fields at NRTF Lualualei. This plant species habitat is specialized, requiring periodic wet-dry conditions to emerge, reproduce, and thrive. <i>Cyperus trachysanthos</i> is found in low spots, ephemeral streams, and seasonal wetlands. In many areas, pu'uka'a only emerges after a significant rain event. This plant species is known to stay dormant for many years. Federal regulations require that those habitat conditions cannot be modified without consultation under ESA. Two of the populations were first observed during a 2004 botanical survey and the third in 2006 by DON landscaping staff.</p>
mēhamehame	 <p>Photo 5-10: <i>Flueggea neowawraea</i></p>	bushweed	<p>Mēhamehame (Photo 5-10) is a member of the spurge family. Found in mesic forests. <i>Flueggea neowawraea</i> is dioecious (the male and female flowers are on separate plants). It is a tree up to 98 feet (30 meters) tall, with a trunk up to 7 feet (2 meters) in diameters. Its leaves are ovate-elliptic, 2 to 6 inches (4 to 14 cm) long, and 0.8 to 4 inches (2 to 9 cm) wide. The small flowers are borne in axillary clusters. The fruits are reddish brown to black, juicy, globose, and 0.11 to 0.22 inch (3 to 6 mm) in diameter. Three trees were found in 1994, one each at Mikilua, Kauhiuhi, and in Hālona (within NAVMAG PH Lualualei). All three trees were found alive in 2004; however, the Mikilua tree is dead and the Kauhiuhi tree was mostly dead. The Hālona tree was surveyed in 2010 by DON staff and is healthy. All three trees showed signs of black twig borer infestation.</p>



Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
Not available	 <p>Photo 5-11: <i>Gouania meyenii</i></p>	Smoothfruit Chewstick	<i>Gouania meyenii</i> (Photo 5-11) is a member of the Buckthorn family. Endemic to islands of Kauai and Oahu, this shrub is from 1.6 to 7.2 feet (0.5 to 2.2 meters) tall. Its leaves are ovate to broadly elliptic and 1 to 3 inches (3 to 7.5 cm) long and 0.6 to 1.77 inches (1.6 to 4.5 cm wide). The flowers are likely unisexual (and plants monoecious) and are found in axillary cymes 0.78 to 3 inches (20 to 80 mm) long; petals and sepals are white and very small (less than 0.1 inch [3 mm]) Its fruit is 2 or occasionally 3 winged, 0.35 to 0.62 inches (9 to 16 mm long).
Not available	 <p>Photo 5-12: <i>Kadua parvula</i></p>	NCN	<i>Kadua parvula</i> (Photo 5-12) is a member of the coffee Family. Endemic to Wai'anae Mountains of O'ahu. Found on steep, mesic cliffs. <i>Kadua parvula</i> is a small, erect to sprawling, many-branched shrub. The lanceolate to ovate-cordate leaves are 0.4 to 1.6 inches (1 to 4 cm) long and 0.3 to 0.9 inch (0.7 to 2.3 cm) wide. The leaves have slightly revolute margins and are usually closely spaced and overlapping. The flowers are perfect or pistillate (containing only female parts), in narrow corymbose inflorescences that may sometimes be grouped together to give the appearance of one large inflorescence. The flowers are white with purplish-pink tinge toward the tips. Four plants were observed at the Wai'anae summit ridge into Hālonā (within NAVMAG PH Lualualei) in 1994; only one plant was found there in 2004. However, 11 plants were found below the ridge top in 2003.


Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
ʻānaunau, naunau, kūnānā	 <p>Photo 5-13: <i>Lepidium arbuscula</i></p>	Waiʻanae Range Pepperwort	<p>ʻĀnaunau (Photo 5-13) is a member of the mustard Family. Endemic to Waiʻanae Mountains. Occurs in dry to mesic habitats, in open shrubby or grassy areas, sparsely vegetated cliffs, and sometimes in scrubby forest. <i>Lepidium arbuscula</i> is a shrub 2 to 4 feet (0.6 to 1.2 meters) tall. The leaves are crowded at the ends of the branches and are 1 to 2 inches (2.6 to 6.0 cm) long and 0.3 to 0.7 inch (0.8 to 1.8 cm) wide. The small white flowers are borne on one to three erect, simple racemes 3 to 6 inches (7 to 15 cm) long.</p> <p>More than 700 plants were seen in Puʻu Kaua and in Hālona (within NAVMAG PH Lualualei) in 1994. No obvious change in abundance was noted for these same areas in 2004.</p>
nehe	 <p>Photo 5-14: <i>Lipochaeta lobata</i> var. <i>leptopylla</i></p>	NCN	<p><i>Lipochaeta lobata</i> (Gaud.) (Photo 5-114) is endemic to the leeward side of the Waiʻanae Mountains. Occurs in dry to mesic habitats on open, grassy, or shrubby ridges and cliffs. <i>L. lobata</i> var. <i>leptopylla</i> is a somewhat woody, perennial herb, with stems arching or decumbent. The leaves are closely spaced, lanceolate to linear lanceolate, and up to 4 inches (9.7 cm) long. Flowers are borne in heads with 20 to 65 disk florets and 8 to 15 yellow ray florets.</p> <p>A total of 140 plants were observed at Mikilua and Kauhiuhi (within NAVMAG PH Lualualei) in 1994. A bigger area was surveyed in 2004 with an estimate of 300 plants at Mikilua.</p>




Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

<i>Hawaiian Name</i>	<i>Photograph/Latin Binomial</i>	<i>Common Name</i>	<i>Comments</i>
‘ōhā, hāhā, ‘ōhāwai	 <p>Photo 5-15: <i>Lobelia niihauensis</i></p>	Ni‘ihau lobelia	<p>Photo 5-12 is a member of the bellflower family. Endemic to Wai‘anae Mountains. Found growing on cliffs in dry and mesic habitats. <i>Lobelia niihauensis</i> is a branched shrub with branches 8 to 16 inches (20 to 40 cm) long. Each branch bears an apical rosette of leaves 3 to 6 inches (7 to 15 cm) long and 0.3 to 0.7 inch (0.7 to 1.8 cm) wide. The unbranched inflorescences, 5 to 6 inches (12 to 15 cm) long, bear magenta flowers. More than 90 plants observed in many locations (within NAVMAG PH Lualualei) in 1994. No obvious change in plant abundance observed in 2004. Several new locations were found in Pūhāwai and Mikilua subdistricts.</p>
‘ihi‘ihi, ihi la‘au	 <p>Photo 5-16: <i>Marsilea villosa</i></p>	villous waterclover	<p>‘Ihi‘ihi (Photo 5-13) is a member of the water-clover family. Endemic. Found in dry areas, usually in depressions that flood during heavy winter rains and dry out completely during the summer. <i>Marsilea villosa</i> is an aquatic fern with creeping rhizomes. The stipes are in clusters of 2-65 per node. The fronds bear four fan-shaped pinnae 0.8 to 1.0 inches (2 to 2.5 cm) long and 0.89 to 0.90 inches (22-23 mm) wide that arise closely from a short rachis, giving an appearance of a “four-leafed clover.” The sori are contained in hard, nut-like sporocarps (spore-bearing structures) borne at the stipe bases. The sporocarps bear two types of spores: microspores and larger megaspores.</p> <p><i>Marsilea villosa</i> is dispersed into seven populations – six at NRTF Lualualei and one at NAVMAG PH Lualualei. A small colony of the ferns is located in a depression of a former cane-haul road located in a former cattle-grazing lot in the northwestern corner of NAVMAG PH Lualualei. Three populations occur in the NRTF Lualualei antenna fields which are regularly mowed. Another population located in a sparse kiawe forest area is not maintained but was previously used for cattle grazing. All populations of <i>Marsilea villosa</i> are monitored year-round.</p>




Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
alani	 <p>Photo 5-17: <i>Melicope pallida</i></p>	Pale Melicope	<p><i>Melicope pallida</i> is a member of the Rue family. Endemic to the islands of Kauai and Oahu, this tree is 19.6 to 32.8 feet (6 to 10 meters) tall. Its leaves are medium green with paler veins on the upper surface, and narrowly elliptic-ovate and folded in a V shape, 2.3 to 8.2 inches (6 to 21 cm) long. The tiny flowers are found in axillary cymes up to 2.3 (6 cm) long, with pale yellowish green petals up to 0.2 inches (5 mm) long. Fruit consists of follicles 0.35 to 0.39 inches (9 to 10 mm) long with two seeds per follicle, each about 0.13 inches (3.5 mm) long. This species has not been recorded within PH LLL but has been observed just outside LLL boundaries and has a fair chance of occurring on DON property.</p>
alani	<p>[no photo available] Photo 5-18: <i>Melicope saint-johnii</i></p>	St. John's Melicope	<p><i>Melicope saint-johnii</i> (Photo 5-18) is a member of the Rue family. Endemic to the island of Oahu, this tree is 9.8 to 19.6 feet (3 to 6 meters) tall. Its leaves are opposite, narrowly to broadly elliptic and 2.3 to 6.3 (6 to 16 cm) long. The flowers are about ¼ inch (less than [5 mm]) and borne in clusters of 3 to 11 in axillary cymes. Its fruit consists of follicles up to ½ inch (12 mm) long and 1 inch (24 mm) wide. This species has not been recorded within PH LLL but has been observed just outside LLL boundaries and has a fair chance of occurring on DON property.</p>



Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
ma'aloa, ma'oloa, 'oloa	 <p>Photo 5-19: <i>Neraudia angulata</i> var. <i>angulata</i></p>	NCN	<p>Ma'aloa (Photo 5-14) is a member of the nettle family. Endemic to Wai'anae Mountains. <i>Neraudia angulata</i> var. <i>angulata</i> is an erect shrub 5 to 10 feet (1.5 to 3.0 meters) tall. Its leaves are elliptic, elliptic-ovate, or ovate, 0.4 to 6 inches (1 to 15 cm) long and 1 to 2 inches (3.0 to 5.5 cm) wide. The leaf undersides are hairy, the hairs project outward, and the leaf margins are sometimes coarsely toothed above the middle. The plants are unisexual, bearing either female or male flowers. The flowers are small and tightly clustered in the leaf axils. The fruit is also small and conspicuously angled and ridged. Approximately 24 plants were observed at several spots in Mikilua, on Pu'u Kaua, and in Hālonā (within NAVMAG PH Lualualei) in 1994; only 14 plants were observed at these same locations in 2004.</p>
Kulu'i	 <p>Photo 5-20: <i>Nototrichium humile</i></p>	Ka'ala rockwort	<p>Kulu'i (Photo 5-15) is a member of the amaranth family. Endemic. Species occurs mainly in the Wai'anae Mountains in dry and mesic forests from 200 to 2,300 feet (60 to 700 meters). <i>Nototrichium humile</i> is a shrub with erect to decumbent stems that are 3 to 16 feet (1 to 5 meters) long. Its leaves are ovate to oblong, 1 to 4 inches (3 to 9 cm) long, and 0.8 to 2 inches (2 to 5 cm) wide. Its small, inconspicuous flowers and fruits are borne on slender spikes 1.2 to 6 inches (3 to 14 cm) long. About 20 plants were observed on Pu'u Kaua and in Mikilua (within NAVMAG PH Lualualei) in 1994. There was no change in plant abundance in 2004.</p>
laukahi kuahiwi, ale	 <p>Photo 5-21: <i>Plantago princeps</i> var. <i>princeps</i></p>	NCN	<p><i>Plantago princeps</i> var. <i>princeps</i> (Photo 5-21) is an endemic herbaceous plant found in wet forests. Its mature height is less than 1 foot (0.3 meter) with a 2-foot (0.6-meter) spread. It has simple green leather leaves with small abundance flowers on inflorescence. Leaves narrowly oblong to elliptic 2.4 to 11.9 inches (6 to 30 cm) long and 0.6 to 2 inches (1.5 to 5 cm) wide. Several scapes 4 to 20 inches (10 to 50 cm) long, flowers arranged on spikes 4.3 to 11 inches (11 to 28 cm) long densely crowded. Not identified in the HNHP survey.</p>



Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
Not available	 <p>Photo 5-22: <i>Sanicula mariversa</i></p>	Wai'anae range blacksnakeroot	<i>Sanicula mariversa</i> is a member of the Parsley family. Endemic to Oahu, this perennial herb is typically 15 to 27 inches (40 to 70 cm) tall. Its leaves are coriaceous and palmately 3-lobed or 5-lobed and split to the middle with spinulose-serrated margins. The flowers are yellow and form capitate umbels and solitary or clustered umbels in leaf axils. Its fruit is ovoid mericarps covered in prickles and up to ¼ inch (6 mm) long.
Not available	 <p>Photo 5-23: <i>Schiedea hookeri</i></p>	sprawling schiedea	<i>Schiedea hookeri</i> (Photo 5-23) is a member of the pink family. Endemic. It occurs mainly in the central and northern Wai'anae Mountains in dry and mesic forests from 1,197 to 2,953 feet (365 to 900 meters). <i>Schiedea hookeri</i> is a sprawling or clumped perennial herb, with stems 12 to 16 inches (30 to 50 cm) long. The leaves are opposite, narrowly lanceolate to narrowly elliptic, 1 to 3 inches (3 to 8 cm) long, and 0.02 to 0.06 inch (0.4 to 1.5 cm) wide. The conspicuous flowers are borne in open paniculate cymes 2 to 9 inches (5 to 22 cm) long. The fruit is a capsule about 0.01 to 0.012 inch (2.5 to 3.0 mm) long. About 20 plants were observed in Mikilua and Pu'u Kaua (within NAVMAG PH Lualualei) in 1994. No obvious change in abundance was noted in 2004.
Not available	 <p>Photo 5-24: <i>Silene perlmanii</i></p>	cliff face catchfly	<i>Silene perlmanii</i> is a member of the Pink family. Endemic to the island of Oahu, this species is a small shrub, with many branches emanating from the base in clumps and is typically 12 to 20 inches (30 to 50 cm) tall. Its leaves are narrowly elliptic and somewhat undulate, 1.9 to 4.1 inches (50-105 mm) long and 0.27 to 0.62 inches (7 to 16 mm) wide. Flowers are white and found in terminal, corymbose cymes. Petals 0.3 to 0.4 inches (8 to 10 mm) long and deeply notched. Its fruit is a capsule, 3 to 4 celled and up to 0.39 inches (10 mm) long. This species has not been recorded within PH LLL but has been observed just outside LLL boundaries and has a fair chance of occurring on DON property.



Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
Not available	 <p>Photo 5-25: <i>Spermodermis hawaiiensis</i></p>	Hawai'i scaleseed	<p><i>Spermodermis hawaiiensis</i> (Photo 5-18) is a member of the parsley family. Endemic. Occurs in dry shrublands and forests from 1,000 to 6,398 feet (305 to 1,950 meters). <i>Spermodermis hawaiiensis</i> is a slender, erect annual herb 2 to 8 inches (5 to 20 cm) tall. Its leaves are finely dissected, and measure from 0.4 to 1.6 inches (1 to 4 cm) long. The small white flowers are borne in compound umbels. The fruits are void, 0.12 to 0.16 inch (3 to 4 mm) long, 0.08 to 0.16 inch (2 to 4 mm) wide, and are covered with irregularly arranged tubercles, some of which bear slender hooked bristles. In 2004, two individuals were seen within the boundaries of NAVMAG PH Lualualei in 2004 and hundreds more were observed a few yards beyond the boundary at Kaua'ōpu'u.</p>
Not available	 <p>Photo 5-26: <i>Tetramolopium filiforme</i> var. <i>filiforme</i></p>	ridgetop Tetramolopium	<p><i>Tetramolopium filiforme</i> var. <i>filiforme</i> (Photo 5-19) is a member of the sunflower family. Narrowly endemic to leeward northern Wai'anae Mountains. Occurs in dry to mesic habitats usually on exposed, sparsely vegetated ridge tops and cliff faces from 1,000 to 3,051 feet (305 to 930 meters). <i>Tetramolopium filiforme</i> is a shrub 2 to 6 inches (5 to 15 cm) tall. Its leaves are 0.4 to 0.8 inch (10 to 20 mm) long and 0.016 to 0.047 inch (0.4 to 1.2 mm) wide. The flower heads are borne on peduncles 0.8 to 1.9 inches (2 to 4.7 cm) long; each peduncle is solitary or two to four per inflorescence. There are 35 to 52 ray florets and 18 to 30 disk florets in the flower head, and the rays are white or pale lavender. Two small plants were observed at Pu'u kū Makali'i (within NAVMAG PH Lualualei) in 1986. Seven mature plants and one immature plant were observed at the same site in 2004. DON staff observed a large population of these plants on a cliff face along Kolekole Pass Road.</p>




Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
Not available	 <p>Photo 5-27: <i>Tetramolopium lepidotum</i> subsp. <i>lepidotum</i></p>	Wai'anae range tetramolopium	<p><i>Tetramolopium lepidotum</i> subsp. <i>lepidotum</i> is a member of the Sunflower family. Endemic to Oahu and Lanai, this is a gynomonoecious small shrub up to 14.2 inches (36 cm) tall. The leaves are filiform to linear or linear-oblongate and up to 1.9 inches (50 mm) long and ¼ inch (7 mm) wide with coarsely 2 to 8 toothed margins. The flowers are corymbose-paniculate in groups of 6 to 12 and are not extended beyond the foliage. Rays are white to pinkish lavender and disc florets are maroon to pale salmon. Fruit is an achene just under 1/10th inch (2.5 mm) long. This species has not been recorded within PH LLL but has been observed just outside LLL boundaries and has a fair chance of occurring on DON property.</p>
Not available	 <p>Photo 5-28: <i>Urera kaalae</i></p>	NCN	<p><i>Urera kaalae</i> is a member of the Nettle family. Endemic to the island of Oahu, this species is a small tree or shrub 9.8 to 22.9 feet (3 to 7 meters) tall. <i>Urera kaalae</i> does not have stinging hairs like many species in the Nettle family. Its leaves are pale green, thin, and membranous, somewhat asymmetrical and up to 10.6 inches (27 cm) long. Flowers are tiny; the calyx is green and covered in reddish glands; flowers are borne in trichotomous paniculate cymes. Its fruit is an ellipsoid achene and only 3/100 inch (1 mm) long. This species has not been recorded within PH LLL but has been observed just outside LLL boundaries and has a fair chance of occurring on DON property.</p>




Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
pāmakani	 <p>Photo 5-29: <i>Viola chamissoniana</i> subsp. <i>chamissoniana</i></p>	NCN	<p>Pāmakani (Photo 5-20) is a member of the violet family. Endemic to the Wai‘anae Mountains. It can be found in mesic habitats, usually on exposed steep slopes and cliffs, and ranges from 2,297 to 3,034 feet (700 to 925 meters). <i>Viola chamissoniana</i> subsp. <i>chamissoniana</i> is a small, branched shrub with leaves about 0.8 to 1.6 inches (2 to 4 cm) long. One to two white flowers are borne per peduncle. The fruit is a capsule 4 to 8 inches (10 to 20 mm) long.</p> <p>Three plants were observed on the top of a ridge extending from the Wai‘anae Ridge Summit into Hālonā (within NAVMAG PH Lualualei) in 1994. No plants were found on the ridge top in 2003; however, 32 mature and 3 immature plants were observed below the ridge top.</p>
Status: Federal Candidate Species			
haha	 <p>Photo 5-30: <i>Cyanea calycina</i></p>	Wai‘anae range rollandia	<p><i>Cyanea calycina</i> is a member of the Bellflower family and is endemic to the island of Oahu, growing up to 9.84 feet (3 meters) tall. Leaves are elliptic or oblanceolate with blades up to 23.6 inches (60 cm) long and 5.5 inches (14 cm) wide. Leaf margins are callose-crenulate with petioles up to 3.54 inches (9 cm) long. Inflorescences bear 4 to 16 flowers up to 0.39 inches (10 mm) long on pedicels 1.1 inches (30 mm) long. Berries are 0.62 to 0.78 inches (16 to 20 mm) long. This species has not been recorded within PH LLL but has been observed just outside LLL boundaries and has a fair chance of occurring on DON property.</p>


Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
alani	 <p>Photo 5-31: <i>Melicope christophersenii</i></p>	Wai‘anae range melicope	<i>Melicope christophersenii</i> is a member of the Rue family. Endemic to Oahu, this species is a shrub or tree typically growing 9.84 to 19.6 feet (3 to 6 meters) tall. Leaves are opposite, coriaceous, elliptic to suborbicular and up to 0.39 inches (12 cm) long. Primary lateral veins are prominent on the lower leaf surface and are usually present in 10 to 14 pairs. The flowers are clustered 3 to 15 in cymes up to 0.16 inches (5 cm) long with petals up to 0.31 inches (8 mm) long. The fruit is a capsule 0.98 to 1.57 inches (25 to 40 mm) wide and 0.47 to 0.78 inches (12 to 20 mm) long with seeds up to ¼ inch (6 mm) long.
pilokea	 <p>Photo 5-32: <i>Melicope cornuta</i> var. <i>decurrens</i></p>	NCN	Pilokea (Photo 5-21) is a member of the citrus family. Endemic to Wai‘anae Mountains from 2,001 to 2,920 feet (610 to 890 meters). <i>Melicope cornuta</i> var. <i>decurrens</i> is an erect, sparingly branched shrub, usually 3 to 7 feet (1 to 2 meters) tall, with leaves clustered at the branch tips. The leaves are 5 to 16 inches (12 to 40 cm) long and 2 to 5 inches (5 to 13 cm) wide. Its flowers are borne in short axillary inflorescences on the bare stems below the leaves. The flowers are white with petals 0.4 to 0.6 inch (9 to 16 mm) long. The plant was observed within NAVMAG PH Lualualei. One individual was seen in 1994. This individual was not found during the 2004 surveys by the HNHP.
Status: Federal Species of Concern			
kāmakahala	 <p>Photo 5-33: <i>Labordia kaalae</i></p>	NCN	Kāmakahala (Photo 5-24) is a member of the logania family. Endemic to Wai‘anae Mountains. Recorded in mesic forests at elevations from 1,903 to 3,806 feet (580 to 1,160 meters). <i>Labordia kaalae</i> is a shrub or small tree 7 to 20 feet (2 to 6 meters) tall. Its leaves are 2 to 7 inches (6 to 17 cm) long and 1 to 3 inches (2.5 to 7.0 cm) wide. The small green to yellowish-green flowers are borne in open inflorescences, with 9 to 25 flowers per inflorescence. The fruits are two-valved, broadly ovoid capsules 0.5 to 0.8 inch (12 to 20 mm) long. Plants were observed within NAVMAG PH Lualualei in the Pu‘u Hāpapa area in 2004.

Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
pānaunau	 <p>Photo 5-34: <i>Lobelia yuccoides</i></p>	NCN	<p>Pānaunau (Photo 5-24) is a member of the bellflower family. Endemic to Wai‘anae Mountains. Found in mesic forests and shrublands from 2,297 to 4,035 feet (700 to 1,230 meters). <i>Lobelia yuccoides</i> has erect stems 5 to 7 feet (1.5 to 2.0 meters) long, with a dense apical rosette of leaves. The leaves are linear, 9 to 14 inches (24 to 35 cm) long, and 0.2 to 0.6 inch (0.5 to 1.5 cm) wide. The corolla of the flower is blue to lilac, 1.4 to 1.6 inches (36 to 40 mm) long, and 0.12 to 0.20 inch (3 to 5 mm) wide. Eight plants were seen in the Hālona near the summit ridge between the Pohakea pass and Palikea within NAVMAG PH Lualualei.</p>
nehe	 <p>Photo 5-35: <i>Melanthera tenuis</i></p>	NCN	<p>Nehe (Photo 5-25) is a member of the sunflower family. Endemic to central Wai‘anae Mountains in dry to mesic forests, often in shrublands and grasslands on open exposed ridges, from 1,017 to 3,117 feet (310 to 950 meters). <i>M. tenuis</i> is a somewhat woody perennial herb, with stems decumbent, 1 to 5 feet (0.3 to 1.5 meters) long. Its leaves are ovate to deltate, 0.9 to 1.7 inches (2.2 to 4.4 cm) long and 0.4 to 0.8 inch (1.0 to 2.1 cm) wide, sometimes with two or four basal lobes. Its flowers are borne in heads with 30 to 60 disk florets and 8 to 12 yellow ray florets. The plant was observed within NAVMAG PH Lualualei.</p>
ma‘aloa, ma‘oloa, ‘oloa	 <p>Photo 5-36: <i>Neraudia melastomifolia</i></p>	angularfruit maoloa	<p>Ma‘aloa (Photo 5-26) is a member of the nettle family. Endemic. Occurs in mesic and sometimes wet forests at elevations ranging from 902 to 4,003 feet (275 to 1,220 meters). <i>Neraudia melastomifolia</i> is a shrub or small tree up to 13 feet (4 meters) tall. Its leaves are elliptic, elliptic-ovate, ovate, or lanceolate; and are 2 to 9 inches (5 to 24 cm) long and 0.6 to 3 inches (1.5 to 7.0 cm) wide. The plants are unisexual, bearing either female or male flowers. The flowers and fruits are small, and tightly clustered in the leaf axils. Several plants were seen in the Hālona area not far below the summit ridge within NAVMAG PH Lualualei.</p>

Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

Hawaiian Name	Photograph/Latin Binomial	Common Name	Comments
Not available	 <p>Photo 5-37: <i>Schiedea pentandra</i></p>	hairy schiedea	<p><i>Schiedea pentandra</i> (Photo 5-27) is a member of the pink family. Endemic to Waiʻanae Mountains. Occurs in mesic and wet forests from 1,755 to 3,198 feet (535 to 975 meters). <i>Schiedea pentandra</i> is a reclining or weakly climbing vine, with stems 3 to 20 feet (1 to 6 meters) long. The leaves are opposite, narrowly lanceolate, 1.8 to 6.1 inches (4.5 to 15.5 cm) long and 0.3 to 2.2 inches (0.8 to 5.5 cm) wide, and sometimes purple tinged. The inflorescence is a panicle cyme 12 to 60 inches (30 to 150 cm) long with small, inconspicuous flowers. The fruit is a capsule 0.10 to 0.14 inch (2.5 to 3.5 mm) long. A group of plants was seen on the summit ridge of Puʻu Hāpapa within NAVMAG PH Lualualei.</p>

Legend: cm = centimeter; ESA = Endangered Species Act; HNHP = Hawaiʻi Natural Heritage Program; mm = millimeter; NAVMAG PH = Naval Magazine Pearl Harbor; NCN = No Common Name; NRTF = Naval Radio Transmitter Facility.

Appendix K-2
Lualualei Annex ESA-listed Flora Descriptions

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K-3 Study Occurrence Terms

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Appendix K-3

Occurrence Definitions for Species with Potential to Occur at JBPHH

Confirmed – This species has been “confirmed present” on site by a professional biologist or registered voucher is on file at the state level. Significant species activities on site include feeding, breeding, propagating, roosting, or nesting. This status does not typically include transient species (see Potentially).

Potentially – This species has been not been confirmed on site; however, suitable habitat may be available for the species to make use of. No surveys have yielded positive confirmed sightings. This status is used for transient species occurrences, such as migrating birds, fish, or insects.

Offsite within 5 miles – Species is not confirmed present on site but has been found (confirmed present on land) within 5 miles of the site or installation.

Confirmed within 5 miles of nearshore waters – Species has been confirmed present within 5 miles of the site, within (or upon) nearshore waters. This status is intended primarily for aquatic species. The ownership or control of the nearshore waters is not important here.

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K-4 Lualualei Annex Fauna Species

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Appendix K-4
Lualualei Annex
Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Invertebrates							
Achatinellidae	<i>Achatinella mustelina</i>	O'ahu tree snail	-	FE, SE	E	Potentially	Evenhuis et al., 2021
Achatinellidae	<i>Tornatellides</i> sp.	-	-	-	E	Potentially	Evenhuis et al., 2021
Agaonidae	<i>Pleistodontes</i> cf. <i>froggatti</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Agromyzidae	<i>Calycomyza</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Agromyzidae	<i>Liriomyza</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Aleyrodidae	<i>Aleurodicus dispersus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Alucitidae	<i>Alucita objurgatella</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Amastriidae	<i>Amastira cylindrica</i>	-	-	-	E	Potentially	Evenhuis et al., 2021
Amastriidae	<i>Leptachatina</i> sp.	-	-	-	E	Potentially	Evenhuis et al., 2021
Ampulicidae	<i>Ampulex compressa</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ampulicidae	<i>Dolichurus stantoni</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Anthomyzidae	<i>Amygdalops nigronotum</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Anthribidae	<i>Araecerus levipennis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Anthribidae	<i>Araecerus vieillardii</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Anthribidae	<i>Exilis lepidus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Anthribidae	<i>Ormiscus</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Aphididae	<i>Aphis</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Aphididae	<i>Neotoxoptera formosana</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Aphrophoridae	<i>Clastoptera xanthocephala</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Apidae	<i>Apis mellifera</i>	-	-	-	I	Confirmed	Evenhuis et al., 2021
Araneidae	<i>Gasteracantha mammosa</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Belidae	<i>Proterhinus</i> sp.	-	-	-	E	Confirmed	Evenhuis et al., 2021
Bethylidae	<i>Sierola laupapa</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Bethylidae	<i>Sierola</i> sp.	-	-	-	E	Confirmed	Evenhuis et al., 2021
Blaberidae	<i>Pycnoscelus indicus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Blattellidae	<i>Balta noctulata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic; I = invasive.

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; - = no data.

Appendix K-4
Lualualei Annex
Species List - Fauna

Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Blattellidae	<i>Balta similis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Blattellidae	<i>Lobopterella dimidiatipes</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Blattidae	<i>Periplaneta australasiae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Bostrichidae	<i>Amphicerus cornutus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Bostrichidae	<i>Xylopsocus castenoptera</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Bostrichidae	<i>Xylopsocus religiosus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Braconidae	<i>Apanteles trifasciatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Braconidae	<i>Heterospilus</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Braconidae	<i>Macrocentrus calacte</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Braconidae	<i>Meteorus laphygmae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Braconidae	<i>Phanerotoma hawaiiensis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Braconidae	<i>Pholetesor bedeliiae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Braconidae	<i>Rhaconotus vagrans</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Braconidae	<i>Spathius prusias</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Bruchidae	<i>Acanthoscelides macrophthalmus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Bruchidae	<i>Stator pruininus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Buthidae	<i>Isometrus maculatus</i>	lesser brown scorpion	kopiana	-	A	Confirmed	USFWS, 2010
Calliphoridae	<i>Calliphora vomitoria</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Calliphoridae	<i>Chrysomya megacephala</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Carcinophoridae	<i>Euborellia annulipes</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Carcinophoridae	<i>Euborellia eteronoma</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cecidomyiidae	<i>Contarinia</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cecidomyiidae	<i>Dasineura mangiferae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cecidomyiidae	<i>Lestodiplosis obtusilobata</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Cerambycidae	<i>Ceresium unicolor</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic.

Regulatory Status: - = no data.

Appendix K-4
Lualualei Annex
Species List - Fauna

Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Cerambycidae	<i>Curtomerus flavus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cerambycidae	<i>Placosternus crinicornis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cerambycidae	<i>Sybra alternans</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cerambycidae	<i>Xystrocera globosa</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ceratopogonidae	<i>Forcipomyia brevis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ceratopogonidae	<i>Forcipomyia hardyi</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Chironomidae	<i>Pseudosmittia maculiventris</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Chloropidae	<i>Cadrema pallida</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Chloropidae	<i>Gampsocera hardyi</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Chloropidae	<i>Gaurax bicoloripes</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Chloropidae	<i>Rhodesiella scutellata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Chloropidae	<i>Tylopterna</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Chrysididae	<i>Trichrysis triacantha</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Chrysomelidae	<i>Diachus auratus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Chrysopidae	<i>Mallada basalis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cicadellidae	<i>Nesolina lineata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cicadellidae	<i>Nesophryne</i> sp. A	-	-	-	E	Confirmed	Evenhuis et al., 2021
Cicadellidae	<i>Nesophryne</i> sp. B	-	-	-	E	Confirmed	Evenhuis et al., 2021
Cicadellidae	<i>Nesophryne</i> sp. nr. <i>myrsines</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Cicadellidae	<i>Scaphytopius loricatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cicadellidae	<i>Sophonia rufofascia</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Cixiidae	<i>Oliarus myoporicola</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Cixiidae	<i>Oliarus</i> sp.	-	-	-	E	Confirmed	Evenhuis et al., 2021
Coccidae	<i>Ceroplastes rubens</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Coccinellidae	<i>Curinus coeruleus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Coccinellidae	<i>Nephaspis bicolor</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Coccinellidae	<i>Olla v-nigrum</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Coccinellidae	<i>Sticholotis ruficeps</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic.

Regulatory Status: - = no data.

Appendix K-4
Lualualei Annex
Species List - Fauna

Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Coccinellidae	<i>Symnobius bilucernarius</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Coenagrionidae	<i>Ischnura posita</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Coenagrionidae	<i>Megalagrion xanthomelas</i>	orangeblack Hawaiian damselfly	pinopinao	FE, SOC	E	Potentially	USFWS 2010
Colletidae	<i>Hylaeus</i> spp.	Hawaiian yellow-faced bee	nalo meli	FE, SOC	E	Potentially	Magnacca 2005
Corylophidae	<i>Gloeosoma rotundus</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Corylophidae	<i>Sericoderus pubipennis</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Cosmopterigidae	<i>Hypsmocoma</i> sp. A	-	-	-	E	Confirmed	Evenhuis et al., 2021
Cosmopterigidae	<i>Hypsmocoma</i> sp. B	-	-	-	E	Confirmed	Evenhuis et al., 2021
Cosmopterigidae	<i>Hypsmocoma</i> sp. C	-	-	-	E	Confirmed	Evenhuis et al., 2021
Culicidae	<i>Aedes albopictus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Curculionidae	<i>Acalles</i> sp.	-	-	-	E	Confirmed	Evenhuis et al., 2021
Curculionidae	<i>Dryophthorus distinguendus</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Curculionidae	<i>Pantomorus cervinus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Curculionidae	<i>Pentarthrum</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Curculionidae	<i>Rhychogonus welchii</i>	-	-	-	E	Potentially	Evenhuis et al., 2021
Cydniidae	<i>Rhytidoporus indentatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Delphacidae	<i>Toya dryope</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Diapriidae	<i>Trichopria</i> sp.	-	-	-	E	Confirmed	Evenhuis et al., 2021
Dicyrtomidae	<i>Dicyrtoma (Papiroides) dubia</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Dolichopodidae	<i>Amblypsilopus pallidicornis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Dolichopodidae	<i>Campsicnemus halonae</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Dolichopodidae	<i>Campsicnemus hao</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic.

Regulatory Status: FE= federally listed endangered; SOC = USFWS designated species of concern; - = no data.

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Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Dolichopodidae	<i>Campsicnemus patellifer</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Dolichopodidae	<i>Chrysosoma globiferum</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Dolichopodidae	<i>Chrysotus longipalpis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Dolichopodidae	<i>Medetera grisescens</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Dettopsomyia formosa</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Drosophila cf. hydei</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Drosophila cf. repleta</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Drosophila immigrans</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Drosophila montgomeryi</i>	Hawaiian picture-wing fly	-	FE, SE	E	Potentially	Evenhuis et al., 2021
Drosophilidae	<i>Drosophila nasutoides</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Drosophila simulans</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Drosophila sulfurigaster bilimbata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Drosophila suzukii</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Scaptomyza buccata</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Drosophilidae	<i>Zaprionus indianus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Dysderidae	<i>Dysdera crocata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Elateridae	<i>Chalcolepidius erythroloma</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Elateridae	<i>Conoderus exsul</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Elipsocidae	<i>Kilauella micramaura</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Elipsocidae	<i>Kilauella</i> sp. A	-	-	-	E	Confirmed	Evenhuis et al., 2021
Elipsocidae	<i>Kilauella</i> sp. B	-	-	-	E	Confirmed	Evenhuis et al., 2021
Encyrtidae	<i>Cheiloneurus</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Entomobryidae	<i>Salina celebensis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Euconulidae	<i>Philonesia</i> sp.	-	-	-	A	Potentially	Evenhuis et al., 2021
Eulophidae	<i>Aprostocetus</i> cf. <i>hagenowii</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic.

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; - = no data.

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Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Eulophidae	<i>Elasmus atratus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Eulophidae	<i>Euplectrus platyhypenae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Eupelmidae	<i>Eupelmus</i> sp.	-	-	-	E	Confirmed	Evenhuis et al., 2021
Evaniidae	<i>Evania</i> sp. prob. <i>appendigaster</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Flatidae	<i>Melormenis basalis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Formicidae	<i>Anoplolepis gracilipes</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Formicidae	<i>Camponotus variegatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Formicidae	<i>Cardiocondyla emeryi</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Formicidae	<i>Leptogenys falcigera</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Formicidae	<i>Pheidole megacephala</i>	big-headed ant	-	-	I	Confirmed	Evenhuis et al., 2021
Formicidae	<i>Solenopsis papuana</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Formicidae	<i>Technomyrmex albipes</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Formicidae	<i>Technomyrmex difficilis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Geometridae	<i>Macaria abydata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Geometridae	<i>Psamatodes abydata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Halictidae	<i>Lasioglossum impavidum</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Heleomyzidae	<i>Trioxscelis ornata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Hemipsocidae	<i>Hemipsocus</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Hydroptilidae	<i>Oxyethira maya</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ichneumonidae	<i>Trathala annulicornis</i>	-	-	-	I	Confirmed	Evenhuis et al., 2021
Kalotermitidae	<i>Neotermes connexus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Keroplidae	<i>Tylparua apicalis</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Keroplidae	<i>Tylparua hawaiiensis</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Labiidae	<i>Spirolabia dubronyi</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Languriidae	<i>Cryptophilus integer</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic; I = invasive.

Regulatory Status: - = no data.

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Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Lasiochilidae	<i>Lasiochilus denigratus</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Lauxaniidae	<i>Homoneura hawaiiensis</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Lauxaniidae	<i>Homoneura unguiculata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Lauxaniidae	<i>Poecilominettia sexseriata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ichneumonidae	<i>Megastylus</i> sp. nr. <i>flavopictus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ichneumonidae	<i>Pimpla punicipes</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ichneumonidae	<i>Trathala annulicornis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ichneumonidae	<i>Trathala flavoorbitalis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ichneumonidae	<i>Vulgichneumon diminutus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Lepidopsocidae	<i>Lepidopsocus fasciatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Lepidopsocidae	<i>Lepidopsocus marmoratus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Libellulidae	<i>Pantala flavescens</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Limoniidae	<i>Dicranomyia hawaiiensis</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Limoniidae	<i>Dicranomyia nigropolita</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Limoniidae	<i>Dicranomyia stygipennis</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Limoniidae	<i>Dicranomyia swezeyi</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Limoniidae	<i>Libnotes perkinsi</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Linyphiidae	<i>Orsenwelles polites</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Lycaenidae	<i>Lampides boeticus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Lycaenidae	<i>Strymon bazochii</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Lycaenidae	<i>Zizina otis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Lygaeidae	<i>Clerada apicornis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Mantidae	<i>Brunneria borealis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic.

Regulatory Status: - = no data.

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Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Mantidae	<i>Tenodera australasiae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Megaspilidae	<i>Dendrocerus</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Miridae	<i>Nesidiorchestes hawaiiensis</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Miridae	<i>Taylorilygus apicalis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Muscidae	<i>Atherigona orientalis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Muscidae	<i>Lispocephala</i> sp.	-	-	-	E	Confirmed	Evenhuis et al., 2021
Muscidae	<i>Musca sorbens</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Mymaridae	<i>Chaetomymar sophoniae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Mymaridae	<i>Chaetomymar</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Mymaridae	<i>Dicopus</i> sp. nr. <i>psyche</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Mymaridae	<i>Gonatocerus dolichocerus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Mymaridae	<i>Polynema</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Neelidae	<i>Neelus minutus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Neriidae	<i>Telostylinus lineolatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Nitidulidae	<i>Carpophilus dimidiatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Nitidulidae	<i>Carpophilus oculatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Nitidulidae	<i>Epuraea (Haptoncus) ocularis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Nitidulidae	<i>Phenolia limbata tibialis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Nitidulidae	<i>Stelidota geminata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Nymphalidae	<i>Agraulis vanillae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Oedemeridae	<i>Thelyphassa apicata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Oligotomidae	<i>Oligotoma saundersii</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Pentatomidae	<i>Nezara viridula</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Philosciidae	<i>Australophiloscia societatis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Pholcidae	<i>Pholcus phalangioides</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic.

Regulatory Status: - = no data.

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Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Phoridae	<i>Chonocephalus simiolus</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Phoridae	<i>Diplonevra peregrina</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Phoridae	<i>Megaselia furcatilis</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Phoridae	<i>Megaselia</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Phoridae	<i>Puliciphora</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Pieridae	<i>Abeis nicippe</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Pieridae	<i>Pieris rapae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Platygastridae	<i>Aphanomerus</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Polyxenidae	<i>Polyxenus</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Porcellionidae	<i>Porcellio laevis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Porcellionidae	<i>Porcellio scaber</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Proctotrupidae	<i>Brachyserphus hawaiiensis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Psocidae	<i>Ptycta kaala</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Psocidae	<i>Ptycta</i> sp. A	-	-	-	E	Confirmed	Evenhuis et al., 2021
Psocidae	<i>Ptycta</i> sp. A	-	-	-	E	Confirmed	Evenhuis et al., 2021
Psocidae	<i>Ptycta</i> sp. A	-	-	-	E	Confirmed	Evenhuis et al., 2021
Psychodidae	<i>Psychoda</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Psychodidae	<i>Psychoda</i> sp. nr. <i>wirthi</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Psyllidae	<i>Heteropsylla</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Pulicidae	<i>Ctenocephalides felis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Pyrgodesmidae	<i>Aporodesminus wallacei</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Reduviidae	<i>Empicoris rubromaculatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Reduviidae	<i>Gallobelgicus saevus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Rhizophagidae	<i>Hesperobaenus capito</i>	-	-	-	N	Confirmed	Evenhuis et al., 2021
Salticidae	<i>Cosmophasis</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Salticidae	<i>Hasarius adansoni</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Salticidae	<i>Myrmarachne</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic; N = native.

Regulatory Status: - = no data.

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Sarcophagidae	<i>Lepidodexia elegans</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sarcophagidae	<i>Sarcophaga peregrina</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sarcophagidae	<i>Tricharaea occidua</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scarabaeidae	<i>Adoretus sinicus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scarabaeidae	<i>Copris incertus prociduus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scarabaeidae	<i>Onthophagus incensus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scatopsidae	<i>Holoplagia guamensis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scelionidae	<i>Dyscritobaeus comitans</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scenopinidae	<i>Scenopinus lucidus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sciaridae	<i>Bradysia spatitergum</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sciaridae	<i>Corynoptera prominens</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sciaridae	<i>Ctenosciara hawaiiensis</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Sciaridae	<i>Epidapus pallidus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sciaridae	<i>Hyperlasion magnisensoria</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Sciaridae	<i>Scaptosciara</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sciaridae	<i>Scatopsciara nigrita</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Scolopendridae	<i>Scolopendra subspinipes</i>	centipede	kanapī	-	A	Confirmed	USFWS, 2010
Scolopendridae	<i>Scolopendra subspinipes</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Cryphalus sylvicola</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Euwallacea fornicatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Euwallacea similis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Hypothenemus birmanus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Hypothenemus seriatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic.

Regulatory Status: - = no data.

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Scolytidae	<i>Wallacellus denticulatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xyleborinus andrewsi</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xyleborinus saxeseni</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xyleborus affinis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xyleborus ferrugineus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xyleborus interjectus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xyleborus lanaiensis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xyleborus perforans</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xyleborus spinulosus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xylosandrus compactus</i>	black twig borer	-	-	I	Confirmed	Evenhuis et al., 2021
Scolytidae	<i>Xylosandrus crassiusculus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sepsidae	<i>Sepsis</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Silvanidae	<i>Cryptamorpha desjardinsi</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sparassidae	<i>Heteropoda venatoria</i>	cane spider	-	-	A	Confirmed	USFWS, 2010
Sphaeroceridae	<i>Leptocera erythrocerata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sphaeroceridae	<i>Poecilosomella punctipennis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sphaeroceridae	<i>Pseudopterogramma brevivenosum</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sphaeroceridae	<i>Spinilimosina rufifrons</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sphecidae	<i>Pison insulare</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sphingidae	<i>Deilephila nerii</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Sphingidae	<i>Hyles calida</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Spirobolidae	<i>Spirobolellus immigrans</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Staphylinidae	<i>Aleochara</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Staphylinidae	<i>Anotylus</i> sp. prob. <i>nitidifrons</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic; I = invasive.

Regulatory Status: - = no data.

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Lualualei Annex
Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Staphylinidae	<i>Atheta</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Staphylinidae	<i>Sunius</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Staphylinidae	<i>Thyreocephalus albertisi</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Stratiomyidae	<i>Gobertina picticornis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Stratiomyidae	<i>Hermetia illucens</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Stratiomyidae	<i>Merosargus</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Succineidae	<i>Succinea caduca</i>	-	-	-	E	Potentially	Evenhuis et al., 2021
Syrphidae	<i>Allograpta obliqua</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Syrphidae	<i>Eumerus aurifrons</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Syrphidae	<i>Ocyptamus dimidiatus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Syrphidae	<i>Ornidia obesa</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Syrphidae	<i>Syritta</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Talitridae	<i>Talitroides topitotum</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Tenebrionidae	<i>Microcrypticus obscurus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Tephritidae	<i>Bactrocera cucurbitae</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Tephritidae	<i>Bactrocera dorsalis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Tephritidae	<i>Procecidochares alani</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Tettigoniidae	<i>Euconocephalus nasutus</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Theridiidae	<i>Steatoda grossa</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Tingidae	<i>Corythucha morrilli</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Tortricidae	<i>Episimus unguiculus</i>	-	-	-	E	Confirmed	Evenhuis et al., 2021
Torymidae	<i>Megastigmus transvaalensis</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Trogositidae	<i>Neaspis variegata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Tropiduchidae	<i>Kallitaxila granulata</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Ulidiidae	<i>Euxesta stigmatais</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Vespidae	<i>Delta pyriformis philippinense</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Vespidae	<i>Nesodynerus</i> sp.	-	-	-	E	Confirmed	Evenhuis et al., 2021

Category: A= alien; E = endemic.

Regulatory Status: - = no data.

Appendix K-4
Lualualei Annex
Species List - Fauna

Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Vespidae	<i>Polistes exclamans</i>	-	-	-	A	Confirmed	Evenhuis et al., 2021
Xylomyidae	<i>Solva</i> sp.	-	-	-	A	Confirmed	Evenhuis et al., 2021
Mammals							
Bovidae	<i>Capra hircus</i>	feral goat	kao	-	I	Potentially	DON, 2001
Canidae	<i>Canis lupus familiaris</i>	feral dog	ʻīlio hihīu	-	I	Potentially	NAVFAC PAC, 2006b
Felidae	<i>Felis catus</i>	feral cat	-	-	I	Potentially	NAVFAC PAC, 2006b
Herpestidae	<i>Herpestes javanicus</i>	mongoose	manakuke	-	I	Potentially	RCUH, 2020
Muridae	<i>Mus musculus</i>	house mouse	ʻīole	-	I	Potentially	NAVFAC PAC, 2006b
Muridae	<i>Rattus exulans</i>	Polynesian rat	ʻīole	-	I	Potentially	NAVFAC PAC, 2006b
Muridae	<i>Rattus norvegicus</i>	Norway rat	ʻīole	-	I	Potentially	NAVFAC PAC, 2006b
Muridae	<i>Rattus rattus</i>	roof rat	ʻīole	-	I	Potentially	NAVFAC PAC, 2006b
Suidae	<i>Sus scrofa</i>	feral pig	puaʻa	-	I	Potentially	NAVFAC PAC, 2006b
Vespertilionidae	<i>Lasiurus cinereus</i>	Hawaiian hoary bat	ʻōpeʻapeʻa	FE, SE	E	Confirmed	Bonaccorso et al., 2019
Reptiles							
Chamaeleonidae	<i>Trioceros jacksonii</i>	Jackson's chameleon	-	-	I	Potentially	Cordell, 2021
Emydidae	<i>Trachemys scripta elegans</i>	red-eared slider	-	-	A	Potentially	USFWS, 2010
Gekkonidae	<i>Hemidactylus frenatus</i>	house gecko	moʻoʻalā	-	A	Potentially	NAVFAC, 2020
Gekkonidae	<i>Lepidodactylus lugubris</i>	mourning gecko	-	-	A	Potentially	NAVFAC, 2020
Birds							
Alaudidae	<i>Alauda arvensis</i>	Eurasian skylark	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Anatidae	<i>Anas wyvilliana</i>	Hawaiian duck	koloa	FE, SE, MBTA	E	Confirmed	RCUH, 2021
Ardeidae	<i>Bubulcus ibis</i>	cattle egret	-	MBTA	I	Confirmed	Hamer Environmental, 2016
Cardinalidae	<i>Cardinalis cardinalis</i>	northern cardinal	-	MBTA	A	Confirmed	CNRH, 2004
Cettiidae	<i>Horornis diphone</i>	Japanese bush warbler	-	-	A	Confirmed	CNRH, 2004

Category: A= alien; E = endemic; I = invasived.

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; MBTA = Migratory Bird Treaty Act protected; - = no data.

Appendix K-4
Lualualei Annex
Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Charadriidae	<i>Pluvialis fulva</i>	Pacific golden-plover	kōlea	MBTA	N	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Columba livia</i>	rock pigeon, rock dove	-	-	A	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Geopelia striata</i>	zebra dove	-	-	A	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Spilopelia chinensis</i>	spotted dove	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Amandava amandava</i>	red avadavat	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Estrilda astrild</i>	common waxbill	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Euodice cantans</i>	African silverbill	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura atricapilla</i>	chestnut munia	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura oryzivora</i>	Java sparrow	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura punctulata</i>	nutmeg mannikin	-	-	A	Confirmed	Hamer Environmental, 2016
Fringillidae	<i>Chlorodrepanis flava</i>	honeycreeper	O'ahu 'amakihi	SOC, MBTA	E	Potentially	eBird, 2021
Fringillidae	<i>Crithagra mozambica</i>	yellow-fronted canary	-	-	A	Confirmed	Hamer Environmental, 2016
Fringillidae	<i>Haemorhous mexicanus</i>	house finch	-	-	A	Confirmed	CNRH, 2004
Fringillidae	<i>Himatione sanguinea</i>	honeycreeper	'apapane	SOC, MBTA	E	Potentially	eBird, 2021
Fringillidae	<i>Vestiaria coccinea</i>	scarlet honeycreeper	'i'iwi	FT, SE (O'ahu, Moloka'i, and Lana'i populations) MBTA	E	Potentially	Sundance-EA Associates, 2019

Category: A= alien; E = endemic; I = invasive; N = native; SE: state listed endangered.

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; MBTA = Migratory Bird Treaty Act protected; - = no data.

Appendix K-4
Lualualei Annex
Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Hydrobatidae	<i>Oceanodroma castro</i>	band-rumped Storm Petrel	‘akē‘akē	FE, SE, MBTA	N	Potentially	eBird, 2021
Leiothrichidae	<i>Garrulax canorus</i>	melodius laughingthrush	-	-	A	Confirmed	CNRH, 2004
Leiothrichidae	<i>Leiothrix lutea</i>	red-billed leiothrix	-	-	A	Confirmed	CNRH, 2004
Mimidae	<i>Mimus polyglottos</i>	northern mockingbird	-	-	A	Confirmed	Hamer Environmental, 2016
Monarchidae	<i>Chasiempis ibidis</i>	O‘ahu ‘elepaio	O‘ahu ‘elepaio	-	E	Potentially	Sundance-EA Associates, 2019
Muscicapidae	<i>Copsychus malabaricus</i>	white-rumped shama	-	-	A	Confirmed	CNRH, 2004
Passeridae	<i>Passer domesticus</i>	house sparrow	-	-	A	Confirmed	Hamer Environmental, 2016
Phaethontidae	<i>Phaethon lepturus</i>	white-tailed tropicbird	koa'e, koa'e kea	MBTA	N	Confirmed	eBird, 2021
Phasianidae	<i>Francolinus erckelii</i>	Erckel's francolin	-	-	A	Confirmed	CNRH, 2004
Phasianidae	<i>Francolinus francolinus</i>	black francolin	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Francolinus pondicerianus</i>	gray francolin	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Gallus gallus</i>	red junglefowl	moa	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Pavo cristatus</i>	common peafowl	-	-	A	Confirmed	Hamer Environmental, 2016
Procellariidae	<i>Pterodroma sandwichensis</i>	Hawaiian Petrel	‘ua‘u	FE, SE, MBTA	E	Potentially	Young et al., 2019
Procellariidae	<i>Puffinus newelli</i>	Newell's Shearwater	‘a‘o	FT, ST, MBTA	E	Potentially	Young et al., 2019
Pycnonotidae	<i>Pycnonotus cafer</i>	red-vented bulbul	-	-	I	Confirmed	Hamer Environmental, 2016
Pycnonotidae	<i>Pycnonotus jocosus</i>	red-whiskered bulbul	-	-	I	Confirmed	Hamer Environmental, 2016
Rallidae	<i>Fulica alai</i>	Hawaiian coot	‘alae ke‘oke‘o	FE, SE, MBTA	E	Confirmed	RCUH, 2021

Category: A= alien; E = endemic; I = invasive; N = native; SE: state listed endangered.

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; MBTA = Migratory Bird Treaty Act protected; - = no data.

Appendix K-4
Lualualei Annex
Species List - Fauna

Family	Latin Name	Common Name	Hawaiian Name	Regulatory Status	Category	Study Area Occurrence	Reference
Rallidae	<i>Gallinula chloropus galeata</i>	Hawaiian gallinule	‘ālae ‘ula	FE, SE, MBTA	E	Potentially	NAVFAC PAC, 2006a
Recurvirostridae	<i>Himantopus mexicanus knudseni</i>	Hawaiian stilt	ae‘o	FE, SE, MBTA	E	Confirmed	RCUH, 2021
Strigidae	<i>Asio flammeus sandwichensis</i>	Hawaiian short-eared owl	pueo	SE, MBTA	E	Confirmed	RCUH, 2021
Sturnidae	<i>Acridotheres tristis</i>	common myna	piha‘ekelo	-	A	Confirmed	CNRH, 2004
Thraupidae	<i>Paroaria coronata</i>	red-crested cardinal	-	-	A	Confirmed	CNRH, 2004
Thraupidae	<i>Sicalis flaveola</i>	saffron finch	-	-	A	Confirmed	Hamer Environmental, 2016
Tytonidae	<i>Tyto alba</i>	barn owl	-	-	I	Confirmed	Hamer Environmental, 2016
Zosteropidae	<i>Zosterops japonicus</i>	Japanese white-eye	-	-	A	Confirmed	Hamer Environmental, 2016

Notes: A= alien; E = endemic; FE= federally listed endangered; FT = federally listed threatened; I = invasive; MBTA = Migratory Bird Treaty Act protected; N = native; SE = state listed endangered; ST = state listed endangered; - = no data; CNRH = Commander, Navy Region Hawai‘i; DON = Department of the Navy; NAVFAC PAC = Naval Facilities Engineering Command, Pacific; RCUH = The Research Corporation of the University of Hawai‘i.

Rules: (1) MBTA designations obtained from U.S. Fish and Wildlife Service at: <https://www.fws.gov/birds/management/managed-species/migratory-bird-treaty-act-protected-species.php>

(2) If a species is native, it is classified as non-invasive.

(3) Invasive species list obtained from Hawai‘i Invasive Species Council at: <https://dlnr.hawaii.gov/hisc/>

Appendix K-4 References

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**K-5 Addendum to 2011 Joint Base Pearl Harbor-Hickam Integrated Natural
Resources Management Plan**

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DEPARTMENT OF THE NAVY

COMMANDER
NAVY REGION HAWAII
850 TICONDEROGA ST STE 110
JBPHH, HAWAII 96860-5101

5750
Ser N45/0583
June 7, 2012

CERTIFIED MAIL NO. 7010 2780 0003 1014 0334

Dr. Loyal Mehrhoff
Field Supervisor
Pacific Islands Fish & Wildlife Office
300 Ala Moana Boulevard
Box 50098
Honolulu, HI 96850

Dear Dr. Mehrhoff:

SUBJECT: ADDENDUM TO 2011 JOINT BASE PEARL HARBOR-HICKAM
INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

We would like to thank you and your staff for taking the time to discuss the subject matter with representatives of Commander, Navy Installations Command, Naval Facilities Engineering Command (NAVFAC) Headquarters, NAVFAC Pacific and NAVFAC HI. The enclosed Addendum provides additional information for Navy-owned parcels at Navy Munitions Command East Asia Division Detachment Joint Base Pearl Harbor-Hickam Lualualei Annex (formerly known as NAVMAG PH Lualualei Branch), Naval Radio Transmitter Facility (NRTF) Lualualei, and Kalaeloa at the former Naval Air Station Barbers Point.

This information will be incorporated in the Joint Base Pearl Harbor-Hickam Integrated Natural Resources Management Plan. We will continue to work with your office and seek your concurrence on this important document.

We appreciate your accommodation and consideration concerning the Navy's request to exclude NAVMAG PH Lualualei Branch, NRTF Lualualei, and Kalaeloa from plant critical habitat designation. We look forward to your feedback.

Should you have any questions, please contact Dr. Cory Campora, (808) 471-1171, extension 244 or email cory.campora@navy.mil.

Sincerely,

J. CORONADO
Captain, CEC, U.S. Navy
Regional Engineer
By direction of the
Commander

5750
Ser N45/0583
June 7, 2012

Enclosure: 1. Addendum to the September 2011 Final Integrated
Natural Resource Management Plan-Joint Base
Pearl Harbor-Hickam.

Copy to: NAVFAC Hawaii (ARE, OPHE2)
NAVFAC Pacific (EV22)

Addendum to the
Integrated Natural Resource Management Plan

Joint Base Pearl Harbor-Hickam

***Navy Munitions Command East Asia Division Detachment Joint Base
Pearl Harbor-Hickam Lualualei Annex,
Naval Radio Transmitter Facility Lualualei, and
Kalaeloa (Former Naval Air Station Barber's Point)
O'ahu, State of Hawai'i***

Commander Navy Region Hawaii
June 2012

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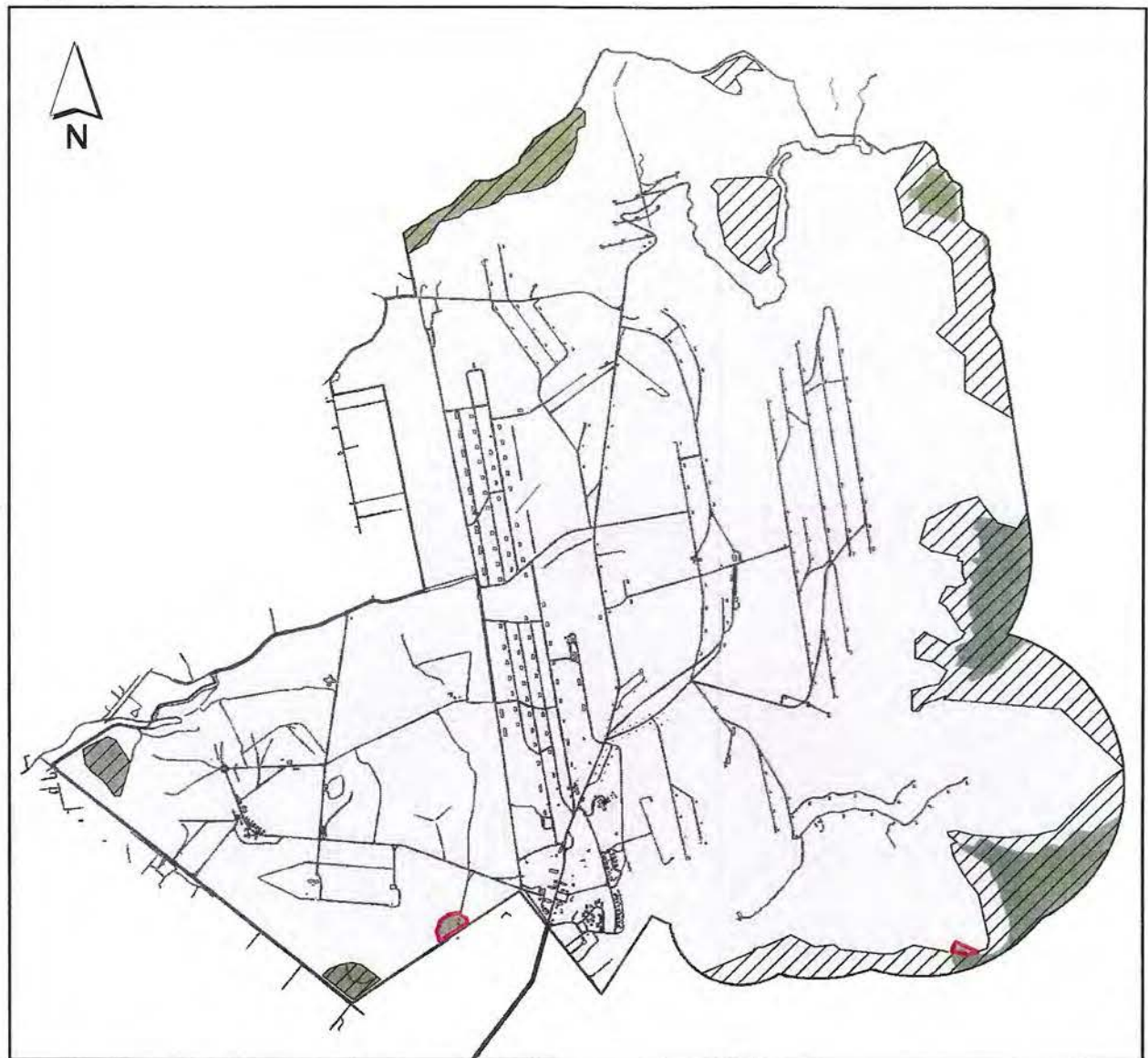
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1.0 Introduction and Overview





This Addendum has been prepared in accordance with and is officially incorporated as part of the JBPHH INRMP (September 2011) to address the proposed critical habitat designations for 42 plant species including *Abutilon sandwicense*, *Alectryon macrococcus*, *Bonamia menziesii*, *Cenchrus agrimonioides*, *Chamaesyce herbstii*, *C. kuwaleana*, *Cyanea acuminata*, *C. calycina*, *C. grimesiana* ssp. *obatae*, *Cyperus trachysanthos*, *Diellia falcata*, *D. unisora*, *Flueggea neowawraea*, *Gouania meyenii*, *Hesperomannia arbuscula*, *Kadua parvula*, *Labordia cyrtandrae*, *Lepidium arbuscula*, *Lipochaeta lobata* var. *leptophylla*, *Lobelia niihauensis*, *L. oahuensis*, *Marsilea villosa*, *Melicope christophersenii*, *M. pallida*, *M. saint-johnii*, *Neraudia angulata*, *Nototrichium humile*, *Phyllostegia hirsuta*, *Plantago princeps* var. *princeps*, *Platydesma cornuta* var. *decurrens*, *Pleomele forbesii*, *Pteralyxia macrocarpa*, *Sanicula marivera*, *Schiedea hookeri*, *S. kaalae*, *S. trinervis*, *Silene perlmanii*, *Spermolepis hawaiiensis*, *Stenogyne kanehoana*, *Tetramolopium lepidotum* ssp. *lepidotum*, *Urera kaalae*, and *Viola chamissoniana* ssp. *Chamissoniana*.

The critical habitat designations would occur on Navy-owned parcels at Navy Munitions Command East Asia Division Detachment Joint Base Pearl Harbor-Hickam Lualualei Annex (formerly known as Naval Magazine Pearl Harbor Lualualei) and Naval Radio Transmitter Facility (NRTF) Lualualei (Figure 1). The critical habitat proposed for Kalaeloa (Former Naval Air Station Barber's Point) occurs only on parcels to be released under the Base Realignment and Closure (BRAC) program (Figure 2).

Figure 1



Current and Proposed Plant Critical Habitat, Lualualei, Oahu, Hawaii

-  JBPHH Lualualei Annex
-  Current Lualualei Plant Critical Habitat
-  2011 Proposed Lualualei Plant Critical Habitat
-  New Area

(Current plant critical habitat = 972 acres)

(Lualualei proposed plant critical habitat = 393 acres)



(New areas of plant critical habitat = 4 acres)



Figure 2.

Kalaeloa (Former NAS Barber's Point) Navy Retained Lands and Proposed Critical Habitat

0 0.25 0.5 1 Kilometers

 Navy Retained Lands
 Proposed CH



2.0 Navy Munitions Command East Asia Division Detachment Joint Base Pearl Harbor-Hickam Lualualei Annex and Naval Radio Transmitter Facility Lualualei

2.1 Additional Information and Progress of Projects Included in the INRMP

The primary strategies to meet management goals at Lualualei are to install ungulate fencing and remove invasive species. This section provides additional details of the programmed projects for endangered plants that are listed in the 2011 Draft INRMP, and summarizes progress made on the programmed projects. See Table 1 for a list of applicable projects excerpted from Table 9.9 in the INRMP.

Table 1 Excerpt from INRMP Table 9.9: JBPHH Ten-Year Fiscal Plan for Projects at Lualualei

Objectives and Projects	Y1 (2012)	Y2 (2013)	Y3 (2014)	Y4 (2015)	Y5 (2016)	Y6 (2017)	Y7 (2018)	Y8 (2019)	Y9 (2020)	Y10 (2021)	Total
11. Monitoring and management of NAVMAG PH Lualualei Branch listed/candidate/species of concern plant species	\$45,000	\$47,000	\$49,000	\$51,000	\$54,000	\$56,000	\$59,000	\$61,000	\$64,000	\$67,000	\$533,000
13. <i>Abutilon menziesii</i> , <i>Marsilea villosa</i> , <i>Cyperus trachysanthos</i> monitoring and management	\$7,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$4,000	\$4,000	\$4,000	\$4,000	\$41,000
19. Monitor, control and exclude feral ungulates within SMAs	\$12,000	\$13,000	\$400,000	\$20,000	\$400,000	\$25,000	\$400,000	\$30,000	\$400,000	\$50,000	\$1,750,000
23. Native habitat management through invasive vegetation removal at SMAs in NAVMAG Lualualei	\$80,000	\$84,000	\$87,000	\$91,000	\$95,000	\$100,000	\$104,000	\$109,000	\$114,000	\$119,000	\$983,000
24. Black-stem borer research	\$0	\$0	\$0	\$0	\$0	\$0	\$30,000	\$30,000	\$0	\$0	\$60,000
43. Continue FFD and/or HFD response to any wildland fires	\$0	\$0	\$65,000	\$0	\$0	\$5,000	\$0	\$0	\$5,000	\$0	\$75,000

Objective 11 - Monitoring and management of NAVMAG PH Lualualei Branch listed/candidate/species of concern plant species

As planned in the INRMP, the Navy funded \$46,400 in FY12 for in-house surveys of known sites within the Magazine area where threatened and endangered and candidate threatened and endangered plant species are documented to occur. This survey effort is currently ongoing and is expected to conclude by the end of September 2012. Surveys are expected to provide updated status of these plants and identify plants that require specialized management. The results of these efforts will be used to create a management plan for endangered plant species at Lualualei. The preparation of the management plan is currently unfunded; however, if additional funds are available at the end of this fiscal year, this management plan is our top priority. If FY12 funds are not available at the end of the year, we will be program the management plan as an FY13 project.

Objective 13 - *Abutilon menziesii*, *Marsilea villosa*, *Cyperus trachysanthos* monitoring and management

As planned in the INRMP, in 2012 the Navy conducted comprehensive in-house surveys of the Lualualei Radio Transmitting Facility (LLL RTF) and additional populations of *Marsilea villosa* were identified within NRTF Lualualei. In 2008, the Navy funded University of Hawai'i to conduct research at NRTF Lualualei to investigate the soil and associated plant community in relation to the *M. villosa* population. The Navy expects to receive a copy of the dissertation and management recommendations strategies for *M. villosa* later this year. The results of these efforts will be used to inform the management plan described in section 2.1 above.

Objective 19 - Monitor, control and exclude feral ungulates within SMAs

The original scope described in the INRMP included ungulate surveys and removal with a budgeted amount of \$12,000. We were able to commit an additional \$140,000 to expand the scope of work to include a fencing plan. This plan will identify and prioritize areas of Lualualei to be fenced and provide cost estimates for fence installation, ungulate removal, and fence maintenance. The contract for an Ungulate Fencing Plan is in the process of being awarded and will be awarded by the end of July. The draft plan is anticipated in May 2013, with the final plan in July 2013. The results of the Ungulate Fencing Plan will be used to update the cost estimates and phasing for construction of the fencing at Lualualei.

Funds for fence construction are already programmed, starting in 2014. The fence will be constructed in phases. Additional funds for construction of future phases, maintenance and monitoring are programmed for subsequent years. Also included in the cost is ungulate removal following fence construction.

Aerial goat surveys were completed in February through a cooperative partnership between the Navy and other members of the Waianae Mountain Watershed Partnership, including the Army, State of Hawai'i, private landowners, and other private stakeholder entities. Funds were part of a larger cooperative agreement with the University of Hawai'i HPI-CESU. Surveys were completed in February. Goat removal is anticipated to begin in FY13.

Objective 23 - Native habitat management through invasive vegetation removal at SMAs in NAVMAG Lualualei

As planned in the INRMP, the Navy funded \$80,000 in FY12 for surveys and removal of invasive vegetation. The work is being done under multiple ongoing projects. One project is a survey specific to locally-restricted invasive plant species, including *Phytolacca dioica*, *Tetraclinus articulata*, and other species that are naturalizing within Lualualei. Work is currently ongoing and being performed by the Oahu Invasive Species Committee. The project funds were part of a larger cooperative agreement with the University of Hawai'i HPI-CESU. Surveys were initiated in April and are expected to conclude by the end of September 2012.

Another project is to remove invasive vegetation and propagate native plants in-situ in the Halona and Mikilua fenced exclosures. Work was initiated in November of 2011 and is expected to conclude by the end of September 2012.

Objective 24 - Black-stem borer research

The goal of this research is to find the methods of reducing damage to *Flueggea neowawraea*. This project is currently programmed for FY18 and FY19.

Objective 43 - Continue FFD and/or HFD response to any wildland fires

The wildland fire prevention management and response plan is currently programmed for FY14; however, we are planning to reprioritize projects in an attempt to push this project up to FY13.

2.2 Additional Projects

In addition to the projects identified in the 2011 Draft INRMP, the projects and actions listed below are priorities for programming as emergent projects or FY15 projects.

1) Develop management plans for endangered plant species at Lualualei. If additional funds are available at the end of this fiscal year, this management plan is our top priority. If FY12 funds are not available at the end of the year, we will be programming the management plan as an FY13 project.

2) Construct fencing around the *M. villosa* population located outside the installation perimeter in the northwestern section of NAVMAG PH Lualualei Branch to protect the plant from potential impacts caused by off-road vehicles and feral ungulates. We will be requesting additional funds as an emergent project this fiscal year. If the funding can be secured, the fencing can be completed within six months of receipt of funds.

3) Aerial application of rodenticides within fenced areas, following construction of the ungulate fence. This project is dependent upon completion of the Programmatic EIS for Hand and Aerial Broadcast of Rodenticide for Conservation Use in the State of Hawai'i. The Navy is a cooperating agency for this EIS and will continue to support this effort. Funding would be programmed in FY15 at the earliest.

4) Develop survey data in conjunction with the Service and other stakeholders to collect data that can be used to document population status and effects of management actions. We anticipate having draft forms for the Service and stakeholders review by the end of the fiscal year.

5) Request permission through the chain of command to outplant threatened and endangered species to augment and stabilize populations within Navy property at Lualualei. The request package will be sent up for review by the end of the fiscal year. If approved, the Navy will program additional funds to integrate outplanting into the INRMP. The Navy will work with the Service on the species priority and preferred locations for outplanting. The Navy would explore the possibility of working with the Army in the outplanting efforts.

3.0 Kalaeloa (Former Naval Air Station Barber's Point)

3.1 Additional Information and Progress of Projects Included in the INRMP

This section provides additional details of the programmed project for endangered plants that are listed in the 2011 Draft INRMP, and summarizes progress made on the programmed project. Table 2 is excerpted from Table 9.9 in the INRMP.

Table 2 Excerpt from INRMP Table 9.9: JBPHH Ten-Year Fiscal Plan for Projects at Barbers Point

Objectives and Projects	Y1 (2012)	Y2 (2013)	Y3 (2014)	Y4 (2015)	Y5 (2016)	Y6 (2017)	Y7 (2018)	Y8 (2019)	Y9 (2020)	Y10 (2021)	Total
7. Kalaeloa 'akoko management	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$3,000	\$3,000	\$3,000	\$3,000	\$24,000

Objective 7 – Kalaeloa 'akoko management

The INRMP programmed funds for 'akoko management on an annual basis; however, in 2012 the funds were reallocated to other natural resource management projects in anticipation of pending BRAC actions. As part of the BRAC process, surveys for 'akoko were completed March 2012. A conservation plan is being developed to ensure conservation of 'akoko following land transfer under the BRAC program. When completed, the INRMP may incorporate applicable conservation measures.

3.2 Additional Projects

Additional projects may be proposed following the completion of the 'akoko conservation plan.

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K-6 Niuli'i Pond Management Plan

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Purpose of plan

The purpose of creating a wildlife management plan for the U.S. Navy Wildlife Refuge at Niuli'i Ponds is to establish a framework of priorities and specific actions to be carried out in support of the management goals and objectives of the land manager. This management plan was written for the United States Navy under the direction and advisory of Vanessa Pepi and is in agreement with the following U.S. Navy wildlife mission statement:

“The U.S. Navy complies with the Endangered Species Act, the Marine Mammal Protection Act, and other laws to protect threatened and endangered species and their habitat” (United States Navy 2007).

The state of Hawaii is noted for its unique and fragile ecosystems. The isolation of the Hawaiian island chain has led to the evolution through adaptive radiation of many endemic species that are highly susceptible to displacement by nonnative invasive species. According to the United States Department of Agriculture Wildlife Services, “Many unique Pacific Island plants and animals are threatened with extinction. Hawaii has the highest number of endangered species in the nation,” (Pitzler 2006). High levels of endemism and loss of native biodiversity within Hawaiian ecosystems has raised protective and conservative environmental efforts.

Wildlife Services also stresses that it is important to “protect endangered water birds

at State sanctuaries and wetland sites on military lands from introduced predators such as the small Indian mongoose,” (Pitzler 2006).

Area description

The wildlife refuge is located on a Naval Reservation in a large coastal valley on Oahu's southwestern shore. Niuli'i Pond Complex is located on a 1,700 acre Naval Radio Transmitting Facility (NRTF) on the western side of the valley. Adjacent to the NRTF is a Naval Magazine (NAVMAG), which occupies over 8,000 acres of the eastern side of the valley. Surrounding the area is agriculture and conservation land. Rainfall averages about 20 inches per year, with a higher rate of potential evaporation. Freshwater comes from the NAVMAG due to salinization of wells at lower elevations (ATSDR, 1998). The site lies on fairly level terrain at an elevation of 39-43 meters above sea level. The NRTF is located on a foundation of limestone, covered by alluvial and coastal sediments (Pike, 2000). The soil in the area is made up of Lualualei stony clay and Pulehu clay loam (NRCS).

The Niuli'i Pond Complex is approximately 9.6 acres on an 88.4 acre wildlife refuge and was established as early as 1943. It began to be used as an oxidation and settling basin for the wastewater from the NAVMAG community in 1957. The complex consists of two distinct ponds, separated by a small roadway, within a fenced area. The south pond (Pond 1) is substantially larger than the north pond (Pond 2). Pond 1 has a large pipe that transports wastewater from the NAVMAG via gravity into the pond for secondary treatment. Freshwater began to be fed into Pond 1 from the Naval Reservation water supply in 2005. Rudimentary piping has been recently installed to transfer water from Pond 1 to Pond 2.

Goals and objectives

The overarching purpose of the U.S. Navy wildlife refuge at Niuli'i ponds is to encourage an increase in endangered Hawaiian bird populations, specifically the populations of Hawaiian moorhens, Hawaiian coots, and Hawaiian stilts. The land managers desire one of the ponds within the refuge to serve as a suitable habitat for Hawaiian moorhens and Hawaiian coots and the other pond to be modified to suit the ecological needs of the Hawaiian stilt. There are four specific management measures that the land manager would like to implement in the attempt to raise the bird populations: establishing a continuous water supply, planting native vegetation, banding all endangered birds, and constructing of an educational sign for the refuge entrance.

This management plan seeks to further the goals and objectives of the land manager through modifications to the current physical environment of the refuge as well as modifications to the management techniques. The plan considers the interactions between the refuge organisms and their physical environment as an integrated system, to be managed as a cohesive ecosystem. The management plan has been formed based on technical, physical and economic feasibility for the land managers.



Figure 1. Niuli'i Pond Complex

Methods

Species identification is an important aspect of any plan dealing with the management of flora and fauna. This management plan called for a complete identification of all current bird species and plant species. Separate identification methods were utilized for the identification of birds and plants.

Bird species were identified by observation from five established viewing sites. Birds were observed from each location for fifteen minute time periods. Two people were designated as observers and were equipped with binoculars. One person, equipped with multiple field guides, served as data recorder. The data recorder tallied the bird sightings from each location and verified the species identification by referencing the field guide descriptions.

Plant species found on the site were systematically identified using plot transects. Pond 1 was divided into four equally spaced horizontal transects and three equally spaced vertical transects. The plant types on these transects were identified and promptly recorded. . The same method of plant identification was employed for Pond 2, using three horizontal transects and one vertical transect. A pictorial representation of the pond transects and the plant species found along them is provided in Appendix 1.

Samples were taken of any plant species that were not immediately identifiable. These samples were further analyzed and researched off-site.

Current Vegetation

The current vegetation within the fenced wildlife refuge is mainly composed of non-native species of plants. The native species are highlighted, and additionally there were 12 unidentified plant species at the sight. These unidentified plant species are small populations, and do not seem to pose any immediate threat or obstacle to the goals for this site. The dominant species at the site are (in order of frequency) California grass, Koa Haole and Kiawe. These species are considered to be aggressive invasive, as identified by use of Hawaii Wetland Field Guide (Erickson and Puttock, 2006). The California grass is the dominant species on the floor of the ponds and encroaches up the banks, while the two woody invasives are prominent along the perimeter of the pond. It was noted that the Koa Haole and Kiawe within the area were of manageable size at the time of the survey, however with mature trees bordering the exterior it is possible that these trees are the current seed source for the infestation within the fenced area.

Table 1. Current Vegetation

Scientific	Common	Hawaiian
<i>Chloris barbata</i>	Swollen Fingergrass	Mau'u lei
<i>Ludwigia octovalvis</i>	Primrose Willow	Kamole
<i>Bacopa monnieri</i>	Water Hyssop	'Ae 'ae
<i>Urochloa mutica</i>	California grass, para grass	Kiawe
<i>Prosopis palida</i>	Mesquite	
<i>Leucaena leucocephala</i>	Koa Haole	
	Tomato	
	Thistle	
<i>Typha Sp.</i>	Cattail	Ilima
<i>Sida fallax</i>		

Current Wildlife Resources

The wildlife species present on the refuge can be divided into three categories: bird species, insect species, and predator species. The bird species were specifically identified, but the insect and predator species were only identified by their common names. The following table lists the current wildlife at the site, with the species of interest highlighted. The species are listed in order of increasing frequency.

Table 2. Current Wildlife

	Scientific	Common	Hawaiian
Bird Species			
	<i>Bubulcus ibis</i> <i>Paroaria coronata</i> <i>Zosterops japonicus</i> <i>Estrilda melpoda</i> <i>Streptopelia chinensis</i>	Cattle Egret Red-crested Cardinal Japanese White-eye Orange-cheeked Waxbill Spotted Dove	
	<i>Fulica alai</i>	Hawaiian Coot	`Alae ke`oke`o
	<i>Geopelia striata</i> <i>Carpodacus mexicanus</i> <i>Lonchura punctulata</i> <i>Estrilda astrild</i>	Zebra Dove House Finch Nutmeg Mannikin Common Waxbill	
	<i>Gallinula chloropus sandvicensis</i>	Hawaiian Moorhen	`Alae `ula
	<i>Passer domesticus</i>	House Sparrow	
Insect Species			
		Dragonfly Ladybug Honeybee Bumblebee Spiders Grasshoppers Butterflies	
Predator Species			
		Mongoose Cat	

Current Predator Control

A chain-link fence was constructed in the early 1990's in order to keep cattle, pigs, and dogs out of the site. Within the boundary, an unpaved service road follows the fence line, allowing vehicle access to the whole area. There are currently multiple holes underneath the fence created by burrowing predators such as mongoose. Animal traps line the fence, spaced approximately 10 meters apart. This predator control started in 1994 to keep out predators such as cats, mongoose, and rats. A pest control agent checks the traps every other day.



Figure 2. Predator control trap containing mongoose

Bird Species of Interest

Hawaiian Coot / `Alae ke`oke`o / (*Fulica alai*)

Hawaiian Coot adults are dark slate gray with a white bill and a large frontal shield. The frontal shield is usually white but can vary from bluish white to yellow to dark blood red. They have white under tail feathers that are seen when swimming or during their courtship displays. Male and female coots look alike. Hawaiian Coots are endemic to Hawaii and are smaller than their mainland relatives, measuring 15 inches in length (US Fish and Wildlife Service 2008).

Chicks have black down, except on the head, neck and throat, where the down is reddish-orange. They are able to run and swim soon after hatching but maintain contact with parents by frequent calling. Their calls include a variety of short, harsh croaks.

Coots are found in fresh and brackish-water marshes and ponds. They rarely fly, but are capable of sustained flight close to the water. When nesting, the Hawaiian coot builds floating nests in aquatic vegetation. Typically in which four to ten eggs are laid. Adults defend their nests vigorously. The diet of the Hawaiian Coot consists of seeds and leaves of aquatic plants, insects, tadpoles, and small fish (US Fish and Wildlife Service 2008).

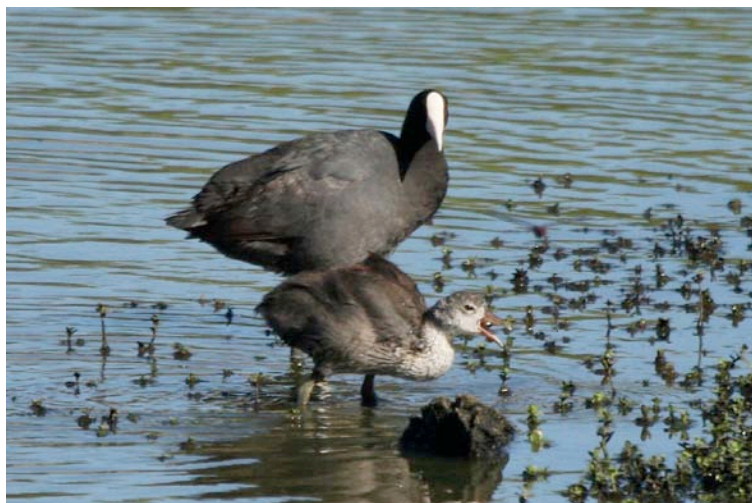


Figure 3. Hawaiian Coot

Hawaiian Moorhen / Alae `ula / (*Gallinula chloropus sanvicensis*)

The Hawaiian Moorhen adults are dark gray bird with a black head and neck, and white feathers on their flanks and under tail feathers. They have a very distinctive red frontal shield, and their bill tip is yellow with a red base. Their legs and feet are greenish and without lobes. They usually measure about 13 inches in length. Both sexes are similar in appearance and have chicken-like cackles and croaks.

The Hawaiian Moorhen can be found in freshwater marshes, taro patches, irrigation ditches, reservoirs, and wet pastures. They favor dense emergent vegetation near to open water, floating or barely emergent mats of vegetation, and water depths of less than one meter.

Moorhens nest year-round but the active season is usually from March through August. It is believed that the timing of nesting is related to water levels and vegetation growth. The Hawaiian Moorhen typically lays an average of 5 to 6 eggs per clutch with an incubation period of about 22 days. The diet of the Hawaiian Moorhen is primarily comprised of small mollusks, insects, water plants, and grasses (US Fish and Wildlife Service 2008).

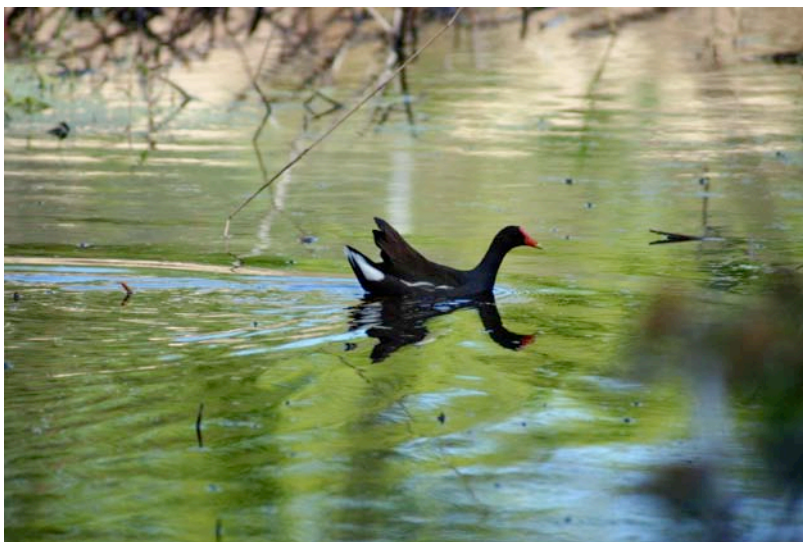


Figure 4. Hawaiian Moorhen

Hawaiian Stilt / Ae`o / (*Himantopus mexicanus knudseni*)

Hawaiian stilts are slender wading birds. They can be identified by their black back, white forehead, black neck and white chin. Females have a tinge of brown on their backs. Stilts have long pink legs and a long black bill. The Hawaiian subspecies differs from the North American stilt by having more black on its face and neck, and a longer bill, tarsus, and tail. Stilts can grow up to 16 inches in length.

Stilts use a variety of aquatic habitats. They like to walk around in open mudflats, pickle weed mats, and open pasturelands where visibility is good and predator populations are low. Nest sites are typically separated from feeding sites and stilts move between these areas daily. Nesting sites are adjacent to or on low islands within bodies of fresh, brackish, or salt water. Feeding habitats are shallow bodies of water providing them with a wide variety of invertebrates and other aquatic organisms such as worms, crabs, or small fish (US Fish and Wildlife Service 2008).



Figure 5. Hawaiian Stilt

Management Recommendations- Vegetation

1. Short term

Short-term management for the vegetation is integral in establishing a habitat for native birds. The first step for managing the site will be to eliminate the dominating California grass that covers the floor of the ponds. A general herbicide such as Round-up would be sufficient for controlling the invasive grass, as long as the herbicide is approved for the site. However, this will also remove the native species of wetland plant ‘ae ‘ae (*Bacopa monnieri*). The species that dominate the perimeter of the ponds (Koa Haole and the Kiawe) should be removed by hand, as currently practiced.

In order for the removal of invasive species to be at all effective, the ponds must be promptly refilled with water. If the pond is not refilled with water from the Naval Reservation water supply or an alternate water source, then the invasive species will quickly return to dominate the pond ground surface. The continual flow of water is necessary to the control measures against the invasive grasses and other aggressive vegetation.

2. Long Term

Long-term management of the vegetation will involve both the control of nonnative invasive species and establishing native plant species that will assist in the creation of a native wetland habitat that will encourage native wildlife. Hand-weeding will be necessary to manage the vegetation after an initial large-scale invasive plant removal. Large-scale removal using herbicide and potentially weed-whackers could be necessary on an annual basis.

Another long-term management strategy that would significantly reduce the amount of hand-weeding necessary would be the removal of the larger Kiawe and Koa Haole outside of the

fenced area. These trees that are surrounding the fence perimeter are a constant seed source for the highly invasive trees that litter the fenced-in area.

Native plant introduction will be reliant on a constant source of water. Listed below are native wetland plant species that could be used to increase the native plant population on site, as well as establishing native wetland bird habitat.

Pond 1, which is focused on encouraging moorhens and coots, would benefit from having native species established. The suitable native species for Pond 1 are listed in *Table 3* in green. These wetland plants are tolerant to flooding, and could be planted close to the edge of the waterline. *Bacopa monnieri*, which is already present at the site, could be propagated and planted into other areas of both Pond 1 and Pond 2 to encourage native wetland birds. Hawaiian stilts are known to inhabit mudflats and pickleweed mats. *Bacopa monnieri*, which is a pickleweed ('ae'ae), could be planted in Pond 2 in an effort to increase Hawaiian stilt populations. The suitable native species for Pond 2 are listed in *Table 3* in blue. These are native wetland species and their success will be highly dependent on water availability.

Table 3.

Scientific	Common	Hawaiian
<i>Bacopa monnieri</i>	water hyssop	'ae'ae
<i>Sesuvium portulacastrum</i>	sea purslane	'akulikuli
<i>Bolboschoenus maritimus</i>	bulrush	kaluha
<i>Cyperus laevigatus</i>	smooth flatsedge	makaloa
<i>Schoenoplectus lacustris</i>	great bulrush	'aka'akai

Management Recommendations- Wildlife

All wildlife management practices for the Lualualei Naval Base are dependent upon the acquisition of a reliable and adequate supply of water for the two ponds. The Hawaiian Coot, Moorhen, and Stilt are only attracted to the site when there is water present. Since these birds are wetland species, a consistent water supply is crucial to their habitat. These birds have particular habits and prefer different depths of water in which to feed, reproduce, and nest.

1. Short Term

Short-term wildlife management recommendations for the ponds at Lualualei are to:

- Obtain a stable and consistent source of water
- Reduce the amount of predators entering into the area
- Provide habitat for Hawaiian coots, moorhens, and stilts

The source of water for the ponds is currently the Naval Reservation water supply, but this source has proved inconsistent due to faulty technology and varying water availability. The timer for the water gauge first needs to be repaired in order to ensure water distribution whether the land manager is present or not. The timer should be programmed in a way that guarantees a daily water flow of at least ten minutes. This management recommendation must be followed before any further wildlife management may be attempted.

It will also be necessary to establish a method of transferring water from Pond 1 to Pond 2. In the past there was a covert that allowed for water from the first pond into the second pond, however the source of water for the second pond was extinguished when the covert collapsed. Currently, there is an ineffective piping system to transfer water from Pond 1 to Pond 2 that

consists of a small network of PVC pipes. The piping has proven to be inefficient in water transfer and a new system will be necessary to pump water into Pond 2.

Once the water source has been established, the predator species must be effectively controlled. In order to successfully reduce the amount of predators entering the area, there are two short-term options that may be considered. First, the holes that are currently underneath the fence must be filled. Without filling the holes, any adjustments to fencing type or height would prove to be useless. The second priority for reducing predators would be to outfit the perimeter fence with a “cap” or “hat.” The current fence is approximately six feet tall, which is not tall enough to prevent cats from jumping over the fence. A cap/hat is an overhanging structure that is attached to the top of the fence. Such hats have been used and have proven to be effective at keeping cats out of fenced areas (Karori Wildlife Sanctuary 2008).

When considering the option of providing habitat for the select species of native Hawaiian wetland birds, it is necessary to consider the water levels of the ponds. Each of the three birds of interest has specific habitat preferences, requiring different water levels. One of the management objectives of the land manager is to divide the two ponds into sections that cater to the needs of each species of wetland bird. The various sections of habitat would be determined by water depth.

Pond 1 would be suitable for both the Hawaiian Coot and the Hawaiian Moorhen. The coot would prefer the deeper, central water of the pond and the perimeter of the pond with emergent vegetation would serve as a habitat for the moorhen. Pond 2 would make the ideal location to create a shallow mud basin, with surrounding vegetation. This habitat would provide for the wading of the Hawaiian Stilt.

2. Long Term

Long-term wildlife management recommendations for the ponds at Lualualei are:

- Install improved predator fencing
- Manage water levels in order to stimulate breeding and nesting
- Set in place a program for marking/banding any unmarked/unbanded birds

To further reduce the amount of predators that enter into the site, it is important that a new and improved fence be installed. This fence would effectively combat the predator situation. In order to stop any animals that may be burrowing under the fence the new fence would have to have an underground skirt. An underground skirt is simply a portion of the fence that is located beneath the ground and is in the shape of an “L.” When confronted with a predator control fence, burrowing predators do not attempt to dig under the fence from a distance, but they dig at the point where the fence makes contact with the ground. The underground skirt works by prohibiting any burrowing animal from tunneling beneath the fence (Karori Wildlife Sanctuary 2008).

The second aspect of a new predator control fence would be the hat or cap. This overhang would successfully prevent any climbing animal such as feral cats from being able to scale the fence.

In addition to cats and mongoose, there is also the issue of mice and rats. Mice and rats can easily pass through the holes in the common chain-link fence, and prey on young chicks and eggs. The most effective way to prohibit a mouse or rat from bypassing the fence is to have the lower portion of the fence equipped with wire mesh and a tin wall. The wire mesh acts as a barrier through which even the smallest mouse or rat cannot pass, and the tin wall prohibits the progress of any animal that may be inclined to attempt to climb over the wire mesh layer.

With the introduction of a virtually impassible predator control fence, the number of predators entering into the site would be significantly reduced. This would also reduce the need for predator control traps, thus reducing the expense of personnel checking the traps and disposing of any captured animals.

Along with the reduction of predator species, there would be an increased survival rate of eggs and hatchlings within the area. The native bird populations at the ponds would be protected, and birds such as the Hawaiian stilt, which has a tendency not to nest if there could be predators in the area, would be more likely to create nests onsite.

Water levels also play an important role in the breeding and nesting cycles of Hawaiian wetland birds. The Hawaiian Coot, for example, builds floating nests, thus if the water level is too low the nests will not float and it is not likely that the birds will be inclined to nest at that time. In contrast, the Hawaiian Moorhen does not build floating nests, but prefers to nest in dense vegetation close to the water. The Hawaiian moorhen typically nests between March and August since these months are notably drier than the winter months in Hawaii. In the wetter months, typically September through February it would be beneficial to increase water levels within the ponds, to suit the nesting conditions preferred by the Hawaiian coot. In the drier summer months of March through August, the water levels of the ponds should be reduced to coincide with and match the desired nesting conditions for the Hawaiian moorhen. Regulating the water level of the ponds would simulate the annual flooding and drying of Hawaii's natural wetlands. If these water management practices are put into effect, there should be an increase in the number of eggs laid, chicks hatched, and wetland bird populations.

With the addition of habitat and bird populations it is assumable that unmarked native birds will be attracted to the site. In order for these birds to be protected and populations measured

accurately, a marking/banding program would be beneficial. In the United States, it is illegal for an unauthorized individual to capture and band a bird. Federal regulations require that a federal or state agency capture and band waterfowl. In Hawaii, there are various institutions that can be used to develop a banding program. The USGS: Biological Resource Division (USGS-BRD) Hawaii division, known as the Pacific Islands Ecosystem Research Center, has been involved in banding native Hawaiian birds. To better establish a banding program at Niuli'I Ponds, contact with USGS should be made. Information concerning banding programs or permitting may be obtained from the following sources:

Pacific Island Ecosystems Research Center
677 Ala Moana Blvd. Suite 615, Honolulu, HI 96813
Telephone: 808-587-7452
Fax: 808-587-7451

Loyal Mehrhoff, Center Director
Telephone: 808-587-7455
677 Ala Moana Blvd. Suite 615, Honolulu, HI 96813
Loyal_Mehrhoff@usgs.gov

John Alexander (President & NABC Rep)
Klamath Bird Observatory
PO Box 758
Ashland, OR 97520-0758
jda@klamathbird.org

Michael Boyles (1st Vice President)
National Park Service
601 Nevada Highway
Boulder City, NV 89005-2426
michael_i_boyles@nps.gov

Educational Outreach

A sign needs to be created to inform people of the nature of the refuge, as well as the endangered species that inhabit the site and their requirements. The wording should include the name Niuli'i Reservoir, the types of endangered species found in the pond complex and the phrase "No Hunting-Wildlife Refuge". The sign should also warn against the introduction of specific invasive species, such as tilapia.

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Appendix L
Key Biological Reference Documents for Wahiawa Annex

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L-1 Wahiawa Annex Flora Species

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Wahiawa Annex
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Acanthaceae	<i>Asystasia gangetica</i>	Chinese violet	-	A	Confirmed	AECOM, 2016
Acanthaceae	<i>Graptophyllum pictum</i>	caricature plant	-	A	Confirmed	AECOM, 2016
Acanthaceae	<i>Ruellia prostrata</i>	prostrate wild petunia	-	A	Potentially	DON, 2001
Agavaceae	<i>Cordyline fruticosa</i>	ti plant	ti, kī	A	Confirmed	AECOM, 2016
Agavaceae	<i>Furcraea foetida</i>	Mauritius hemp	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Alternanthera pungens</i>	khaki weed	-	A	Confirmed	AECOM, 2016
Anacardiaceae	<i>Mangifera indica</i>	mango	manakō	A	Confirmed	AECOM, 2016
Anacardiaceae	<i>Schinus terebinthifolius</i>	Christmas berry	wilelaiki	I	Potentially	DON, 2001
Apiaceae	<i>Centella asiatica</i>	Asiatic pennywort	-	A	Confirmed	AECOM, 2016
Apiaceae	<i>Cryptotaenia canadensis</i>	honewort	-	A	Potentially	DON, 2001
Apiaceae	<i>Cyclospermum leptophyllum</i>	marsh parsley	-	A	Potentially	DON, 2001
Apiaceae	<i>Hydrocotyle sibthorpioides</i>	lawn marsh pennywort	-	A	Confirmed	AECOM, 2016
Apocynaceae	<i>Allamanda cathartica</i>	allamanda	laniali'i	A	Potentially	DON, 2001
Apocynaceae	<i>Alyxia stellata</i>	-	maile	E	Potentially	DON, 2001
Apocynaceae	<i>Catharanthus roseus</i>	periwinkle	-	A	Confirmed	AECOM, 2016
Apocynaceae	<i>Ochrosia compta</i>	holei	-	E	Potentially	DON, 2001
Apocynaceae	<i>Rauvolfia sandwicensis</i>	devil's pepper	hao	E	Potentially	HNHP, 2004
Apocynaceae	<i>Thevetia peruviana</i>	luckynut	-	A	Confirmed	AECOM, 2016
Araceae	<i>Alocasia macrorrhizos</i>	giant taro	'ape	A	Potentially	DON, 2001
Araceae	<i>Epipremnum pinnatum</i>	pothos	-	A	Confirmed	AECOM, 2016
Araceae	<i>Syngonium podophyllum</i>	arrowhead vine	-	A	Confirmed	AECOM, 2016
Araceae	<i>Xanthosoma robustum</i>	rosy malanga	'ape	A	Confirmed	AECOM, 2016
Araucariaceae	<i>Araucaria columnaris</i>	Cook Island pine	-	A	Potentially	HNHP, 2004
Araucariaceae	<i>Araucaria cunninghamii</i>	hoop pine	-	A	Potentially	HNHP, 2004
Araucariaceae	<i>Araucaria heterophylla</i>	Norfolk Island pine	-	A	Potentially	DON, 2001
Arecaceae	<i>Cocos nucifera</i>	coconut palm	niu	A	Confirmed	AECOM, 2016
Arecaceae	<i>Phoenix dactylifera</i>	date palm	-	A	Potentially	HNHP, 2004
Asparagaceae	<i>Chrysodracon halapepe</i>	royal hala pepe	-	A	Potentially	HNHP, 2004
Aspleniaceae	<i>Asplenium contiguum</i>	forest spleenwort	-	E	Potentially	HNHP, 2004
Aspleniaceae	<i>Asplenium nidus</i>	Hawai'i bird's nest fern	'ekaha	N	Potentially	DON, 2001

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Asteraceae	<i>Acanthospermum australe</i>	Paraguayan starbur	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Ageratina riparia</i>	spreading snakeroot	Hāmākua pāmakani	A	Potentially	HNHP, 2004
Asteraceae	<i>Ageratum conyzoides</i>	tropical whiteweed	maile hohono	A	Confirmed	AECOM, 2016
Asteraceae	<i>Bidens cynapiifolia</i>	West Indian beggarticks	-	A	Potentially	DON, 2001
Asteraceae	<i>Bidens pilosa</i>	common beggarticks	kī	A	Potentially	DON, 2001
Asteraceae	<i>Bidens torta</i>	corkscrew beggarticks	kō'oko'olau	E	Potentially	HNHP, 2004
Asteraceae	<i>Calyptocarpus vialis</i>	straggler daisy	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Chromolaena odorata</i> ¹	devil weed	-	I	Potentially	NAVFAC HI, 2021
Asteraceae	<i>Conyza bonariensis</i>	asthmaweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Conyza canadensis</i>	Canadian horseweed	-	A	Potentially	DON, 2001
Asteraceae	<i>Crassocephalum crepidioides</i>	redflower ragleaf	-	A	Potentially	DON, 2001
Asteraceae	<i>Cyanthillium cinereum</i>	little ironwood	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Eclipta prostrata</i>	false daisy	-	A	Potentially	HNHP, 2004
Asteraceae	<i>Emilia fosbergii</i>	Florida tasselflower	pualele	A	Confirmed	AECOM, 2016
Asteraceae	<i>Emilia sonchifolia</i>	lilac tasselflower	-	A	Potentially	HNHP, 2004
Asteraceae	<i>Erechtites valerianifolia</i>	tropical burnweed	-	A	Potentially	DON, 2001
Asteraceae	<i>Erigeron belliioides</i>	bellorita	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Gamochaeta purpurea</i>	purple cudweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Pluchea carolinensis</i>	sourbush	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Senecio madagascariensis</i>	fireweed	-	A	Potentially	1NAVFAC, 2021, pers. comm.
Asteraceae	<i>Sphagneticola triloba</i>	Bay Biscayne creeping-oxeye	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Synedrella nodiflora</i>	nodeweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Taraxacum officinale</i>	dandelion	lauhele	A	Confirmed	AECOM, 2016
Asteraceae	<i>Tridax procumbens</i>	coat buttons	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Youngia japonica</i>	Oriental hawksbeard	-	A	Confirmed	AECOM, 2016
Athyriaceae	<i>Deparia prolifera</i>	prolific false spleenwort	-	E	Potentially	HNHP, 2004

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Bignoniaceae	<i>Jacaranda mimosifolia</i>	black poui	-	A	Confirmed	AECOM, 2016
Bignoniaceae	<i>Spathodea campanulata</i>	African tulip tree	-	A	Confirmed	AECOM, 2016
Blechnaceae	<i>Blechnum appendiculatum</i>	palm fern	-	A	Confirmed	AECOM, 2016
Blechnaceae	<i>Blechnum occidentale</i>	hammock fern	-	A	Potentially	DON, 2001
Blechnaceae	<i>Doodia kunthiana</i>	Kunth's hacksaw fern	'okupukupu lau'i'i	E	Potentially	HNHP, 2004
Boraginaceae	<i>Euploca procumbens</i>	fourspike heliotrope	-	A	Confirmed	AECOM, 2016
Caricaceae	<i>Carica papaya</i>	papaya	mīkana	A	Confirmed	AECOM, 2016
Caryophyllaceae	<i>Drymaria cordata</i>	chickweed	pipili	A	Confirmed	AECOM, 2016
Casuarinaceae	<i>Casuarina equisetifolia</i>	ironwood	-	A	Confirmed	AECOM, 2016
Clusiaceae	<i>Clusia rosea</i>	autograph tree	-	A	Confirmed	AECOM, 2016
Combretaceae	<i>Terminalia catappa</i>	tropical almond	-	A	Confirmed	AECOM, 2016
Combretaceae	<i>Terminalia myriocarpa</i>	East Indian almond	-	A	Potentially	HNHP, 2004
Commelinaceae	<i>Commelina diffusa</i>	spreading dayflower	honohono	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea indica</i>	blue morning-glory	koali 'awa	N	Potentially	HNHP, 2004
Convolvulaceae	<i>Ipomoea obscura</i>	obscure morning-glory	-	A	Confirmed	AECOM, 2016
Cucurbitaceae	<i>Momordica charantia</i>	wild bitter melon	-	I	Potentially	HNHP, 2004
Cupressaceae	<i>Callitris columellaris</i>	white cypress-pine	-	A	Confirmed	AECOM, 2016
Cupressaceae	<i>Juniperus chinensis</i>	Chinese juniper	-	A	Confirmed	AECOM, 2016
Cyatheaceae	<i>Cibotium chamissoi</i>	Chamisso's manfern	hapu'u	E	Potentially	HNHP, 2004
Cyatheaceae	<i>Sphaeropteris cooperi</i>	Australian tree fern	-	I	Potentially	HNHP, 2004
Cyperaceae	<i>Carex meyenii</i>	Meyen's sedge	-	A	Potentially	DON, 2001
Cyperaceae	<i>Carex wahuensis</i>	O'ahu sedge	-	E	Potentially	DON, 2001
Cyperaceae	<i>Cyperus gracilis</i>	slimjim flatsedge	-	A	Confirmed	AECOM, 2016
Cyperaceae	<i>Cyperus polystachyos</i>	manyspike flatsedge	-	N	Confirmed	DON, 2001
Cyperaceae	<i>Fimbristylis dichotoma</i>	forked fimbry	-	N	Confirmed	AECOM, 2016
Cyperaceae	<i>Gahnia aspera</i>	round sawsedge	'uki'uki	N	Potentially	HNHP, 2004
Cyperaceae	<i>Cyperus brevifolius</i>	shortleaf spikesedge	kili'o'opu	A	Confirmed	AECOM, 2016
Cyperaceae	<i>Rhynchospora caduca</i>	beakrush	-	A	Confirmed	AECOM, 2016
Cyperaceae	<i>Rhynchospora rugosa</i>	claybank beaksedge	pu'uko'a	N	Potentially	DON, 2001
Dennstaedtiaceae	<i>Pteridium aquilinum</i> subsp. <i>decompositum</i>	decomposition brackenfern	kilau	A	Confirmed	AECOM, 2016

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Dicksoniaceae	<i>Cibotium chamissoi</i>	Chamisso's manfern	hāpu'u	E	Potentially	HNHP, 2004
Ebenaceae	<i>Diospyros sandwicensis</i>	-	lama	E	Potentially	HNHP, 2004
Ericaceae	<i>Leptecophylla tameiameia</i>	Hawaiian heather	pūkiawe	N	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Aleurites moluccanus</i>	candlenut	kukui	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia hirta</i>	pillpod sandmat	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia hypericifolia</i>	graceful sandmat	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia prostrata</i>	ground spurge	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Phyllanthus debilis</i>	phyllanthus weed	niruri	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Phyllanthus distichus</i>	-	pāmakani mähū	E	Potentially	DON, 2001
Euphorbiaceae	<i>Ricinus communis</i>	castor bean	koli	A	Potentially	DON, 2001
Fabaceae	<i>Acacia confusa</i>	Formosan koa	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Acacia koa</i>	-	koa	E	Confirmed	AECOM, 2016
Fabaceae	<i>Albizia lebeck</i>	woman's tongue	-	A	Potentially	DON, 2001
Fabaceae	<i>Alysicarpus vaginalis</i>	Alyce clover	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Caesalpinia decapetala</i>	cat's claw	puakelekino	A	Potentially	HNHP, 2004
Fabaceae	<i>Chamaecrista nictitans</i>	sensitive plant	lauki	A	Confirmed	AECOM, 2016
Fabaceae	<i>Crotalaria retusa</i>	rattleweed	-	A	Potentially	DON, 2001
Fabaceae	<i>Crotalaria pallida</i>	smooth rattlepod	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Desmanthus pernamhucanus</i>	pigeon bundleflower	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Desmodium incanum</i>	tickclover	kaimi	N	Confirmed	AECOM, 2016
Fabaceae	<i>Desmodium sandwicense</i>	Hawai'i ticktrefoil	Pua pilipili	N	Potentially	DON, 2001
Fabaceae	<i>Desmodium triflorum</i>	three-flowered beggarweed	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Falcataria moluccana</i>	peacock's plume	-	I	Confirmed	AECOM, 2016
Fabaceae	<i>Indigofera hendecaphylla</i>	creeping indigo	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Indigofera suffruticosa</i>	indigobush	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Leucaena leucocephala</i>	white leadtree	koa haole	A	Confirmed	AECOM, 2016
Fabaceae	<i>Lotus sp.</i>	lotus	-	A	Potentially	DON, 2001
Fabaceae	<i>Macroptilium atropurpureum</i>	purple bushbean	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Macroptilium lathyroides</i>	wild bushbean	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Medicago lupulina</i>	hop clover	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Mimosa pudica</i>	shameplant	-	A	Confirmed	AECOM, 2016

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Fabaceae	<i>Neonotonia wightii</i>	perennial soybean	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Trifolium repens</i>	white clover	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Vachellia farnesiana</i> var. <i>farnesiana</i>	sweet acacia	klu	A	Confirmed	AECOM, 2016
Gentianaceae	<i>Centaurium erythraea</i>	European centaury	-	A	Confirmed	AECOM, 2016
Gleicheniaceae	<i>Dicranopteris linearis</i>	Old World forkedfern	‘uluhe	N	Confirmed	AECOM, 2016
Gleicheniaceae	<i>Diplopterygium pinnatum</i>	scrambling fern	-	E	Potentially	DON, 2001
Goodiaceae	<i>Scaevola gaudichaudiana</i>	-	naupaka kuahiwi	E	Confirmed	AECOS 2020
Goodiaceae	<i>Scaevola taccada</i>	beach naupaka	naupaka kahakai	N	Confirmed	AECOM, 2016
Hymenophyllaceae	<i>Crepidomanes minutum</i>	tiny bristle fern	-	N	Potentially	HNHP, 2004
Iridaceae	<i>Crocasmia x crocosmiiflora</i>	montbretia	-	A	Confirmed	AECOM, 2016
Iridaceae	<i>Sisyrinchium rosulatum</i>	blue-eyed “grass”	-	A	Confirmed	AECOM, 2016
Lauraceae	<i>Persea americana</i>	avocado	-	A	Confirmed	AECOM, 2016
Liliaceae	<i>Asparagus densiflorus</i>	asparagus fern	-	A	Confirmed	AECOM, 2016
Liliaceae	<i>Dianella sandwicensis</i>	Hawaiian lily	‘uki‘uki	N	Confirmed	AECOM, 2016
Lindsaeaceae	<i>Odontosoria chinensis</i>	Chinese creepingfern	pala’a	A	Confirmed	AECOM, 2016
Lomariopsidaceae	<i>Elaphoglossum crassifolium</i>	royal tonguefern	-	E	Potentially	HNHP, 2004
Lomariopsidaceae	<i>Nephrolepis brownii</i>	Asian swordfern	-	A	Potentially	DON, 2001
Lomariopsidaceae	<i>Nephrolepis exaltata</i> subsp. <i>hawaiiensis</i>	common swordfern	kupukupu	E	Confirmed	AECOM, 2016
Lycopodiaceae	<i>Lycopodiella cernua</i>	staghorn clubmoss	wāwae‘iole	N	Potentially	DON, 2001
Lythraceae	<i>Cuphea carthagenensis</i>	Columbian waxweed	puakamoli	A	Potentially	DON, 2001
Lythraceae	<i>Cuphea hyssopifolia</i>	false heather	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Hibiscus arnottianus</i>	white rosemalllow	koki’o ke’o ke’o	E	Confirmed	AECOM, 2016
Malvaceae	<i>Malvaviscus penduliflorus</i>	mazapan	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Sida fallax</i>	yellow ‘ilima	‘ilima	N	Confirmed	AECOM, 2016
Malvaceae	<i>Talipariti tiliaceum</i>	beach hibiscus	hau	A	Potentially	HNHP, 2004
Malvaceae	<i>Waltheria indica</i>	malva blanca	‘uhaloa	N	Confirmed	AECOM, 2016
Marattiaceae	<i>Angiopteris evecta</i>	Madagascar tree fern	-	A	Potentially	HNHP, 2004
Melastomataceae	<i>Arthrostemma ciliatum</i>	pinkfringe	-	A	Confirmed	AECOM, 2016
Melastomataceae	<i>Clidemia hirta</i>	Koster’s curse	-	A	Confirmed	AECOM, 2016
Melastomataceae	<i>Pterolepis glomerata</i>	false meadowbeauty	-	A	Confirmed	AECOM, 2016
Meliaceae	<i>Toona ciliata</i>	Australian red cedar	-	A	Potentially	HNHP, 2004

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Menispermaceae	<i>Cocculus orbiculatus</i>	queen coralbead	huehue	N	Confirmed	AECOM, 2016
Moraceae	<i>Ficus microcarpa</i>	Chinese banyan	-	A	Confirmed	AECOM, 2016
Moraceae	<i>Ficus rubiginosa</i>	Port Jackson fig	-	A	Confirmed	AECOM, 2016
Musaceae	<i>Musa acuminata</i>	banana	-	A	Confirmed	AECOM, 2016
Myrsinaceae	<i>Ardisia crenata</i>	Hilo holly	-	A	Confirmed	AECOM, 2016
Myrsinaceae	<i>Ardisia elliptica</i>	shoebutton ardisia	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Eucalyptus deglupta</i>	kamarere	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Eucalyptus globulus</i>	Tasmanian bluegum	-	A	Potentially	DON, 2001
Myrtaceae	<i>Eucalyptus pilularis</i>	blackbutt	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Eucalyptus robusta</i>	swamp mahogany	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Eugenia reinwardtiana</i>	mountain stopper	nioi	A	Potentially	HNHP, 2004
Myrtaceae	<i>Lophostemon confertus</i>	vinegar tree	-	A	Potentially	HNHP, 2004
Myrtaceae	<i>Melaleuca quinquenervia</i>	paperbark	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Metrosideros polymorpha</i>	ohia	‘ōhi‘ā lehua	E	Confirmed	AECOM, 2016
Myrtaceae	<i>Pimenta dioica</i>	allspice	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Psidium cattleianum</i>	strawberry guava	waiawī	I	Confirmed	AECOM, 2016
Myrtaceae	<i>Psidium guajava</i>	common guava	kuawa	N	Confirmed	AECOM, 2016
Myrtaceae	<i>Syzygium cumini</i>	Java plum	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Syzygium jambos</i>	rose apple	-	A	Potentially	HNHP, 2004
Myrtaceae	<i>Syzygium malaccense</i>	mountain apple	-	A	Confirmed	AECOM, 2016
Myrtaceae	<i>Syzygium sandwicense</i>	-	‘ōhi‘a hā	E	Potentially	DON, 2001
Nyctaginaceae	<i>Boerhavia coccinea</i>	false alena	-	A	Confirmed	AECOM, 2016
Nyctaginaceae	<i>Pisonia brunoniana</i>	Australasian catchbirdtree	pāpala kēpau	N	Potentially	DON, 2001
Nyctaginaceae	<i>Pisonia sandwicensis</i>	-	āulu	E	Potentially	HNHP, 2004
Oleaceae	<i>Jasminum multiflorum</i>	star jasmine	-	A	Confirmed	AECOM, 2016
Oleaceae	<i>Nestegis sandwicensis</i>	Hawai‘i olive	olopua	E	Potentially	HNHP, 2004
Orchidaceae	<i>Arundina graminifolia</i>	bamboo orchid	-	A	Confirmed	AECOM, 2016
Orchidaceae	<i>Epidendrum x obrienianum</i>	O'Brien's star orchid	-	A	Confirmed	AECOM, 2016
Orchidaceae	<i>Phaius tankervilleae</i>	nun's orchid	-	A	Confirmed	AECOM, 2016
Orchidaceae	<i>Spathoglottis plicata</i>	Philippine ground orchid	-	A	Confirmed	AECOM, 2016
Oxalidaceae	<i>Oxalis corniculata</i>	yellow wood sorrel	‘ihi‘ai	A	Confirmed	AECOM, 2016
Oxalidaceae	<i>Oxalis debilis var. corymbosa</i>	pink wood sorrel	-	A	Confirmed	AECOM, 2016

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Pandanaceae	<i>Freycinetia arborea</i>	-	'ie'ie	N	Potentially	HNHP, 2004
Pandanaceae	<i>Pandanus tectorius</i>	Tahitian screwpine	hala	N	Confirmed	AECOM, 2016
Passifloraceae	<i>Passiflora edulis</i>	passionflower	liliko'i	A	Confirmed	AECOM, 2016
Passifloraceae	<i>Passiflora foetida</i>	scarletfruit passionflower	-	A	Potentially	DON, 2001
Passifloraceae	<i>Passiflora suberosa</i>	wild passionfruit	huehue haole	A	Confirmed	AECOM, 2016
Phytolaccaceae	<i>Rivina humilis</i>	rougeplant	-	A	Potentially	DON, 2001
Plantaginaceae	<i>Plantago lanceolata</i>	English plantain	-	A	Confirmed	AECOM, 2016
Plantaginaceae	<i>Plantago major</i>	broadleaf plantain	laukahi	A	Confirmed	AECOM, 2016
Plantaginaceae	<i>Bacopa monnieri</i>	-	'ae'ae	N	Confirmed	AECOS 2020
Poaceae	<i>Andropogon virginicus</i>	broomsedge	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Axonopus compressus</i>	broadleaf carpet grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Axonopus fissifolius</i>	narrowleaved carpetgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Bothriochloa pertusa</i>	pitted beardgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cenchrus clandestinus</i>	kikuyu grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cenchrus echinatus</i>	southern sandbur	-	A	Potentially	DON, 2001
Poaceae	<i>Cenchrus polystachios</i>	feathery pennisetum	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cenchrus purpureus</i>	elephant grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Chrysopogon aciculatus</i>	golden beardgrass	-	A	Potentially	HNHP, 2004
Poaceae	<i>Coix lacryma-jobi</i>	Job's tears	-	A	Potentially	DON, 2001
Poaceae	<i>Cynodon dactylon</i>	Bermuda grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Dichanthium annulatum</i>	kleberg bluestem	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Digitaria ciliaris</i>	Henry's crabgrass	-	A	Potentially	DON, 2001
Poaceae	<i>Digitaria eriantha</i>	pangolagrass	-	A	Potentially	DON, 2001
Poaceae	<i>Digitaria violascens</i>	violet crabgrass	kūkae pua'a uka	A	Confirmed	AECOM, 2016
Poaceae	<i>Eleusine indica</i>	goose grass	manienie ali'i	A	Potentially	DON, 2001
Poaceae	<i>Eragrostis pectinacea</i>	tufted lovegrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Eragrostis tenella</i>	Japanese lovegrass	-	A	Potentially	DON, 2001
Poaceae	<i>Megathyrsus maximus</i>	green panic grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Melinis minutiflora</i>	molasses grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Melinis repens</i>	rose Natal grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Oplismenus hirtellus</i>	basket grass	-	A	Confirmed	AECOM, 2016

Category: A = alien; N = native.

Appendix L-1
Wahiawa Annex
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Poaceae	<i>Paspalum conjugatum</i>	Hilo grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Paspalum dilatatum</i>	dallis grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Paspalum fimbriatum</i>	Panama grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Paspalum macrophyllum</i>	bigleaf paspalum	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Paspalum plicatulum</i>	browntop millet	-	A	Potentially	DON, 2001
Poaceae	<i>Paspalum scrobiculatum</i>	ricegrass	mau'u laiki	N	Confirmed	AECOM, 2016
Poaceae	<i>Paspalum urvillei</i>	vaseygrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sacciolepis indica</i>	Glenwood grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Setaria palmifolia</i>	palmgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Setaria parviflora</i>	yellow bristlegrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sorghum halepense</i>	Johnson grass	-	A	Potentially	DON, 2001
Poaceae	<i>Sporobolus africanus</i>	rattail grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sporobolus diandrus</i>	Indian dropseed	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sporobolus indicus</i>	smutgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Stenotaphrum secundatum</i>	St. Augustine grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Urochloa mutica</i>	paragrass	-	A	Confirmed	AECOM, 2016
Polygonaceae	<i>Polygala paniculata</i>	bubblegum plant	-	A	Confirmed	AECOM, 2016
Polypodiaceae	<i>Lepisorus thunbergianus</i>	weeping fern	'ekaha	N	Potentially	HNHP, 2004
Polypodiaceae	<i>Phlebodium aureum</i>	golden polypody	-	A	Confirmed	AECOM, 2016
Polypodiaceae	<i>Phymatosorus grossus</i>	musk fern	laua'e	A	Confirmed	AECOM, 2016
Polypodiaceae	<i>Polypodium pellucidum</i>	dotted polypody	'ae	E	Potentially	DON, 2001
Primulaceae	<i>Anagallis arvensis</i>	scarlet pimpernel	-	A	Potentially	DON, 2001
Proteaceae	<i>Grevillea robusta</i>	silk oak	-	A	Confirmed	AECOM, 2016
Psilotaceae	<i>Psilotum nudum</i>	whisk fern	moa	N	Confirmed	AECOM, 2016
Pteridaceae	<i>Adiantum raddianum</i>	delta maidenhair	-	A	Confirmed	AECOM, 2016
Pteridaceae	<i>Cheilanthes viridis</i>	green cliffbrake	-	A	Potentially	HNHP, 2004
Pteridaceae	<i>Pityrogramma calomelanos</i> var. <i>austroamericana</i>	goldback fern	-	A	Confirmed	AECOM, 2016
Rosaceae	<i>Osteomeles anthyllidifolia</i>	Hawai'i hawthorn	'ūlei	N	Confirmed	AECOM, 2016
Rosaceae	<i>Rubus rosifolius</i>	thimbleberry	ola'a	A	Confirmed	AECOM, 2016
Rubiaceae	<i>Bobea brevipes</i>	-	'ahakea lau li'i	E	Potentially	DON, 2001
Rubiaceae	<i>Bobea elatior</i>	-	'ahakea lau nui	E	Potentially	HNHP, 2004
Rubiaceae	<i>Paederia foetida</i>	skunk vine	maile pilau	I	Confirmed	AECOM, 2016

Category: A = alien; E = endemic; I = invasive; N = native.

Appendix L-1
Wahiawa Annex
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Rubiaceae	<i>Psychotria kaduana</i>		kopiko kea	E	Potentially	DON, 2001
Rubiaceae	<i>Psychotria mariniana</i>	forest wild coffee	-	E	Potentially	HNHP, 2004
Rubiaceae	<i>Richardia brasiliensis</i>	tropical Mexican clover	-	A	Confirmed	AECOM, 2016
Rubiaceae	<i>Spermacoce remota</i>	buttonweed	-	A	Confirmed	AECOM, 2016
Rutaceae	<i>Murraya paniculata</i>	orange jasmine	-	A	Confirmed	AECOM, 2016
Santalaceae	<i>Santalum freycinetianum</i>	sandalwood	ʻIliahi	E	Potentially	HNHP, 2004
Sapindaceae	<i>Dodonaea viscosa</i>	hopbush	ʻaʻaliʻi	N	Confirmed	AECOM, 2016
Sapindaceae	<i>Filicium decipiens</i>	fern tree	-	A	Confirmed	AECOM, 2016
Sapotaceae	<i>Chrysophyllum oliviforme</i>	satinleaf	-	A	Confirmed	AECOM, 2016
Sapotaceae	<i>Pouteria sandwicensis</i>	-	ʻalaʻa	E	Potentially	DON, 2001
Scrophulariaceae	<i>Buddleja asiatica</i>	dog tail	-	A	Confirmed	AECOM, 2016
Scrophulariaceae	<i>Castilleja arvensis</i>	Indian paintbrush	-	A	Confirmed	AECOM, 2016
Solanaceae	<i>Solanum mauritianum</i>	earleaf nightshade	pua nana honua	A	Confirmed	AECOM, 2016
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	parasitic maiden fern	-	A	Confirmed	AECOM, 2016
Thymelaeaceae	<i>Wikstroemia oahuensis</i>	Oʻahu false ohelo	ʻākia	E	Confirmed	AECOM, 2016
Tiliaceae	<i>Heliocarpus americanus</i>	white moho	-	A	Confirmed	AECOM, 2016
Ulmaceae	<i>Trema orientalis</i>	gunpowder tree	nalita	A	Confirmed	AECOM, 2016
Urticaceae	<i>Cecropia obtusifolia</i>	guarumo	-	A	Confirmed	AECOM, 2016
Urticaceae	<i>Pilea microphylla</i>	rockweed	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Citharexylum caudatum</i>	juniper berry	-	A	Potentially	HNHP, 2004
Verbenaceae	<i>Citharexylum spinosum</i>	fiddlewood	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Lantana camara</i>	lantana	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Stachytarpheta cayennensis</i>	snakeweed	oi	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Stachytarpheta jamaicensis</i>	light blue snakeweed	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Verbena litoralis</i>	seashore vervain	ʻōwī	A	Potentially	DON, 2001
Viscaceae	<i>Korthalsella cylindrica</i>	Hawaiʻi korthal mistletoe	hulumoa	E	Potentially	DON, 2001

Category: A = alien; E = endemic; N = native.

**Appendix L-1
Wahiawa Annex
Species List - Flora**

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Zingiberaceae	<i>Alpinia mutica</i>	shell ginger	-	A	Confirmed	AECOM, 2016
Zingiberaceae	<i>Hedychium coronarium</i>	white ginger	‘awapuhi ke’oke’o	A	Potentially	HNHP, 2004
Zingiberaceae	<i>Zingiber zerumbet</i>	bitter ginger	‘awapuhi	A	Potentially	HNHP, 2004

Notes: A = alien; E = endemic; N = native; I = invasive; - = no data; DON = Department of the Navy; HNHP = Hawai‘i Natural Heritage Program; HAVFAC = Naval Facilities Engineering Systems Command.

¹*Chromolaena odorata* was observed on the outside of the Opana perimeter fence during a NAVFAC HI site visit on April 2, 2021. A single plant was observed. There are ongoing efforts by the U.S. Army to eradicate this species in the U.S. Army Kahuku Training Area that surrounds Opana. Given that Opana is entirely landscaped and managed grass, it is unlikely this species will expand into the site.

Rules:

- (1) If a species is native, it is classified as non-invasive.
- (2) Invasive species list obtained from Hawaii Invasive Species Council at: <https://dlnr.hawaii.gov/hisc/>
- (3) For species not listed in Integrated Taxonomic Information System, refer to: <http://www.worldfloraonline.org/>
- (4) Native status removed for species not listed on U.S. Department of Agriculture as native to Hawai‘i: <https://plants.usda.gov/>

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- AECOM. (2016). Botanical Surveys of U.S. Navy Properties in Support of an Integrated Natural Resources Management Plan at Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i Prepared by AECOS Inc. January 2016.
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L-2 Wahiawa Annex Fauna Species

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**Appendix L-2
Wahiawa Annex
Species List - Fauna**

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Mammals							
Canidae	<i>Canis lupus familiaris</i>	feral dog	-	-	I	Confirmed	HNHP, 2004a
Felidae	<i>Felis catus</i>	feral cat	-	-	I	Confirmed	HNHP, 2004a
Herpestidae	<i>Herpestes javanicus</i>	mongoose	manakuke	-	I	Confirmed	HNHP, 2004a
Suidae	<i>Sus scrofa</i>	feral pig	pua'a	-	I	Confirmed	DON, 2001
Vespertilionidae	<i>Lasiurus semotus</i>	Hawaiian hoary bat	‘ōpe‘ape‘a	FE, SE	E	Confirmed	Bonaccorso et al., 2019; USGS 2015
Birds							
Alaudidae	<i>Alauda arvensis</i>	Eurasian skylark	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Ardeidae	<i>Bubulcus ibis</i>	cattle egret	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Cardinalidae	<i>Cardinalis cardinalis</i>	northern cardinal	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Cettiidae	<i>Horornis diphone</i>	Japanese bush warbler	-	-	A	Confirmed	Hamer Environmental, 2016
Charadriidae	<i>Pluvialis fulva</i>	Pacific golden-plover	kōlea	MBTA	N	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Columba livia</i>	rock pigeon, rock dove	-	-	A	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Geopelia striata</i>	zebra dove	-	-	A	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Spilopelia chinensis</i>	spotted dove	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Estrilda astrild</i>	common waxbill	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Euodice cantans</i>	African silverbill	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura atricapilla</i>	chestnut munia	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura malacca</i>	tricolored munia	-	-	A	Confirmed	DON, 2001

Category: A= alien; E = endemic; I = invasive; N = native; SE: state listed endangered.

Regulatory Status: FE= federally listed endangered; SE = state listed endangered; MBTA = Migratory Bird Treaty Act protected; - = no data.

Appendix L-2
NCTAMS PAC Wahiawa, Camp Stover Housing Community, Opana
Species List - Vertebrates

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Estrildidae	<i>Lonchura oryzivora</i>	Java sparrow	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura punctulata</i>	nutmeg mannikin	-	-	A	Confirmed	Hamer Environmental, 2016
Fringillidae	<i>Haemorhous mexicanus</i>	house finch	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Hydrobatidae	<i>Oceanodroma castro</i>	band-rumped storm petrel	‘akē‘akē	FE, SE	N	Offsite within 5 miles	N. Dunn, personal communication, January 19, 2021
Leiothrichidae	<i>Garrulax canorus</i>	melodius laughing thrush	-	-	A	Confirmed	Hamer Environmental, 2016
Leiothrichidae	<i>Leiothrix lutea</i>	red-billed leiothrix	-	-	A	Confirmed	Hamer Environmental, 2016
Muscicapidae	<i>Copsychus malabaricus</i>	white-rumped shama	-	-	A	Confirmed	Hamer Environmental, 2016
Passeridae	<i>Passer domesticus</i>	house sparrow	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Francolinus francolinus</i>	black francolin	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Francolinus pondicerianus</i>	gray francolin	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Gallus gallus</i>	red junglefowl	moa	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Pavo cristatus</i>	common peafowl	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Phasianus colchicus</i>	ring-necked pheasant	-	-	A	Confirmed	Hamer Environmental, 2016
Procellariidae	<i>Pterodroma sandwichensis</i>	Hawaiian petrel	‘ua‘u	FE, SE	N	Offsite within 5 miles	Young et al., 2019
Procellariidae	<i>Puffinus newelli</i>	Newell’s shearwater	‘a‘o	FT, ST	N	Offsite within 5 miles	Young et al., 2019

Category: A= alien; I = invasive; N = native.

Regulatory Status: FE= federally listed endangered; FT = federally listed threatened; MBTA = Migratory Bird Treaty Act protected; SE = state listed endangered; ST = state listed endangered; - = no data.

Appendix L-2
NCTAMS PAC Wahiawa, Camp Stover Housing Community, Opana
Species List - Vertebrates

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Pycnonotidae	<i>Pycnonotus cafer</i>	red-vented bulbul	-	-	I	Confirmed	Hamer Environmental, 2016
Pycnonotidae	<i>Pycnonotus jocosus</i>	red-whiskered bulbul	-	-	I	Confirmed	Hamer Environmental, 2016
Strigidae	<i>Asio flammeus sandwichensis</i>	Hawaiian short-eared owl	pueo	SE, MBTA	E	Potentially	RCUH, 2019
Sturnidae	<i>Acridotheres tristis</i>	common myna	piha'ekelo	-	A	Confirmed	Hamer Environmental, 2016
Thraupidae	<i>Paroaria coronata</i>	red-crested cardinal	-	-	A	Confirmed	Hamer Environmental, 2016
Thraupidae	<i>Sicalis flaveola</i>	saffron finch	-	-	A	Confirmed	Hamer Environmental, 2016
Tytonidae	<i>Tyto alba</i>	barn owl	-	-	A	Confirmed	Hamer Environmental, 2016
Zosteropidae	<i>Zosterops japonicus</i>	Japanese white-eye	-	-	A	Confirmed	Hamer Environmental, 2016

Notes: A= alien; E = endemic; FE= federally listed endangered; FT = federally listed threatened; I = invasive; MBTA = Migratory Bird Treaty Act protected; N = native; SE = state listed endangered; ST = state listed endangered; - = no data; DON = Department of the Navy; HNHP = Hawai'i Natural Heritage Program.

Rules: (1) MBTA designations obtained from U.S. Fish and Wildlife Service at: <https://www.fws.gov/birds/management/managed-species/migratory-bird-treaty-act-protected-species.php>

(2) If a species is native, it is classified as non-invasive.

(3) Invasive species list obtained from Hawai'i Invasive Species Council at: <https://dlnr.hawaii.gov/hisc/>

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- AECOM. (2016). Botanical Surveys of U.S. Navy Properties in Support of an Integrated Natural Resources Management Plan at Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i Prepared by AECOS Inc. January 2016.
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Appendix M
Key Biological Reference Documents for Kalaeloa

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M-1 Kalaeloa Flora Species

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Appendix M-1
Kalaeloa
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Acanthaceae	<i>Asystasia gangetica</i>	Chinese violet	-	A	Confirmed	AECOM, 2016
Acanthaceae	<i>Barleria cristata</i>	crested Philippine violet	-	A	Potential	CNRH, 1997
Acanthaceae	<i>Ruellia prostrata</i>	prostrate wild petunia	-	A	Potential	CNRH, 1997
Agavaceae	<i>Agave sisalana</i>	sisal hemp	-	A	Potential	Char, 2000
Aizoaceae	<i>Sesuvium portulacastrum</i>	sea purslane	‘ākulikuli	N	Potential	CNRH, 1997
Aizoaceae	<i>Tetragonia tetragonioides</i>	New Zealand spinach	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Achyranthes aspera</i>	devil's horsewhip	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Alternanthera pungens</i>	khaki weed	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Amaranthus spinosus</i>	spiny amaranth	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Amaranthus viridis</i>	slender amaranth	-	A	Confirmed	AECOM, 2016
Amaranthaceae	<i>Dysphania pumilio</i>	keeled goosefoot	-	A	Confirmed	AECOM, 2016
Anacardiaceae	<i>Mangifera indica</i>	mango	manakō	A	Potential	CNRH, 1997
Anacardiaceae	<i>Schinus terebinthifolius</i>	Christmas berry	wilelaiki	I	Potential	Char, 2000
Apocynaceae	<i>Thevetia peruviana</i>	luckynut	-	A	Potential	Char, 2000
Araliaceae	<i>Schefflera actinophylla</i>	octopus tree	-	A	Potential	CNRH, 1997
Arecaceae	<i>Livistona chinensis</i>	Chinese fan palm	-	A	Confirmed	AECOM, 2016
Asclepiadaceae	<i>Cryptostegia madagascariensis</i>	Madagascar rubber vine	-	I	Potential	CNRH, 1997
Asclepiadaceae	<i>Stapelia gigantea</i>	Zulu giant	-	A	Potential	Char, 2000
Asparagaceae	<i>Agave americana</i>	century plant	-	A	Potential	CNRH, 1997
Asparagaceae	<i>Sansevieria trifasciata</i>	bowstring hemp	-	A	Potential	Char, 2000
Asteraceae	<i>Ageratina riparia</i>	spreading snakeroot	hāmākua pāmakani	A	Potential	CNRH, 1997
Asteraceae	<i>Ageratum conyzoides</i>	tropical whiteweed	maile hohono	A	Potential	CNRH, 1997
Asteraceae	<i>Bidens cynapiifolia</i>	West Indian beggarticks	-	A	Potential	Char, 2000
Asteraceae	<i>Bidens pilosa</i>	common beggarticks	kī	A	Confirmed	AECOM, 2016
Asteraceae	<i>Calyptocarpus vialis</i>	straggler daisy	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Conyza bonariensis</i>	asthmaweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Crassocephalum crepidioides</i>	redflower ragleaf	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Cyanthillium cinereum</i>	little ironwood	-	A	Potential	CNRH, 1997
Asteraceae	<i>Eclipta prostrata</i>	false daisy	-	A	Potential	CNRH, 1997
Asteraceae	<i>Emilia fosbergii</i>	Florida tasselflower	pualele	A	Potential	NAVFAC PAC, 2006
Asteraceae	<i>Emilia sonchifolia</i>	lilac tasselflower	-	A	Potential	CNRH, 1997
Asteraceae	<i>Flaveria trinervia</i>	clustered yellowtops	-	A	Potential	CNRH, 1997

Category: A = alien; N = native; I = invasive.

Appendix M-1
Kalaeloa
Species List - Flora

Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Asteraceae	<i>Gamochaeta purpurea</i>	purple cudweed	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Lactuca serriola</i>	prickly lettuce	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Pluchea carolinensis</i>	sourbush	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Pluchea indica</i>	Indian fleabane	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Reichardia picroides</i>	common brighteyes	-	A	Potential	CNRH, 1997
Asteraceae	<i>Sonchus oleraceus</i>	sow thistle	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Synedrella nodiflora</i>	nodeweed	-	A	Potential	CNRH, 1997
Asteraceae	<i>Taraxacum officinale</i>	dandelion	lauhele	A	Confirmed	AECOM, 2016
Asteraceae	<i>Tridax procumbens</i>	coat buttons	-	A	Potential	CNRH, 1997
Asteraceae	<i>Verbesina encelioides</i>	golden crown-beard	-	A	Confirmed	AECOM, 2016
Asteraceae	<i>Xanthium strumarium</i>	cocklebur	kīkānia	A	Potential	CNRH, 1997
Asteraceae	<i>Youngia japonica</i>	Oriental hawksbeard	-	A	Potential	CNRH, 1997
Bataceae	<i>Batis maritima</i>	turtleweed	-	A	Confirmed	AECOM, 2016
Brassicaceae	<i>Lepidium virginicum</i>	Virginia pepperweed	-	A	Confirmed	AECOM, 2016
Cactaceae	<i>Opuntia ficus-indica</i>	tuna cactus	pānini	A	Confirmed	AECOM, 2016
Cannaceae	<i>Canna indica</i>	Indian shot	-	A	Confirmed	AECOM, 2016
Capparaceae	<i>Capparis sandwichiana</i>	native caper	maiapilo	A	Confirmed	AECOM, 2016
Capparaceae	<i>Gynandropsis gynandra</i>	spiderwisp	-	A	Confirmed	AECOM, 2016
Caricaceae	<i>Carica papaya</i>	papaya	mīkana	A	Confirmed	AECOM, 2016
Caryophyllaceae	<i>Spergularia salina</i>	salt sandspurry	-	A	Confirmed	AECOM, 2016
Casuarinaceae	<i>Casuarina equisetifolia</i>	ironwood	-	A	Confirmed	AECOM, 2016
Casuarinaceae	<i>Casuarina glauca</i>	saltmarsh ironwood	-	A	Confirmed	AECOM, 2016
Chenopodiaceae	<i>Atriplex muelleri</i>	Mueller's saltbush	-	A	Confirmed	AECOM, 2016
Chenopodiaceae	<i>Atriplex semibaccata</i>	Australian saltbush	-	A	Confirmed	AECOM, 2016
Chenopodiaceae	<i>Atriplex suberecta</i>	peregrine saltbush	-	A	Confirmed	AECOM, 2016
Chenopodiaceae	<i>Chenopodium album</i>	lamb's quarters	-	A	Confirmed	AECOM, 2016
Chenopodiaceae	<i>Chenopodium murale</i>	nettleleaf goosefoot	-	A	Confirmed	AECOM, 2016
Clusiaceae	<i>Calophyllum inophyllum</i>	mastwood	kamani	A	Confirmed	AECOM, 2016
Clusiaceae	<i>Clusia rosea</i>	autograph tree	-	A	Confirmed	AECOM, 2016
Combretaceae	<i>Terminalia catappa</i>	tropical almond	-	A	Confirmed	AECOM, 2016
Commelinaceae	<i>Commelina benghalensis</i>	Benghal dayflower	-	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Cuscuta sandwichiana</i>	-	kauna'oa	E	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea alba</i>	tropical white morning-glory	-	A	Confirmed	AECOM, 2016

Category: A = alien; E = endemic; N = native.

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Convolvulaceae	<i>Ipomoea batatas</i>	sweet potato	‘uala	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea carica</i>	mile a minute vine	koali ‘ai	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea imperati</i>	beach morning glory	hunakai	N	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea indica</i>	blue morning-glory	koali ‘awa	N	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea obscura</i>	obscure morning-glory	-	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea pes-caprae</i>	bayhops	pōhuehue	N	Confirmed	AECOM, 2016
Convolvulaceae	<i>Ipomoea triloba</i>	little bell	-	A	Confirmed	AECOM, 2016
Convolvulaceae	<i>Jacquemontia ovalifolia</i>	oval-leaf clustervine	pā‘ūohi‘iaka	N	Confirmed	AECOM, 2016
Convolvulaceae	<i>Merremia aegyptia</i>	hairy woodrose	-	A	Potential	CNRH, 1997
Cordiaceae	<i>Cordia sebestena</i>	geiger tree	-	A	Potential	CNRH, 1997
Cordiaceae	<i>Cordia subcordata</i>	-	kou	N	Potential	CNRH, 1997
Cucurbitaceae	<i>Coccinia grandis</i>	scarlet-fruited gourd	-	A	Potential	NAVFAC PAC, 2006
Cucurbitaceae	<i>Cucumis dipsaceus</i>	teasel gourd	-	A	Potential	CNRH, 1997
Cucurbitaceae	<i>Momordica charantia</i>	wild bitter melon	-	A	Potential	Char, 2000
Cucurbitaceae	<i>Sicyos pachycarpus</i>	paha	kūpala	E	Potential	CNRH, 1997
Cyperaceae	<i>Bolboschoenus maritimus</i>	cosmopolitan bulrush	kaluhā	N	Potential	CNRH, 1997
Cyperaceae	<i>Cyperus involucratus</i>	umbrella sedge	-	A	Potential	Char, 2000
Cyperaceae	<i>Cyperus javanicus</i>	Japanese flatsedge	ahu‘awa	N	Potential	CNRH, 1997
Cyperaceae	<i>Cyperus laevigatus</i>	smooth nutgrass	makaloa	N	Potential	CNRH, 1997
Cyperaceae	<i>Cyperus rotundus</i>	nut grass	kili‘o‘opu	A	Potential	CNRH, 1997
Cyperaceae	<i>Eleocharis geniculata</i>	Canada spikesedge	-	A	Potential	CNRH, 1997
Cyperaceae	<i>Fimbristylis dichotoma</i>	forked fimbry	-	N	Potential	CNRH, 1997
Euphorbiaceae	<i>Codiaeum variegatum</i>	garden croton	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia heterophylla</i>	Mexican fireplant	kaliko	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia hirta</i>	pillpod sandmat	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia hypericifolia</i>	graceful sandmat	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia neriiifolia</i>	Indian spurge tree	-	A	Potential	Char, 2000
Euphorbiaceae	<i>Euphorbia prostrata</i>	ground spurge	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia tirucalli</i>	pencil tree	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Euphorbia tithymaloides ssp. tithymaloides</i>	slipper flower	-	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Phyllanthus debilis</i>	phyllanthus weed	niruri	A	Confirmed	AECOM, 2016
Euphorbiaceae	<i>Ricinus communis</i>	castor bean	koli	A	Confirmed	AECOM, 2016
Fabaceae	<i>Acacia mearnsii</i>	black wattle	-	A	Potential	CNRH, 1997

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Fabaceae	<i>Alysicarpus vaginalis</i>	Alyce clover	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Canavalia cathartica</i>	-	maunaloa	N	Confirmed	AECOM, 2016
Fabaceae	<i>Chamaecrista nictitans</i>	sensitive plant	lauki	A	Confirmed	AECOM, 2016
Fabaceae	<i>Crotalaria incana</i>	shakeshake	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Dalea emarginata</i>	prairie clover	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Delonix regia</i>	royal poinciana	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Desmanthus pernamucanus</i>	pigeon bundleflower	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Desmodium incanum</i>	tickclover	kaimi	N	Confirmed	AECOM, 2016
Fabaceae	<i>Desmodium sandwicense</i>	Hawai'i ticktrefoil	Pua pilipili	N	Confirmed	AECOM, 2016
Fabaceae	<i>Desmodium tortuosum</i>	Dixie ticktrefoil	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Enterolobium cyclocarpum</i>	monkeysoap	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Erythrina sandwicensis</i>	-	wiliwili	E	Confirmed	AECOM, 2016
Fabaceae	<i>Falcataria moluccana</i>	peacock's plume	-	I	Confirmed	AECOM, 2016
Fabaceae	<i>Guilandina bonduc</i>	-	kākalaioa	N	Potential	CNRH, 1997
Fabaceae	<i>Indigofera hendecaphylla</i>	creeping indigo	-	A	Potential	Char, 2000
Fabaceae	<i>Indigofera suffruticosa</i>	indigobush	-	A	Potential	CNRH, 1997
Fabaceae	<i>Leucaena leucocephala</i>	river tamarind	koa haole	A	Confirmed	AECOM, 2016
Fabaceae	<i>Macroptilium atropurpureum</i>	purple bushbean	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Macroptilium lathyroides</i>	wild bushbean	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Medicago polymorpha</i>	bur clover	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Neonotonia wightii</i>	perennial soybean	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Pithecellobium dulce</i>	monkeypod	'opiuma	A	Confirmed	AECOM, 2016
Fabaceae	<i>Prosopis juliflora</i>	long-thorn kiawe	kiawe	I	Confirmed	AECOM, 2016
Fabaceae	<i>Prosopis pallida</i>	common kiawe	kiawe	A	Confirmed	AECOM, 2016
Fabaceae	<i>Samanea saman</i>	raintree	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Senna surattensis</i>	glossy shower	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Tamarindus indica</i>	tamarind	-	A	Confirmed	AECOM, 2016
Fabaceae	<i>Vachellia farnesiana</i> var. <i>farnesiana</i>	sweet acacia	klu	A	Potential	Char, 2000
Heliotropaceae	<i>Euploca procumbens</i>	fourspike heliotrope	-	A	Confirmed	AECOM, 2016
Heliotropaceae	<i>Heliotropium anomalum</i>	Polynesian heliotrope	-	A	Potential	CNRH, 1997
Heliotropaceae	<i>Heliotropium curassavicum</i>	seaside heliotrope	kīpūkai	N	Confirmed	AECOM, 2016
Heliotropaceae	<i>Tournefortia argentea</i>	tree heliotrope	-	A	Confirmed	AECOM, 2016
Hydrophyllaceae	<i>Nama sandwicensis</i>	-	hinahina kahakai	E	Potential	CNRH, 1997

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Lamiaceae	<i>Hyptis pectinata</i>	comb hyptis	-	A	Potential	CNRH, 1997
Lamiaceae	<i>Leonotis nepetifolia</i>	Christmas candlestick	-	A	Potential	CNRH, 1997
Lamiaceae	<i>Ocimum gratissimum</i>	African basil	-	A	Potential	CNRH, 1997
Lamiaceae	<i>Stachys arvensis</i>	staggerweed	-	A	Potential	CNRH, 1997
Lauraceae	<i>Cassytha filiformis</i>	devil's gut	kauna'oa pehu	N	Confirmed	AECOM, 2016
Lauraceae	<i>Persea americana</i>	avocado	-	A	Confirmed	AECOM, 2016
Liliaceae	<i>Asparagus densiflorus</i>	asparagus fern	-	A	Confirmed	AECOM, 2016
Liliaceae	<i>Crinum asiaticum</i>	giant lily	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Abutilon grandifolium</i>	hairy Indian mallow	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Abutilon incanum</i>	hoary abutilon	ko'olua keokeo	N	Confirmed	AECOM, 2016
Malvaceae	<i>Malva parviflora</i>	cheese weed	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Malvastrum coromandelianum</i>	false mallow	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Sida ciliaris</i>	bracted sida	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Sida fallax</i>	yellow 'ilima	'ilima	N	Confirmed	AECOM, 2016
Malvaceae	<i>Sida rhombifolia</i>	arrowleaf sida	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Sida spinosa</i>	prickly sida	-	A	Confirmed	AECOM, 2016
Malvaceae	<i>Talipariti tiliaceum</i>	-	hau	A	Confirmed	AECOM, 2016
Malvaceae	<i>Thespesia populnea</i>	portia tree	milo	A	Confirmed	AECOM, 2016
Malvaceae	<i>Waltheria indica</i>	malva blanca	'uhaloa	N	Confirmed	AECOM, 2016
Menispermaceae	<i>Cocculus orbiculatus</i>	queen coralbead	huehue	N	Confirmed	AECOM, 2016
Moraceae	<i>Ficus elastica</i>	Indian rubberplant	-	A	Potential	CNRH, 1997
Moraceae	<i>Ficus microcarpa</i>	Chinese banyan	-	A	Confirmed	AECOM, 2016
Moraceae	<i>Morus alba</i>	white mulberry	-	A	Confirmed	AECOM, 2016
Moringaceae	<i>Moringa oleifera</i>	horseradish tree	-	A	Confirmed	AECOM, 2016
Myoporaceae	<i>Myoporum sandwicense</i>	-	naio	N	Confirmed	AECOM, 2016
Myrtaceae	<i>Psidium guajava</i>	common guava	kuawa	N	Confirmed	AECOM, 2016
Nyctaginaceae	<i>Boerhavia coccinea</i>	false alena	-	A	Confirmed	AECOM, 2016
Nyctaginaceae	<i>Boerhavia repens</i>	-	alena	N	Confirmed	AECOM, 2016
Nyctaginaceae	<i>Bougainvillea spectabilis</i>	bougainvillea	-	A	Confirmed	AECOM, 2016
Oxalidaceae	<i>Oxalis corniculata</i>	yellow wood sorrel	'ihi'ai	A	Confirmed	AECOM, 2016
Passifloraceae	<i>Passiflora foetida</i>	scarletfruit passionflower	-	A	Confirmed	AECOM, 2016
Passifloraceae	<i>Passiflora suberosa</i>	wild passionfruit	huehue haole	A	Confirmed	AECOM, 2016

Category: A = alien; N = native.

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Phytolaccaceae	<i>Rivina humilis</i>	rougeplant	-	A	Confirmed	AECOM, 2016
Plantaginaceae	<i>Plantago lanceolata</i>	English plantain	-	A	Confirmed	AECOM, 2016
Plantaginaceae	<i>Plantago major</i>	broadleaf plantain	laukahi	A	Confirmed	AECOM, 2016
Plumbaginaceae	<i>Plumbago zeylanica</i>	wild leadwort	'ilie'e	N	Confirmed	AECOM, 2016
Poaceae	<i>Bothriochloa pertusa</i>	pitted beardgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cenchrus ciliaris</i>	buffelgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cenchrus echinatus</i>	southern sandbur	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cenchrus polystachios</i>	feathery pennisetum	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Chloris barbata</i>	swollen fingergrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Chloris radiata</i>	radiate fingergrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cynodon dactylon</i>	Bermuda grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Cynodon x. magennisii</i>	Tifdwarf Bermuda	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Dactyloctenium aegyptium</i>	crowfoot grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Digitaria ciliaris</i>	Henry's crabgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Digitaria insularis</i>	sourgrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Eleusine indica</i>	goosegrass	manienie ali'i	A	Confirmed	AECOM, 2016
Poaceae	<i>Eragrostis cilianensis</i>	stink grass	-	A	Potential	CNRH, 1997
Poaceae	<i>Eragrostis pectinacea</i>	tufted lovegrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Eragrostis tenella</i>	Japanese lovegrass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Leptochloa fusca subsp. uninervia</i>	sprangletop	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Megathyrsus maximus</i>	Guinea grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Melinis repens</i>	rose Natal grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Panicum repens</i>	torpedo grass	wainaku grass	A	Confirmed	AECOM, 2016
Poaceae	<i>Paspalum conjugatum</i>	Hilo grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Saccharum officinarum</i>	sugar cane	kō	A	Confirmed	AECOM, 2016
Poaceae	<i>Setaria verticillata</i>	bristly foxtail	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sorghum halepense</i>	Johnson grass	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sporobolus diandrus</i>	Indian dropseed	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Sporobolus virginicus</i>	seashore dropseed	'aki'aki	N	Confirmed	AECOM, 2016
Poaceae	<i>Urochloa distachya</i>	-	-	A	Confirmed	AECOM, 2016
Poaceae	<i>Urochloa mutica</i>	paragrass	-	A	Confirmed	AECOM, 2016
Polygonaceae	<i>Antigonon leptopus</i>	Mexican creeper	-	A	Confirmed	AECOM, 2016
Polygonaceae	<i>Coccoloba uvifera</i>	seagrape	-	A	Confirmed	AECOM, 2016

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Portulacaceae	<i>Portulaca oleracea</i>	pigweed	akulikuli kula	N	Potential	CNRH, 1997
Portulacaceae	<i>Portulaca pilosa</i>	chisme	‘ihi	A	Potential	CNRH, 1997
Primulaceae	<i>Anagallis arvensis</i>	scarlet pimpernel	-	A	Potential	CNRH, 1997
Psilotaceae	<i>Psilotum nudum</i>	whisk fern	moa	N	Potential	CNRH, 1997
Rhizophoraceae	<i>Rhizophora mangle</i>	red mangrove	-	I	Potential	CNRH, 1997
Rubiaceae	<i>Hedyotis corymbosa</i>	flattop mille graines	-	A	Confirmed	AECOM, 2016
Rubiaceae	<i>Morinda citrifolia</i>	Indian mulberry	noni	A	Confirmed	AECOM, 2016
Rutaceae	<i>Murraya paniculata</i>	orange jasmine		A	Confirmed	AECOM, 2016
Santalaceae	<i>Santalum ellipticum</i>	coastal sandalwood	‘iliahialo’e	E	Confirmed	AECOM, 2016
Santalaceae	<i>Santalum freycinetianum</i>	sandalwood	‘iliahi	E	Confirmed	AECOM, 2016
Scrophulariaceae	<i>Buddleja asiatica</i>	dog tail	-	A	Potential	CNRH, 1997
Solanaceae	<i>Capsicum annuum</i> var. <i>glabriusculum</i>	red pepper	nioi	A	Potential	CNRH, 1997
Solanaceae	<i>Lycium sandwicense</i>	-	‘ōhelo kai	N	Potential	CNRH, 1997
Solanaceae	<i>Nicandra physalodes</i>	apple of Peru	-	A	Potential	CNRH, 1997
Solanaceae	<i>Nicotiana glauca</i>	tree tobacco	-	A	Potential	NAVFAC PAC, 2006
Solanaceae	<i>Solanum americanum</i>	purple nightshade	pōpolo	A	Confirmed	AECOM, 2016
Solanaceae	<i>Solanum lycopersicum</i>	garden tomato	-	A	Confirmed	AECOM, 2016
Solanaceae	<i>Solanum seaforthianum</i>	Brazilian nightshade	-	A	Confirmed	AECOM, 2016
Strelitziaceae	<i>Strelitzia reginae</i>	bird-of-paradise	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Lantana camara</i>	lantana	-	A	Potential	CNRH, 1997
Verbenaceae	<i>Stachytarpheta cayennensis</i>	snakeweed	oi	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Stachytarpheta jamaicensis</i>	light blue snakeweed	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Stachytarpheta urticifolia</i>	nettleleaf velvetberry	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Verbena litoralis</i>	seashore vervain	‘ōwī	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Vitex trifolia</i>	simpleleaf chastetree	-	A	Confirmed	AECOM, 2016
Verbenaceae	<i>Vitex trifolia</i> var. <i>subtrisecta</i>	simpleleaf chastetree	polinalina	A	Confirmed	AECOM, 2016
Xanthorrhoeaceae	<i>Aloe vera</i>	aloe	-	A	Confirmed	AECOM, 2016

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Family	Latin Name	Common Name	Hawaiian Name	Category	Occurrence	Reference
Zygophyllaceae	<i>Tribulus cistoides</i>	puncture vine	nohu	E	Confirmed	AECOM, 2016
Zygophyllaceae	<i>Tribulus terrestris</i>	puncture vine	-	A	Confirmed	AECOM, 2016

Notes: A = alien; E = endemic; N = native; I = invasive; - = no data; DON = Department of the Navy; HNHP = Hawai'i Natural Heritage Program; NAVFAC = Naval Facilities Engineering Systems Command. **There are no Endangered Species Act listed plant species present within the Kalaeloa study area.**

Rules: (1) If a species is native, it is classified as non-invasive.

(2) Invasive species list obtained from Hawaii Invasive Species Council at: <https://dlnr.hawaii.gov/hisc/>

(3) For species not listed in Integrated Taxonomic Information System, refer to: <http://www.worldfloraonline.org/>

(4) Native status removed for species not listed on U.S. Department of Agriculture as native to Hawai'i: <https://plants.usda.gov/>

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M-2 Kalaeloa Fauna Species

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Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Invertebrates							
Colletidae	<i>Hylaeus</i> spp.	Hawaiian yellow-faced bee	nalo meli maoli	FE	N	Unconfirmed, Potential	-
Terrestrial Mammals							
Canidae	<i>Canis lupus familiaris</i>	feral dog	-	-	I	Confirmed	NAVFAC PAC, 2011
Felidae	<i>Felis catus</i>	feral cat	-	-	I	Confirmed	NAVFAC PAC, 2011
Herpestidae	<i>Herpestes javanicus</i>	mongoose	manakuke	-	I	Confirmed	NAVFAC PAC, 2011
Muridae	<i>Mus musculus</i>	house mouse	‘iole	-	I	Confirmed	SOH DOT, 2020
Muridae	<i>Rattus exulans</i>	Polynesian rat	‘iole	-	I	Potential	NAVFAC PAC, 2011
Muridae	<i>Rattus norvegicus</i>	Norway rat	‘iole	-	I	Potential	NAVFAC PAC, 2011
Muridae	<i>Rattus rattus</i>	roof rat	‘iole	-	I	Potential	NAVFAC PAC, 2011
Vespertilionidae	<i>Lasiurus semotus</i>	Hawaiian hoary bat	‘ōpe‘ape‘a	FE, SE	N	Unconfirmed, Potential	-
Marine Mammals							
Phocidae	<i>Neomonachus schauinslandi</i>	Hawaiian monk seal	‘iliiholoikauaua	FE, SE	N	Confirmed	NMFS PIFSC, 2018; Johanos, 2019
Marine Reptiles							
Cheloniinae	<i>Chelonia mydas</i>	green sea turtle (Central North Pacific distinct population segment)	honu	FT, ST	N	Confirmed	NAVFAC HI, 2021
Birds							
Alaudidae	<i>Alauda arvensis</i>	Eurasian skylark	-	MBTA	A	Offsite within 5 miles	SOH DOT, 2020
Anatidae	<i>Anas acuta</i>	northern pintail	Koloa Mapu	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Anatidae	<i>Anas americana</i>	American wigeon	-	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Anatidae	<i>Anas clypeata</i>	northern shoveler	Koloa Mōhā	MBTA	N	Offsite within 5 miles	SOH DOT, 2020

Category: A= alien; I = invasive; N = native.

Regulatory Status: FE= federally listed endangered; FT = federally listed threatened; SE = state listed endangered; ST = state listed endangered; MBTA = Migratory Bird Treaty Act - = no data.

Appendix M-2
Kalaeloa
Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Anatidae	<i>Anas discors</i>	blue-winged teal	-	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Anatidae	<i>Anas platyrhynchos</i>	mallard	-	MBTA	A	Potential	SOH DOT, 2020
Anatidae	<i>Anas spp.</i>	Mallard-Koloa Hybrid	-	MBTA	A	Potential	SOH DOT, 2020
Anatidae	<i>Anas wyvilliana</i>	Hawaiian duck	Koloa	FE, SE, MBTA	N	Potential	SOH DOT, 2020
Anatidae	<i>Aythya affinis</i>	lesser scaup	-	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Anatidae	<i>Branta hutchinsii</i>	cackling goose	-	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Anatidae	<i>Cairina moschata</i>	Muscovy duck	-	-	A	Offsite within 5 miles	SOH DOT, 2020
Anatidae	<i>Cygnus atratus</i>	black swan	-	-	A	Offsite within 5 miles	SOH DOT, 2020
Anatidae	<i>Anas platyrhynchos</i>	mallard	-	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Ardeidae	<i>Bubulcus ibis</i>	cattle egret	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Ardeidae	<i>Nycticorax nycticorax</i>	black-crowned night-heron	‘auku‘u	MBTA	N	Confirmed	Hamer Environmental, 2016
Cardinalidae	<i>Cardinalis cardinalis</i>	northern cardinal	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Charadriidae	<i>Pluvialis fulva</i>	Pacific golden plover	kōlea	MBTA	N	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Columba livia</i>	rock dove	-	-	A	Offsite within 5 miles	SOH DOT, 2020
Columbidae	<i>Geopelia striata</i>	zebra dove	-	-	A	Confirmed	Hamer Environmental, 2016
Columbidae	<i>Spilopelia chinensis</i>	spotted dove	-	-	A	Confirmed	Hamer Environmental, 2016
Diomedidae	<i>Phoebastria immutabilis</i>	Laysan albatross	-	MBTA	N	Offsite within 5 miles	SOH DOT, 2020

Category: A= alien; N = native.

Regulatory Status: FE= federally listed endangered; MBTA = Migratory Bird Treaty Act; SE = state listed endangered; - = no data.

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Estrildidae	<i>Amandava amandava</i>	red avadavat	-	-	A	Offsite within 5 miles	SOH DOT, 2020
Estrildidae	<i>Estrilda astrild</i>	common waxbill	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Euodice cantans</i>	African silverbill	-	-	A	Offsite within 5 miles	SOH DOT, 2020
Estrildidae	<i>Lonchura atricapilla</i>	chestnut munia	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura oryzivora</i>	Java sparrow	-	-	A	Confirmed	Hamer Environmental, 2016
Estrildidae	<i>Lonchura punctulata</i>	nutmeg mannikin	-	-	A	Confirmed	Hamer Environmental, 2016
Fregatidae	<i>Fregata minor</i>	great frigatebird	'iwa	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Fringillidae	<i>Crithagra mozambica</i>	yellow-fronted canary	-	-	A	Confirmed	Hamer Environmental, 2016
Fringillidae	<i>Haemorhous mexicanus</i>	house finch	-	MBTA	A	Confirmed	Hamer Environmental, 2016
Hydrobatidae	<i>Oceanodroma castro</i>	band-rumped storm petrel	'akē'akē	FE, SE	N	Potential	Pyle and Pyle, 2017
Laridae	<i>Gygis alba</i>	white tern	manu o kū	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Laridae	<i>Leucophaeus atricilla</i>	laughing gull	-	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Laridae	<i>Leucophaeus pipixcan</i>	Franklin's gull	-	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Laridae	<i>Onychoprion fuscatus</i>	sooty tern	'ewa'ewa	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Leiothrichidae	<i>Leiothrix lutea</i>	red-billed leiothrix	-	-	A	Offsite within 5 miles	SOH DOT, 2020
Mimidae	<i>Mimus polyglottos</i>	northern mockingbird	-	MBTA	A	Offsite within 5 miles	SOH DOT, 2020

Category: A= alien; N = native.

Regulatory Status: FE= federally listed endangered; MBTA = Migratory Bird Treaty Act; SE = state listed endangered; - = no data.

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<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Muscicapidae	<i>Copsychus malabaricus</i>	white-rumped shama	-	-	A	Confirmed	Hamer Environmental, 2016
Passeridae	<i>Passer domesticus</i>	house sparrow	-	-	A	Confirmed	Hamer Environmental, 2016
Phaethontidae	<i>Phaethon rubricauda</i>	red-tailed tropicbird	-	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Phasianidae	<i>Francolinus pondicerianus</i>	gray francolin	-	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Gallus gallus</i>	red junglefowl	moa	-	A	Confirmed	Hamer Environmental, 2016
Phasianidae	<i>Pavo cristatus</i>	common peafowl	-	-	A	Confirmed	Hamer Environmental, 2016
Procellariidae	<i>Pterodroma sandwichensis</i>	Hawaiian petrel	‘ua‘u	FE, SE, MBTA	E	Potential	Young et al., 2019
Procellariidae	<i>Puffinus newelli</i>	Newell’s shearwater	‘a‘o	FT, ST, MBTA	E	Potential	Young et al., 2019
Psittacidae	<i>Psittacula krameri</i>	rose-ringed parakeet	-	-	I	Offsite within 5 miles	SOH DOT, 2020
Pycnonotidae	<i>Pycnonotus cafer</i>	red-vented bulbul	-	-	I	Confirmed	Hamer Environmental, 2016
Pycnonotidae	<i>Pycnonotus jocosus</i>	red-whiskered bulbul	-	-	I	Confirmed	Hamer Environmental, 2016
Rallidae	<i>Fulica alai</i>	Hawaiian coot	‘alae ke‘oke‘o	FE, SE, MBTA	E	Potential	RCUH, 2017; SOH DOT, 2020
Rallidae	<i>Gallinula chloropus galeata</i>	Hawaiian common moorhen	‘alae ‘ula	FE, SE, MBTA	E	Potential	RCUH, 2017; SOH DOT, 2020
Recurvirostridae	<i>Himantopus mexicanus knudseni</i>	Hawaiian stilt	ae‘o	FE, SE, MBTA	E	Confirmed	Hamer Environmental, 2016; SOH DOT, 2020
Scolopacidae	<i>Arenaria interpres</i>	ruddy turnstone	‘akekeke	MBTA	N	Confirmed	Hamer Environmental, 2016
Scolopacidae	<i>Calidris alba</i>	sanderling	hunakai	MBTA	N	Offsite within 5 miles	SOH DOT, 2020

Category: A= alien; E = endemic; I = invasive; N = native.

Regulatory Status: FE= federally listed endangered; FT = federally listed threatened; MBTA = Migratory Bird Treaty Act; SE = state listed endangered; ST = state listed endangered; - = no data.

Appendix M-2
Kalaeloa
Species List - Fauna

<i>Family</i>	<i>Latin Name</i>	<i>Common Name</i>	<i>Hawaiian Name</i>	<i>Regulatory Status</i>	<i>Category</i>	<i>Study Area Occurrence</i>	<i>Reference</i>
Scolopacidae	<i>Numenius tahitiensis</i>	bristle-thighed curlew	kioea	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Scolopacidae	<i>Tringa incana</i>	wandering tattler	ulili	MBTA	N	Confirmed	Hamer Environmental, 2016
Sturnidae	<i>Acridotheres tristis</i>	common myna	piha'ekelo	-	A	Confirmed	Hamer Environmental, 2016
Sulidae	<i>Sula leucogaster plotus</i>	brown booby	'Ā	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Sulidae	<i>Sula sula rubripes</i>	red-footed booby	'Ā	MBTA	N	Offsite within 5 miles	SOH DOT, 2020
Thraupidae	<i>Paroaria coronata</i>	red-crested cardinal	-	-	A	Confirmed	Hamer Environmental, 2016
Thraupidae	<i>Sicalis flaveola</i>	saffron finch	-	-	A	Confirmed	Hamer Environmental, 2016
Tytonidae	<i>Tyto alba</i>	barn owl	-	MBTA	I	Offsite within 5 miles	SOH DOT, 2020
Zosteropidae	<i>Zosterops japonicus</i>	Japanese white-eye	-	-	A	Confirmed	Hamer Environmental, 2016

Notes: A= alien; E = endemic; FE= federally listed endangered; FT = federally listed threatened; I = invasive; MBTA = Migratory Bird Treaty Act protected; N = native; SE = state listed endangered; ST = state listed endangered; - = no data; DON = Department of the Navy; HNHP = Hawai'i Natural Heritage Program.

Rules: (1) MBTA designations obtained from U.S. Fish and Wildlife Service at: <https://www.fws.gov/birds/management/managed-species/migratory-bird-treaty-act-protected-species.php>

(2) If a species is native, it is classified as non-invasive.

(3) Invasive species list obtained from Hawai'i Invasive Species Council at: <https://dlnr.hawaii.gov/hisc/>

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- State of Hawaii (SOH) Department of Transportation (DOH). (2020). Wildlife Hazard Assessment Kalaeloa Airport (JRF) Kapolei, Hawai'i.
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Appendix N
Biological Opinions, Consultations, and Example BMPs

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N-1 Hickam Air Force Base Activities Biological Opinion

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850



In Reply Refer To:
2008-F-0186

AUG 26 2009

Mr. Gary O'Donnell
Chief, Environmental Planning Element
75 H Street
Hickam Air Force Base, Hawaii 96853

Subject: Formal Section 7 Consultation on Endangered Waterbird Air Strike Hazard
Interaction at Hickam Air Force Base, Oahu

Dear Mr. O'Donnell:

This Biological Opinion responds to your request for formal consultation regarding activities and operations at Hickam Air Force Base and adverse effects to four species of endangered Hawaiian waterbirds; Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian moorhen (*Gallinule chlororopus sandvicensis*), and Hawaiian duck (*Anas wyvilliana*). At issue is the proposed take of active endangered Hawaiian stilt nests that have been documented in recent history within the Bird and Wildlife Air Strike Hazard (BASH) zone; potential air strike interactions between waterbirds and flight operations; construction activities in support of the aircraft missions; and the continued hazing of listed waterbirds conducted by the United States Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services (Wildlife Services). This response represents the U.S. Fish and Wildlife Service's (Service) Biological Opinion regarding the effects from the proposed project to the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck pursuant to the Endangered Species Act of 1973 (16 U.S.C. 1531), as amended (Act). This consultation is based on your Biological Assessment, information gained during site visits, telephone conversations, electronic mail (email), (see Consultation History and References) and other information available to us. A full administrative record is available at Pacific Islands Fish and Wildlife Office (PIFWO).

CONSULTATION HISTORY

December 18, 2006. Hickam Air Force Base submitted a Biological Assessment to the Service in which it made a determination that the proposed project "may affect, but is not likely to adversely affect" listed Hawaiian waterbirds.



Mr. Gary O'Donnell

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March 8, 2007. Hickam Air Force Base revised the Biological Assessment to provide further information requested by Peter Cohen (Service biologist).

July 9, 2007. The Service did not concur with Hickam Air Force Base's not likely to adversely affect determination, and in an email recommended initiation of formal consultation based on Hickam Air Force Base request to "take" endangered waterbirds.

July 17, 2007. Aaron Hebshi (Air Force), Darrin Phelps (Wildlife Services), Holly Herod and Aaron Nadig (Service biologists) attended a site visit at Hickam Air Force Base Flight line to discuss the development of a consultation package.

July 19, 2007. Aaron Nadig (Service) provided guidance to Aaron Hebshi (Air Force) via email describing the information necessary to assemble a complete package for formal consultation.

April 18, 2008. The Hickam Air Force Base consultation package was received by PIFWO.

May 16, 2008. A letter was sent to Mr. Gary O'Donnell acknowledging initiation of formal consultation for ongoing activities related to air operations at Hickam Air Force Base.

July 25, 2008. The project scope was changed to include actions for restoration of Oxbow wetlands at Bellows Air Force Station, modification of work at Ahua Reef, and hazing activities for BASH. The Air Force reviewed the changes and commitments with Kadena Air Force Base which maintains management authority for Bellows Air Force Station. A meeting was scheduled by Aaron Hebshi (Air Force) to meet with Flight Safety 15th Air Wing to approve actions near Hickam Air Force Base and was postponed until January 2009.

January 21, 2009. Due to a BASH program Flight Safety 15th Air Wing quarterly meeting, the project description was revised to maintain flight safety. Aaron Hebshi (Air Force) sent the final project description with revisions to Aaron Nadig (Service).

BIOLOGICAL OPINION

Description of the Proposed Action

Site Description

Hickam Air Force Base occupies approximately 2,520 acres and is located on the south shore of Oahu on a coastal plain between Pearl Harbor and the Honolulu International Airport (Figure 1). Much of the land is fill material that was used to construct a base of operations before and during World War II. Hickam Air Force Base is the Headquarters for the Pacific Air Forces and the 15th Air Wing. Although Hickam Air Force Base shares the airfield with Honolulu International Airport, many of the ramp areas and taxiways on Hickam Air Force Base are used exclusively by the Air Force and Hawaii Air National Guard.



Figure 1. Location of Hickam Air Force Base.

Hickam Air Force Base maintains a system of open drainage canals (3.5 miles) to convey water from the runways and ramp areas. Figure 2 shows the drainage canal system in the vicinity of the airfield. A catchment pond, located south of the airfield (Figure 3), is used for irrigation of a nearby golf course. Currently, a temporary leak in the pond's lining keeps water from accumulating and limits the pond's attractiveness to waterbirds; however, surface water has been observed pooled around the catchment area. The pond will need to be repaired in the near future to limit the extent of pooling and improve the drainage in the area.

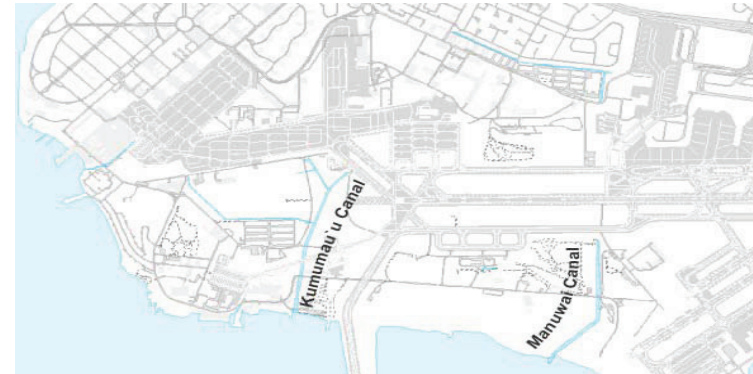


Figure 2. Drainage canals associated with Hickam Air Force Base.

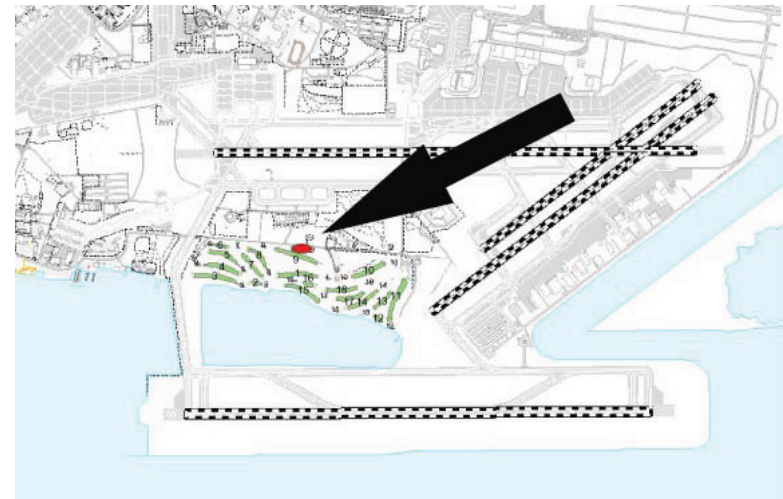


Figure 3. Permanent catchment pond associated with Hickam Air Force Base.

A four-acre wetland (Ahua Reef) and an adjacent expanse of mud and reef flat habitat exist at Hickam Air Force Base (Figure 4) although the wetland is fairly degraded by invasive red mangrove (*Rhizophora mangle*) and pickleweed (*Batis maritima*). The majority of the Hickam Air Force Base is classified as “improved grounds” used for facilities, infrastructure, or landscaping.

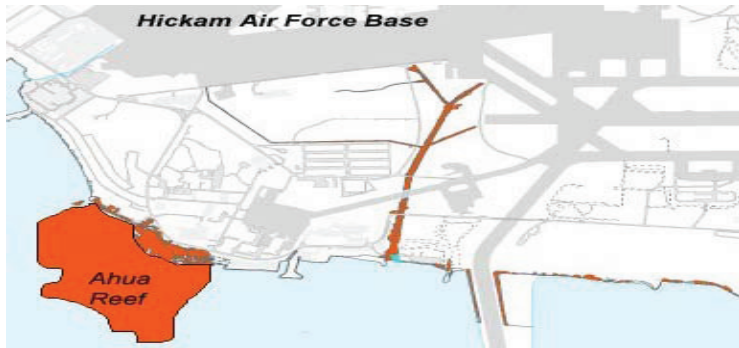


Figure 4. Ahua Reef wetland within Hickam Air Force Base.

Four endangered Hawaiian waterbird conservation areas are within five miles of Hickam Air Force Base (Figure 5). Pouhala Marsh, located 4.3 miles to the northwest of Hickam Air Force Base at Pearl Harbor, is a 70-acre waterbird sanctuary managed by the State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW). The Service manages the Pearl Harbor National Wildlife Refuge (NWR) which is composed of two separate units for Hawaiian waterbirds; the 37-acre Honouliuli wetland and the 25-acre Waiawa wetland. Data from the bi-annual State waterbird counts from Pouhala Marsh and Pearl Harbor NWR show significant populations of endangered Hawaiian waterbirds at these wetlands. Also, a private landowner, Haseko, Inc., maintains a 22-acre, Army Corps of Engineers Wetland Preservation Area in Ewa, about 4.9 miles west of Hickam Air Force Base (Figure 5). Because of the close proximity of the wetlands to Hickam Air Force Base, Hawaiian waterbirds can easily disperse to Hickam Air Force Base in order to forage and nest. Wetland habitat, managed by DOFAW, also exists at Keehi Lagoon in the vicinity of the Honolulu International Airport Reef Runway (east), but bi-annual State waterbird counts from this location are generally low.



Figure 5. Hawaiian waterbird conservation areas in proximity to Hickam Air Force Base.

Summary of Proposed Action

Proposed operations include maintenance of drainage canal systems, ongoing and increasing aircraft operations, construction activities, which may involve the creation of dewatering ponds, and efforts to control bird hazards to aircraft. The action encompasses ongoing operations that the Air Force currently conducts and will continue to conduct into the foreseeable future. The action area pursuant to section 7 regulations consists of “all areas to be affected directly or indirectly by the Federal action.” The action area associated with the proposed action is delineated by the outer perimeter of Hickam Air Force Base installation (see Figure 1) and includes conservation work that will be conducted at Bellows Air Force Station (Figure 6) within the Oxbow wetland of Waimanalo stream.



Figure 6. Bellows Air Force Station.

Proposed Aircraft Operations

Hickam Air Force Base houses the 15th Airlift Wing of the Pacific Air Forces, which currently operates eight C-17 aircraft, 20 F-15 aircraft, and four KC-135 aircraft. Hickam Air Force Base also serves as a stopover hub for military aircraft traveling throughout the Pacific. The current level of air traffic present on the airfield is summarized in Tables 1 and 2; numbers exclude transient (Department of Defense) aircraft using Hickam Air Force Base as a stopover. The level of air traffic is routine and an integral component of Hickam Air Force Base operations, and will continue into the foreseeable future.

Table 1. Current and proposed military aircraft sorties (one sortie is defined as a single aircraft conducting a take-off, flight, and landing) at Hickam Air Force Base.

Aircraft	Sorties: Current (2007)	Sorties: Proposed	Percent Increase
F-22	N/A	4320	50%*
KC-135	495	743	50%
8 C-17s, 1 C-20, 2 C-37s, 1 C-40	2974	~2974	0%

*from current F-15 operations, which will be eliminated when the F-22 beddown occurs.

Table 2. Baseline Operations at Hickam Air Force Base and Honolulu International Airport. Each take-off or landing is considered an operation.

Fiscal Year	Military	Civilian	Total Operations
2003	16,088	289,577	305,665
2004	17,101	303,174	320,275
2005	14,819	315,727	330,546

Data from SAIC (2007), E2m (2008), and 15th AW Wing Aviation Resource Management.

Facility Construction, Renovation, and Demolition

Two beddown activities are currently proposed for Hickam Air Force Base. The Air force is proposing the reassignment of four KC-135 aircraft from Grand Forks Air Force Base, North Dakota, to the KC-135R inventory in Hawaii; additional infrastructure improvements; increase in staffing levels by 154 additional personnel; and construction of a 6,600-square-foot KC-135 Flight Simulator Training Facility. The Hawaii Air National Guard has proposed replacing the existing 20 F-15 aircraft with 20 F-22A aircraft beginning in fiscal year 2011. Demolition and renovation of several buildings and structures, and the construction of additional facilities in support of the beddown are proposed. All construction, renovation, and demolition activities, including the staging of equipment and materials, will occur on previously developed land.

Dewatering Ponds Associated with Construction

Dewatering ponds are occasionally created at new construction sites to collect shunted ground water from excavation activities. In 2006, for instance, construction of new facilities in support of the C-17 beddown required the use of dewatering ponds, which attracted Hawaiian stilts and Hawaiian ducks (or mallard-hybrids). The four dewatering ponds, currently filled, ranged in size between 0.5 and 2 acres. Construction activities in the area of the Hawaii Air National Guard, such as those in support of the F-22 beddown, will create similar dewatering ponds, and are expected to be in use for construction activities over the next five to 10 years (Figure 7) (SAIC 2007). Individual dewatering ponds from the various construction activities may persist for up to four years. Although these dewatering ponds are not permanent structures, such ponds will likely be created for the construction of each new facility. When construction projects are completed, the ponds are filled with coral rubble and soil.

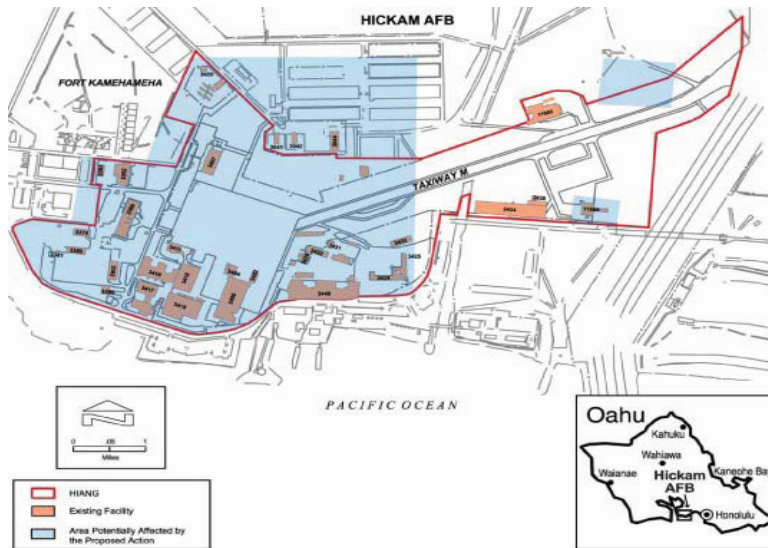


Figure 7. Hickam Air Force project area for F-22A beddown.

Bird and Wildlife Airstrike Hazard Program

To minimize the risk of aircraft collisions with birds or other wildlife, Wildlife Services implements an integrated wildlife control operation within the BASH zone (Figure 8) at Hickam Air Force Base, based on the findings of Linnell's (1995) thesis work. Methods include both lethal and non-lethal techniques. Lethal methods include shooting introduced bird species such as zebra doves (*Geopelia striata*), mynahs (*Acridotheres tristis*), spotted doves (*Streptopelia chinensis*), cattle egrets (*Bubulcus ibis*), and mannikins (*Lonchura* sp.) in high probability bird-strike zones along the runways and taxiways. Non-lethal control includes trapping and relocation, hazing using pyrotechnics, flushing using vehicles or personnel on foot. Only non-lethal control is used for Federally protected and endangered birds such as Pacific golden-plover (*Pluvialis dominica*), Hawaiian stilt, Hawaiian coot, Hawaiian duck, and Hawaiian moorhen. Wildlife Services is authorized to haze endangered birds from airfields in the Hawaiian Islands as an agent of the Service, pursuant to the Service's October 2006, Agent Designation Letter. This agreement, as amended, addresses increases in airports within Hawaii and has been in place since 1991. In addition, each airport maintains a Migratory Bird permit for hazing activities within the designated BASH zone.

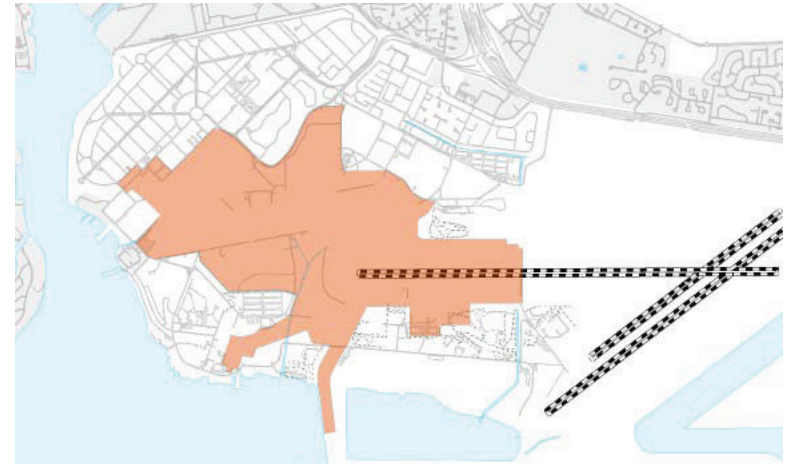


Figure 8. Hickam Air Force Base BASH zone.

Conservation Measures

The following are conservation measures proposed by Hickam Air Force Base to avoid and minimize effects to the endangered Hawaiian waterbirds and are considered part of the project description.

- 1) Minimize nuisance attractants within the BASH zone to prevent attraction and minimize potential interactions between Hawaiian waterbirds and aircraft:
 - a) Develop and implement alternatives to dewatering ponds. Hickam Air Force Base has 3.5 miles of drainage ditches associated with the Airport. When feasible, drainage directly into ditches should be investigated as an alternative to establishing dewatering ponds.
 - b) When the project site mandates use of dewatering ponds, ponds shall be constructed with side slopes that will have a 1.5 horizontal to 1.0 vertical slope (approximately 45 degree slope) which will minimize the potential for creating shallow water habitat for Hawaiian waterbirds. The Hickam Air Force Base will monitor the ponds and immediately repair any edge areas that are not at a 45 degree slope (due to rainstorms, wave action, etc.) to ensure habitat is not created within dewatering ponds. The Hickam Air Force Base shall ensure that water level is continuously maintained at a depth greater than three feet in all dewatering ponds. Ponds shall be covered by a method selected by the Hickam Air Force Base and approved by the Service, to reduce the attractiveness of these features to

- endangered Hawaiian waterbirds. Acceptable methods include the installation and maintenance of systems of bird balls, netting, or tarps to prevent bird access to the ponds.
- c) To minimize the risk of attracting nesting Hawaiian waterbirds, the Hickam Air Force Base will evaluate the BASH program on a quarterly basis to determine where avian attraction or hotspots occur. This will allow Hickam Air Force Base to evaluate habitat modifications for locations that may be attracting waterbirds into the BASH zone.
 - d) If heavy rain events occur during the Hawaiian stilt breeding season (Mid-February through August), Hickam Air Force Base will require Wildlife Services to contact the Flight Safety Office to coordinate any BASH zone staffing increases necessary to prevent Hawaiian stilts from nesting on or around the airfield during these wet periods.
 - e) Hickam Air Force Base will reduce the attractiveness of the drainage canals within the BASH zone. Although the canals draining the runway areas cannot be filled, as that would lead to an increase in standing water in and around the airfield, the Hickam Air Force Base will remove woody vegetation, which can provide cover to the Hawaiian waterbirds, around canals to keep canals open and clear.
 - f) Hickam Air Force Base will repair the water catchment at the golf course to eliminate surface pooling water thus reducing its attractiveness to waterbirds.
- 2) The Air Force will restore wetland areas at Hickam Air Force Base and Bellows Air Force Station to provide habitat outside the BASH zone for endangered Hawaiian waterbirds. The four-acre wetland (Ahua Reef) at Hickam Air Force Base currently is used by Hawaiian stilts for foraging, but a large portion of potential foraging habitat in this wetland is overgrown with mangroves and pickleweed. Likewise, the Oxbow wetland of Waimanalo stream on Bellows Air Force Station (Figure 9) has been overgrown with red mangroves. Air Force will develop a management plan and implement actions to control invasive vegetation and control predators at these two locations beginning in Fiscal Year 2010.
- a) Ahua Reef wetland shall be managed for the following:
 - open water (1-6 inch depth) and mudflat (saturated and dry);
 - interspersed with less than 25 percent cover of pest plants including pickleweed, and red mangrove;
 - minimize predation of adult waterbirds by feral mammalian predators [e.g., cats (*Felis catus*), dogs (*Canis familiaris*)];
 - Air Force shall enforce their policy to restrict domestic pets from Ahua Reef wetland area for the protection of listed waterbirds.
 - b) Bellows Air Force Station Oxbow wetland restoration will include the following:
 - mudflat (dry and saturated) and open water (from less than 1 to 18 inches depth);
 - interspersed 30 to 60 percent cover of tall (3 to 8 feet) emergent vegetation (e.g., cattail), grasses (sprangletop, knot-grass, millet), and sedges (California bulrush, flatsedge, and *Fimbristylis* sp.) that provide seed and green browse and a mosaic of concealment cover, open water, and thermal cover;

- less than 25 percent cover of pest plants including marsh fleabane, pickleweed, water hyssop, California bulrush and California grass;
 - interspersed vegetation with sufficient edge providing visual barriers to maximize territories available for breeding;
 - minimize predation [e.g., mongoose (*Herpestes javanicus*), feral cats, feral dogs, rats (*Rattus* sp.), American bullfrogs (*Rana catesbeiana*), and cattle egrets];
 - Recreation and training in the Oxbow wetland area will be restricted to minimize human disturbance.
- c) Live trapping for feral cats will be conducted year round at Ahua Reef, and mongoose and feral cat trapping will be conducted year round at Bellows Air Force Station Oxbow wetland for the protection of listed waterbirds. Live traps for small mammals and frogs will be checked every 48 hours when trapping activity occurs. Bait stations (utilizing approved rodenticide) will be utilized during the breeding season at Bellows Air Force Station Oxbow wetland to reduce rat predation on listed species.
 - d) Bellows Air Force Station Oxbow wetland will be surveyed on a regular basis for early detection of American bullfrogs. If bullfrogs are discovered, methods should be implemented for immediate eradication.
 - e) Hawaiian ducks are declining primarily due to hybridization with mallard ducks (Engilis and Pratt 1993). Mallard and Hawaiian duck hybrid populations on Oahu are increasing based on DOFAW bi-annual waterbird survey data (Figure 10). Because feral ducks could displace listed ducks and have the potential to perpetuate hybridization, a program of survey and control will be coordinated with PIFWO prior to implementation. Methodology will be based on criteria outlined in the Hawaiian duck-hybrid Identification Key (Eadie et. al. 2009, Fowler et. al. 2008) to address incursions of these hybrid duck at Bellows Air Station Oxbow wetland. Specimens of hybrid ducks shall be retained and disposition of carcasses shall be coordinated with PIFWO.

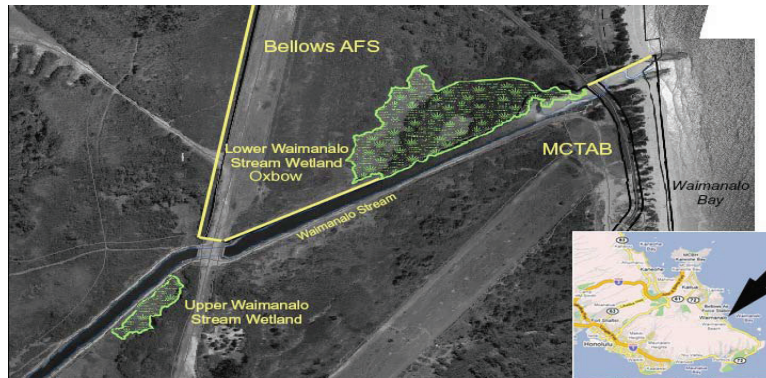
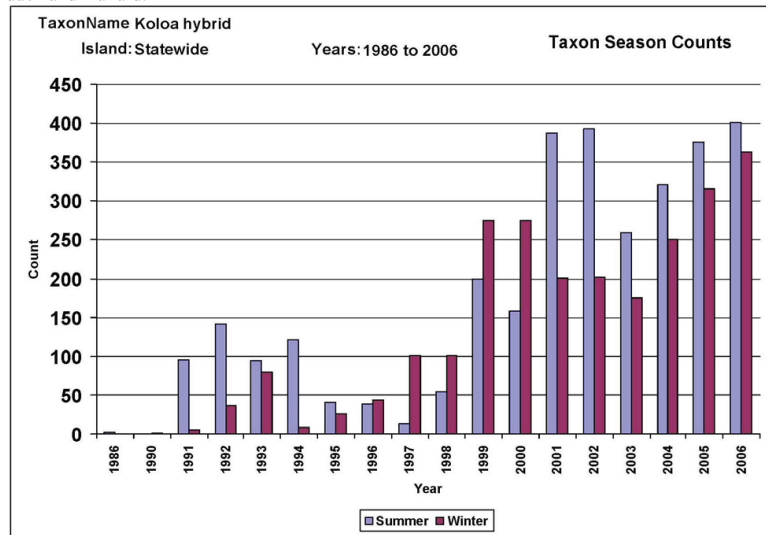


Figure 9. Oxbow Wetland of Waimanalo Stream on Bellows Air Force Station.

Figure 10. State waterbird surveys 1986 – 2006, summer and winter counts of hybrid Hawaiian duck and mallard.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

STATUS OF THE SPECIES

Hawaiian stilt or Ae o (*Himantopus mexicanus knudseni*)

Legal Status

The Hawaiian stilt was listed as an endangered species on October 13, 1970 (Service 1970) pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released in May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4 (c)(2) of the Act which requires five year review after listing. Critical habitat has not been designated for the Hawaiian stilt (Service 2005).

Description

The Hawaiian stilt is a slender wading bird, black above (except for the forehead), white below, and with distinctive long, pink legs. Sexes are distinguished by the color of the back feathers (brownish in the female, black in the male) as well as by voice (females having a lower voice). Downy chicks are well camouflaged and are tan with black speckling. Immature birds have brownish-back and white patches on their cheeks (Pratt *et al.* 1987). A comprehensive summary of the current knowledge of stilts in North America has recently been published by The Birds of North America (Robinson *et al.* 1999).

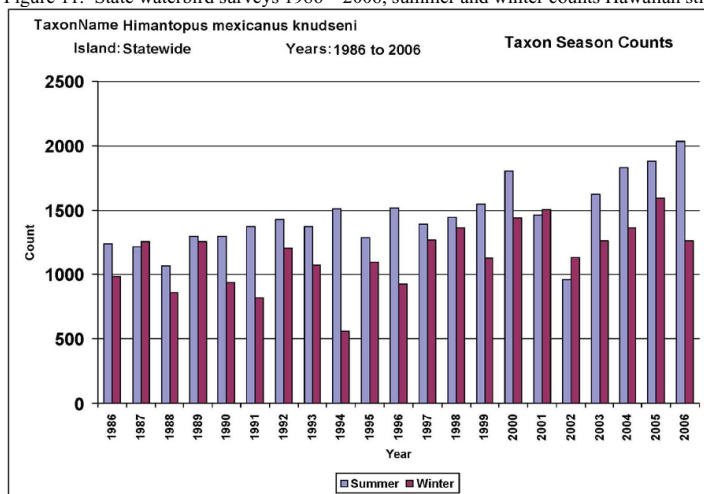
Range and Distribution

Hawaiian stilts were historically known from all of the major Hawaiian Islands, except Lanai and Kahoolawe (Paton and Scott 1985). The first stilts on Lanai were documented in 1989, at the Lanai City wastewater treatment ponds (Hawaii Division of Forestry and Wildlife 1976 to 2003). Stilts are now found on all of the main Hawaiian Islands except Kahoolawe.

Population Densities

By the early 1940s, statewide population numbers were estimated to be between 200 to 1,000 Hawaiian stilts (Munro 1960, Schwartz and Schwartz 1949). However, these population estimates did not account for the Hawaiian stilts present on Niihau and are therefore considered underestimates. Though Hawaiian stilt census data show high year-to-year variability in the number of stilts observed (Engilis and Pratt 1993), long-term census data indicate that statewide populations have been relatively stable or slightly increasing (Reed and Oring 1993). Currently, the population of Hawaiian stilts is considered to be stable to increasing (Service 2005) and is estimated to be between 1,200 to 1,600 birds (Griffin *et al.* 1989; Engilis and Pratt 1993, Hawaii Waterbird Database-Hawaii Natural Heritage Program 2007) (Figure 11). Hawaiian stilts readily disperse between islands and constitute a homogenous metapopulation within Hawaii (Reed *et al.* 1994; Reed *et al.* 1998).

Figure 11. State waterbird surveys 1986 – 2006, summer and winter counts Hawaiian stilt.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Habitat Types

Hawaiian stilts use a variety of aquatic habitats but are limited by water depth and vegetation cover. Hawaiian stilts are known to use ephemeral lakes, anchaline ponds, prawn farm ponds, marshlands and tidal flats. Stilts need early successional marshlands or other aquatic habitat with water depth less than 9 inches, perennial vegetation that is limited and low growing for foraging areas. Native low-growing wetland plants associated with stilt nesting areas include water hyssop (*Bacopa monnieri*); sea purslane (*Sesuvium portulacastrum*); and the sedges, makaloa (*Cyperus laevigatus*) and kaluha (*Bolboschoenus maritimus*) (Robinson *et al.* 1999). They may also use taro (*Colocasia esculenta*) ponds where the full-grown vegetation forms a protective canopy.

Breeding

Hawaiian stilts have higher nesting densities on freshly exposed mudflats, interspersed with low growing vegetation (Service 1983). Nesting has also been documented on low relief islands (natural and man-made) in fresh or brackish ponds, man-made floating nest structures, floating wooden platforms, and cleared level areas near foraging habitats (Shallenberger 1977; Morin 1994; Navy pers. comm. 2008). The nest itself is a simple scrape on the ground. They have also been observed using grass stems and rocks for nesting material (Coleman 1981). Hawaiian stilts defend an area of 66 to 99 feet around the nest and are semi-colonial. The nesting season normally extends from mid-February through August (Robinson *et al.* 1999). Peak nesting varies among years and re-nesting can occur after a loss of a clutch (Robinson *et al.* 1999). Stilts

usually lay three to four eggs that are incubated for approximately 24 days (Coleman 1981; Chang 1990). Chicks are precocial, leaving the nest within 24 hours of hatching. Adults with three-day old chicks have been observed to move three-tenths of a mile from the nest site (Reed and Oring 1993). Young may remain with both parents for several months after hatching (Coleman 1981).

Diet

Stilts are opportunistic feeders. They eat a wide variety of invertebrates and other aquatic organisms available in shallow water and mudflats. Specific organisms taken include water boatmen (Corixidae), beetles (Coleoptera), possibly brine fly (*Ephydra riparia*) larvae, polychaete worms, small crabs, Mozambique tilapia (*Tilapia mossambica*), western mosquito fish (*Gambusia affinis*), and tadpoles (*Bufo* spp.) (Robinson *et al.* 1999; Shallenberger 1977).

Hawaiian coot or Alae keokeo (*Fulica alai*)

Legal Status

The Hawaiian coot was listed as an endangered species on October 13, 1970 (Service 1970) pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released in May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4 (c)(2) of the Act which requires five year review after listing. Critical habitat has not been designated for the Hawaiian coot (Service 2005).

Description

The Hawaiian coot adult males and females have a black head, a slate gray body with white undertail feathers, and a prominent white frontal shield and bill; feet are lobed rather than webbed and are greenish-gray.

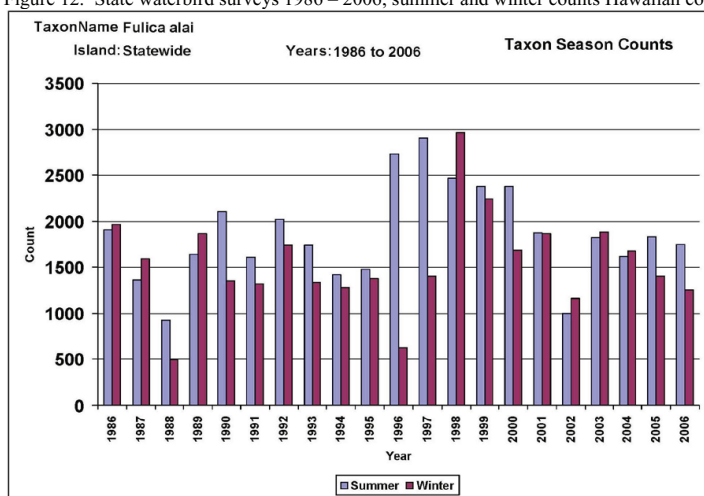
Range and Distribution

Hawaiian coots occur in coastal plain wetlands usually below 1,320 feet elevation on all the main Hawaiian Islands except for Kahoolawe; however, breeding is restricted to relatively few sites. About 80 percent of the population occurs on Kauai (Hanalei, Huleia, Opaekaa), Oahu (coastal wetlands and reservoirs such as Lake Wilson and Nuuanu Reservoir, Kahuku Point and along the windward shore), and Maui (Kanaha and Kealia Ponds, Nuu Pond) (Service 2005). The remaining 20 percent of the population occurs in coastal ponds and playa wetlands, such as Paialoa Pond on Molokai, the Lanai City wastewater treatment pond, Aimakapa, Opaekaa, Waiakea, and Loko Waka ponds on the island of Hawaii (Service 2005).

Population Densities

Island-wide population, based on bi-annual waterbird counts conducted by DOWAW, suggests that the population is stable and is estimated at between 2,000 and 3,000 individuals (Figure 12).

Figure 12. State waterbird surveys 1986 – 2006, summer and winter counts Hawaiian coot.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Habitat Types

Life history and breeding biology are poorly known. The species is somewhat gregarious and uses freshwater and brackish wetlands including agricultural areas (e.g., taro fields) and aquaculture ponds. Hawaiian coot generally occur in low elevation, wetland habitats with suitable emergent plant growth interspersed with open water, especially freshwater wetlands, but also freshwater reservoirs, cane field reservoirs, sewage treatment ponds, taro loi, brackish wetlands, and limited use of saltwater habitats. However, on Kauai, some birds occur in plunge pools above 4,900 feet elevation and on the island of Hawaii, stock ponds up to 6,600 feet elevation. The species typically forages in water less than 12 inches deep, but will dive in water up to 48 inches deep. Compared to Hawaiian moorhen, Hawaiian coots prefer to forage in more open water. Logs, rafts of vegetation, narrow dikes, mud bars, and artificial islands are utilized for resting. Ephemeral wetlands support large numbers of coots during the non-breeding season. Some important habitats are located on NWR and in State waterbird sanctuaries and these sites receive management attention. However, other important habitats are not protected. These unprotected habitats include wetlands facing development or those used for agriculture or aquaculture. Examples include: playa lakes on Niihau, Opaekaa marsh, Lumahai wetlands on Kauai, Amorient prawn farms, Laie wetlands, Uko, Punahoolapa, and Waihee marshes, Waialua lotus fields, and Waipio Peninsula ponds on Oahu, Paialoa and Ooia playa fishponds on Molokai, and Opaekaa, and Waiakea-Loko Waka ponds on the island of Hawaii.

Breeding

Nesting habitat includes freshwater and brackish ponds, irrigation ditches, and taro fields. Floating nests are constructed of aquatic vegetation and found in open water or anchored to emergent vegetation. Open water nests are usually composed of mats of bulrush (*Schoenoplectus* spp.), water hyssop (*Bacopa monnieri*) and Hilo grass (*Paspalum conjugatum*). Nests in emergent vegetation are typically platforms constructed from buoyant stems of species such as bulrush (*Schoenoplectus* spp.). Nesting occurs year round. Nest initiation is tied to rainfall as higher water levels are critical to nest success. Clutch size range from three to ten eggs, and precocial young hatch after a 25 day incubation period.

Diet

Hawaiian coots are generalists and feed on land, grazing on grass adjacent to wetlands, or in the water. They have been observed grazing from the surface of the water, or foraging by diving to obtain food resources. Food items include seeds and leaves, snails, crustaceans, insects, tadpoles, and small fish. The species will travel long distances, including between islands, when local food sources are depleted.

Hawaiian moorhen or Alae Ula (*Gallinula chloropus sandvicensis*)

Legal Status

The Hawaiian moorhen is an endemic subspecies of the North American mainland Common moorhen. The Hawaiian moorhen was listed as an endangered species in 1967 pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released in May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4 (c)(2) of the Act which requires five year review after listing. Critical habitat has not been designated for the Hawaiian moorhen (Service 2005).

Description

The Hawaiian moorhen is a dark, gray bird with a black head and neck and white feathers on their flanks and undertail coverts. They have a very distinctive red frontal shield, and their bill tip is yellow with a red base. Their legs and feet are greenish and without lobes. The Hawaiian moorhen usually measure about 13 inches in length. Both sexes are similar and have chicken-like cackles and croaks. The Hawaiian moorhen is very similar to the common moorhen on the mainland in appearance. A comprehensive summary of the current knowledge of moorhen in North America has recently been published by The Birds of North America (Robinson *et al.* 1999). In Hawaiian legend, these birds were thought to have brought fire from the gods to the Hawaiian people.

Range and Distribution

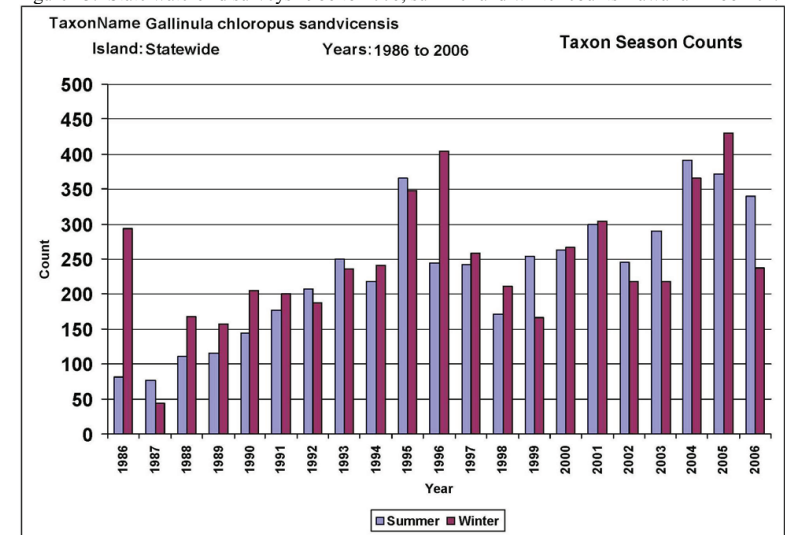
Hawaiian moorhen generally occur in wetland habitats below 410 feet elevation on the islands of Kauai and Oahu, although there have been reports from Keanae Peninsula on Maui and from the island of Hawaii. On Kauai, the largest populations occur in the Hanalei and Wailua river valleys. Hawaiian moorhen also occur in the irrigation canals on the Mana Plains of western Kauai and in taro fields. On Oahu, the species is widely distributed with most birds found between Haleiwa and Waimanalo; small numbers occur at Pearl Harbor and the leeward coast at

Lualualei Valley. Historically, Hawaiian moorhen occurred on all the main Hawaiian Islands except for Lanai and Kahoolawe.

Population Densities

No historical population estimates are available for the endemic Hawaiian moorhen. Because they are such secretive birds, it is difficult to conduct population surveys for this species. It is believed that they were common on the main Hawaiian Islands, except Lanai and Kahoolawe, in the 1800's but radically declined by the mid-1900. Surveys from the 1950's through the 1960's estimated only 57 individuals. Currently Hawaiian moorhen inhabit the islands of Kauai and Oahu (Service 2005). The State attempted a re-introduction of six banded moorhen (three females and three males) on May 18, 1983, to the island of Molokai at Kakahaia NWR. One of the banded birds was found dead January 2, 1985, and a local resident mistook the other five for chickens they were consumed (Dibben-Young 2009). Island-wide population, based on bi-annual waterbird counts conducted by DOFAW, suggests that the population is increasing, but count numbers are variable. Between 1993 and 2003, the average annual number of Hawaiian moorhen observed has been just under 300 individuals (Figure 13). However, these survey numbers are thought to be underestimates because of the moorhen's cryptic behavior. Standard survey methods in these counts include visual and aural detection. Recent research conducted by DesRochers between 2005 and 2007, has shown that passive surveys of cryptic waterbirds underestimate numbers of individuals present in the wetlands. Alternatively, broadcasting vocalizations of cryptic waterbirds to elicit responses increases detection. On average, DesRochers research has shown, broadcasting calls increased moorhen detection by 30 percent.

Figure 13. State waterbird surveys 1986 to 2006, summer and winter counts Hawaiian moorhen.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Habitat Types

Hawaiian moorhen are the most secretive of the native waterbirds, preferring to forage, nest and rest in dense, late succession wetland vegetation. Most birds feeding along the waters edge or in open water will quickly seek cover when disturbed. The preferred habitat for moorhens includes: interspersed dense stands of robust late succession vegetation near open water (approximately 50 percent water to 50 percent vegetation) floating or barely emergent mats of vegetation and water depth less than 3 feet (Service 2005).

Breeding

These birds nest year-round but appear to have two active seasons from November through February and May through August (Service 2005). It is believed that the timing of nesting is related to water levels and late succession wetland vegetation. The Hawaiian moorhen usually lay an average of 5 to 6 eggs, although clutches have been up to 13 eggs, and incubation is about 25 days (Service 2005). Nesting phenology is apparently tied to water levels and the presence of appropriately dense vegetation. Platform nests are constructed in dense vegetation over water or near the waters edge. The particular species of emergent plant used for nest construction is not as important as stem density and vegetation height (Service 2005).

Diet

Hawaiian moorhen are opportunistic feeders and their diet likely varies with habitat, but includes algae, grass seeds, insects, snails, introduced fishes, crustaceans, mollusks, emergent grasses, and wetland plants (Service 2005).

Hawaiian duck or kaloa maoli (*Anas wyvilliana*)

Legal Status

The Hawaiian duck was listed as an endangered species in 1967 (Service 1967) pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released on May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4 (c)(2) of the Act which requires five year review after listing. Critical habitat has not been designated for the Hawaiian duck (Service 2005).

Description

The Hawaiian duck is one of two extant native duck species (Family: Anatidae) found in Hawaii and is closely related to the well-known, but non-native mallard. Both sexes are mottled brown overall similar in appearance to a female mallard. Adult males have darker heads, with distinctive brown chevrons on the breast, flank and back feathers, and olive bills (Englis et. al 2002). Adult females are similar but are smaller than males on average and slightly lighter in color, with plainer, buff colored chin and back feathers (Englis et. al 2002).

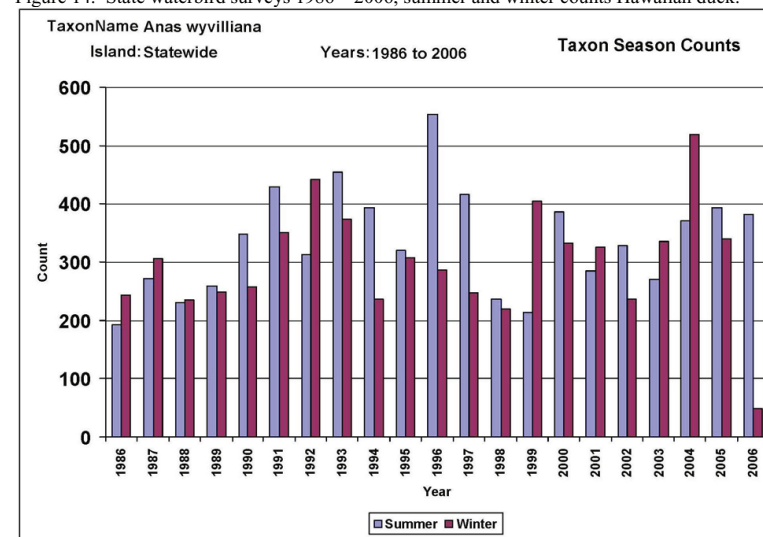
Range and Distribution

Historically, Hawaiian ducks occurred on all the main Hawaiian Islands except for Lanai and Kahoolawe. Currently, Hawaiian ducks are generally found in wetland habitats from sea level to 9,900 feet elevation on all the main Hawaiian Islands except for Kahoolawe; populations on all islands except for Kauai originated from re-introduced birds. On Kauai, populations are found in Hanalei NWR and montane streams. On Oahu, populations are found in Kawainui, Hamakua, and Heeia marshes, James Campbell NWR, and in wetland habitats in or near Punahoolapa, Haleiwa, Pearl Harbor, and Lualualei Valley. On Maui, Hawaiian ducks are found in Kahului, Kanaha and Kealia ponds. On the island of Hawaii populations occur in the Kohala Mountains, in Pololu, Waimanu and Waipio valleys, and Mauna Kea.

Population Densities

The Hawaiian duck population is estimated to be approximately 2,000 individuals with 80 percent of individuals occurring on Kauai (Englis et. al 2002). State bi-annual waterbird survey data count numbers range from 300 to 500 individuals (Figure 14). Because of the remoteness and inaccessibility of some habitats, the State waterbird counts are likely an underestimate. Historically, Hawaiian duck were fairly common in natural and agricultural wetland habitats. By 1949, only about 530 individuals remained, with 30 on Oahu and the remainder on Kauai (Service 2005).

Figure 14. State waterbird surveys 1986 – 2006, summer and winter counts Hawaiian duck.



Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Habitat Types

Hawaiian ducks occur in a wide variety of natural and artificial wetland habitats including freshwater marshes, flooded grasslands, coastal ponds, streams, montane pools, forest swamplands, taro, lotus, shrimp, and fish ponds, irrigation ditches, reservoirs, and mouths of larger streams (Service 2005). Some important habitats are located on NWR or on State lands and receive management attention. However, other important habitats are not protected. These mostly include wetlands facing development or those used for agriculture or aquaculture. Examples include: playa lakes on Niihau, Opaekaa marsh, Lumahai wetlands on Kauai, Amorient prawn farms, Laie wetlands, Uko, Punahoolapa, and Waihee marshes, Waialua lotus fields, and Waipio Peninsula ponds on Oahu, Paialoa and Ooia playa fishponds on Molokai, and Opaaula, and Waiakea-Loko Waka ponds on the island of Hawaii.

Breeding

Hawaiian ducks nesting biology is poorly understood. Although some pairs nest in lowland habitats on Kauai, Hawaiian ducks have also been observed nesting in the upper Alakai swamp (Service 2005). Nesting occurs year round, but most activity occurs between January and May (Englis et. al 2002). Nests are usually on the ground near water, but few nests are found in areas frequented by humans or areas supporting populations of mammalian predators. Generally eight to ten eggs are laid, and the precocial chicks hatch after an unknown incubation period, but likely less than 30 days.

Diet

Hawaiian ducks forage in a wide variety of freshwater habitats, including artificial wetlands. Movements between feeding and breeding habitats and between Kauai and Niihau occur. The species typically forages in shallow water (less than five inches deep). Like mallards, Hawaiian ducks are opportunistic and their diet includes snails, dragonfly larvae, earthworms, grass seeds, green algae, and seeds/leaf parts of wetland plants. Hawaiian ducks are usually found alone or in pairs and are wary, especially when nesting or molting, although during the winter they may gather in larger numbers to exploit abundant food resources (Service 2005).

Threats and Recovery Needs for all Hawaiian Waterbirds

The primary causes of the decline of the Hawaiian waterbirds are the loss of wetland habitat, predation by introduced animals, hunting in the late 1800's and early 1900's, disease, and environmental contaminants. A significant amount of Hawaii's wetlands have been lost due to human activities. Modification of wetlands includes filling and draining for agriculture, houses, hotels and golf courses. The Service estimates 22,475 acres of wetlands existed within the coastal plains of Hawaii circa 1780 (Service 1990). In 1990, the Service estimated only 15,474 acres remained a decrease of 31 percent (Service 2005). This loss of suitable wetland habitat is compounded by the alteration of wetland plant communities due to invasion by non-native plants. Species such as California grass, pickleweed, water hyacinth, Indian fleabane and red mangrove all present a serious threat by out-competing more desirable species and eliminating open water habitats. Unmanaged vegetation has reduced open water, shallow water, bare ground, and exposed mudflat habitat. All of these habitats are under serious threat without management to control these aggressive plant species (Service 2005).

Other major contributors to the decline of endangered Hawaiian waterbirds are introduced predators. Small Indian mongoose, feral cats, and feral dogs are all presently found within wetlands and pose a serious threat to Hawaiian waterbird reproductive success. All three of these predatory species are known to take eggs, young birds, and even adults. Both cats and dogs are of particular concern because of the close proximity of Hawaii wetlands to urban areas. Other species, such as the cattle egret, American bullfrog, and rats have been observed congregating around nesting waterbirds just prior to chicks hatching or in areas where young chicks have suddenly disappeared from nests (Woodside 1997). Oahu NWR staff have documented predation of waterbird chicks by cattle egret and black-crowned night heron. An American bullfrog was documented preying upon a Hawaiian moorhen chick at Hanalei NWR (Viernes 1995). More recently the key predators study of 2003 to 2004, on James Campbell NWR provided the first multiple observations of Hawaiian stilt chick predation by American bullfrogs, which accounted for 45 percent chick losses over the study period (Eijzenga 2005). Predation by introduced mammals and other native and non-native species is currently the most important factor limiting recovery for the Hawaiian waterbirds (Service 2005, Robinson *et al.* 1999). Recovery of the Hawaiian waterbirds focuses on the following objectives: (1) increase population numbers to a statewide baseline level; (2) establish multiple, viable breeding populations throughout each species' historic range; and (3) establish a network of wetlands on the main islands that are protected and managed for waterbirds (Service 2005).

Threats and Recovery Needs Specific to Hawaiian Duck

Currently the most important threat to the Hawaiian duck population is hybridization with non-native mallards. This is especially problematic on Oahu where most of the individuals are hybrids. In addition, feral pigs (*Sus scrofa*) and goats (*Capra hircus*) significantly reduce the suitability of nesting habitat for Hawaiian ducks along montane streams (Service 2005).

ENVIROMENTAL BASELINE*Status of the Species in the Action Area*

Hawaiian stilts, are regular visitors to Hickam Air Force Base, frequently foraging in several watercourses and on the reef flat (Ahua Reef) extending off of the wetland area. However, this habitat does not provide for nesting or loafing opportunities making it marginal habitat for endangered waterbird life cycle needs. Occasional sightings of Hawaiian coots, Hawaiian moorhen, and Hawaiian ducks have been documented at Hickam Air Force Base.

Existing data for endangered Hawaiian waterbirds on Hickam Air Force Base is derived from the State bi-annual waterbird surveys conducted by DOFAW and by Hickam Air Force Base Natural Resources personnel. These data were collected systematically, with each survey being conducted by at least one person familiar with the site and one person experienced in waterbird identification. DOFAW waterbird surveys conducted between 1987 and 2004 encompassed only the reef flats off the Hickam Air Force Base wetland area (Ahua Reef and Fort Kamehameha Flat). Surveys were timed to coincide with low tide. Only the Hawaiian stilt was observed during these surveys averaging zero to four stilts per survey (Tables 3 and 4). Hickam Air Force Base Natural Resources personnel conducted waterbird surveys from 2006 to 2008, and included a broader area of coastline and wetlands. In July 2006, zero endangered waterbirds were observed; in January 2007, two adult stilts were observed at Ahua Reef; and in January 2008, two adult stilts were observed at the mouth of the Manuwai Canal.

The wetland area located at Bellows Air Force Station is not currently used by Hawaiian waterbirds. Unfortunately, the wetland is overgrown with non-native red mangrove and does not currently provide any function for Hawaiian waterbirds.

Between 2002 and 2006, Wildlife Services personnel documented all endangered species hazing events within the Hickam Air Force Base BASH zone. This information also includes data from nesting events and bird aircraft interactions and removal of pre-fledgling chicks from the Hickam Air Force runway (Table 5 and Figure 15). Hazing events can fluctuate from year to year as depicted in Table 5. In 2002 the number of hazing events for the Hawaiian stilt was 28 while in 2006, Wildlife Services documented 340 interactions with Hawaiian stilts. It is not known if these numbers represent many individuals or only a few individuals hazed repetitively. We do know that there is some level of repetitive hazing as it is highly unlikely that 340 individual Hawaiian stilts have passed through the Hickam Air Force Base.

Breeding by Hawaiian stilts though rare, has been documented near Hickam Air Force Base/Honolulu International Airport in 2002 and 2006, as both eggs and chicks have been

removed by Wildlife Services for aircraft safety concerns. Wildlife Services attempts to discourage nesting activities prior to eggs being laid to minimize Hawaiian waterbird mortality.

When comparing State bi-annual waterbird data with BASH data collected by Wildlife Services, it may appear to be inconsistent. However, point in time surveys are only done for a short period of time versus the recorded incidents of hazing which are conducted out throughout the entire year. It is likely that the number of birds within the action area is low because the birds are highly transitory and only utilizing area in and around Hickam for foraging, with the exception of the Hawaiian stilts that have opportunistically attempted nesting during wet years.

Table 3. State waterbird surveys 1987 – 2003, summer counts Fort Kamehameha Flats Hawaiian waterbird count summary report.

Island: Oahu																	
Wetland:																	
Fort Kam Flats																	
	Year	Aras wyvilliana-Adult	Aras wyvilliana-Chick	Aras wyvilliana-Total	Fulica alai-Adult	Fulica alai-SubAdult	Fulica alai-Unknown	Fulica alai-Total	Gallinula chloropus sandvicensis-Adult	Gallinula chloropus sandvicensis-SubAdult	Gallinula chloropus sandvicensis-Unknown	Gallinula chloropus sandvicensis-Total	Himantopus mexicanus knudseni-Adult	Himantopus mexicanus knudseni-SubAdult	Himantopus mexicanus knudseni-Unknown	Himantopus mexicanus knudseni-Total	
Season: Summer																	
	2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2002	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2000	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3
	1999	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
	1998	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4
	1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1993	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4
	1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1988	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	1987	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Table 4. State waterbird surveys 1987 – 2004, winter counts Fort Kamehameha Flats Hawaiian waterbird count summary report.

Island: Oahu																	
Wetland:																	
Fort Kam Flats																	
Year	Year	Aras wyvilliana-Adult	Aras wyvilliana-Total	Fulica alai-Adult	Fulica alai-SubAdult	Fulica alai-Unknown	Fulica alai-Total	Gallinula chloropus sandvicensis-Adult	Gallinula chloropus sandvicensis-SubAdult	Gallinula chloropus sandvicensis-Unknown	Gallinula chloropus sandvicensis-Total	Himantopus mexicanus knudseni-Adult	Himantopus mexicanus knudseni-SubAdult	Himantopus mexicanus knudseni-Unknown	Himantopus mexicanus knudseni-Total	Himantopus mexicanus knudseni-Total	
Season: <u>Winter</u>																	
2004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007.

Table 5. Endangered waterbird actions within the BASH 2002-2006, at Honolulu International Airport and Hickam Air Force Base.

Species	Year	Incidents	Disposition
Hawaiian stilt	2002	28	hazed
Hawaiian stilt	2002	1	nest removal-2 eggs
Hawaiian stilt	2003	19	hazed
Hawaiian stilt	2004	36	hazed
Hawaiian stilt	2005	44	hazed
Hawaiian duck	2005	27	hazed
Hawaiian duck	2005	3	aircraft strike
Hawaiian stilt	2006	340	hazed
Hawaiian duck	2006	60	hazed
Hawaiian coot	2006	65	hazed
Hawaiian stilt	2006	2	chick removal

Data: Wildlife Services Letter designee annual reports 2003-2007.

Figure 15. Hawaiian stilt chicks removed from Hickam Air Force Base and Honolulu International Airport Runway 2006.



Photo: Wildlife Services

EFFECTS OF THE ACTION

Potential risks to listed waterbirds from the ongoing and increasing operations at Hickam Air Force Base include: (1) aircraft operations; (2) BASH program at Hickam Air Force Base; (3) short term and permanent water catchments and drainage canals associated with construction and renovation of airport facilities; and (4) management actions related to Bellows Air Force Station Oxbow wetland.

The issue of aircraft flight safety and collision with birds has been well documented and airports are responsible for reducing this risk through various management methods. Between 1998 and 2004, 164 aircraft have been destroyed and 194 people have lost their lives as a result of bird and other wildlife strikes with civil and military aircraft (Richardson et. al. 2000, Thorpe 2003, Wright 2008). Hickam Air Force Base's ongoing operations and forecasted expansion of air operations (SAIC 2007, E2m 2008) will have the potential for waterbird-aircraft collisions. It is anticipated that although there will be an increase in military operations that avoidance and minimization measures will stabilize or decrease potential for interactions. Despite preventative measures on the part of the Hickam Air Force Base and Wildlife Services, there remains the possibility for take of endangered Hawaiian waterbirds due to direct collision with an aircraft. For example, three ducks (one Hawaiian duck and two mallard/Hawaiian duck hybrids) were attracted to a Hickam Air Force Base ditch filled with standing water and were struck in 2005, in a single incident by a commercial aircraft (see Table 5). Mr. Willie Glover from the entomology

department of Hickam Air Force Base, documented a Hawaiian coot with a broken wing, brought to him by personnel who had recovered the bird from the flight line in early 2000 (INRMP 2003). Increased vigilance through interdepartmental and interagency communication of changing conditions (weather and habitat) within the BASH zone, and management to reduce water attractants within the BASH will minimize these lethal interactions with Hawaiian waterbirds.

One method employed to help reduce the potential for bird/aircraft collision is direct hazing of avifauna on the Hickam Air Force Base/Honolulu International Airport by Wildlife Services. Hazing includes endangered Hawaiian waterbirds and is performed in the BASH zone at Hickam Air Force Base. The hazing activities occur seven days a week during Hickam Air Force Base operational hours. Hazing activities include using pyrotechnics, flushing using vehicles or personnel on foot within the BASH zone, results in startle response flushing of foraging waterbirds from the airport area which could result in injury through collision with aircraft, fences, or structures. In addition, Wildlife Services personnel haze waterbirds to preclude nesting activities in the BASH zone. Again, this is necessary for the safe operations of the airport and hazing a pair of birds while attempting to nest reduces the risk of having to destroy an active nest with eggs or chicks. Harassment of waterbirds prior to nesting may also move the pair offsite to establish a nest in a more suitable location. In the last five years, according to data collected by Wildlife Services (see Table 5), one Hawaiian stilt nest was destroyed and two chicks were removed in 2006. These events result in the mortality of eggs and/or young.

The greatest number of hazing incidents recorded over the last five years reported by Wildlife Services was 340 Hawaiian stilts at Hickam Air Force Base/Honolulu International Airport (see Table 5). In 2006, 65 hazing events was recorded for Hawaiian coots along with 60 events for Hawaiian duck (because of Hawaiian duck hybrid identification issues; all birds are documented as Hawaiian ducks) (see Table 5). Since many of these birds are not banded or band identification is not collected, we do not know how many individual birds these numbers actually represent. For example, it is highly unlikely that 340 individual Hawaiian stilts have passed through the Hickam Air Force Base/Honolulu International Airport in one year. It is likely that the number of birds within the action area is low because the birds are highly transitory and only utilizing area in and around Hickam for foraging. In addition, it is anticipated that very few of the hazing incidents may result in injury, and that the hazing overall is an appropriate avoidance and minimization tool to avoid bird-aircraft collisions.

Water attractants within the BASH zone increase the potential for waterbird-aircraft collision resulting in injury and mortality of Hawaiian waterbirds. In March 2006, a pair of Hawaiian stilt nested adjacent to the runway where dewatering ponds and a leaky pipe from a construction project provided a nuisance attractant. Wildlife Services contacted the Service requesting permission to remove the nest from the area in an attempt to reduce the potential for an aircraft strike. In this case, it was determined the nest could remain in place, but the chicks failed to fledge (Darrin Phelps pers. comm.). In 2002, Hawaiian stilts nested within the BASH zone and Service personnel (Law Enforcement) were called to remove the nest due to safety concerns. Facility construction, renovation, and demolition will require short term dewatering ponds (up to 2 years) be constructed. Construction of these ponds will be straight sided and water levels will be maintained so that there will be no shallow water. These dewatering ponds will be covered

(bird balls, nets, tarps, etc.) to reduce attractiveness to the ponds. The permanent airport facility drainage canals are required and also provide waterbird habitat within the BASH zone. To reduce the attractiveness of the canals to waterbirds, Hickam Air Force Base will remove woody vegetation and keep the canals open and clear. In addition, Hickam Air Force Base will repair the water catchment at the golf course to eliminate surface pooling water thus reducing its attractiveness to waterbirds. Eliminating or reducing the attractiveness of these temporary and permanent water sources will help to reduce the number of Hawaiian waterbirds utilizing Hickam Air Force Base thus reducing the harm and harassment to Hawaiian waterbirds.

The loss of wetland habitat has been identified as the primary cause for the decline of the Hawaiian waterbirds (Service 2005). The Air Force's proposed action includes increasing managed wetland habitat for Ahua Reef wetland and Bellows Air Force Station for the benefit of Hawaiian waterbirds. Restoration of Ahua Reef wetland will increase available foraging and loafing habitat. Restoration of the Bellows Air Force Station Oxbow wetland will provide additional foraging, loafing, and nesting habitat. The restored habitat will provide for increased reproduction and numbers of Hawaiian waterbirds. Since Oxbow wetland is currently unsuitable for waterbird use, the improvements to the site (habitat restoration and predator control) will provide additional habitat thus increasing wetland acreage suitable for waterbird nesting.

Predator control is necessary for Hawaiian waterbirds to successfully reproduce. Unfortunately, predator control traps attract the curious Hawaiian moorhen and birds have been captured in the predator traps. The use of predator control traps at Bellows Air Force Station Oxbow wetland may result in take of Hawaiian moorhen once a population becomes established. The trapability of moorhen was demonstrated by a study conducted in 2005 through 2007, by David DesRochers (Tufts University Massachusetts) and Oahu NWR Complex staff (DesRochers et al. 2006). Within a two-year time period, 90 Hawaiian moorhen were banded with 162 captures with no injuries. A moorhen was incidentally captured on James Campbell NWR, Kii Unit on April 2, 2002, which resulted in a broken wing from catching on a hanging bait jar. On July 1, 1994, an adult Hawaiian moorhen was found dead in one of the traps at Hanalei NWR followed an incident on November 27, 1994 where one adult and three juvenile moorhens were captured in one trap where one of the juveniles died. Therefore, due to their curious nature and hence attraction to predator control traps, it is anticipated that Hawaiian moorhen will be captured in live traps which could result in injury or mortality.

The Hawaiian duck is declining primarily due to hybridization with mallard ducks (Engilis and Pratt 1993). Mallard and Hawaiian duck hybrid populations on Oahu are increasing based on data from State bi-annual waterbird surveys (see Figure 10). Because feral ducks have the potential to perpetuate hybridization and could displace listed species, the Air Force will assess a program for hybrid duck surveys and eradication. Any future duck control plan will be coordinated with the Service prior to implementation. The mallard/hybrid duck control plan has long-term beneficial effect of helping to minimize the potential for hybridization of Hawaiian ducks and mallards at the Bellows Air Force Station Oxbow wetland.

Avian botulism outbreaks are common in Hawaii and can be a significant localized cause of waterbird mortality (Pratt and Brisbin 2002). The first documented outbreak in Hawaii occurred on Oahu at Kaelepu pond, which is also known as Enchanted Lake, in Kailua in 1952 (Brock

and Breese 1953). Since then, avian botulism outbreaks have been documented at Hanalei NWR on Kauai (Pratt and Brisbin 2002), Aimakapa pond at Kaloko-Honokahau National Historical Park on Hawaii (Morin 1998), Ohiapilo pond on Molokai, and at Kealia NWR on Maui (Service 2005). Avian botulism is caused by a toxin produced by a widespread bacterium. Normally dormant, these spores release toxins only when certain conditions occur, including warm temperatures and stagnant waters. Birds usually acquire the disease by eating invertebrates containing the toxin. Typical signs in birds include weakness, lethargy, and inability to hold up the head or to fly (Work 2008, pers. comm.). There is a possibility that the proposed project may increase the risk for an outbreak of avian botulism. Botulism can occur in any area with standing fresh or brackish water frequented by waterbirds. The Air Force will maintain surveillance for outbreaks; respond to such outbreaks by removal of carcasses, and post-outbreak waterbird population monitoring.

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur within the area of action subject to consultation. Cumulative effects include the impacts of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. The project areas are under Federal jurisdiction. We are unaware of any future State activities effects within the action area since it is all under Federal jurisdiction.

Conclusion

After reviewing the current status of each species, the environmental baseline for the species within the action area, and the effects, ongoing aircraft missions, construction impacts and management activities, including the cumulative effects, it is our Biological Opinion that implementation of the proposed action is not likely to jeopardize the survival and recovery of the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck. No critical habitat has been designated for these species; therefore, none will be affected.

The proposed action is not likely to jeopardize Hawaiian stilt, Hawaiian coot, Hawaiian moorhen and Hawaiian duck because as discussed in the above environmental baseline, the number of birds within the action area is low. Although they will be impacted by the effects as previously discussed, the loss of birds will have a minimal impact on the status of the species as a whole. In addition, restoration of Bellows Air Force Station Oxbow wetland will provide additional foraging, loafing, and nesting habitat. The restored habitat will provide for increased reproduction and numbers of Hawaiian waterbirds.

Incidental Take Statement

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined (50 CFR 17.3) by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior

patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Air Force so that they become binding conditions in order for the exemption in section 7(o)(2) to apply. The Air Force has a continuing duty to regulate the activity covered by this incidental take statement. If the Air Force (1) fails to assume and implement the terms and conditions or (2) fails to require any contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to any permit or contract, then the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Air Force must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

Amount or Extent of Take

The Service anticipates that take will occur in the form of harm, harassment, and death as a result of Air Force activities described in this Biological Opinion.

Hawaiian stilt

The Service anticipates that one (1) Hawaiian stilt will be harmed, injured or killed due to potential waterbird-aircraft collision at Hickam Air Force Base every five years. The Service anticipates that two (2) Hawaiian stilt nest will be taken resulting in the mortality of up to seven eggs within a five year period. The Service anticipates a maximum of 340 harassment incidents of Hawaiian stilts may result from BASH zone hazing activities annually at Hickam Air Force Base.

Hawaiian coot

The Service anticipates that one (1) Hawaiian coot will be harmed due to potential waterbird-aircraft collision at Hickam Air Force Base every five years. The Service anticipates a maximum of 65 harassment incidents of Hawaiian coot may result from BASH zone hazing activities annually at Hickam Air Force Base.

Hawaiian moorhen

The Service anticipates take of not more than two (2) Hawaiian moorhen in the form of harassment due to capture in predator control traps at Bellows Air Force Station Oxbow wetland annually. Take in the form of injury or death of two (2) Hawaiian moorhen may occur every five years while conducting predator control for the duration of this management action at Bellows Air Force Station Oxbow wetland.

Hawaiian duck

The Service anticipates that one (1) Hawaiian duck will be harmed due to potential waterbird-aircraft collision at Hickam Air Force Base in a five year period. The Service anticipates a maximum of 60 harassment incidents of Hawaiian duck (or Hawaiian duck hybrid if identification is not feasible) may result from BASH hazing activities annually. The Service

anticipates take of not more than two (2) Hawaiian duck that may result in the injury or death through implementing a feral mallard duck removal program once the Bellows Air Force Station Oxbow wetland is restored. This level of take is for the life of the project.

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §703-712), if such take is in compliance with the terms and conditions specified herein.

Effect of Take

In this Biological Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy of the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck.

Reasonable and Prudent Measures

The reasonable and prudent measures given below, with their implementing terms and conditions, are designed to minimize the impacts of incidental take that might otherwise result from the proposed actions. If, during the course of the action, the level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review the reasonable and prudent measures provided. In addition, the Air Force must cease the activities that caused the taking; must immediately provide an explanation of the causes of the taking; and must review with the Service the need for possible modification of the reasonable and prudent measures. The Air Force project incorporates many of the measures to minimize and avoid take of listed species. The Service believes the following Reasonable and Prudent Measures are necessary and appropriate to minimize incidental take of Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck. The measures described below are non-discretionary and must be implemented.

1. Hawaiian waterbird injury and mortality from aircraft interactions will be minimized.
2. Harassment of Hawaiian waterbirds and nest and egg removal of Hawaiian stilt will be minimized.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Air Force must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting or monitoring requirements. These terms and conditions are non-discretionary.

1. The following terms and conditions implement reasonable and prudent measure number one:
 - 1.1. The Air Force will fund a scientific research study to evaluate the effects of hazing activities within the BASH zone. The study will focus on Hawaiian waterbird movement in and around the BASH zone and it should determine the number of individuals actually represented by the harassment incidents and how these hazing incidents affect the long-term survivorship of these individuals. The study will be coordinated and implemented jointly with Air Force and PIFWO.

2. The following terms and conditions implement all reasonable and prudent measures:

- 2.1. Annual reporting, in the form of a written report, of actual numbers of individuals taken will be submitted to PIFWO by the end of the Federal fiscal year (September 30).
- 2.2. Air Force will complete Bellows Air Force Station Oxbow wetland restoration management plan coordinated with our office and finalized on or before completion of restoration efforts in 2010 to 2011. The management plan will include details on vegetation modification, predator control, waterbird monitoring, and an avian botulism surveillance response plan.
- 2.3. Our office will be notified before restoration begins and upon completion of restoration activities at Bellows Air Force Station Oxbow and Ahua Reef wetlands. Notification will be via electronic mail.
- 2.4. A written report will be provided to the Service to document the effectiveness of the waterbird monitoring. The written reports should be a summary documentation and will be submitted via mail to the Service.
- 2.5. The depository designated to receive specimens of Hawaiian waterbirds that are collected is the B.P. Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii, 96817 [phone: (808) 547-3511]. If the B.P. Bishop Museum does not wish to accession the specimens, the Service's Division of Law Enforcement in Honolulu, Hawaii [phone: (808) 861-8525; fax: (808) 861-8515] should be contacted for instructions on disposition.

Conservation Recommendations

Section 7(a)(1) of the Endangered Species Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

1. We recommend that Air Force monitor migratory waterbird and shorebird use at Bellows Air Force Station Oxbow wetlands once restored to determine the effectiveness of the predator control program.
2. We recommend that if Hawaiian moorhen are captured in live traps; attempts should be made to band individual birds. Air Force biologist responsible for Bellows Air Force Station Oxbow wetland will be contacted immediately, and if available, will band the birds and coordinate with PIFWO. Birds should be banded with color bands and U.S. Geological Service's aluminum bands. Banding information will yield important life history information that will aid in recovery of the species.
3. We recommend that Air Force develop a routine monitoring of predator control program as part of the management plan. Goals should be to detect and remove initial animals

within restored Bellows Air Station Oxbow wetland addressed in this Biological Opinion and document rate of detection of newly immigrated animals into trapping area.

Reinitiation Statement

This concludes formal consultation on the proposed project described in this biological opinion. As required in 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law), and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operation causing such take must cease pending reinitiation. Should there be a failure to carry out any or all of the described measures, or if the measures are not effective or are modified in any way without Service coordination, reinitiation of consultation will be required. If you have any questions regarding this Biological Opinion, please contact Fish and Wildlife Biologist Aaron Nadig (808) 792-9400.

Sincerely,



Loyal Mehrhoff
Field Supervisor

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N-2 West Loch Magazine Construction Biological Opinion

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850



In Reply Refer To:
01EPIF00-2020-F-0215

June 18, 2020

Corrina Carnes
Natural Resources Manager
Naval Facilities Engineering Command Hawaii, Environmental Planning
400 Marshall Road, Building 55
Joint Base Pearl Harbor Hickam, Hawaii 96860-3134

Subject: U.S. Navy Construction of Magazines for Munitions and Associated
Improvements at Joint Base Pearl Harbor Hickam West Loch Annex, Honolulu
County, Hawaii

Dear Ms. Carnes:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BiOp) addressing the effects of the subject action on the following endangered species: the Hawaiian hoary bat (*Lasiurus cinereus semotus*). No critical habitat has been designated for the Hawaiian hoary bat. This BiOp was prepared in accordance with the requirements of section 7 of the Endangered Species Act (ESA)(16 U.S.C. 1531et seq.). Your request for formal consultation and a biological evaluation (BE) was received by the Service on February 10, 2020.

This BiOp is based on best available information presented in the West Loch Munitions BE developed by the Department of the Navy (Navy), and otherwise cited below. A complete decision record of this consultation is on file at the Service's Pacific Islands Fish and Wildlife Office in Honolulu, Hawaii. The Service's log number for this consultation is 01EPIF00-2020-F-0215.

A separate informal consultation is found in Appendix A for project impacts that the Navy has determined "may affect, but are not likely to adversely affect" the federally endangered Hawaiian waterbirds (Hawaiian coot (*Fulica alai*), Hawaiian duck (*Anas wyvilliana*), Hawaiian common gallinule (*Gallinula galeata sandvicensis*), and the Hawaiian stilt (*Himantopus mexicanus knudseni*)).

INTERIOR REGION 9
COLUMBIA-PACIFIC NORTHWEST

IDAHO, MONTANA*, OREGON*, WASHINGTON
*PARTIAL

INTERIOR REGION 12
PACIFIC ISLANDS

AMERICAN SAMOA, GUAM, HAWAII, NORTHERN
MARIANA ISLANDS

CONSULTATION HISTORY

14 June 2019: Cory Campora, natural resources manager for the Navy requested informal consultation related to the construction of munition magazines and associated improvements at West Loch Annex, Ewa, on the island of Oahu and provided a BE.

1 Aug 2019: Joy Browning (Service) informed Justin Fujimoto, natural resource specialist, Naval Facilities Engineering Command (NAVFAC) Pacific that given the description of the action, the Service would not be able to concur with the Navy's determination of may affect, not likely to adversely affect for the Hawaiian hoary bat. The proposed action description would trigger formal consultation due to anticipated adverse effects to the bat from the installation of a new barbed wire fence.

9 Aug 2019: NAVFAC Pacific provided the Service with additional information regarding the phasing of proposed construction and noted the perimeter fencing construction would not start until the second phase of construction in financial year 2022. NAVFAC Pacific requested options that would allow them to proceed without a delay of construction of the 1st phase of magazines, which was planned in financial year 2020.

3 Sep 2019: The Service provided NAVFAC Pacific, two potential paths forward for ESA compliance on the project.

10 February 2020: Corrina Carnes, natural resources manager for the Navy provided a revised BE to the Service.

20 March 2020: A phone conversation occurred between the Navy and the Service regarding the Service's recommendation of informal consultation, and the inclusion of conservation measures to minimize potential adverse consequences, for the endangered Hawaiian waterbirds.

23 March 2020: The Service sent the Navy a letter acknowledging receipt of a complete BE for purposes of initiating formal consultation.

13 May 2020: A phone conversation occurred between the Navy and Service regarding the informal consultation, with the Navy agreeing to implement conservation measures for the waterbird consultation.

19 May 2020: The Service sent the Navy an email with recommended conservation measures to be applied to the informal consultation (Appendix A).

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Navy proposes to construct 24 magazines for naval long ordnance storage and related improvements at the Joint Base Pearl Harbor Hickam (JBPHH) West Loch Annex facility. Additional improvements to the facility include magazine access roads and concrete aprons,

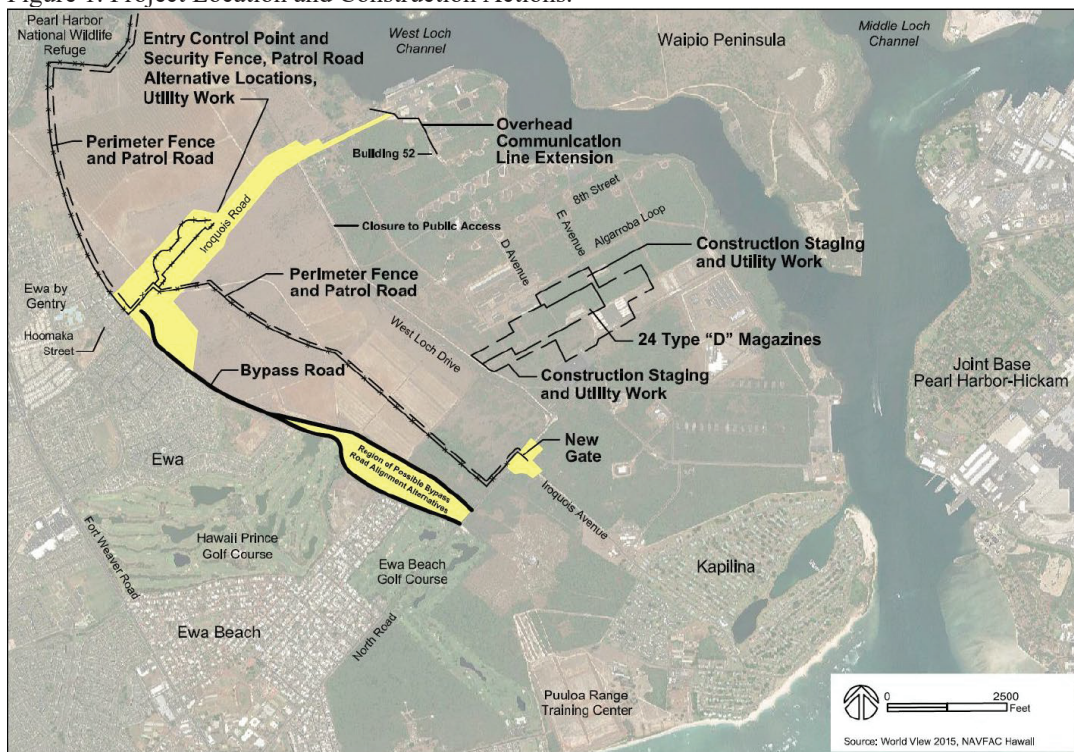
construction staging areas, perimeter fencing, entry control point, gatehouse, and a bypass road. The action would clear up to a maximum of 300 acres of mixed kiawe grassland vegetation.

The purpose of the proposed action is to provide sufficient storage space for JBPHH to meet its current ordnance storage requirement. The proposed action would provide needed ordnance storage at West Loch Annex, which enhances combat and ammunition ship accessibility. The proposed action enhances long-term Department of Defense (DoD) ordnance capability, as well as supporting military readiness in the Western Pacific.

Action Location

The action is located at West Loch Annex, a branch of the JBPHH in the Ewa district of Oahu. The Annex is located on the shoreline of Pearl Harbor's West Loch Channel. Neighboring properties around the Annex include Ewa Gentry to the west, Ewa Beach Golf Club to the south and Kapilina Community (formerly Iroquois Point) to the southeast. Access to the West Loch Annex is via either Iroquois Road or North Road. Land use at the Annex currently consists of munitions storage and agriculture outlease near the western perimeter (Figure 1).

Figure 1. Project Location and Construction Actions.

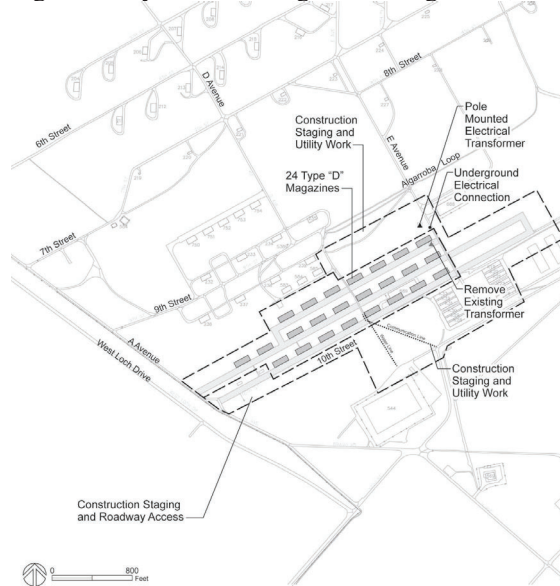


Details of the Proposed Action

The action consists of constructing 24 type D box munition storage magazines of reinforced concrete and related improvements to the installation. Improvements to the installation include, roads leading to the magazines, concrete pads, electrical utilities, fire hydrant improvements, and construction staging areas. The magazines will be constructed in three rows between 9th and

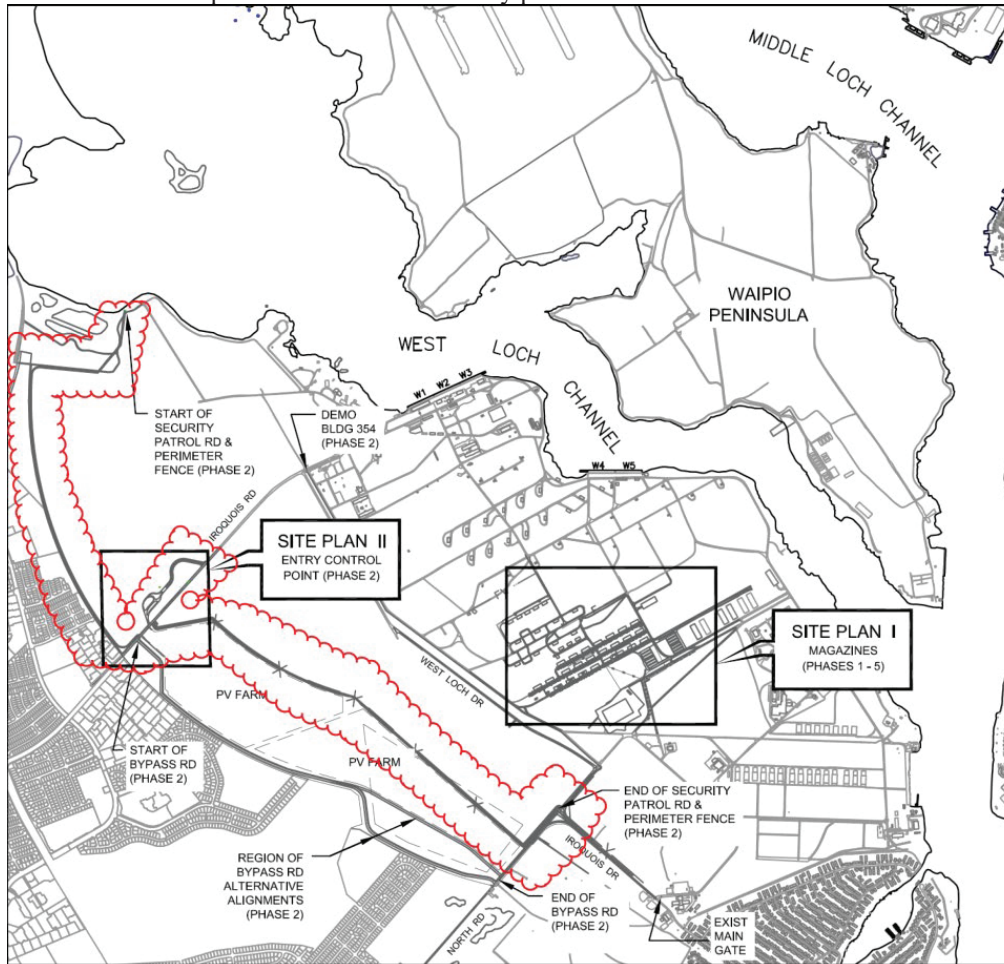
10th Streets. They will be constructed in parallel rows similar to the existing facilities (Figure 2). Dimensions of the magazines are approximately 160 feet wide by 50 feet long and 15 feet high. They will be spaced in accordance with Navy ordnance storage safety standards to prevent chain reaction explosions. Approximately 80 acres of mixed kiawe grassland will be removed for construction staging, utilities, and the magazine storage units. The soil will be graded for concrete pads and foundations.

Figure 2. Layout of the magazine storage units, including construction staging and utilities areas to be cleared.



Explosive safety separation requirements associated with the new magazines will fall within the boundaries of the installation. However, overlaying the new explosive safety standoff requirements upon the existing safety separation distances requires securing the installation property line and will be part of this proposed action. A perimeter fence marking the installation boundary and around the Entry Control Point will be constructed, consisting of a 10-foot tall chain link fence, approximately 4.5 miles long and topped with three strands of barbed wire. The perimeter fence will be installed along the western boundary of the Annex starting from the northern shoreline near the Pearl Harbor National Wildlife Refuge, Honouliuli Unit and connect to the existing fence at the intersection of North Road and Iroquois Road (highlighted in red in Figure 3). An inner unimproved security patrol road, 20 feet wide, would be installed adjacent to the security fence. The width for the new fence and unimproved patrol road will be 50 feet. The maximum total area to be impacted for the new security fence and security patrol road is 50 acres. Access to the Annex will be through a new Entry Control Point constructed on Iroquois Road. New electrical and water utilities will connect to the Entry Control Point and will be placed next to the existing road. The fence would close public use of the Navy-owned West Loch Drive and Iroquois Road. Land use where the fence would be placed is currently agricultural outlease and overgrown vegetation. The maximum total area for the Entry Control Point and new utilities would be approximately 142 acres.

Figure 3. Improvements to the installation boundary related to magazine construction. The red bubble highlights the location where the perimeter fence and security patrol road would be installed.

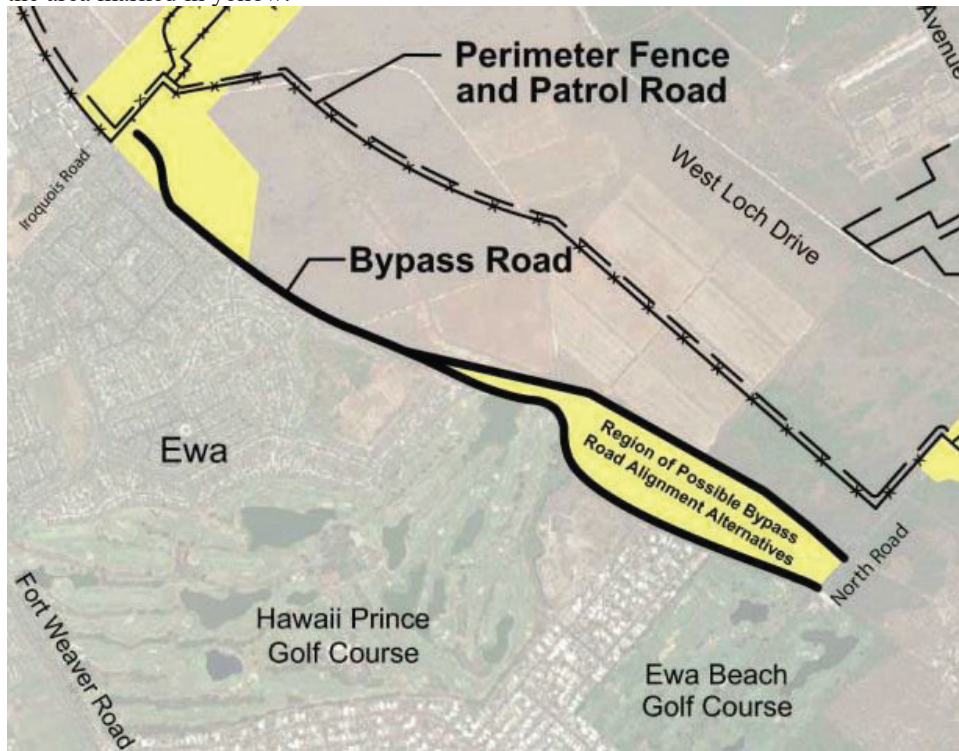


West Loch Drive Closure and Bypass Road

Currently, the public has access to the Navy owned West Loch Drive. Closure of this road would significantly disrupt traffic on Fort Weaver Road. Therefore, as part of the action, the Navy will construct a new bypass road outside of the explosive safety quantity distance arc, stretching from Iroquois Road to North Road in the current agricultural outlease lands (Figure 4). The road will be 1.65 miles long and 36 feet wide, with two lanes. Total area cleared for the bypass road would be 28 acres. The layout of the road connecting to North Road has not been chosen at this time. Site investigations will determine the final alignment, but it will be placed within the indicated space. This consultation includes the layout that would have the longest distance and largest estimated acreage impacted in order to be conservative.

The total impacted area from all components of the action would be 300 acres (80 acres for the magazine storage units, 50 acres for the security fence, 142 acres for the entry control point and utilities, and 28 acres for the bypass road).

Figure 4. Proposed bypass road connecting Iroquois Road to North Road. Final layout of the road may be placed in the area marked in yellow.



The 24 magazines and required improvements will be built over five years in 5 phases (Table 1). During the first phase, planned for Fiscal Year (FY) 2020, the Navy will build four magazines within the planned cluster. In Phase 2, planned for FY 2022, the Navy will build three magazines and the 4.5-mile perimeter fence, Entry Control Point, and bypass road. In Phase 3, 4, and 5, in FYs 2023, 2024, and 2025, the Navy will build the remaining 17 magazines. The start of construction on any of the phases is conditional on congressional authorization and allocation of funding for military construction.

Table 1. Summary of the construction phases and planned construction year.

Phase number	Fiscal Year	Number of magazines	Other notes
Phase 1	2020	4	
Phase 2	2022	3	perimeter fence, entry control points, bypass road
Phase 3	2023	6	
Phase 4	2024	6	
Phase 5	2025	5	

Conservation Measures

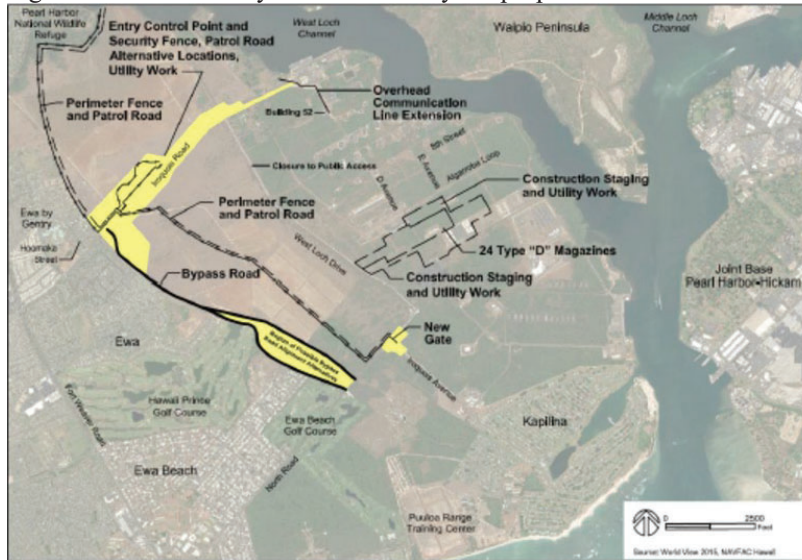
The Navy will implement the following avoidance, minimization, and conservation measures for the benefit of the Hawaiian hoary bat:

- Trees greater than 15 feet in height will not be cut or removed during the bat pupping season, from June 1 through September 15, in order to avoid injury or death of flightless pups.
- The Navy will follow a previously implemented plan for monitoring barbed wire fencing for bat mortality at the Navy's Pacific Missile Range Facility (PMRF). Details of that plan are described in Herring (2017). That plan was based on Service protocols established for monitoring seabird mortalities. This protocol utilizes carcass scavenging and searcher efficiency trials to determine the frequency at which mortality surveys should be conducted (Kleidosty 2010, 2015). Following key elements from this Service protocol, the Navy will conduct carcass-scavenging trials to determine the length of time a carcass remains detectable in the search area. Carcasses (mice or rat) will be placed randomly along the barbed wire fence line, which will be checked regularly for 30 days. Searcher efficiency trials, in conjunction with the carcass searches, will be conducted in order to estimate the percentage of bat mortalities searchers are able to find. These two trials will be conducted simultaneously, at least one month prior to the bat mortality surveys, in order to avoid artificially increasing predator traffic along the fence line. Results of the two field trials will then inform the frequency and duration of the bat mortality surveys along the barbed wire fence at West Loch. The Navy will conduct bat barbed wire fence monitoring until such measure can be incorporated in the installations INRMP at which time the Navy has satisfied its obligation under this consultation.
- The Navy will provide the results of the trials and the protocol for bat mortality surveys along the fence line, including frequency and duration of the surveys, to the Service. It is expected that a minimum of one survey per week will be required to detect mortalities, but this survey interval may be shortened or lengthened based on results of carcass search trials. Generally, these mortality surveys will occur in the fall, when bats are thought to inhabit lower elevations (Bonaccorso et al. 2011; Wolfe 2019).

Action Area

The implementing regulations for section 7 of the ESA define "action area" as "...all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR § 402.02). All consequences of the actions proposed by the Navy will occur wholly on the JBPHH West Loch Annex property within the 300-acre action area (Figure 5)

Figure 5. The area likely to be affected by the proposed action.



Analytical Framework for the Jeopardy Determination

In accordance with regulation (see 84 FR 44976), the jeopardy determination in this BiOp relies on the following four components:

1. The *Status of the Species*, which evaluates the species' current range-wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; its survival and recovery needs; and explains if the species' current range-wide population is likely to persist while retaining the potential for recovery or is not viable;
2. The *Environmental Baseline*, which evaluates the current condition of the species in the action area relative to its reproduction, numbers, and distribution absent the consequences of the proposed action; the factors responsible for that condition; and the relationship of the action area to the survival and recovery of the species;
3. The *Effects of the Action*, which evaluates all future consequences to the species that are reasonably certain to be caused by the proposed action, including the consequences of other activities that are caused by the proposed action, and how those impacts are likely to influence the survival and recovery role of the action area for the species; and
4. *Cumulative Effects*, which evaluates the consequences of future, non-Federal activities reasonably certain to occur in the action area on the species, and how those impacts are likely to influence the survival and recovery role of the action area for the species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the consequences of the proposed Federal action in the context of the species' current range-wide status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The key to making this finding is clearly establishing the role of the action area in the conservation of the species as a whole, and how

the effects of the proposed action, taken together with cumulative effects, are likely to alter that role and the continued existence (i.e., survival) of the species.

STATUS OF THE SPECIES

Hawaiian Hoary Bat

Species Description

The Hawaiian hoary bat is a medium-sized (0.5 to 0.8 ounces), nocturnal, insectivorous bat, with a wingspan of 10.5 to 13.5 inches. “Hoary” refers to the white-tinged, frosty appearance of the bat’s grayish brown or reddish brown fur. Additional morphological analyses are underway (Pinzari, USGS, pers. comm. 2020). Hawaiian hoary bats are not colonial, and roost solitarily in tree foliage (Service 1998).

The Hawaiian hoary bat is classified under the Family Vespertilionidae of the Suborder Microchiroptera, and is one of three recognized hoary bat subspecies. The other two subspecies are *Lasiurus cinereus cinereus*, one of the most common and widespread bats in North America, and *Lasiurus cinereus vilosissimus*, which occurs in South America and the Galapagos (Shump and Shump 1982). Jacobs (1996) reported morphological divergence in the Hawaiian hoary bat from the North American subspecies involving characteristics related to flight and feeding. According to Jacobs (1996), the Hawaiian hoary bat has a 45 percent reduction in body size with allometric responses in the size of its wings when compared to the continental North American subspecies, *L. c. cinereus*. The wing changes result in a lower ratio of weight to wing area, and are expressed as long, narrow wings relative to the continental North American subspecies. This physical trait permits slower and more maneuverable flight near vegetation and enduring flight in open areas. This increased flexibility in flight behavior has allowed the Hawaiian hoary bat to expand its foraging habitat to include both open habitats similar to those of *L. c. cinereus*, and closed habitats not used by *L. c. cinereus*. Skeletal features related to feeding also diverge with Hawaiian hoary bats having relative increases in the size of the mouth opening (gape), the size of the muscle that closes the jaw (masseter muscle) and the height of the coronoid process relating to the structure of the jawbone. These changes give the jaw more crushing power for more efficient processing of large and hard-bodied prey. This has enabled the Hawaiian hoary bat, despite a marked reduction in body size, to include large, hard-bodied insects such as beetles, not taken by *L. c. cinereus* in its diet. Similarly, Barclay et al. (1999) found that Hawaiian hoary bats use on average higher frequency calls (26.2-29.8 kHz) compared to *L. c. cinereus* (20.1 kHz).

The Hawaiian hoary bat has been in Hawaii for at least 10,000 years and possibly as long as 1.8 million years (Russell et al. 2015; Baird et al. 2015). Genetic analyses indicate the species migrated from North America at least twice, and possibly more times (Russell et al. 2015; Bonaccorso and McGuire 2013). The population structure and genetic basis of these multiple migration events of the Hawaiian hoary bat are currently being researched.

Three different publications have been released in the past few years that analyzed the genetic relationships of the Hawaiian hoary bat, both within the larger *Lasiurus* complex and within the Hawaiian Islands (Russell et al. 2015, Baird et al. 2015, 2017). These studies indicate that two genetically distinct groups or clades of hoary bats derived from different arrivals to the islands exist within Hawaii. While both clades have been found on Oahu and Maui, no “pure” forms of the *L. c. cinereus* clade have been found on the other islands as of yet, although putative hybrids between the

two clades have been found from Hawaii island (Baird et al. 2017). Very few samples have been tested from Kauai, and no analyses of bats from Molokai, Lanai, or Kahoolawe have been published. Until the genetic differences and hybridization status are further resolved, the Hawaiian hoary bat taxonomic classification follows the current listing status, which is recognized as one subspecies across the State of Hawaii.

Listing Status

The Hawaiian hoary bat was listed as endangered on October 13, 1970 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. The recovery plan was approved on May 11, 1998. A species five-year review was conducted on September 30, 2011 pursuant to ESA section 4(c)(2). On January 22, 2018 a new five-year review was initiated for the Hawaiian hoary bat, which is expected to be completed in 2020 (83 Fed. Reg. 3014). Critical habitat for the Hawaiian hoary bat has not been designated.

Historic and Current Distribution

The Hawaiian hoary bat is endemic to the State of Hawaii and is the only existing terrestrial mammal. The Hawaiian hoary bat was listed under the ESA based on perceived habitat loss and limited knowledge of its distribution and life history requirements (Service 1970, 1998). At the time of listing, there was no population estimate and no documentation of a population decline. However, over the past 50 years, and especially in the last 10 years, research has helped to inform Hawaiian hoary bat distribution, life history, and threats.

The Hawaiian hoary bat is distributed across Kauai, Oahu, Maui, Molokai and Hawaii islands, with breeding confirmed or highly likely to occur based on current monitoring data (Bonaccorso and Pinzari 2011; Wolfe 2018; Hosten and Poland 2018). On Lanai Island, breeding status is unknown (Tetra Tech 2011), and on Kahoolawe, Hawaiian hoary bats appear to occur seasonally (KIRC 2017). Movement of bats between the major islands is thought to be infrequent (Pinzari, USGS, pers. comm. 2020).

The methods for detecting Hawaiian hoary bats are limited to acoustic detectors and night vision cameras, though each method has its own limitation. Acoustic detectors are limited to providing presence and absence data, only. Acoustic detectors are the most readily used technology for determining Hawaiian hoary bat distribution and have been used for occupancy studies, which are statistically designed to conduct temporal comparisons. Gorresen et al. (2015) found that Hawaiian hoary bats are acoustically cryptic (8 percent chance of detection on a given night if it was present during the study). Multiple instances were observed in which bats flew close to microphones but were not recorded (Gorresen et al. 2015). They also noted a lack of recorded feeding calls despite concurrent video evidence of frequent foraging-like behavior, thus demonstrating acoustic detection is inefficient at detecting bat presence. Most recently, Gorresen et al. (2018) confirmed video-derived observations provided higher and more accurate estimates of the prevalence of bat flight activity and feeding events than acoustic sampling alone.

Occupancy studies to determine the Hawaiian hoary bat population trend require intensive monitoring over multiple years. WEST, Inc. (2015) conducted a power analysis using acoustic data gathered by the U.S. Geological Survey (USGS) in a five-year study on Hawaii Island (Gorresen et al. 2013). WEST's analysis suggests it would take approximately 5 to 10 years of acoustic monitoring at hundreds of sites per island to determine population trends ranging from 20-40 percent

with an acceptable level of confidence. Based on this information, acoustical studies have been launched on the island of Oahu to evaluate the occupancy trend of the bat with regard to that island's population. However, the technologies that allow for the development of a population estimate do not yet exist.

While systematic acoustic monitoring has not occurred throughout the islands, bat presence has been documented nearly everywhere monitoring does occur. No Hawaiian hoary bat population estimates that meet scientific rigor with reasonable statistical confidence levels exist, though breeding has been documented or suspected on all five (Kauai, Oahu, Maui, Molokai and Hawaii) of the eight main Hawaiian Islands.

On Kauai, only a few studies have been conducted on the species to look at occupancy (Bonaccorso and Pinzari 2011; Wolfe 2018). They found bats widely spread across the island, at least in the lowlands, with some indications that they move seasonally into higher elevation areas.

On Oahu, monitoring for bats has been conducted primarily at several locations including at wind facilities, military lands training areas in the Koolau and Waianae mountain ranges, Waikiki, Ford Island, the north shore of Oahu, and the NWR Complex comprised of James Campbell, Kalaeloa Unit of the Pearl Harbor NWR and at the Oahu Forest NWR (Pinzari 2014, Oahu Army Natural Resource Program 2016, Wolfe 2018). An intensive, multi-year study is currently ongoing on Oahu to look at year-round distribution and occupancy of the Hawaiian hoary bat across the island. Preliminary results showed bat activity at 61 percent of 87 randomly selected sites across all types of landscape on Oahu (Starcevich et al. 2019). The highest rate of acoustical detection based only on the locations of the 87 detectors was in Waimea (Starcevich et al. 2019) which suggests this area provides a resource that favors bat presence.

The USGS conducted bat detection surveys on Navy installations across Oahu at Wahiawa Gulch, Wahiawa Housing, Pearl Harbor National Wildlife Refuge, Waiawa Watershed, Ford Island, Hickam Air Force Base, Red Hill Storage Facility, Naval Magazine Lualualei, and Naval Telecommunication Facility Lualualei from February 2012 to February 2015. Bats were detected at all of the sites except for three locations (Telecommunication Facility Lualualei, Pearl Harbor National Wildlife Refuge, and Waiawa Watershed) (Bonaccorso et al. 2012).

The West Loch Annex itself was not surveyed during the Bonaccorso et al. (2012) study, but two sample sites nearby (Ahua Reef and Ford Island, 2.5 miles and 3 miles away respectively) did result in bat detections, from a period between November 2012 and March 2013. Pearl Harbor National Wildlife Refuge is 3.4 miles away, but bat detections were not made there. In a separate study, the Service placed a detector at the Honouliuli Wildlife Refuge Unit from December 2016 to May 2019. Over the 877 nights of sampling, four bats detections were recorded (three in October 2017 and one in February 2018) (Wolfe, unpublished data 2019).

As of 2018, the Hawaiian hoary bat is known from all islands of Maui Nui, with bats likely breeding on Molokai and Maui (Service 1998; Hosten and Poland 2018). Research on the Hawaiian hoary bat has been conducted on the south slope of Haleakala (Todd et al. 2016), and additional research is ongoing on the west slope (H. T. Harvey 2016; Johnston et al. 2018).

The Hawaiian hoary bat is widespread across all major islands; however, no island or statewide population estimates are available, as there is no appropriate scientifically-based method to estimate

the population of this highly mobile, solitary, cryptic, nocturnal species that provides reasonable statistical confidence levels. The mobility of the Hawaiian hoary bat within an island contributes to the resiliency of the species by lessening the impacts of localized threats and contributes to its continued survival and recovery. Island subpopulations likely provide a source of biological redundancy statewide. High mobility of the species can also provide for genetic exchange and representation. Habitat conservation, restoration, and protection are expected to provide increased conservation and productivity benefits to Hawaiian hoary bats by providing additive habitat value to the landscape used by the bats.

Much of the research on the Hawaiian hoary bat has been conducted on Hawaii Island (Menard 2001; Todd 2012; Gorresen et al. 2013; Bonaccorso et al. 2015; Service 2019). Gorresen et al. (2013) documented hoary bat occurrences over most of the island, including seasonal movements between lower elevation pupping areas and upper elevation wintering areas. Menard (2001) and Bonaccorso et al. (2015) found that hoary bats pupped in elevations typically below 3,280 feet and then moved seasonally to higher elevations in winter, presumably to take advantage of better foraging conditions. The study does not exclude the possibility of pupping at higher elevations. A pregnant female has been observed at 5,413 feet, although it is unknown if she was roosting. Based on a five-year study from 2006-2011, the Hawaiian hoary bat showed a stable to increasing trend in occupancy during the breeding season on the island (Gorresen et al. 2013). Recent observations have been made of the Hawaiian hoary bat foraging in caves up to 11,800 feet on Mauna Loa (Bonaccorso et al. 2016). In addition to seasonal movements, the Hawaiian hoary bat has also been documented to move over distances up to 6.8 miles one way nightly in search of the best foraging areas (Bonaccorso et al. 2015).

Life History

Day-roost habitat requirements for the Hawaiian hoary bat are tall (greater than 15 foot crown height), shady trees frequently including mature ohia lehua (*Metrosideros polymorpha*), but also including a wide variety of introduced species such as lychee (*Litchi chinensis*), various species of eucalyptus (*Eucalyptus* spp.), mango (*Mangifera indica*), and numerous other tree species (Bonaccorso et al. 2015). Roost trees noted from radio-tracked bats on Maui include blue gum eucalyptus (*Eucalyptus globulus*), African tulip tree (*Spathodea campanulata*), and Monterey cypress (*Cupressus macrocarpa*) (Johnston et al. 2018).

The Hawaiian hoary bat primarily feeds on nocturnal moths and beetles, which it hunts in flight across a wide array of habitat types and plant communities from sea level to at least 11,800 feet above sea level (Whitaker and Tomich 1983; Jacobs 1999; Todd 2012; Bonaccorso et al. 2015; Bonaccorso et al. 2016). Bonaccorso et al. (2015) found Hawaiian hoary bats using foraging areas up to 571 acres in size with smaller, core use ranges of around 62 acres targeted within that larger landscape. Bats can use widely dispersed resources and move away from poor foraging conditions, such as heavy rain. Overall, bat activity and movements on the landscape are not determined by one variable, but an interaction of a complex array of environmental factors. Seasonal changes in temperature, rainfall, wind, insect abundance, and energetic costs associated with reproduction of the Hawaiian hoary bat all play important roles in its movement and habitat use (Todd 2012; Gorresen et al. 2013; Bonaccorso et al. 2015; Gorresen et al. 2015; Bonaccorso et al. 2016; Todd et al. 2016).

The physical structure of the spaces in which the Hawaiian hoary bat forages are also extremely varied, including forest gaps and clearings, forest edges along planted windrows of trees, above forest canopies, and along roads. These areas can occur in a range of habitats including undisturbed

native forest, mature eucalyptus plantations having mixed understory trees and shrubs, lowland forest dominated by introduced trees, suburban and urban areas planted with ornamental trees, grassland or pasture, river gorges, arboretums, macadamia nut orchards, and coastal bays (Bonaccorso et al. 2015; Gorresen et al. 2013). An estimated 1.475 million acres of forest habitat occurs across the major Hawaiian Islands (Reeves and Amidon 2018). About 50 percent or 700,000 acres of dry, mesic, and wet forest habitat is owned by County, State, or Federal government agencies.

The lifespan of the solitary, Hawaiian hoary bat is estimated to be between 4 to 10 years (Bonaccorso 2016). The average number of pups produced each year is estimated to be 1.8 and survival rate is estimated to be 30 percent. Thus, Hawaiian hoary bat reproductive success is estimated at 0.5 pups per female. Hawaiian hoary bat breeding activity takes place between April and August, with pregnancy and the birth of two, or occasionally one, pup(s), occurring from April to June (Bogan 1972). The pups are completely dependent on the female until weaning at three months of age. Several studies have examined Hawaiian hoary bat movement and habitat use across the islands (Todd 2012, Gorresen et al. 2013, Bonaccorso et al. 2015, Gorresen et al. 2015, Bonaccorso et al. 2016, Todd et al. 2016). The median core use area for a male bat was estimated as 20.3 acres based on raw data from Bonaccorso et al. (2015) and excluding data from juvenile individuals without established core use areas (DOFAW 2015; Bonaccorso et al. 2015). Female Hawaiian hoary bats may have overlapping core use areas (Bonaccorso et al. 2015). Lactating females have been documented from June to August, and a female tending pups has been observed in early September (Pinzari, USGS, pers. comm. 2020). The Hawaiian hoary bat pupping season is considered to be June 1 through September 15, when mature females are likely caring for dependent young.

Threats

Expansion of land-based wind energy facilities is the greatest known source of mortality of the Hawaiian hoary bat. As of June 2018, there have been 76 observed Hawaiian hoary bat fatalities at the six facilities monitoring and reporting take of bats; these data reflect a likely take amount of 90 to 164 bats. Other threats include habitat loss, tree trimming and cutting during the period when pups cannot fly, entanglement on barbed wire fences, pesticides, competition from invasive species such as coqui frogs, and predation from native and non-native owls and hawks, as well as non-native rats and cats (Service 1998).

Development and urban sprawl are two of the greatest sources of habitat loss. Bats have been shown to use areas of low development so long as resources, including food and shelter, are available. In addition to development, forests are threatened with degradation through non-native weed species such as strawberry guava (*Psidium cattleianum*) which forms monotypic stands, alters the hydrology, and has not been documented to be used by the Hawaiian hoary bat. Non-native ungulates also cause damage to mature trees and decrease or destroy the regeneration of mature forest suitable for roosting habitat for the Hawaiian hoary bat.

Conservation Needs of the Species

The overall recovery strategy for the Hawaiian hoary bat is to rely on research that can provide information on the subspecies' abundance and distribution, life history, and habitat associations. The primary recovery goal is to conduct research essential to the conservation of the Hawaiian hoary bat. Research should focus on developing standardized survey and monitoring protocols for determining abundance and distribution, roosting habitat associations, basic life history biology, and food habits. Other recovery goals are to protect and manage current populations by identifying and managing

threats, including protection of key roosting and foraging areas; conduct a public education program; evaluate progress towards recovery; and revise recovery criteria as necessary (Service 1998).

Ongoing Conservation Actions

The Service, The State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW), and Bat Conservation International (BCI), a nonprofit conservation and education organization, are stakeholders in a public-private Hawaiian Hoary Bat Research Cooperative (Cooperative) which collaboratively prioritizes and funds management-oriented research on the Hawaiian hoary bat's abundance, distribution, and habitat requirements. Major stakeholders include private landowners, agricultural and commercial forestry interests, environmental groups, local governments, and Federal and State agencies. Most of the Cooperative's current funding is provided by the Service's Cooperative Endangered Species Conservation Funds (Section 6 of the Endangered Species Act) grants to the State.

ENVIRONMENTAL BASELINE

The action area is vegetated with non-native dryland vegetation, primarily Kiawe trees that range in size, but with a maximum height of 20 feet. Koa haole (*Leucaena leucocephala*), and opiuma (*Pithecellobium dulce*) is interspersed within and at the edges of the forest. Buffel grass (*Cenchrus ciliaris*) is the only vegetation below the kiawe trees creating an open understory. Buffelgrass also fills in the forest edges. There are also open fields of koa haole and buffelgrass that surrounds the kiawe forest. Historically, the land at West Loch Annex was used for agriculture before the munition magazines were built. The inner edges of the annex are still used for agricultural crops with areas of fallow shrubland.

Surveys for the Hawaiian hoary bat have not been conducted in the action area. However, bats have been detected as close as 2.5 miles away (Bonaccorso et al. 2012), well within their nightly movement range. Assuming the general habitat use described by Bonaccorso et al. (2015) applies to all bat populations, the habitat within the action area is suitable for feeding, breeding, and roosting by the Hawaiian hoary bat.

Factors Affecting the Species Environment within the Action Area

JBPHH West Loch Annex is currently being used to fulfill the Navy's congressionally mandated roles and responsibilities under 10 U.S.C. Section 5062, which states that the Navy shall be organized, trained, and equipped primarily for prompt and sustained combat incident to operations at sea. This action would further the Navy's execution of that mandate with munitions storage to support the equipment of the Navy to fulfill those operations. No ESA consultation was completed for the construction of JBPHH West Loch Annex and no consultations on the Hawaiian hoary bat have occurred within the action area.

CONSEQUENCES OF THE ACTION

The Hawaiian hoary bat roosts in both native and non-native woody vegetation across all of the major Hawaiian islands and will leave young unattended in trees and shrubs when they forage. If trees or shrubs 15 feet or taller are cleared during the pupping season, there is a risk that young

bats could inadvertently be harmed or killed since they are too young to fly or may not move away. Hawaiian hoary bats forage for insects from as low as 3 feet to higher than 500 feet above the ground. Barbed wire installed higher than three feet above the ground is a potential flight obstacle that the Hawaiian hoary bat can become entangled in resulting in harm (injury or death) to the bat.

All proposed actions at the West Loch Annex will take place within the range of the Hawaiian hoary bat on the island of Oahu. Bats are widely distributed across the island and the project would affect an insignificant portion of their range. The consequences of the actions will be limited to the identified locations (Figure 5) within the action area.

Vegetation removal

The action area has trees greater than 15 feet tall, potentially providing suitable habitat for the Hawaiian hoary bat to roost. Vegetation removal included in the proposed action is necessary to prepare the area for the construction of the projects components. The actions would remove 300 acres of habitat suitable for bat use as foraging and roosting habitat. Removal of available habitat would have a minimal effect on the species population within the action area due to an abundance of habitat available for use by the bat for foraging and roosting outside of the action area.

If flightless Hawaiian hoary bat pups are located in trees and branches during vegetation removal, they would be killed. However, because the Navy is implementing a conservation measure to clear taller vegetation (greater than 15 feet) outside of the Hawaiian hoary bat pupping season, (June 1 through September 15) impacts to dependent pups are highly unlikely, and therefore discountable. In addition, if any bat pups are discovered in the construction zone, vegetation clearing will stop and personnel will move a minimum of 300 feet away. Construction will not resume until the bat pups have departed the area. Once vegetation clearing is finished, adult bats would be able to utilize the remaining vegetation within the action area for foraging or roosting. Disturbance to maintain a clear fence line would occur as needed, but would not include the removal of vegetation higher than 15 feet tall.

Up to 192 acres of habitat removed during construction will have the potential to return to a vegetated state, given sufficient time. Areas where project components are built or fence is constructed will be permanent and would result in the permanent loss of existing habitat features that may be used by the bat.

Barbed wire fencing

The installation of the security fence may occur anytime throughout the year 2022. Where barbed wire is installed, the barbed wire has the potential to cause direct effects to foraging bats for as long as it remains within the action area. If an adult bat is injured or killed at the barbed wire fence, any dependent juvenile they have would likely also die.

To evaluate the potential for adverse consequences in the form of injury or mortality to Hawaiian hoary bats due to entanglement on barbed wire fencing, the Service uses a formula derived by USGS studies. The formula estimates that 0.013 bats may be harmed per mile of each barbed

wire strand per year (Service 2014). This estimate is derived from data gathered from known bat fatalities on barbed wire fencing. While this formula is based on a limited data set, it is used as an indication of the risk of taking a Hawaiian hoary bat caused by the installation of barbed wire for the proposed project.

In the case of this project, up to 3.51 bat injuries or mortalities are estimated to occur over a 20-year timeframe. Since take of a species cannot be counted in fractions of individuals, we will round the estimate up to four bats taken over the next 20 years (the life expectancy of a barbed wire fence). To verify the estimated number of bat mortalities from collision with barbed wire, the Navy will survey the barbed wire strands for bat carcasses. It is expected that a minimum of one survey per week will be required to detect mortalities, but as mentioned in the conservation measures section above, this survey interval may be shortened or lengthened based on results of carcass search trials.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur within the action area considered in this BiOp. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA, as appropriate. The Service is unaware of any foreseeable non-Federal actions within the action area.

CONCLUSION

Vegetation proposed to be removed within the action area is suitable habitat for the bat, but is a very small portion (300 acres) of the total estimated 1.475 million acres habitat (Reeves and Amidon 2018) available on Oahu or across all of the Hawaiian islands for the bat's recovery. Because of this, the action area plays a very small part in the conservation of the Hawaiian hoary bat on Oahu. In addition, there is sufficient breeding, feeding, and roosting habitat available adjacent to the action area that we do not anticipate a reduction of fitness or survival of any Hawaiian hoary bats that currently utilize the action area due to the removal of habitat.

The Service has determined that the implementation of the proposed action, including the installation of 13.5 miles of barbed wire fencing, is anticipated to cause harm (take) in the form of injury or mortality of up to four Hawaiian hoary bats every 20 years. The number of individuals potentially harmed or killed by the action is estimated to be a very small portion of the total population of bats on Oahu, based off of preliminary results of a multi-year distribution and occupancy study which showed bat activity at 61 percent of 87 randomly selected sites across all types of landscape on Oahu (Starcevich et al. 2019).

Based on a total take estimate of four bats over the next 20 years, an average of 0.2 bat fatalities per year would be expected to occur as a result of this action. This includes indirect effects, in the form of lethal harm to dependent juvenile bats if the mother bat is killed by the barbed wire fencing during the breeding season. Bats may live up to 10 years, though it is unknown if they breed each year or how many years they may produce young. The loss of an adult bat would be expected to result in the additional loss of future generations of bats on Oahu.

Considering the species' overall population and individual ranges, the disturbance of this action may result in adverse effects on a very small portion of the potential population within the action area. Therefore, the action poses the potential for limited long-term disturbance to the Hawaiian hoary bat; however, it would not hinder the species' recovery potential.

After reviewing the status of the species, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that implementation of the proposed action, discussed herein, is not likely to jeopardize the continued existence of the Hawaiian hoary bat for the reasons discussed above.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including, breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Navy so that they become binding conditions for the exemption in section 7(a)(2) to apply. If the Navy fails to assume and implement the terms and conditions or fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(a)(2) may lapse. In order to monitor the impact of incidental take, the Navy must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement and reporting requirements below [50 CFR 402.14(i)(3)].

Amount or Extent of Take Anticipated

Based on the analysis presented in this BiOp, the Service anticipates the following take may occur as a result of the proposed action: Incidental take of up to four Hawaiian hoary bats, in the form of injury or mortality, may occur over the next 20 years. Take would be exceeded if that number is reached before the end of the 20-year period, or if take occurs in a form not considered in this BiOp.

Effect of Take

In this BiOp, the Service has determined that this level of anticipated take is not likely to result in jeopardy of the Hawaiian hoary bat. As explained in the Effects of The Action section above,

the Service believes that the implementation of Navy's proposed actions will not significantly alter the Hawaiian hoary bats ability to feed, breed, or take shelter, and the overall population of species would not be affected. There will be minimal consequences to feeding, breeding, and sheltering due to the removal of 300 acres of available habitat, however those consequences are offset by the ability for the species to accomplish those life functions where appropriate habitat exists in the immediate vicinity of the action area.

Reasonable and Prudent Measures

The reasonable and prudent measures given below, with their implementing terms and conditions, are designed to minimize the impacts of incidental take that might otherwise result from the proposed actions. If, during the course of the action, the level of incidental take is exceeded, this represents new information requiring reinitiating of consultation and review of the provided reasonable and prudent measures. In addition, the action that caused the taking must cease; the action agency must immediately provide an explanation of the causes of the taking; and must review with the Service the need for possible modification of the reasonable and prudent measures.

The following reasonable and prudent measures are non-discretionary and must be implemented to minimize the effect of take on Hawaiian hoary bats in this consultation:

1. The Navy shall minimize the potential for death or injury of Hawaiian hoary bats.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Navy must comply with the following terms and conditions that outline required reporting and monitoring requirements.

These terms and conditions are non-discretionary:

Minimize impacts of Naval activities on the survival and reproduction of the Hawaiian hoary bat.

- The Service shall be notified within 24 hours of a take incident. In addition, a report shall be submitted to our office in writing within three days of the incident.
- Should an injured Hawaiian hoary bat be found, the bat should be taken to a permitted wildlife rehabilitation facility. Before transporting the injured bat, the Navy will coordinate with the wildlife rehabilitation facility to determine proper procedures.
- Should there be a take of a Hawaiian hoary bat and the carcass recovered, the depository designated to receive specimens is the Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii, 96817 (Telephone: 808-847-3511). If the Bishop Museum does not wish to accept the specimen, the Navy will contact the Service's Division of Law Enforcement in Honolulu, Hawaii (Telephone: 808-861-8525) for instructions on disposition.
- The Navy will monitor and report on the levels of take that occur between January 1 and December 31 each year.
 - The annual report will document the effectiveness of all monitoring actions, and will summarize annual counts of Hawaiian hoary bats found.
 - The report will be submitted by the first business day of March each calendar year to the Service's Pacific Islands Fish and Wildlife Office (300 Ala Moana Boulevard, Room 3-122, Honolulu, Hawaii 96850).

CONSERVATION RECOMMENDATIONS

Section 7(a) (1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service does not have any conservation recommendations for the Navy at this time.

REINITIATION-CLOSING STATEMENT

This concludes formal consultation on the proposed action considered in this BiOp. As provided in 50 CFR § 402.16, re-initiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) if the amount or extent of taking specified in the incidental take statement is exceeded; (2) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action.

If you have any questions concerning this consultation, please contact Johnathon Kraska, Fish and Wildlife Biologist, at 808-792-9400 or by email at johnathon_kraska@fws.gov.

Sincerely,

KATHERINE
MULLETT

Digitally signed by KATHERINE
MULLETT
Date: 2020.06.18 21:14:10
-10'00'

Katherine Mullett
Field Supervisor

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PERSONAL COMMUNICATIONS

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Appendix A – Lest Loch Magazine Informal Consultation



United States Department of the Interior



FISH AND WILDLIFE SERVICE
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In Reply Refer To:
01EPIF00-2020-F-0215

June 18, 2020

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NAVFAC Hawaii, Environmental Planning
400 Marshall Road, Building 55
Joint Base Pearl Harbor-Hickam, HI 96860-3134

Subject: Appendix A: Informal Consultation with the United States Navy on Proposed Construction of Magazines for Naval Munitions and Associated Improvements at Joint Base Pearl Harbor Hickam (JBPHH) West Loch Annex, Honolulu County, Hawaii

Dear Ms. Carnes:

The U.S. Fish and Wildlife Service (Service) received your “may affect, but not likely to adversely affect” determination for the proposed Construction of Magazines for Naval Munitions and Associated Improvements at JBPHH West Loch Annex, on the island of Oahu. The action has the potential to affect the federally endangered Hawaiian coot (*Fulica alai*), Hawaiian duck (*Anas wyvilliana*), Hawaiian common gallinule (*Gallinula galeata sandvicensis*), and Hawaiian stilt (*Himantopus mexicanus knudseni*). For the purposes of the effects analysis in this consultation, the term Hawaiian waterbirds will refer to these species collectively. This response was prepared in accordance with the requirements of section 7 of the Endangered Species Act (ESA)(16 U.S.C. 1531et seq.).

We based the findings and recommendations in this consultation on the data presented in your February 2020 Biological Evaluation, and the March 20 and May 13, 2020 phone conversations regarding the inclusion of conservation measures for potential consequences to endangered waterbirds, along with our review of your effects analysis. A complete project record is on file in our office.

DESCRIPTION OF THE PROPOSED ACTION

See above BiOp for project description.

EFFECTS OF THE ACTION

INTERIOR REGION 9
COLUMBIA-PACIFIC NORTHWEST

IDAHO, MONTANA*, OREGON*, WASHINGTON
*PARTIAL

INTERIOR REGION 12
PACIFIC ISLANDS

AMERICAN SAMOA, GUAM, HAWAII, NORTHERN
MARIANA ISLANDS

Vegetation Removal

Individual birds or pairs of birds may be discouraged from nesting or foraging in the project area because of the human noise and activity during vegetation removal. This temporary displacement of waterbirds would reduce the amount of nesting, or foraging habitats available. This displacement could alter an individual's typical nesting, foraging, and roosting patterns. However, this impact would be insignificant because the displacement would only occur for a short period during construction activities and adjacent foraging and nesting habitat is available for displaced waterbirds to use.

In areas where suitable nesting habitat occurs, waterbird nest searches will be conducted by a qualified biologist before any work is conducted and after any subsequent delay in work of three or more days (during which birds may attempt nesting). The results of the pre-construction survey will be submitted to the Service. If a waterbird nest with eggs or chicks or ducklings is discovered in the construction limits, work in that area will be halted and will not begin until the chicks or ducklings have fledged and left the area. Waterbird nests, chicks, or broods found in the survey area before or during construction will be reported to the Service within 48 hours. A biological monitor will be present on the project site during all construction activities to ensure that Hawaiian waterbirds and nests are not adversely impacted.

CONCLUSION

By incorporating the conservation measures listed above, potential effects to listed species are extremely unlikely to occur, and therefore discountable. Because effects from the action are discountable, the proposed project is not likely to adversely affect the Hawaiian coot, Hawaiian duck, Hawaiian common gallinule, and Hawaiian stilt. Therefore, the Service concurs with your effects determination.

No further action pursuant to section 7 of the ESA is necessary unless: (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this letter; or (3) if a new species is listed or critical habitat designated that may be affected by the identified action.

If you have any questions concerning this consultation, please contact Johnathon Kraska, Fish and Wildlife Biologist, at 808-792-9400 or by email at johnathon.kraska@fws.gov.

Sincerely,

KATHERINE
MULLETT

 Digitally signed by KATHERINE
MULLETT
Date: 2020.06.18 21:14:49 -10'00'

Katherine Mullett
Field Supervisor

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N-3 West Loch Ox Pond Biological Opinion

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850



In Reply Refer To:
01EPIF00-2021-F-0249

August 13, 2021

Ms. Sherri Eng
Director
Regional Environmental Department
Navy Region Hawaii
850 Ticonderoga St., Suite 110
JBPHH, Hawaii 96850-5101

Subject: West Loch Oxidation Pond Operations and Maintenance, Joint Base Pearl Harbor
Hickam, Oahu

Dear Ms. Eng:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BiOp) addressing the effects of the subject action on the federally endangered Hawaiian coot (*Fulica alai*), Hawaiian common gallinule (*Gallinula galeata sandvicensis*), and the Hawaiian stilt (*Himantopus mexicanus knudseni*), collectively referred to as "Hawaiian waterbirds." No critical habitat has been designated for these species. This BiOp was prepared in accordance with the requirements of section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.). Your request for formal consultation and a biological evaluation (BE) were received by the Service on March 29, 2021. The endangered Hawaiian duck (*Anas wyvilliana*) is not included in the formal consultation, as the ducks observed on Oahu are hybrids, which are not listed and do not receive protection under the ESA.

This BiOp is based on best available information presented in the BE for the West Loch Oxidation Pond (WLOP) prepared by the Naval Facilities (NAVFAC) Engineering Systems Command, and otherwise cited below. A complete decision record of this consultation is on file at the Service's Pacific Islands Fish and Wildlife Office in Honolulu, Hawaii. The Service's log number for this consultation is 01EPIF00-2021-F-0249.

CONSULTATION HISTORY

29 March 2021: Navy biologist, Corrina Carnes, submits request for formal consultation via electronic mail.

11 May 2021: Service submitted a 30-day letter acknowledging receipt of the Navy's request for formal consultation and requested information on several issues in order to proceed with consultation. Assigned consultation log number 01EPIF00-2021-F-0249.

11 May 2021: Service biologist, James Kwon, and Navy biologist, Corrina Carnes, met via Microsoft Teams to discuss information needs.

14 June 2021: Service biologist, James Kwon, and Navy biologist, Nicole Olmstead, spoke via telephone regarding the timeline for completion of the BiOp.

05 August 2021: Service biologist, James Kwon, and Navy biologist, Corrina Carnes, spoke via telephone clarifying the action area and project description.

10 August 2021: Service biologist, James Kwon, and Navy biologist, Corrina Carnes, spoke via telephone regarding data on nesting and flooding events.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Purpose

The purpose of the WLOP and associated maintenance facilities is to accumulate wastewater from vessels in Pearl Harbor and from facilities in the West Loch Annex (Annex), thus supporting activities carried out by these vessels and facilities. In addition, natural resource management activities at the pond serve the additional purpose of conserving protected species on Department of Defense lands in accordance with the ESA and Sikes Act. Natural resource management activities include tracking presence and nesting behavior of the three endangered Hawaiian waterbird species, as well as several species of shorebirds and migratory waterfowl known to use the pond, deterring nesting in areas where nests will be at risk of flooding, and protecting birds from predation and nest disturbance.

Action Location

The WLOP is located at the north end of the Annex, a branch of Joint Base Pearl Harbor Hickam (JBPHH) in the Ewa district of Oahu. The Annex is located on the shoreline of Pearl Harbor's West Loch Channel. Neighboring properties include Ewa Gentry to the west, Ewa Beach Golf Club to the south, and Kapilina Homes to the southeast. The Annex can be accessed via Iroquois Road or Iroquois Drive. Land use at the Annex currently consists of military operations and agriculture outlease near the western perimeter (Figure 1).

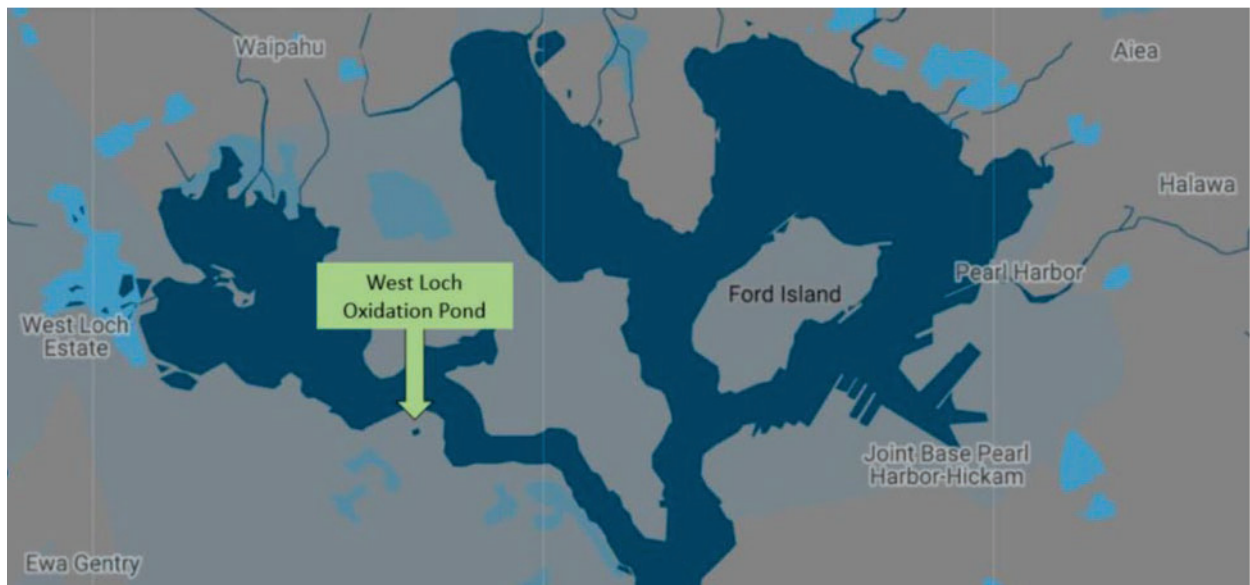


Figure 1. Location of West Loch Oxidation Pond.

Details of the Action

WLOP Facility Operations and Maintenance

The WLOP receives wastewater from facilities and vessels via the underground sanitary sewer system. Wastewater is treated in the pond through the interaction of sunlight, bacteria, and algae. Water level in the pond is controlled by an overflow flex hose, which can be raised or lowered to allow wastewater to flow into a sewer lift station, which discharges to the City and County of Honolulu's Honouliuli Wastewater Treatment Facility.

Maintenance activities occurring at or near the pond include clearing debris and vegetation from the overflow flex hose, sewer manhole cleaning, inspections and rehabilitation, sewer line hydro-cleaning and closed circuit television inspection monitoring, preventive maintenance, repair and replacement of various gate, plug, check and air release valves, motors and pumps, along with emergency generator, general electrical and Supervisory Control and Data Acquisition (SCADA) maintenance are performed at the various sewer lift stations. Maintenance may also include raising or lowering water level in the pond to deter nesting activity or to avoid flooding of existing nests. Water level is controlled by adjusting the overflow flex hose level, but water can also be pumped out manually.

Vegetation control is conducted at the WLOP outside of waterbird nesting season from September through November. This work is performed every two weeks by a two-person crew. Equipment may include weed whackers or push mowers.

Natural Resources Management Actions

Listed Waterbird Surveys

Surveys will be conducted by JBPHH Natural Resources staff or by contracted field biologists to

document presence of protected waterbird species, seasonal site use, breeding/nesting behavior, and fledging success. Surveys for endangered Hawaiian waterbirds are conducted at the WLOP once every two weeks from September through January and weekly during Hawaiian stilt nesting season (February to August). These surveys are primarily conducted at a distance of several hundred feet via binoculars/spotting scope from a single point, and nests are only approached when necessary to determine flooding risk or to service trail cameras (see below). During stilt nesting season, surveys may also include traversing the edge of the WLOP on foot in order to detect and monitor nests. When active nests are present on the pond liner, surveys are conducted every other day to ensure water level remains below the nest.

Trail Cameras

In order to determine sources of nest predation, trail cameras may be occasionally deployed at a nest to capture footage throughout the incubation and pre-fledgling period. Cameras are silent and motion activated, and are attached to a bucket for quick deployment. In order to minimize disturbance, cameras will be placed at a distance of more than 10 feet away from the nest and initially deployed when birds are away from the nest. Cameras will be visited as infrequently as possible – typically once per week to check for battery life and SIM card data retrieval. Cameras will be removed from each nest after all hatchlings fledge, nests become inactive, or the nest determined to have failed.

Predator Trapping

Predator trapping for mongoose, rodents and feral cats is conducted in areas where protected species are known to occur. This work is executed through contract or cooperative agreement with oversight by JBPHH Natural Resources staff. Predator trapping at the WLOP occurs year-round and involves use of Tomahawk and DOC250 traps. Animals caught in traps may be dispatched on site.

Passive Hazing

In order to deter birds from nesting at the pond, passive hazing methods will be implemented prior to the waterbird nesting season during Rim of the Pacific Exercise (RIMPAC) years or other periods of high-volume use of the WLOP. The hazing period for each nesting season will be informed by examining nesting data from previous seasons, with hazing devices deployed two to four weeks before anticipated nesting periods to maximize efficacy of passive hazing tools. Proposed methods and timeline are outlined in Appendix A. Hazing will be implemented by biologists knowledgeable of the listed and non-listed waterbird species that may be present at the pond, with oversight by JBPHH Natural Resources staff.

Conservation Measures

The Navy will implement the following avoidance, minimization, and conservation measures:

- 1) The site will be monitored for waterbird presence once every two weeks during the months of September through January and once per week during the months of February through August. In addition to collecting data on behavioral observations and use of the site over time, birds will be monitored for signs of avian botulism. Any waterbird carcasses or suspected cases of botulism will be reported to USFWS and multi-agency response coordinated as needed.

- 2) Waterbird monitoring will primarily be conducted at a distance using binoculars and/or a spotting scope from a single point to minimize disturbance.
- 3) Predator control for mongoose, rodents and feral cats will be conducted at the pond year-round (see above for details).
- 4) Vegetation control at the pond will be halted from December to August to prevent destruction of nests laid in the grass, with the exception of clearing vegetation from the overflow flex hose to maintain functionality.
- 5) The pond's overflow flex hose will be inspected in February to ensure it is not clogged and is otherwise functioning improperly.
- 6) Maintenance personnel and contractors will be informed of the presence of endangered species and advised to reduce vehicle speeds in areas immediately surrounding the pond.
- 7) Maintenance activities will be scheduled outside of Hawaiian stilt nesting season whenever possible. For maintenance that occurs during nesting season, a biological monitor that is familiar with the species' biology will conduct Hawaiian waterbird nest surveys prior to project commencement. Surveys will be repeated again within three days of project initiation and after subsequent delay of work of three or more days. If a nest or active brood is found:
 - i. A 100-foot buffer will be established around all active nests and/or broods until the chicks have fledged. No potentially disruptive activities or habitat alteration will occur within this buffer.
 - ii. A biological monitor that is familiar with the species' biology will be present on the project site during all construction or earth moving activities until the chicks fledge to ensure that Hawaiian waterbirds and nests are not adversely impacted.
- 8) The following procedures will be implemented from February to August, when Hawaiian stilt and Hawaiian coot nesting are most likely to occur:
 - a. Water level in the pond will be kept as high as possible to prevent sludge build-up and reduce surface area available for nesting on the pond liner.
 - b. The site will be monitored weekly for waterbird presence, nesting activity, and water level/sludge buildup.
 - c. The pond liner will be kept free of debris to maximum extent possible to avoid attracting nesting activity.
 - d. Passive hazing will be implemented during periods of high-volume use of the pond. If nests are discovered, all passive hazing at the pond will stop immediately to prevent nest abandonment.

9) The following procedures will be implemented if nests are detected on the pond liner or in sludge at edge of pond:

- a. NAVFAC Hawaii Natural Resources staff will coordinate with NAVFAC Utilities Management, Wastewater, Port Operations, and others needed to obtain vessel schedules and lower or reroute water in accordance with Conservation Measures.
- b. Water level will be maintained at 4 to 6 inches below the nest. Water level can be controlled by temporarily halting vessel offloading to the pond or by lowering the overflow flex hose and/or using a portable pump and hose to send the overflow to the nearby pump station. If JBPHH wastewater holding facilities are at capacity, the water level will not be lowered.
- c. Water level relative to the nest will be monitored each day prior to a ship arrival and every two days while ships are in port.
- d. A contact list of all coordinating parties will be maintained by NAVFAC Hawaii Natural Resources and will be updated annually or as needed.

Action Area

The implementing regulations for section 7 of the ESA define “action area” as “...all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 CFR § 402.02). All consequences of the actions proposed by the Navy will occur within the WLOP and associated areas totaling approximately 2.2 acres (0.89 hectares) as shown in Figure 2.



Figure 2. WLOP showing pond and associated areas.

Analytical Framework for the Jeopardy Determination

In accordance with regulation (see 84 FR 44976), the jeopardy determination in this BiOp relies on the following four components:

1. The *Status of the Species*, which evaluates the species' current range-wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; its survival and recovery needs; and explains if the species' current range-wide population is likely to persist while retaining the potential for recovery or is not viable;
2. The *Environmental Baseline*, which evaluates the current condition of the species in the action area relative to its reproduction, numbers, and distribution absent the consequences of the proposed action; the factors responsible for that condition; and the relationship of the action area to the survival and recovery of the species;
3. The *Effects of the Action*, which evaluates all future consequences to the species that are reasonably certain to be caused by the proposed action, including the consequences of other activities that are caused by the proposed action, and how those impacts are likely to influence the survival and recovery role of the action area for the species; and
4. *Cumulative Effects*, which evaluates the consequences of future, non-Federal activities reasonably certain to occur in the action area on the species, and how those impacts are likely to influence the survival and recovery role of the action area for the species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the consequences of the proposed Federal action in the context of the species' current range-wide status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The key to making this finding is clearly establishing the role of the action area in the conservation of the species as a whole, and how the effects of the proposed action, taken together with cumulative effects, are likely to alter that role and the continued existence (i.e., survival) of the species.

STATUS OF THE SPECIES

Hawaiian common gallinule

The Hawaiian common gallinule was listed as endangered in 1970 (USFWS 1970). Gallinules are currently found only on the islands of Kauai and Oahu, though historically they were found on all the main islands except Lanai and probably Niihau (USFWS 2011). State-wide gallinule counts have been stable, but remain low, with average totals of 287 birds over 10 years from 1998 to 2007 (DOFAW unpublished data 1976-2008, USFWS 2011). The reduced distribution of this species is a major concern in the ability to recover it and reintroduction to protected and managed sites on two additional islands is an important recovery action in the recovery plan (USFWS 2011). Gallinules are widely distributed on Oahu where about half the state-wide population occurs (USFWS 2011). They are most prevalent on the north and east coasts between Haleiwa and Waimanalo, with large numbers at the Kii Unit of James Campbell National Wildlife Refuge (NWR) and only small numbers at Pearl Harbor NWR (USFWS 2011).

Currently, the main threats to the gallinule are predation by a large variety of introduced species, loss and degradation of wetland habitat, including alteration of hydrology and invasion of habitat by non-native plants, disease (especially botulism), its reduced distribution and small population size, human disturbance, environmental contaminants, and climate change (USFWS 2010a, 2011, 2015a). Climate change may be expected to further exacerbate these threats, for example, through increased temperature, increased occurrences of drought cycles and numbers of hurricanes, sea level rise, and changes in precipitation.

Hawaiian coot

The Hawaiian coot was listed as endangered in 1970 (USFWS 1970). Hawaiian coots were historically known from all the main Hawaiian Islands except Lanai and Kahoolawe which lacked suitable wetland habitat (USFWS 2011). Hawaiian coots were likely once common in large natural wetland habitats, however, no population estimates are available prior to the 1950s, although Schwartz and Schwartz (Schwartz and Schwartz 1949, USFWS 2011) identified a decline and potential threat of extinction. Censuses from the late 1950s to late 1960s estimated a population of fewer than 1,000 birds (USFWS 1978). Wetland loss and degradation, egg harvest, hunting, human disturbance, and introduced predators contributed to low population numbers (USFWS 2011). Currently, Hawaiian coots occur on all the main islands except Kahoolawe (USFWS 2011). Although data are missing from some islands in certain years, winter counts from the biannual state-wide waterbird surveys from 1997 to 2006 indicate the population averages approximately 2,000 birds, fluctuating between approximately 1,500 to 2,800 birds (USFWS 2011; DOFAW unpublished data 1976-2008). Summer counts tend to be more variable than winter counts, possibly due to variability in hatch-year bird survival (USFWS 2011). Kauai, Oahu, and Maui support 80 percent of the Hawaiian coots detected in surveys (USFWS 2011; DOFAW unpublished data 1976-2008). Currently, the main threats to the Hawaiian coot are predation by a large variety of introduced species, loss and degradation of wetland habitat, including alteration of hydrology and invasion of habitat by non-native plants, disease (especially botulism), human disturbance, and environmental contaminants (USFWS 2010b, 2011, 2015b). Climate change may be expected to further exacerbate these threats, for example, through increased temperature, increased occurrences of drought cycles and numbers of hurricanes, sea level rise, and changes in precipitation.

Hawaiian stilt

The Hawaiian stilt is a slender, wading bird listed as endangered in 1970 (USFWS 1970). Hawaiian stilts were historically known from all the main Hawaiian Islands except Lanai and Kahoolawe (Paton and Scott 1985). Hawaiian stilt are currently found on all the main islands except Kahoolawe (USFWS 2011), readily move between the islands and are widely distributed. Long-term census data indicate state-wide populations have been relatively stable or slightly increasing over the past 30 years, though there is year-to-year variability in the numbers of birds surveyed (Reed and Oring 1993, USFWS 2011). This variability may be partially explained by rainfall and reproductive success (Engilis and Pratt 1993). Based on biannual state-wide Hawaiian waterbird surveys conducted from 1998 through 2007, the population averaged 1,484 birds, but fluctuated between approximately 1,100 and 2,100 birds (DOFAW 1976-2008, USFWS 2011). Currently, the main threats to Hawaiian stilts are predation by a large variety of introduced predators and loss and degradation of wetland habitat, including grazing by feral

ungulates, invasion of habitat by non-native plants, and alteration of hydrology. Other factors include avian botulism, environmental contaminants, and human disturbance (USFWS 2010c, 2011). Climate change is expected to further exacerbate these threats, for example, through increased temperature, increased occurrences of drought cycles and numbers of hurricanes, sea level rise, and changes in precipitation (USFWS 2016).

ENVIRONMENTAL BASELINE

The WLOP is a man-made 58,300 square foot, rubber-lined pond that is surrounded by a border of landscaped grass and shrubs that provides limited foraging, loafing, and nesting habitat for Hawaiian coots, Hawaiian gallinules, and Hawaiian stilts. Standing water, in the form of partially treated wastewater, is present year-round at approximate depths of 6 to 36 inches, and accumulation of sludge at the edges of the pond mimics the wetland mudflats commonly used for nesting by Hawaiian stilts. Algal blooms are common at the pond.

Hawaiian stilt

The island of Oahu supports the largest number of Hawaiian stilts (Engilis 1988; DOFAW 1976-2008). Over 5 years, 35 to 50 percent of their statewide population occurred on Oahu, with approximately 450 to 700 birds counted during any single year (DOFAW 1976-2008, USFWS 2011). Large concentrations of birds occur at the nearby Honouliuli and Waiawa Units of the Pearl Harbor NWR, as well as James Campbell NWR, and on Nuupia Ponds in Kaneohe (USFWS 2011, USFWS 2020 in litt.). Stilts are primarily found foraging and loafing in and adjacent to shallow water areas, and infrequently in upland, vegetated areas surrounding the WLOP. Stilts utilize the sloped sides on the pond liner as well as the flat, upland areas adjacent to the pond for nesting activities. In 2016, two stilt nests were found flooded in sludge at the water's edge on the pond liner after heavy rains. Beginning in 2017, JBPHH Natural Resources Staff have coordinated with NAVFAC Wastewater and Utilities staff to maintain water in the pond at levels that prevent sludge build-up to discourage nesting on the pond liner. Between 2017 to 2020, a total of 16 nests and 6 fledglings were observed indicating a consistent, but low level of nesting and reproductive success (Table 1). In 2019, a range of 2 to 15 stilts were observed at the WLOP during weekly and biweekly waterbird surveys. In 2020, a nest was presumed to be flooded after eggs were found floating in the pond (Carnes 2021, in litt.). Between 2017 to 2020, an average of 1.5 stilt nests have been found on the pond liner and 2.5 stilt nests have been found in upland areas.

Table 1. FY17-FY20 Hawaiian stilt nesting at the WLOP. For Total Nests, first number denotes nests on pond liner, second number denotes nests in upland areas (Carnes 2021, in litt.).

	FY17	FY18	FY19	FY20
Total Nests	3 (2/1)	6 (2/4)	4 (0/4)	3 (2/1)
Total Eggs Laid	12	20	19	11
Total Hatchlings	5	2	3	2
Total Fledglings	2	1	3	0
Hatching Success Rate	42%	10%	16%	18%
Fledgling Success Rate	40%	50%	100%	0%

Hawaiian coot

The Hawaiian coot population on Oahu has fluctuated between approximately 500 to 1,000 birds in recent years (USFWS 2011; DOFAW unpublished data 1976-2008). Large concentrations of coots occur at the Honouliuli Unit of the Pearl Harbor NWR, as well as Kii Unit of James Campbell NWR, Kahuku aquaculture ponds, the Kuilima wastewater treatment plant, Kaelepulu Pond in Kailua, and the Hawaii Prince Golf Course in southwestern Oahu (USFWS 2011; USFWS 2020 in litt.). Coots may utilize open and shallow water areas at the WLOP for foraging and sheltering, and construct nests around the edge of the pond. Between September 2018 to March 2021, one to three coots have been observed year-round at the WLOP, with one nest containing five eggs recorded in 2019 (Navy 2021).

Hawaiian gallinule

Approximately half of the State's total population of the Hawaiian gallinule (an average total of 287 birds over 10 years from 1998 to 2007) occurs on Oahu (DOFAW 1976-2008, USFWS 2011). Due to the inaccuracy of the methodology used in counts for this species, an accurate population estimate is not available (USFWS 2011). Hawaiian gallinule are widely distributed on Oahu, but are most common on the northern and eastern coasts between Haleiwa and Waimanalo (USFWS 2011). No gallinules have been observed during bi-weekly surveys at the WLOP, however, small numbers are consistently observed at the nearby Honouliuli and Waiawa units of the Pearl Harbor NWR (USFWS 2011, USFWS 2020 in litt., Navy 2021).

Factors affecting the species environment within the action area

The main factors potentially impacting the Hawaiian waterbird species within the action area include human disturbance and predation (Navy 2021). Non-native species and predators observed or captured at the site include the cattle egret (*Bubulcus ibis*), small Indian mongoose (*Herpestes auropunctatus*), and domestic cat (*Felis catus*) (NAVFAC Hawaii raw data and Quarterly Field Reports, 2016-2020, United States Department of Agriculture Monthly Wildlife Damage Reports, 2016-2020 in Navy 2021).

CONSEQUENCES OF THE ACTION*Operations and Maintenance*

Human presence and noise associated with routine maintenance activities, such as clearing debris and vegetation from the overflow flex hose and upland areas, sewer manhole cleaning, inspections and rehabilitation, sewer line hydro-cleaning, preventive maintenance, repair and replacement of various gate, plug, check and air release valves, motors and pumps, along with emergency generator, general electrical and SCADA maintenance have the potential for short-term disturbance to foraging, loafing/sheltering, and nesting activities of the three Hawaiian waterbird species. Based on implementation of conservation measures to avoid and minimize disturbance such as education of maintenance personnel and contractors, timing of maintenance activities outside of the breeding season, and year-round surveys for waterbird presence, we anticipate adverse effects to the Hawaiian waterbird species as a result of routine maintenance

activities would be insignificant (too small to measure) or discountable (highly unlikely to occur).

Water levels at the WLOP are maintained to accommodate wastewater from facilities and vessels, as well as to deter nesting activity or avoid flooding of nests. There is the potential for adverse effects to Hawaiian stilt and Hawaiian coot nests as a result of flooding due to higher than expected water levels. The occurrence of higher than expected water levels is more likely during years when RIMPAC exercises are held due to increased wastewater loads from facilities and participating vessels. RIMPAC exercises are typically month-long in duration, held every two years, and scheduled to resume in 2022. Flooding of nests would result in the loss/mortality of Hawaiian stilt (on average four eggs or unfledged chicks per nest) and Hawaiian coot (on average five eggs or unfledged chicks per nest). Implementation of the following conservation measures will help to minimize the occurrence of flooding of Hawaiian stilt and Hawaiian coot nests: maintaining high water levels to prevent sludge build-up and reduce surface area for nesting on the pond liner; weekly surveys for waterbird/nest presence/sludge build-up; passive hazing to discourage waterbird presence/nesting; increased monitoring and water level maintenance protocols if nests are established on the pond liner; and regular coordination between NAVFAC Hawaii Natural Resources and NAVFAC UM Wastewater, Port Operations, and others.

Natural Resources Management Actions

Surveys

Human presence during waterbird surveys have the potential for short-term disturbance to foraging, loafing/sheltering, and nesting activities of the three Hawaiian waterbird species. Implementation of survey protocols to monitor at a distance from a single location when possible, will minimize potential disturbance. In addition, regular surveys of waterbird presence and nesting activity will assist in the management of water levels and aid in the ability to avoid potential impacts to nesting. Based on the above information, we anticipate adverse effects to the Hawaiian waterbirds from the proposed survey activities would be insignificant or discountable.

Trail camera nest monitoring

Deployment of trail cameras and weekly maintenance checks create the potential for short-term disturbance to foraging, loafing/sheltering, and nesting activities of the three Hawaiian waterbird species. In addition, proximity of cameras to waterbird nests have the potential to adversely affect the Hawaiian stilt and Hawaiian coot in the form of nest abandonment and increased predation. Implementation of conservation measures to place cameras at a distance of 10 feet and to avoid nests when occupied by adults will avoid adverse impacts to waterbird nesting. Based on the above information, we anticipate adverse effects to the Hawaiian waterbirds from the proposed trail camera nest monitoring activities would be insignificant or discountable.

Passive hazing

Implementation of passive hazing tools have the potential to adversely affect the three Hawaiian waterbird species by discouraging the use of potential foraging, loafing/sheltering, and nesting habitat at the WLOP. However, based on predation rates being on par with other wetland habitats and limited foraging and nesting habitat provided at the WLOP, the site is not considered high quality habitat. Moreover, several sites with more suitable wetland habitat exist

within a 5-mile radius, including Honouliuli and Waiawa Units of the Pearl Harbor NWR (1.5 and 2.5 miles, respectively), Pouhala Marsh (1.9 miles) and Ordy Pond (4.75 miles). It is expected that birds displaced from the WLOP by hazing will relocate to more optimal habitat, where they are likely to experience increased nesting success. Based on the above information, we anticipate adverse effects to the Hawaiian waterbirds from passive hazing activities would be insignificant or discountable.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur within the action area considered in this BiOp. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA, as appropriate. The Service is unaware of any foreseeable non-Federal actions within the action area.

CONCLUSION

The Service has determined that the implementation of the proposed action, including the operations and maintenance of the WLOP, is anticipated to result in the inundation and complete loss of up to 15 Hawaiian stilt nests (60 eggs or unfledged chicks) and 5 Hawaiian coot nests (25 eggs or unfledged chicks) every 10 years. This level of take is based on an average of 1.5 Hawaiian stilt nests per year on the pond liner that are at risk of flooding, and 1 Hawaiian coot nest that is at risk of flooding every two years due to unanticipated increases in water levels at the WLOP primarily during RIMPAC exercises. No Hawaiian gallinule have been observed nesting at WLOP, therefore we do not anticipate any loss of gallinule nests due to inundation there. Implementation of conservation measures is expected to reduce the likelihood of flooding overall, particularly in non-RIMPAC years. The number of individuals potentially harmed or killed by the action is estimated to be a very small portion of the total population of these species on Oahu.

Considering the species' overall population numbers and distribution and the low reproductive success at WLOP, the impacts caused by this action may result in adverse effects on a very small portion of the potential population. Therefore, the action poses the potential for limited impacts to the three endangered Hawaiian waterbird species, but would not result in a significant reduction in the species' survival or recovery potential.

After reviewing the status of the species, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that implementation of the proposed action, discussed herein, is not likely to jeopardize the continued existence of the Hawaiian waterbirds. Critical habitat has not been designated for the Hawaiian waterbirds, therefore, will not be adversely affected through implementation of the proposed actions.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in

any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including, breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Navy so that they become binding conditions for the exemption in section 7(a)(2) to apply. If the Navy fails to assume and implement the terms and conditions or fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(a)(2) may lapse. In order to monitor the impact of incidental take, the Navy must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement and reporting requirements below [50 CFR 402.14(i)(3)].

Amount or Extent of Take Anticipated

Based on the analysis presented in this BiOp, the Service anticipates the following take may occur as a result of the proposed action: Incidental take of no more than 60 Hawaiian stilt eggs or unfledged chicks (15 nests) and 25 Hawaiian coot eggs or unfledged chicks (5 nests), in the form of mortality due to nest inundation associated with unexpectedly high wastewater levels in the pond may occur over the next 10 years. Take would be exceeded if the number of stilt eggs or chicks or the number of coot eggs or chicks is reached before the end of the 10-year period, or if take of any Hawaiian gallinule nests occurs resulting in the loss of eggs or unfledged chicks, or if any take of fledged or adult stilts, coots, or gallinules occurs, or if take occurs in a form not considered in this BiOp.

Effect of Take

In this BiOp, the Service has determined that this level of anticipated take is not likely to result in jeopardy of the Hawaiian coot, Hawaiian common gallinule, or Hawaiian stilt. As explained in the Effects of The Action section above, the Service believes that the implementation of the Navy's proposed actions will not significantly alter the three Hawaiian waterbirds ability to feed, breed, or take shelter, and the overall population of the species would not be affected. There will be minimal consequences to feeding, breeding, and sheltering due to the temporary disturbances, however those consequences are offset by the ability for the species to accomplish those life functions where appropriate habitat exists in the immediate vicinity of the action area.

Reasonable and Prudent Measures

The reasonable and prudent measures given below, with their implementing terms and conditions, are designed to minimize the impacts of incidental take that might otherwise result

from the proposed actions. If, during the course of the action, the level of incidental take is exceeded, this represents new information requiring reinitiating of consultation and review of the provided reasonable and prudent measures. In addition, the action that caused the taking must cease; the action agency must immediately provide an explanation of the causes of the taking; and must review with the Service the need for possible modification of the reasonable and prudent measures.

The following reasonable and prudent measures are non-discretionary and must be implemented to minimize the effect of take on the three Hawaiian waterbirds in this consultation:

1. The Navy shall minimize the potential for death or injury of the three Hawaiian waterbirds.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Navy must comply with the following terms and conditions that outline required reporting and monitoring requirements.

These terms and conditions are non-discretionary:

Minimize impacts of the Navy's activities on the survival and reproduction of the three Hawaiian waterbirds.

- The Service shall be notified within 24 hours of a take incident. In addition, a report shall be submitted to our office in writing within three days of the incident.
- Should an injured waterbird be found, the waterbird should be taken to a permitted wildlife rehabilitation facility. Before transporting the injured waterbird, the Navy will coordinate with the wildlife rehabilitation facility to determine proper procedures.
- Should there be a take of a waterbird and the carcass recovered, the depository designated to receive specimens is the Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii, 96817 (Telephone: 808-847-3511). If the Bishop Museum does not wish to accept the specimen, the Navy will contact the Service's Division of Law Enforcement in Honolulu, Hawaii (Telephone: 808-861-8525) for instructions on disposition.
- The Navy will monitor and report on the levels of take that occur between January 1 and December 31 each year.
 - The annual report will document the effectiveness of all monitoring actions, and will summarize annual counts of waterbirds found.
 - The report will be submitted by the first business day of March each calendar year to the Service's Pacific Islands Fish and Wildlife Office (300 Ala Moana Boulevard, Room 3-122, Honolulu, Hawaii 96850).

CONSERVATION RECOMMENDATIONS

Section 7(a) (1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to

help implement recovery plans, or to develop information. The Service does not have any conservation recommendations for the Navy at this time.

REINITIATION-CLOSING STATEMENT

This concludes formal consultation on the proposed action considered in this BiOp. As provided in 50 CFR § 402.16, re-initiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) if the amount or extent of taking specified in the incidental take statement is exceeded; (2) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action.

If you have any questions concerning this consultation, please contact James Kwon, Fish and Wildlife Biologist, at 808-792-9443 or by email at james_kwon@fws.gov.

Sincerely,

**GREGORY
KOOB**

Digitally signed by
GREGORY KOOB
Date: 2021.08.13
12:52:41 -10'00'

Gregory A. Koob
Assistant Field Supervisor for Programmatic
Operations

Enclosure: Appendix A, Passive Hazing Plan to deter ESA-listed bird nesting at West Loch Oxidation Pond

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In litt.

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N-4 Consultations

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850



In Reply Refer To:
J-2-2004-J-207

SEP 10 2004

Mr. R. M. Wakumoto
Director, Regional Environmental Department
Navy Region Hawaii
850 Ticonderoga Street, Suite 110
Pearl Harbor, Hawaii 96860-5201

Dear Mr. Wakumoto:

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Thank you for your July 23, 2004, letter in which you request that the U.S. Fish and Wildlife Service (Service) concur that the activities at the Naval Computer and Telecommunications Area Master Station Pacific may affect, but are not likely to adversely affect the endangered *Cyperus trachysanthos*. This letter was received July 30, 2004. Dr. Greg Koob, of this office, participated in a site visit on July 14, 2004, to observe the *C. trachysanthos* population. During the site visit recommendations were discussed that would allow the Navy to continue its operations and avoid adversely affecting this species.

The Navy proposes to implement the following management actions:

- install warning signs and markers to delineate plant habitat occurrence(s)
- brief the maintenance personnel on the location of listed plants and prohibited activities
- suspend mowing when there is mud in the depression where the plants have been observed
- monitor the plants by observing seed fall, until at least 50 percent of the seeds have fallen from the plants, and
- resume mowing when the mud hole is not present and after at least 50 percent of the seeds have fallen.

We reviewed the information you provided and with implementation of the above mentioned management actions, we concur with your determination that the proposed action is not likely to adversely affect *Cyperus trachysanthos*. If you have any questions, please contact Dr. Greg Koob, Fish and Wildlife Botanist (phone: 808/792-9400; fax: 808/792-9580).

Sincerely,


Jeff M. Newman
Acting Field Supervisor



DEPARTMENT OF THE NAVY

COMMANDER
NAVY REGION HAWAII
850 TICONDEROGA ST STE 110
PEARL HARBOR HI 96860-5101

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Ser N465/
23 JUL 2004

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Ser N465/
23 JUL 2004

Mr. Jeff M. Newman
Acting Field Supervisor
U. S. Fish & Wildlife Service
Pacific Islands Office
300 Ala Moana Boulevard Room 3-122
P. O. Box 50088
Honolulu HI 96850-0001

SUBJECT: INFORMAL CONSULTATION FOR THE MANAGEMENT OF *CYPERUS*
TRACHYSANTHOS AT NAVAL COMPUTER AND TELECOMMUNICATIONS AREA
MASTER STATION PACIFIC (NCTAMSPAC)

Dear Mr. Newman:

This letter is a follow-up regarding our on-site management of *Cyperus trachysanthos* recently found at the Naval Computer and Telecommunications Area Master Station Pacific, Radio Transmitting Facility (RTF) Lualualei (FWS ref number TES-1-2-2004-0036; Navy letter dated May 17, 2004, reference number Ser N465/00279).

On July 14, 2004, Dr. Greg Koob, of your office, participated in a site visit to the *C. trachysanthos* population to observe the plants and discuss recommendations that would allow the Navy to continue its operations at RTF Lualualei with minimal impact to this species.

The Navy proposes to implement the following management actions:

- a. Suspend mowing during onset of a "wet season."
- b. Installation of warning signs and markers to delineate plant habitat.
- c. Brief maintenance personnel of location and prohibited activities.
- d. Monitor the plants for seed fall.
- e. Resume mowing when mud hole is not present (and after seed fall).

The mud hole in the drainage ditch will be used as an indicator of the "wet season." When the mud hole appears during a rainy season, known sites and adjacent areas will be monitored for *C. trachysanthos*. When present, sites will be marked and mowing ceased in areas currently known to contain this species, or new areas found to contain the species, until the plants have grown, flowered, fruited, and dropped their seeds.

Protection from fire and control of competing alien plants has been determined to be needed recovery actions in the "Recovery Plan for the Multi-Island Plants" (USFWS, 1999). There have been two fires on the installation in the last decade with the latest occurring in July 2003. Due to the inherent risk of fire from the drying vegetation, it is prudent to resume mowing when a qualitative assessment determines that more than 50% of the seeds have fallen. This will ensure establishment of a seed bank for future generations of this species, adequately reduce the risk from fires, and reduce competition from woody plants and other alien vegetation.

This species acts as an annual in seasonally wet areas such as the RTF Lualualei site. After it has grown, flowered, fruited and dropped its seeds the plants will die back during dry times. For example, this species has never been previously recorded in the RTF Lualualei facility and only showed up with the onset of wet weather and the presence of standing water in the current locations. Mowing of the tops of the plants (i.e. removal of the uppermost portions of the drying leaves) after seed drop and during the dry season will not significantly affect the numbers, distribution or reproduction of this species.

It is the Navy's determination that implementation of these management activities may affect, but are not likely to adversely affect *C. trachysanthos*. We request your concurrence with this determination.

Thank you for your cooperation and assistance in developing these management actions. Should you have any questions regarding the information provided, please contact Mr. Randy Miyashiro, at 471-1171, extension 233 or email at: randy.miyashiro@navy.mil.

Sincerely,

R. M. WAKUMOTO
Director
Regional Environmental Department
By direction of
Commander, Navy Region Hawaii

1105. 1A2P



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Blvd, Rm 3-122
Box 50088
Honolulu, HI 96850

In Reply Refer To:
1-2-2002-I-117

SEP 25 2002

Melvin N. Kaku
Environmental Planning Division
Department of the Navy, Pacific Division
Naval Facilities Engineering Command
258 Makalapa Dr., Ste. 100
Pearl Harbor, Hawaii 96860-3134

Dear Mr. Kaku:

Re: Informal Consultation for Possible Effects of Mowing on *Marsilea villosa* at
NCTAMSPAC

The U.S. Fish and Wildlife Service (Service) has reviewed the information in your August 22, 2002, letter concerning a proposal to change the grass mowing strategy within the antennae fields at Naval Computer and Telecomm Area Master Station Pacific (NCTAMSPAC) where a population of the endangered fern, *Marsilea villosa*, is known to occur. Currently, the Navy abides by an agreement with the Service in which the area where *Marsilea villosa* occurs is mowed only after the plants have completely dried and are dormant for the season. The Navy sets the mower blades at a height that allows the mower to cut the invasive grasses, while leaving the *Marsilea villosa* uncut. Under this regime, invasive grasses, that may increase the risk of wildfire, are allowed to seed before mowing occurs. In order to control the reproductive output of invasive grasses, the Navy proposes that, in addition to the late summer mowing, the vicinity will also be mowed during the spring or early summer when *Marsilea villosa* are emergent.

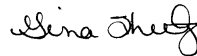
We concur with the Navy's determination that this activity is not likely to adversely affect *Marsilea villosa* or its proposed critical habitat (see enclosed map), based upon the current mower blade height and the past history of not impacting the *Marsilea villosa* when mowing occurred. While the mowing may occasionally impact a small minority of leaves of *Marsilea villosa* that could grow abnormally high, this is extremely unlikely, and the action will be beneficial to the species, since it will not only be likely to decrease the risk from wildfire, but may also eliminate some competition for light and water from the invasive grasses.

Melvin N. Kaku

2

If you have questions or comments, please contact Fish and Wildlife Biologist Christina Crooker at (808) 541-3441.

Sincerely,


Paul Henson
Field Supervisor

Marsilea villosa Proposed Critical Habitat

Lualualei Naval Magazine



Lualualei Naval Magazine

Marsilea villosa Proposed Critical Habitat

Map Location



U.S. Fish and Wildlife Service
Pacific Islands Office



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N-5 JBPHH Example BMPs

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This appendix is meant to help ensure Best Management Practice (BMP) guidance is analogous between projects. It can also be used as a starting point to discuss how projects can avoid and minimize impacts. However, these BMPs are not meant to avoid consultation. In many cases this language can and will be incorporated into consultation documents. Additionally, each individual project will still need to be reviewed by a Subject Matter Expert.

BMPs	Elevated Noise	Sedimentation and Turbidity	Disturbance from Human Activity and equipment	Physical Impact (EFH benthic impact)	Collision with Vessels	Entanglement & Entrapment	Waste & Discharge	Invasive Species	Shading	ESA	EFH
A contingency plan to control and clean spilled petroleum products and other toxic materials (from a vessel or on land) is required. Appropriate materials to contain and clean potential spills will be stored and readily available at the activity site.							x			x	x
All equipment will be inspected daily. If found to be leaking, it will be removed from the action site immediately and will only be returned once it is repaired and fully operational.			x				x			x	x
All equipment used for construction will be used in a manner that will minimize the suspension of sediment into the water column.		x	x	x						x	x
All fueling or repairs to equipment must be done in a location with the appropriate controls that prevents the introduction of contaminants to marine environment.			x				x			x	x
All material associated with concrete work will not be released into the water column. All forms shall be water-tight and sealed in order to prevent leaking.							x			x	x
All personnel will stay more than 50 yards away from Hawaiian monk seals and sea turtles that haul-out on land.			x							x	
All project related debris and other waste will be contained and will not enter or remain in the marine environment. The Contractor or other shall provide a temporary platform or other suitable means of capturing debris from construction, and these structures shall be in-place prior to commencing in-water activities.							x			x	x
All project-related materials and equipment placed in the water shall be free of pollutants.			x				x			x	x
All sightings of ESA-listed marine species shall be recorded.			x		x	x				x	
Any debris released during construction or other activity will be contained within the barrier and removed.		x					x			x	x
Appropriate materials to contain and clean potential spills shall be stored at the work site, and be readily available.							x			x	x
Collect all accumulated sediment and/or debris and remove them entirely from the water and place onto a surface vessel; debris should not be towed outside a containment.		x		x			x			x	x
Comply with vessel operating procedures: - When piloting vessels, vessel operators shall alter course or halt in order to remain at least 50 yards from ESA-listed species - When piloting vessels at or within 50 yards from ESA-listed species, reduce vessel speed to 10 knots or less In areas of known or suspected sea turtle activity, vessel operators shall be vigilant to watch for sea turtles at or near the surface, and if practicable, reduce vessel speed to 5 knots or less. - If an ESA-listed species approaches the vessel, vessel operators will put the engine in neutral until the animal is at least 50 yards away, and then move away slowly. - Marine mammals and sea turtles shall not be encircled nor trapped between multiple vessels or between vessels and the shore.	x		x		x					x	
Constant vigilance shall be kept for the presence of ESA-listed species during all aspects of the proposed action, particularly during in-water activities such as boat operations, operating pre-drilling and pile driving equipment, and deployment of silt curtain, anchors, and mooring lines.	x		x		x	x				x	

Marine

During all in-water activities, observer will use binoculars to survey the project area each day, beginning 30 minutes prior to the start of work and repeated hourly throughout the day. - During the survey period, the observer shall record the environmental and project-related information, including but not limited to date, time, weather, action undertaken, and any ESA-listed marine animals. - If no ESA-listed marine animal is sighted during the survey period, the project activities may commence. - If an ESA-listed marine animal is sighted during the survey period, the observer shall alert the on-site foreman or other immediately via radio communications, and the animal shall be monitored continuously. If the animal is within 50 yards (or within the determined PTS or TTS distance during other activities like pile driving) of the in-water activity, animal behavior observations shall be recorded. Work may not commence until the animal departs the area voluntarily or after 30 minutes passed since the last animal sighting.	x		x				x				x	
Ensure that all concrete grout, cement, sealant, and epoxy used are non-toxic and non-hazardous to aquatic organisms.							X				x	x
Ensure that all gravel used during construction is prewashed and is clean prior to be installed.							X				x	x
Fueling of land-based vehicles and equipment shall take place at least 50 ft. away from the water, preferably over an impervious surface. Fueling of vessels shall be done at approved fueling facilities. With respect to equipment (e.g. on the barge crane) that cannot be fueled out of the water, spill prevention booms will be employed to contain any potential spills. Any fuel spilled will be cleaned immediately.			x				x				x	x
If a plume is observed outside of the silt curtains, project activity will stop and corrective action will be taken immediately. Work shall resume after the correction was made		x		x							x	x
If practical use vibratory hammering and/or a cap to minimize the impact of noise on ESA-listed species and EFH.	x		x								x	x
Implement measures to attenuate the sound or minimize impacts to aquatic resources during piling installation. Methods to mitigate sound impacts include, but are not limited to, the following: surround the pile with dewatered cofferdam and/or air bubble curtain system.	x		x								x	x
In the event of approaching tropical storms and hurricanes, equipment will either be removed from the project site or adequately secured.		x	x	x	x	x	x				x	x
Install sediment, turbidity, and/or pneumatic curtains, and use real-time monitoring (automated or manual) to detect failure and implement stop-work processes if pre-determined project thresholds are reached (use standards from Clean Water Act 401 water quality certification). In areas of soft sediment, consider partial length turbidity curtains in order to reduce resuspension of sediment during high winds and currents.		x		x							x	x
Installment of the barrier around the project footprint will be closely monitored. Once installed, the barrier will be deployed only as long as needed to accomplish the desired task.		x				x					x	x
In-water tethers and mooring lines for vessels and marker buoys shall be kept to the minimum lengths necessary and shall remain deployed only as long as needed to accomplish the required task.		x	x	x		x					x	x
Neutralize or treat contaminated sediments and/or waters prior to release from project site.		x					x				x	x
No pile driving will be conducted after dark.	x		x								x	
No waste water shall be discharged to the harbor and/or ocean.							x				x	x

Marine

Operators shall perform daily pre-work equipment inspections for cleanliness and leaks. Should a leak be detected, all heavy equipment operations shall be postponed or halted and shall not proceed until the leak is repaired and equipment cleaned.			x				x			x	x
Prevent bentonite drilling fluid from contacting live benthic organisms.			x	x			x			x	x
Prevent debris from entering the marine environment.			x	x			x			x	x
Prevent discharges of chemicals and other fluids dissimilar from seawater into the water column.			x	x			x			x	x
Prior to commencing in-water work, the Navy, Contractor, or other shall ensure that all contracted vessel and barges complete an aquatic invasive species (AIS) risk assessment that meets the biosecurity standards defined by the Navy and the State of Hawaii.			x					x		x	x
Prior to mobilizing, ensure all activities and construction equipment, ballast, and vessel hulls do not pose a risk of introducing new invasive species and will not increase abundance of those invasive species present at the project location.			x					x		x	x
The barrier around the project area shall be installed in place with care in order to minimize impact to the natural environment.			x	x						x	x
The project manager, action proponent or other shall designate an appropriate number of competent observers to survey the areas adjacent to the proposed action for ESA-listed marine species.			x							x	
Turbidity and siltation from project-related work shall be minimized and contained through the appropriate use of erosion control practices, effective silt containment devices, and the curtailment of work during adverse weather and tidal/flow conditions. During all in-water or over-water work, silt curtains that extend the full depth of the water column will completely enclose the work area to the maximum extent practicable.		x		x			x			x	x
Use diffusers on the end of subtidal discharge pipes to minimize impacts from discharges.							x			x	x
Use vibratory hammer to install piles when possible. Under conditions where impact hammers are required, when possible, drive as deep as possible with vibratory hammer prior to the use of impact hammer.	x		x							x	x
Whenever possible utilize environmental clamshell buckets for mechanical dredging.		x	x							x	x
Workers shall not attempt to feed, touch, ride, or otherwise intentionally interact with any ESA-listed species.			x							x	
All anchors will be set on sandy bottom devoid of corals and seagrass (if possible). Anchor locations will be chosen based on considerations of potential damage that could occur from the anchor chain if the vessel swings due to currents or tides.			x	x							x
All objects will be lowered to the bottom (or installed) in a controlled manner. This can include the use of buoyancy controls such as lift bags, or the use of cranes, winches, or other equipment that affect positive control over the rate of descent.		x	x	x							x
All physical contact with the bottom will be minimized to the extent possible and will be restricted to unconsolidated sediment that is devoid of corals and seagrass.			x	x							x
When feasible design the structure to maintain or replicate natural stream channel and flow conditions to the greatest extent practicable.		x	x								x
If feasible conduct work during the dry season and/or calm sea states; cease work during adverse weather conditions (e.g. high winds, strong currents, high surf, heavy rains, and storms).			x	x							x
If feasible conduct work in the intertidal zone during the low and/or slack tides.			x	x							x

Terrestrial

	Tree Trimming	Barbed Wire Fencing	Clearing Mangroves	Green Waste	Landscaping	Hawaiian Waterbird Habitat	Active Nests in Trees/Bushes	Standing water in BASH Zone	Night Lighting	ESA	MBTA	EO 13112/12751, Invasive Species
BMPs												
Trees 15 feet in height or taller should not be trimmed or cleared during the Hawaiian hoary bat pupping season (<i>June 1st through September 15th</i>). If removal cannot be avoided during this period, thermal IR surveys may be required prior to removal.	x			x	x		x			x		
Fencing should avoid the use of barbed wire whenever possible to avoid impacts to the Hawaiian hoary bat. If fencing includes barbed wire.		x								x		
Attention will be paid to minimize disturbance of sediments causing turbidity. A turbidity curtain may be employed when necessary to contain disturbed sediment.			x							x	x	x
No material shall be discharged into navigable water (<i>i.e., Pearl Harbor, Māhala Bay, or Āhūa Reef</i>).	x		x	x	x	x						x
In order to prevent mangrove re-growth once the initial clearing is complete, monthly/bi-monthly efforts must be made to clear mangrove propagules and re-growth for a minimum of one year (ideally for two years) beyond initial clearing.	x		x	x	x	x						x
Mangrove on firm ground shall be cut down to the existing ground level without disturbing the ground.			x	x	x							x
Mangrove in the water shall be cut down to a uniform height between mean lower low water (MLLW) and six inches above MLLW, based on tidal datum on local tide tables. These mangroves shall be cut without pulling of the roots and disturbance of the sediments.			x	x	x							x
All green waste generated should be disposed of as outlined in the Greenwaste Management Plan to prevent the spread of the Coconut Rhinoceros Beetle	x		x	x	x							x
Incorporate Hawaiian native flora as much as possible in landscape designs.					x						x	x
Ensure potted plants brought onto JBPH-H are inspected and free from invasive pests such as coqui frogs, insect infestations (ants, etc.) and coconut rhinoceros beetles, etc.					x							x
Project personnel and contractors shall be informed about the presence of endangered species.	x		x		x	x	x	x		x	x	
In areas where waterbirds are known to be present, post and implement reduced speed limits.						x				x	x	
Hawaiian waterbird nest surveys will be conducted when appropriate habitat occurs within the vicinity of the proposed project site. Surveys will be repeated again within three (3) days of project initiation and after subsequent delays of work of three (3) or more days (during which birds may attempt to nest).						x				x	x	
Establish and maintain a 100-foot buffer around all active nests and/or broods until the chicks/ducklings have fledged. No potentially disruptive activities or habitat alteration will occur within this buffer.						x				x	x	
If a nest or active brood is found a biological monitor that is familiar with the species' biology will be present on the project site during all construction or earth moving activities until the chicks/ducklings fledge to ensure that Hawaiian waterbirds and nests are not adversely impacted.						x				x	x	
When clearing vegetation, the contractor must verify that trees or bushes scheduled for removal do not contain the active nests of migratory birds.	x				x	x	x			x	x	
Pueo adults/nests/chicks are found and/or flushed out during clearing operations, contractors must stop work and immediately. Note: Pueo are ground nesters							x				x	
If the proposed action is located within the Bird Aircraft Strike Hazard (BASH) Management Emphasis Area: the final project design should ensure that no standing water accumulates at the project site during or after construction. If dewatering basins are installed, they must have bird deterrents (<i>bird balls, etc.</i>) in them at all times.						x		x		x	x	

Terrestrial

Avoid all night lighting not needed for Anti-Terrorism/Force Protection (AT/FP) or personnel safety, and install only full cutoff exterior down-lighting fixtures for all new construction whenever possible. Exterior lights shall be LED lights with full cut-off fixtures to comply with the MBTA. Lights that are International Dark sky Association (IDA http://www.darksky.org) certified are preferred.										x	x		x	
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