

3.9 BIOLOGICAL RESOURCES

3.9.1 Introduction/Region of Influence

Mākua Military Reservation

This section describes biological resources around MMR. As shown in Figure 3.9-1, the ROI includes the following:

- MMR and a buffer area around it that corresponds with that identified in the 2007 BO (USFWS 2007b);
- Trails where troop marches are proposed or are currently conducted, plus a 164-foot (50-meter) buffer area paralleling both sides of these trails; and
- Coastal areas adjacent to project activities.

The coastal portion of the ROI is made up of Mākua Beach, in its entirety, and contiguous waters out to 0.5 mile (0.8 kilometers). The coastal portion of the ROI was determined based on a combination of helicopter use patterns and high-use dolphin habitat (Dollar 1999; Lammers 2003a).

For the 2007 ESA Section 7 consultation, the action area was determined by running the fire spread model Fire Area Simulator (FARSITE) (Finney 1998). This model accounts for the area that would be impacted by an un-suppressed fire ignited at the outer perimeter of the potential ignition area for all weapons, with high risk weather conditions. The model calculated fire spread based on hourly inputs of weather data and GIS-generated maps of vegetation fuels, canopy characteristics, slope, elevation, and aspect.

The extent of the ROI for this EIS is based on the following:

- Types of vegetation /fuel load;
- Fire history;
- Natural and human-made barriers;
- Fire fighting resources and capabilities of state, federal, and Army;
- The extent of noise and visual impacts along the trails and coastal edge of MMR (beach, shoreline, and a portion of the coastal waters over which aircraft maneuvers may occur); and
- Trampling and erosion in areas where troop marches are proposed.

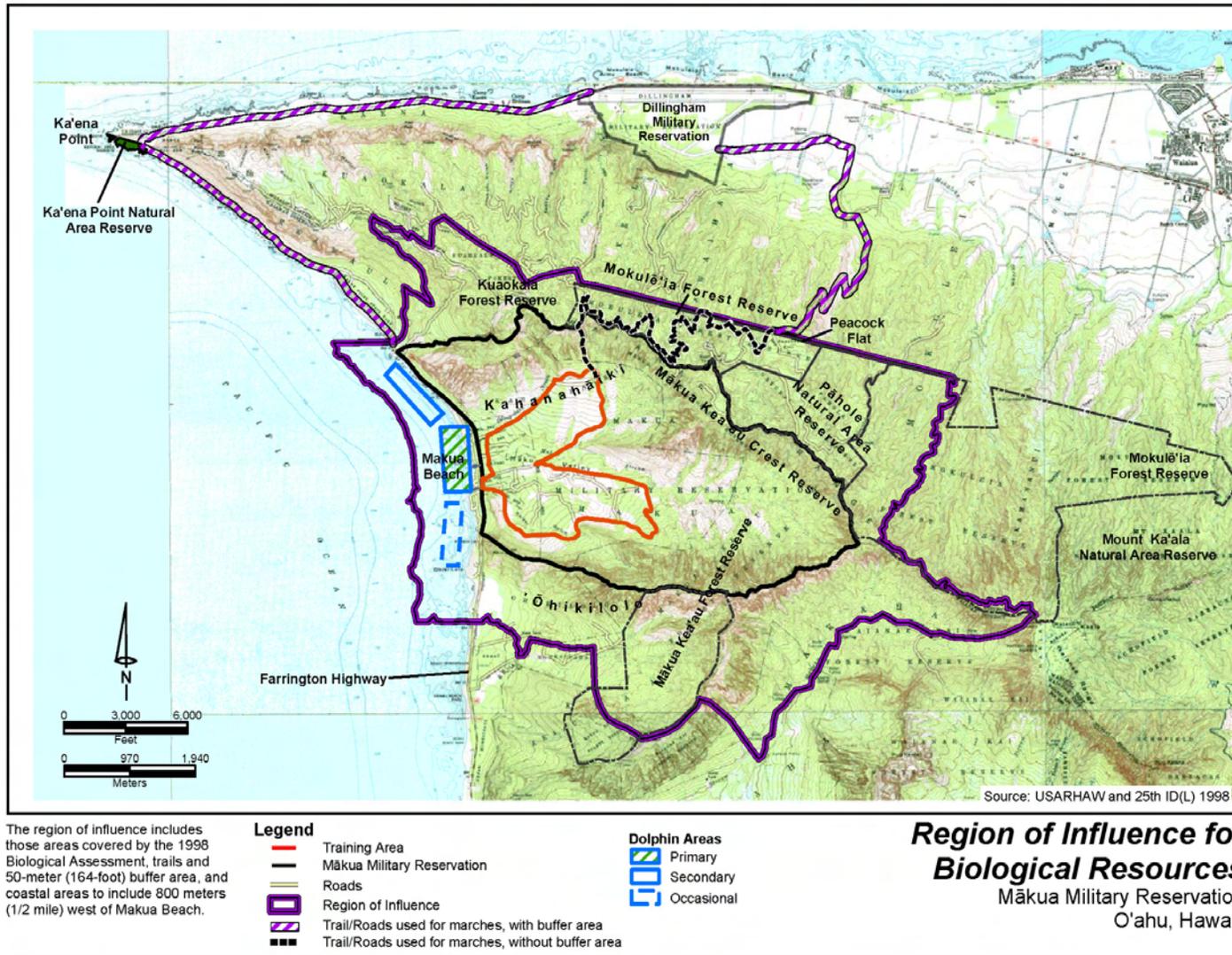


Figure 3.9-1 Region of Influence for Biological Resources, MMR

Vegetation, wildlife, sensitive habitats, and special status species that have been recorded in or that have the potential to be found within this ROI, based on the presence of suitable habitat, are discussed in this section. Damages to the native, listed, and nonnative communities and species from the July 2003 prescribed burn (described in the Chapter 3 introduction) are discussed in this section as appropriate. Figure 3.9-2 presents the ROI for biological resources.

Biological resources in the ROI include those that are limited in number or habitat or restricted in movement (e.g., plants and small mammals). The resources also include those that are more mobile and can range onto and off the property from surrounding habitat areas (e.g., fish, birds, and terrestrial, and marine mammals). Marine wildlife and organisms, including coral, are evaluated when they occur adjacent to or in the vicinity of the terrestrial ROI.

Neighboring lands along the Wai‘anae Mountain ridges include Pāhole Natural Area Reserve, Mokulē‘ia Forest Reserve, and Kuaokalā Forest Reserve (Figure 2-2). The Mākua Kea‘au Forest Reserve and private lands border MMR to the south. The lowland portions of MMR are mainly composed of nonnative plants and wildlife, as the result of years of agricultural use and, more recently, disturbance from training activities. The Wai‘anae Mountains, which border MMR to the north, east, and south, are less disturbed and are known to harbor many native and protected species. The coastal area adjacent to MMR has been disturbed by recreational activities but remains an important habitat for marine wildlife species (see Figure 3.9-1).

In addition to the project description in Chapter 2, the following assumptions were used for the analysis of project impacts:

- No smoking would be allowed during marches;
- Soldiers would be restricted to established trails or roads when on marches, and marching formation would conform to the width of the trail;
- Trails would be surveyed before and after each march by a qualified natural resource staff person, capable of determining if there has been damage to the trail and the surrounding flora and fauna that would contribute to species and habitat deterioration;
- DPW Environmental staff would brief Soldiers on sensitive area restrictions;

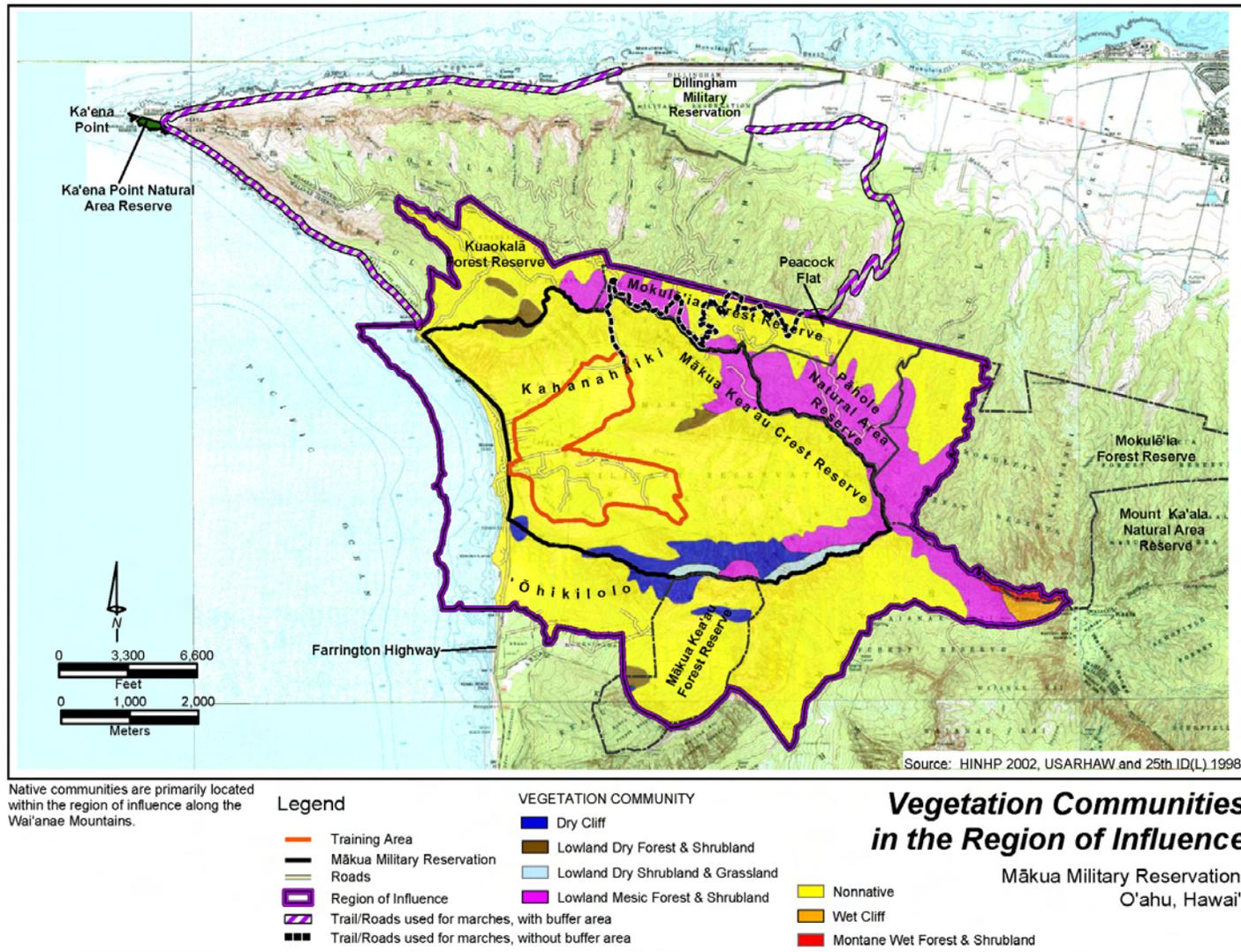


Figure 3.9-2 Vegetative Communities in the Region of Influence, MMR

- To ensure that Soldiers stay on the trails, trails would be marked with flagging tape prior to the march;
- If damage is detected to surrounding habitat, then the march protocol would be modified;
- Cadence would be prohibited along Ka'ena Point Trail marches during the Laysan albatross breeding season (November to July);
- All aircraft fire would be directed and confined to the ordnance impact area;
- Aircraft operations under Alternatives 1, 2, and 3 would be conducted as part of CALFEX training; and
- Ammunition would not be fired at areas outside the existing CCAAC firebreak road.

These assumptions are based on previous measures outlined in USFWS consultations, state Natural Area Reserve System (NARS) regulations, and Integrated Natural Resource Management Plan (INRMP) program statements.

Comments received during the scoping process by the public regarding biological resources include the following:

- Wildlife endangerment;
- Direct and indirect contamination of native plant and wildlife species;
- Measures to ensure ecosystem recovery;
- Alterations in marine mammal behavior;
- Threats to nesting patterns and habitat of native birds;
- Destruction of native plants and animals that are common sources of medicinal and nutritional benefits; and
- Land use management.

The history of fire at MMR and fire-inducing activities is discussed in Section 3.14, Wildfires. In addition, that section presents improvements the Army has made in recent years regarding fire management and provides an overview of the IWFMP.

Pōhakuloa Training Area

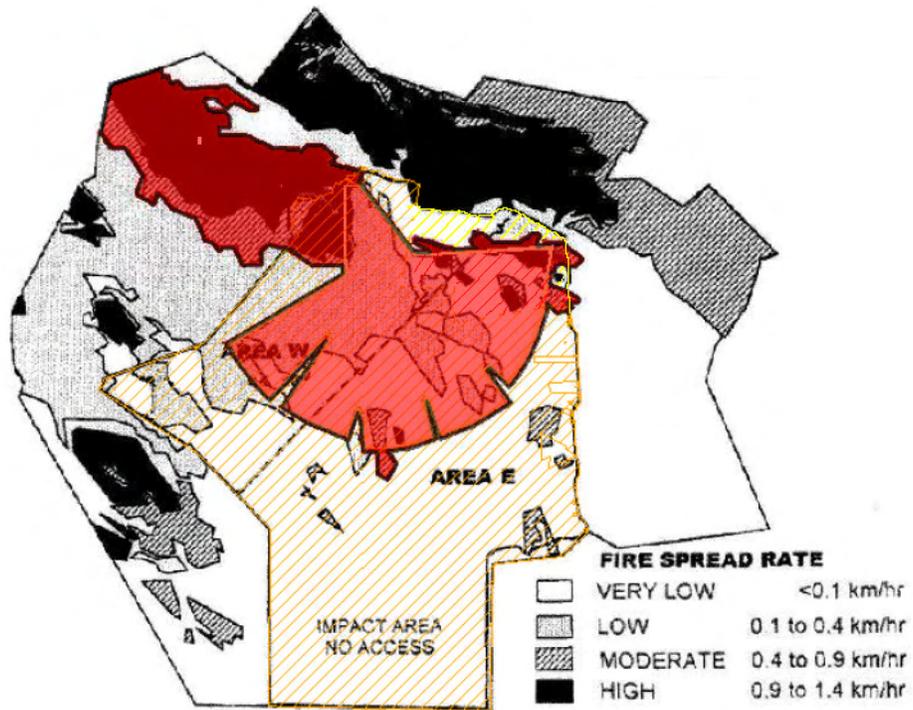
This section describes biological resources around the PTA range site alternative. As shown in Figure 3.9-3, the ROI for the Proposed Action includes the range footprint and the moderate to high fire spread rate areas that would be impacted by an unsuppressed fire ignited at the outer perimeter of the potential ignition area for all weapons, with high risk weather conditions.

The moderate to high fire spread rate areas that could result from fire ignition were determined by vegetation types of highest flammability and fire spread rate.

Vegetation (Figure 3.9-4), wildlife, sensitive habitats, and special status species that have been recorded in or that have the potential to be found within this ROI, based on the presence of suitable habitat, are discussed in this section.

Biological resources in the ROI include those that are limited in number or habitat or restricted in movement (e.g., plants and small mammals). The resources also include those that are more mobile and can range onto and off the property from surrounding habitat areas (e.g., birds and terrestrial mammals). The following assumptions were used for the analysis of project impacts:

- No smoking would be allowed within the training area or along routes used for marches or other dismounted activities;
- To avoid damage to sensitive habitat, Soldiers would be restricted to established trails or roads when on marches, and marching formation would conform to the width of the trail;
- Trails would be surveyed before and after each march by a qualified natural resource staff person, capable of determining if there has been damage to the trail and the surrounding flora and fauna that would contribute to species and habitat deterioration;
- DPW Environmental staff would brief Soldiers on sensitive area restrictions;
- To ensure that Soldiers stay on the trails, trails would be marked with flagging tape prior to the march;
- If damage is detected to surrounding habitat, then the march protocol would be modified;
- All aircraft fire would be directed and confined to the ordnance impact area;

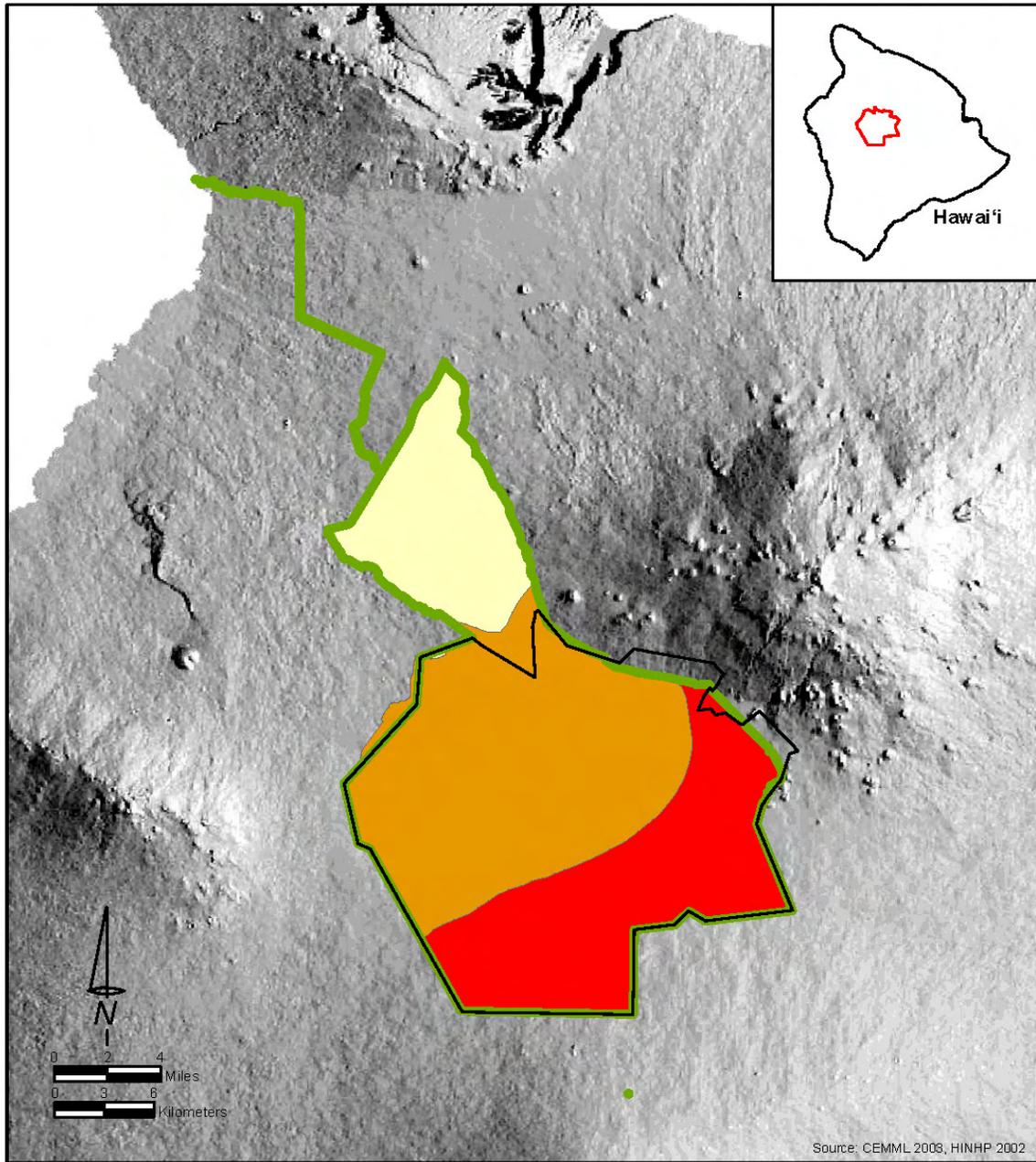


Legend

- Region of Influence
- Impact Area



Figure 3.9-3 Terrestrial and Aquatic Biological Region of Influence, PTA



The twenty eight sub-groups of vegetation communities occur within the main types identified here.

Legend

- Pōhakuloa Training Area Boundary
- Region of Influence

COMMUNITY

- Montane Dry Forest & Shrubland
- Nonnative
- Subalpine Dry Forest & Shrubland

**Vegetation Communities at the
Pōhakuloa Training Area
Terrestrial Biological Region of Influence**

Island of Hawai'i, Hawai'i

Figure 3.9-4 Vegetative Communities, PTA Terrestrial Region of Influence

- Aircraft operations would be conducted as part of CALFEX training; and
- Ammunition would not be fired at areas outside the existing impact area.

3.9.2 Biological Resource Management Mākuā Military Reservation

The environmental regulatory history of MMR includes consultation under ESA Section 7 for federally listed species and their federally designated or proposed critical habitat. During 1989 to 1991, the Army consulted with USFWS regarding the O‘ahu tree snail. In 1991, the USFWS released a BO, a legally binding memorandum produced at the end of formal consultation with that agency, stating that there would be “no jeopardy” to this species as long as the Army agreed to the following conditions:

- Eliminate the use of high fire-risk ordnance, such as flares and rockets;
- Limit firing of high-explosive and tracer munitions to inside the CCAAC firebreak road; and
- Produce semiannual reports of fires that escape control (USARHAW and 25th ID[L] 2001a).

In 1998, the Army initiated formal consultation with the USFWS under ESA Section 7 to determine if routine military training at MMR would jeopardize the continued existence of 41 endangered species. The Army also prepared a BA detailing routine training and conservation measures for 13 sensitive plant species considered stable in MMR. The remaining 27 plant species and one snail species are the subjects of a Mākuā Implementation Plan (MIP).

In July 1999, the USFWS issued a BO of “no jeopardy” for routine training at MMR that addressed the impacts of the proposed projects and conservation measures on threatened and endangered species (USFWS 1999c). A supplemental BO followed in October 2001, in which another no jeopardy opinion was issued (USFWS 2001a). The 2001 supplemental BO was issued as a result of additional Army restrictions to training (voluntary withdrawal of tracers, incendiary munitions, and TOW missiles) and the discovery of additional sensitive species in the management area.

The no jeopardy opinion depended on the Army doing the following:

- Creating an IWFMP;

- Implementing management actions for the 13 endangered species considered stable or for which only small portions of the population occur in the action area; and
- Preparing an implementation plan for other protected species.

The Army has been implementing these measures to achieve the following:

- Minimize negative effects on listed species and habitat to prepare for when the Army returns to training at MMR; and
- Help stabilize the population of these species.

As part of these measures, the Mākua Implementation Team (MIT) has developed a number of versions of the MIP (collectively referred to herein as the MIP) (MIT et al. 2003; US Army, Directorate of Public Works 2004, 2005) in a collaborative effort among the Army, the USFWS, the State of Hawai‘i, the Honolulu Board of Water Supply, The Nature Conservancy of Hawai‘i, and endangered species or ecosystem experts. The MIP was developed to offset impacts associated with an action area that does not include the Ka‘ena Point trail or the impacts of sniper training on the ridge between the north and south lobes of the training area. The MIP also was developed to offset impacts associated with the types of weapons systems and munitions proposed for Alternatives 1 and 2 (including tracers and inert TOW missiles), but not for Alternative 3 (155mm HE howitzers, 2.75-caliber rockets, and Javelin anti-tank missiles). The plan identifies 28 target species, including federally listed plants and one snail. The USFWS deemed the Army responsible for stabilizing these species and stipulated that a MIP was needed to detail how the Army can halt species decline and protect habitat. The plan includes the following notable features:

- A timeframe for completing implementation;
- Identification of priority management areas;
- Definitions of success;
- Methods for managing the species and habitats (including monitoring);
- Calculation of the goal stable population size for each species; and
- A cost estimate for implementation.

In addition to the development of a MIP, the Army was tasked with implementing high-priority stabilization actions for those species at

highest risk of fire from military training, which included the following measures listed in the BO As of 2007, the Army has completed all of the urgent actions; which consisted of the following:

- Upgrade the Pāhole Mid-Elevation Facility to meet quarantine standards;
- Develop a database to track information on collection and propagation efforts of rare species;
- Collect an adequate genetic representation of the following sensitive plant species: *Chamaesyce celastroides* var. *kaenana*, *Cyanea superba* ssp. *superba*, *Hibiscus brackenridgei* ssp. *mokuleianus*, *Lipochaeta tenuifolia*, *Neraudia angulata*, and *Tetramolopium filiforme*;
- Fund a seed storage facility for the collected material of the plants listed in the above action;
- Hire an Army horticulturist;
- Hire three additional staff to implement collection, weed control, and ungulate control in naturally occurring populations, as well as species reintroduction of *Cyanea superba* ssp. *superba*;
- Conduct plant surveys for *Chamaesyce celastroides* var. *kaenana*, *Neraudia angulata*, and *Tetramolopium filiforme*;
- Search for additional genetic material for *Cyanea superba* ssp. *superba* in herbarium specimens and propagated specimens;
- Fund genetic analysis of any new material collected on this species;
- Continue implementation of the IWFMP pre-suppression actions; and
- Prepare a fire management plan for the Kaluakauila management unit.

In 2004, the Army reinitiated ESA Section 7 Consultation with USFWS for newly designated critical habitat for 41 threatened and endangered plant species and to comply with the requirement from the 1999 BO to consult in the event of a fire escaping the firebreak road. This consultation was based on training and maintenance operations as described in the 1999 BO (USFWS 1999c) and 2001 Supplemental BO (USFWS 2001a) and the July 2003 wildfire that resulted from a prescribed burn. USFWS issued a BO in September 2004 (USFWS 2004) completing this reinitiation and finalizing the 2001 conference opinion on the effects of training on O‘ahu ‘elepaio designated critical habitat. USFWS concluded that the proposed

actions would have no adverse modification on designated critical habitat, based largely on conservation measures that the Army incorporated into the project. A species list appears in Appendix H-2.

In July 2005, the Army initiated ESA Section 7 consultation with the USFWS on the following:

- Addition of tracers, inert TOW missiles, 2.75-caliber rockets, Javelin, UAVs, and Stryker vehicle firing platforms; and
- Troop marches on Kuaokalā Trail.

Any training activities not already the subject of ESA Section 7 consultation would undergo such consultation prior to being conducted at MMR.

On June 22, 2007, the USFWS issued its BO, in which it concluded that implementing the proposed action was not likely to jeopardize the continued existence of any species or to adversely modify or destroy designated critical habitat covered in the opinion.

Implementing the 2007 BO requirements for stabilization of extremely vulnerable species will ensure that any local destructive event (i.e., fire ignition and spread of invasive species by non-military sources) will not have tragic consequences on the species as a whole. A major factor in minimizing wildfire risk by the mission is the required implementation of weapons restrictions, which are discussed in greater detail below.

The 2007 BO requires that, until the Army has achieved the expedited stabilization for the 12 most at risk species, it could not utilize fire tracers, 2.75 rockets, AT-4/M136, shoulder-launched multi-purpose assault weapons, or Javelin missiles. In addition, the Army would not be able to use mines, simulators, mortars, and artillery/howitzers under higher burning indexes until stabilization occurs. The Army estimates that expedited stabilization will take anywhere from 10 to 15 years to complete.

At the same time, the Army would pursue stabilization of the remaining 16 plant species and the O'ahu tree snail. Stabilization is achieved when there are three naturally reproducing plant populations with all of the threats controlled and eight snail populations with at least 300 individual snails.

Until all 29 species have been stabilized, the Army would not be able to fire inert TOW missiles at MMR (USFWS 2007b). This is due to the fire

starting potential of using a propellant to fire the TOW, even though the TOW itself is inert.

Weather and fuel moisture restrictions on weapons systems, combined with additional fuel modifications, would lessen future fire impacts on sensitive species. Specifically, the use of weapons on MMR would be contingent on the Army removing and reducing grass around *Hibiscus* and *Chamaesyce* plants, completing 197 feet (60 meters) of fuel modification (e.g., mowing the grass) along the inside perimeter of the south lobe of the firebreak road and maintaining on-site fire suppression helicopter staffing (USFWS 2007b).

Impacts on native species would also be minimized and mitigated through required implementation of programs to control weeds and nonnative fauna (such as cannibal snails, rats, and feral ungulates [cattle, goats, pigs, and sheep]). In addition, if any area of plant critical habitat were burned, the Army would implement a post-fire vegetation plan to restore the area. Within the 23 priority management units, weed control would generally be prioritized to areas of high native plant cover, around target taxa individuals, and at potential augmentation/reintroduction sites. Ungulate control, where necessary, would include a combination of monitoring, fencing, hunting, and snaring. The Army is also required to remove all ungulates from within MMR and has already succeeded in removing all goats from the area. In addition, the Army has just about completed an ungulate-proof fence encircling the installation's boundary. Rats would be controlled with such approved applications as aerial rodenticides and trapping.

Impacts from ground training would be minimized by excluding Ka'ena Point trail from any training activities, prohibiting any open fires anywhere, restricting marches on Kuaokalā Trail to established trails or roads, with marching formation conforming to the width of the trail, prohibiting smoking on trails, and surveying trails before and after use.

The USFWS's no jeopardy and no adverse modification of critical habitat conclusions are based on the following:

- The Army conservation and stewardship programs that would increase the baseline number of individuals according to the criteria stipulated in the MIP for 29 species;
- Weapons restrictions, fuels management, fire suppression, and construction of fuelbreaks and firebreaks to minimize the risk of wildland fire;

- Invasive species control, such as rat baiting, ungulate removal, and invasive plant management;
- The Army's multiple actions to minimize and reduce the risk of fire, to minimize introduction and spread of nonnative species, and to increase the current baseline for primary constituent elements of critical habitat; and
- The Army restoring critical habitat should a fire escape the firebreak road.

The USFWS concluded that any losses that occur after implementation of these actions would be short-term and would not result in permanent destruction or alteration of the physical and biological features of critical habitat.

In August 2007 a fire ignited on private land within the Waialua area and burned a significant number of the endangered *Hibiscus brackenridgei* (ma'ō hau hele) resulting in a very large change to the status of the species. The Army reinitiated consultation with the USFWS in January 2008 due to the significant change in status of endangered plant. The resulting June 2008 amendment to the August 2007 BO identifies the conservation measures to be implemented on private land within Waialua to minimize the overall impacts on the hibiscus. The most significant measure is the establishment of an 86-acre (34.8 hectares) fuelbreak extending from Puulu to Alaiheihe. In addition, the Army is working with the private landowner to install a fence around the plants that have resprouted in the Waialua area to protect them from non-native hoofed mammals (i.e., ungulates), and install a separate fence along the boundary of the gulch below the plants where the Army would hire someone to graze animals as a means to maintain the firebreak.

On MMR, in addition to the 2007 BO requirements, the Army would implement the following measures to reduce potential impacts on the hibiscus:

- All live and dead grass will be removed from within 10 feet (3 meters) of all *H. brackenridgei* within the Lower Ohikilolo Management Unit such that total grass cover is maintained at less than one percent. Fuel will also be reduced within the remainder of the weed control area.
- Fuel within the 7.6-acre (3.1-hectare) area between the firebreak road and the *H. brackenridgei* population and within 66 feet (20 meters) of the outer perimeter of the *H. brackenridgei* weed control

area, will be mowed prior to the use of any weapon or prescribed burning.

- Vegetation within a 197-foot (60 meter) strip along the inside edge of the south lobe of the firebreak road will be maintained by mowing.

The conservation measures are to be completed within three years of the issuance of the BO. Within the Pu'ulu to Ala'ihe'ihe Gulches, the fuelbreaks are also to be completed within three years provided permission is secured and maintained by the landowner and lessee. In conclusion, the nondiscretionary measures contained within the 2007 and 2008 BOs, along with the other conservation plans and actions being implemented at MMR, are anticipated to appreciably reduce the significance of the action's impacts on listed species and critical habitat.

The Army has also consulted with the National Marine Fisheries Service (NOAA Fisheries), which is responsible for protecting most marine mammals under the ESA and the Marine Mammal Protection Act (MMPA). ESA Section 7 consultations on this project with NOAA Fisheries began in January 2006 and concluded in October 2006, when NOAA Fisheries issued a concurrence letter with the Army's determination that the proposed action was not likely to adversely affect (NLAA) listed species under NOAA Fisheries' jurisdiction (NOAA Fisheries 2006). As part of this consultation the Army has committed to implementing specific monitoring and mitigation measures (see Chapter 4). These measures would minimize potential training effects on sensitive marine protected species. In addition, these measures will be incorporated into the Army's existing SOPs for MMR, and a copy of this revised SOP will be provided to NOAA Fisheries for their documentation. A copy of the NLAA letter is in Appendix H-3.

Pōhakuloa Training Area

The environmental regulatory history of PTA includes consultation under ESA Section 7 for federally listed species and their federally designated or proposed critical habitat. During the 1990s and into the 2000s, a number of formal consultations were initiated with the USFWS on actions occurring within or in proximity to the ROI for this alternative.

On July 27, 1998, the USFWS issued a BO to the US Department of Transportation, Federal Highway Administration, for the Saddle Road Realignment and Improvement Project. Though this project takes place at a considerable distance from the ROI, the BA and the EIS for the project

identified the MPRC (area to the southwest of range) as partial mitigation for the loss of Palila critical habitat. The BO issued by the USFWS made it clear that their finding of “no jeopardy” to the Palila and *Silene hawaiiensis* and “no adverse modification” to Palila critical habitat was “based in large part on the conservation measures built into the project...” To offset loss of Palila critical habitat resulting from the planned Saddle Road realignment, the Army agreed that 4,045 acres (1,637 hectares) of the Kīpuka Alala (within the MPRC area) would be Palila habitat mitigation. In order to protect and enhance a large portion of *Sophora chrysophylla/Myoporum sandwicense* (māmāne/naio) forest as potential Palila habitat in Kīpuka Alala, a large fence unit was constructed around the area and feral ungulates were removed. The fence was completed in January 2001 and to date, the Kīpuka Alala is ungulate free. A Memorandum of Understanding (MOU) Regarding Implementation of the Saddle Road Palila Critical Habitat Impact Mitigation (1998) details the agreement between the Army, the Federal Highway Administration, and the USFWS regarding Kīpuka Alala. Almost all signatories agreed to participate in the development of a comprehensive, interagency fire plan as well as coordinated fire prevention and suppression activities and planning.

Informal consultation with the USFWS for the Routine Military Training and Other Current Activities at PTA officially began in 1997. The consultation was amended to include the SBCT. In April 2003, the USAG-HI initiated programmatic formal consultation with the USFWS for routine training and transformation activities (SBCT) on PTA with the submission of two separate BAs:

1. Pōhakuloa Training Area, Biological Assessment for Programmatic ESA Section 7 consultation on Routine Training and Related Activities, 25th Infantry Division (Light) and US Army, Hawai‘i.
2. Programmatic Biological Assessment for Transformation of the 2nd Brigade 25th Infantry Division (Light), US Army, Island of Hawai‘i.

The USFWS concluded in its BO (USFWS 2003c) that implementation of the Proposed Actions are not likely to jeopardize the continued existence of any species covered in the BO or adversely modify or destroy critical habitat. Their non-jeopardy and no adverse modification opinions were based, in large part, on the conservation measures and the development and execution of the PIP as described in the Conservation Measures section of the BO. The PIP, which is near completion, outlines the management actions necessary to ensure the long-term survival of

endangered species at PTA and is designed to assure proper conservation of species as construction and use of ranges and facilities occur.

The PIP was prepared to guide conservation efforts that will result in the conservation of federally listed threatened and endangered plant and animal species and Palila critical habitat that could be affected by military training activities at PTA on the Island of Hawai'i. In addition, monitoring protocols were developed for each species to evaluate success of these management actions. Major management actions identified in the PIP include propagation and outplanting, weed control, survey protocols for flora and fauna, rodent control, ungulate control, large-scale fencing, invasive invertebrate control, and an incipient weed program. The majority of actions are planned on Army lands. If at any time there is a change in the training areas or action areas, a change in the species status, or the discovery of additional taxa, the Army would be required to reinitiate consultation with the USFWS.

Example mitigation measures that are to be implemented by the Army at PTA include:

- Enclosure fencing of sensitive plant species to eliminate impacts from human disturbance and ungulates;
- Development and implementation of a fire fuel reduction plan;
- Development and implementation of an alien rat control plan to protect sensitive species;
- Expansion of monitoring programs in potential areas of impact for sensitive species;
- Establishing signage to identify areas that are off limits due to the presence of federally listed species;
- Providing education for each set of new Soldiers regarding the importance of avoiding listed species and disturbance to their habitats;
- Collection of seeds and propagation material from plants in the BAX construction footprint to be used for planting in other areas;
- Conducting surveys to determine presence of the Hawaiian hoary bat; and species presence, abundance, and habitat use by Hawaiian Dark-rumped Petrel or 'ua'u, Hawaiian Goose or nēnē, and Hawaiian Hawk or 'io;
- Implementation of a nonnative invasive plant monitoring program within, and adjacent to, landing zones, trails, and roadsides. Newly

identified nonnative plants shall be eradicated using the most effective means for those species; and

- Thoroughly cleaning vehicles (training and construction) before moving onto PTA.

The USFWS anticipates that take of Hawaiian hoary bats will occur in the form of harm (due to the loss of habitat), harassment, and injury or death as a result of Army activities described in the BO. The USFWS anticipates that an average of approximately 240 acres (97 hectares) may burn annually for five years within the treeland vegetation outside the Impact Area that provides suitable roosting habitat for bats. After the first five years, they anticipate that the effective implementation of the WFMP will reduce the take of bats and no more than 119 acres (48 hectares) of habitat would be lost per year outside of the impact area.

The USFWS issued the following Reasonable and Prudent Measures to minimize incidental take of Hawaiian hoary bat. The measures described below are nondiscretionary and must be implemented.

- Minimize direct and indirect effects on survival and reproduction of Hawaiian hoary bats in the action area. Implement measures such as:
 - Avoid construction in certain areas during breeding and peak lactation periods.
 - Develop and implement conservation plan.
 - Minimize loss and degradation of roosting habitat for Hawaiian hoary bats in the action area. Implement measures such as:
 - Monitor trends in: treeland vegetation cover in fence units and Fire Management Areas to determine the extent of enhanced survival and regeneration of tree species, and numbers of Hawaiian hoary bats present in the action area.
 - Determine the number of bats per area of treeland roosting habitat in selected vegetation types within the action area, in order to refine take estimates measured indirectly by the amount of lost roosting habitat and to determine when those take levels are exceeded.
 - Minimize noise and ground disturbance to Hawaiian hoary bats associated with military activities in the action area.

- Include Hawaiian hoary bat in the Environmental Awareness Program to inform installation users of the need to avoid and minimize impacts to bats.

Within PTA is an approximately 51,003 acres (20,640 hectares) central impact area that is the primary danger area for all indirect fired weapon rounds (not in line of sight). The impact area effectively subdivides PTA into an eastern and western section and is off-limits to unauthorized personnel due to munitions hazards of UXO. Because the impact area is unsafe for human activity, surveys for listed species cannot be conducted, nor can it be accurately determined which species will be lost, or the magnitude of the loss. Vegetation destruction within this large, central impact area fragments natural habitats for the Hawaiian hoary bats, thereby diminishing the abundance and distribution of the subspecies on PTA. Fires in the impact area are not controlled due to the presence of UXO and uncontrolled fires may potentially spread from the impact area to other areas of the installation, though implementation of the WFMP will reduce the fire frequency and intensity at PTA.

The USFWS has determined that there is a high probability that any listed plant species or roosting habitat for the Hawaiian hoary bat within the impact area will be lost through time due to fire or direct impact of live-fire munitions. Even anticipating the loss of listed plants and bat habitat within the impact area, the USFWS still determined that the Proposed Actions would not jeopardize any listed species or result in the destruction or adverse modification of designated critical habitat. In essence, all the conservation and management efforts employed by the Army benefit the species to a much greater extent than the negative impacts on the species resulting from military actions on PTA.

For the SBCT action on PTA, the NEPA and ESA Section 7 consultation requirements covered the area designating the ROI for this action alternative. However, the Proposed Action within the Twin Pu'u range footprint would elevate the threats to the endangered species and habitat within the ROI by increasing the possibility of wildfire and potential spread of invasive species. Due to this fact, if Alternative 4 was selected, the Army would reinitiate formal consultation with the USFWS to address the threats to listed species within the ROI. Even accounting for these new potential threats, the nondiscretionary measures contained within the 2003 BO, along with the other conservation plans and actions being implemented at PTA, would be anticipated to help lessen the significance of the action's impacts on listed species and habitat within the ROI.

3.9.3 Recovery Plans

Recovery plans are documents prepared by USFWS that detail the specific management practices and tasks needed for special status species to recover. They offer guidelines for private, federal, and state cooperation in conserving threatened and endangered species and areas on which they are presently or historically distributed. Under current law, recovery plans are to be developed for endangered and threatened species, unless the plan would not promote the conservation of the species. A plan must include the following components:

- A description of site-specific management actions necessary to achieve the plan's goal;
- Objective measurable criteria which, when met, would result in a determination that the species no longer needs the protection of the ESA and can be removed from the lists; and
- Estimates of the time and costs required to carry out the plan and to achieve intermediate steps toward the goal.

Plant and animal species with recovery plans that occur on the MMR ROI and the PTA ROI are identified in Appendix H-2 and Section 3.9.6, respectively. Recovery plans were/are used in the development of the MIP and PIP.

3.9.4 Vegetation Communities and Vegetation Mākuā Military Reservation

The vegetation communities of MMR are diverse and have been extensively studied. These were well documented in the 1998 BA, from which this discussion draws heavily.

MMR includes the following three ecological zones:

- Lowland native forest zone;
- Ridge crest vegetation zone; and
- Native shrub on cliff and slope zone.

Within these zones are vegetation communities of varying composition. There are two additional vegetation communities that are the direct result of human disturbance (USARHAW and 25th ID[L] 2001a). Figure 3.8-5 shows the distribution of vegetation communities in the ROI. Figure 3.9-5 shows the sensitive plant species in the Region of Influence and Figure 3.9-6 shows sensitive plant species in the biological ROI (PTA).

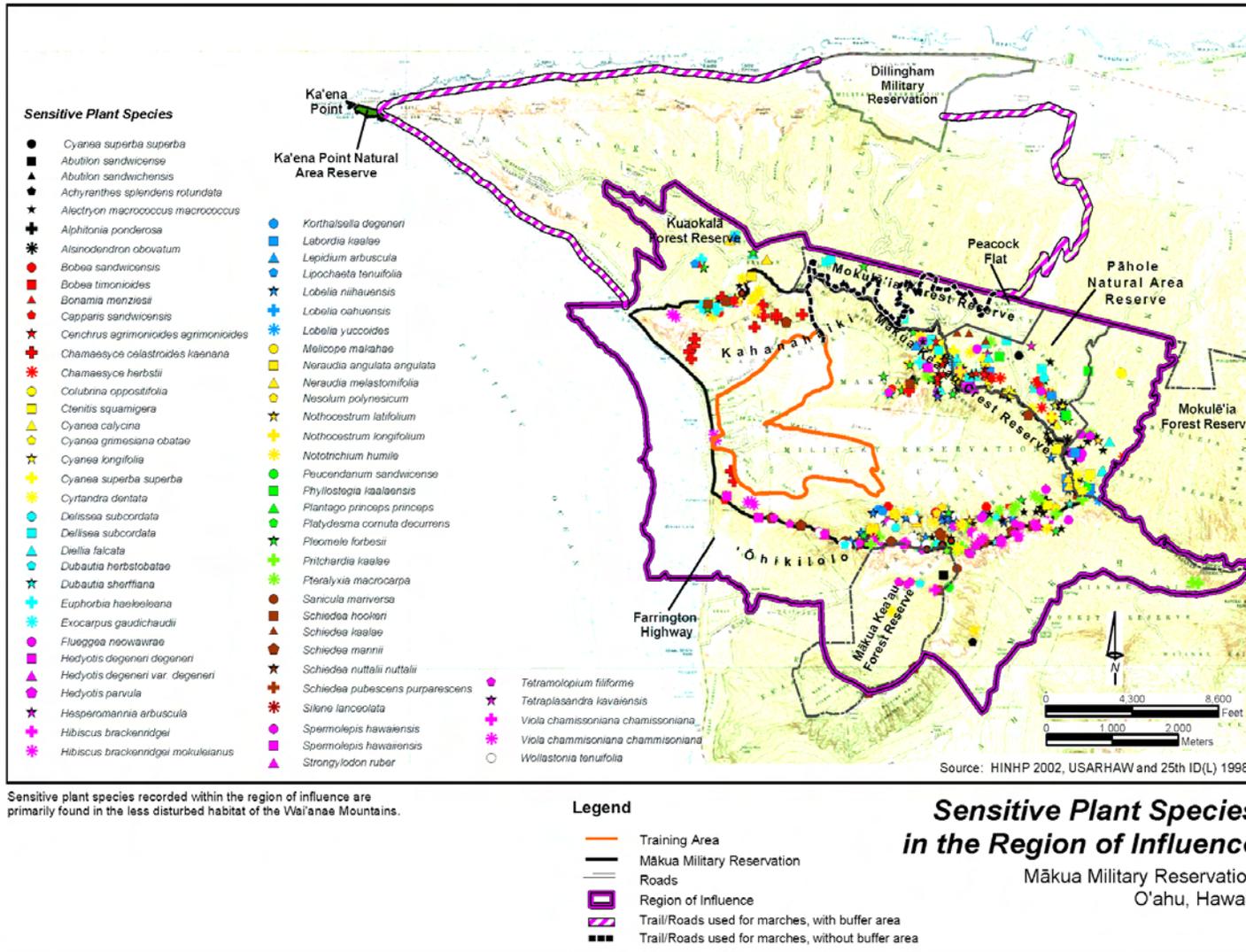


Figure 3.9-5 Sensitive Plant Species in the Region of Influence, MMR

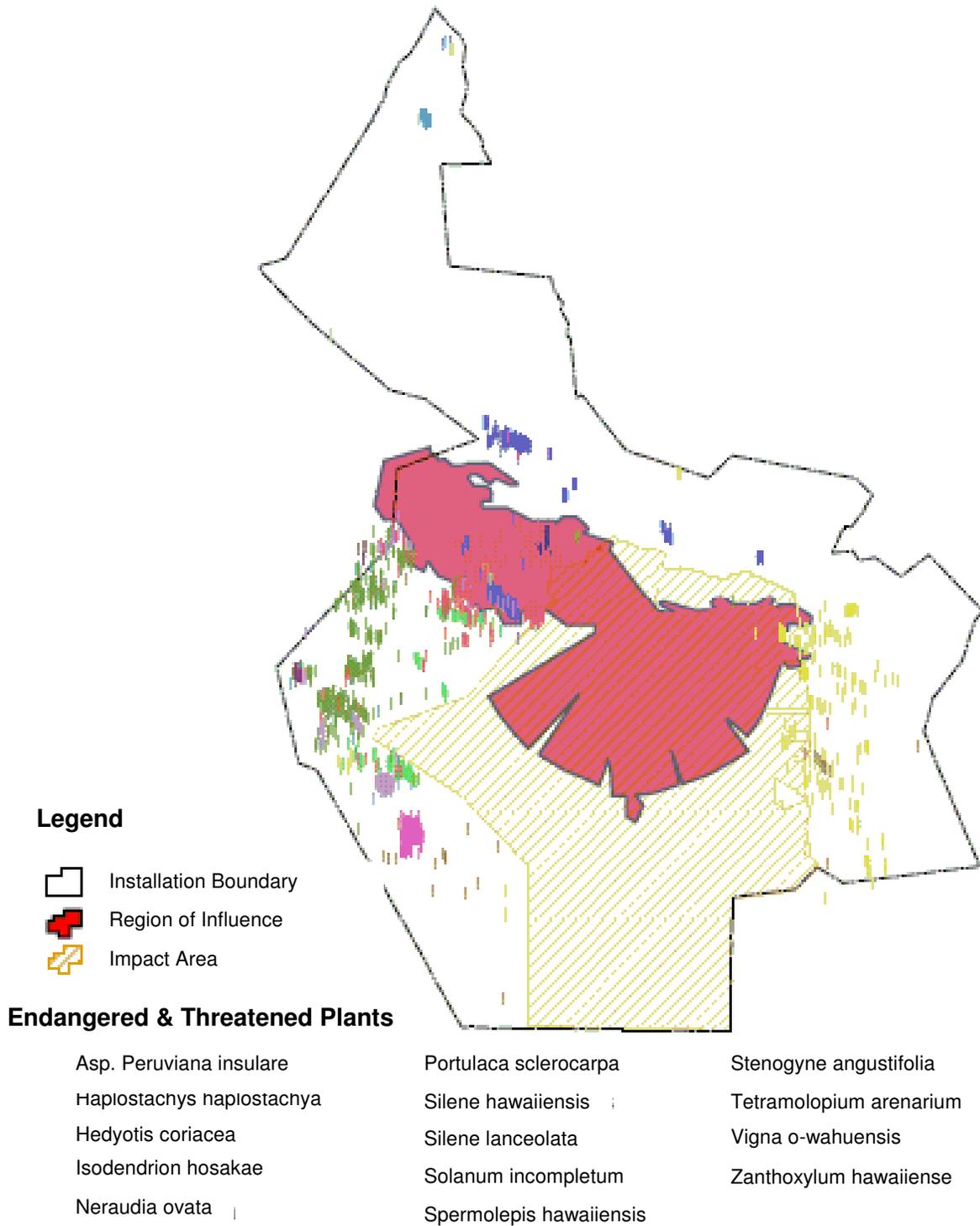


Figure 3.9-6 Sensitive Plant Species in the Biological Region of Influence, PTA

On July 22, 2003, a prescribed burn at MMR went out of prescription and escaped the firebreak road, burning 2,100 acres (850 hectares). Common native plants were burned, and endangered species were also impacted. At least 50 acres (20 hectares) of native dry forest and 150 acres (61 hectares) of native dry grassland were burned. Native forests do not reclaim the burned areas because they are invaded by nonnative, fire-prone grasses. Each fire that destroys native habitat brings the line of flammable nonnative grass dominated area closer and increases the chances of the area being impacted by a subsequent fire. The damages to habitat are discussed below where appropriate (NRS no date).

The Lowland Native Forest Zone

This zone includes six native natural community types. Two of these are rare (O‘ahu Diverse Lowland Moist Forest and Loulu Lowland Moist Forest); the other four types are not rare but support rare species.

Koa/‘Ōhi‘a Lowland Moist Forest

This community is centered on south-facing gentle slopes between 2,000 and 2,300 feet (610 and 701 meters) in elevation. The dominant plant species are koa (*Acacia koa*) and ‘ōhi‘a (*Metrosideros polymorpha*), but other natives include mehame (*Antidesma platyphyllum*), ‘ahakea (*Bobea sandwicensis* and *B. timonioides*), and two species of lama (*Diospyros sandwicensis* and *D. hillebrandii*). The understory plants include the native sedge ‘uki (*Dianella sandwicensis*) and the ferns pala‘ā (*Sphenomeris chinensis*) and palapalai (*Microlepia strigosa*). Rare plants in this community are ma‘aloa (*Neraudia melastomifolia*), ‘ume‘alu (*Cenchrus agrimonioides* var. *agrimonioides*), *Schiedea nuttallii*, and ‘alani (*Melicope sandwicensis*).

Lama Lowland Dry Forest

This community occurs on MMR between 1,000 and 1,300 feet (305 and 396 meters). In addition to the dominant lama *Diospyros sandwicensis* canopy, other natives, such as wiliwili (*Erythrina sandwicensis*) and olopua (*Nestegis sandwicensis*), also occur. The open understory is dominated by alahe‘e (*Psydrax odoratum*). Small patches of ‘a‘ali‘i (*Dodonea viscosa*) shrubland are adjacent to this community. The area also supports dryland mosses, herbs, and the kumuniu fern (*Cheilanthes viridis*). Two areas of native dry forest were impacted by the July 2003 fire. Damage to the perimeter of this native forest at Kaluakauila and South Kahanahāiki was significant. In Kaluakauila, corridors that connected patches of this native dry forest were destroyed, and the habitat size is permanently reduced (NRS no date).

Lama/‘Ōhi‘a Lowland Moist Forest

This is a moist community at MMR that occurs between 1,205 and 2,015 feet (367 and 614 meters). These forests are dominated by ‘ōhi‘a and lama but include the rare species māhoe (*Alectryon macrococcus* var. *macrococcus*), halapepe (*Pleomele forbesii*), kalua (*Pteralyxia macrocarpa*), mehamehame (*Flueggea neowawraea*), keahi (*Nesoluma polynesianum*), and ‘aiea (*Nothocestrum latifolium*).

Loulu Lowland Moist Forest

This rare natural community type typically has shallow well-drained soil on moderate to steep slopes. This forest is dominated by the globally rare loulu (*Pritchardia kaalae*), although other common native species are present. While loulu occurs at other places in the Wai‘anae Mountains, this is the only instance in which it forms a closed canopy of trees. It blends gently into the surrounding ‘ōhi‘a forest and shrubland communities. Other trees dispersed through the 1-acre (0.4-hectare) forest type include kōlea (*Myrsine lessertiana*) and kōpiko (*Psychotria* spp.).

O‘ahu Diverse Lowland Moist Forest

This diverse forest has no clear dominant canopy tree species. The substrate is rocky and sometimes steep, and at MMR it is present west of the eastern valley rim at 2,100 feet (640 meters). The native canopy trees include lama, ‘ala‘a, pāpala (*Charpentaria tomentosa*), kōpiko (*Psychotria* spp.), and kōlea. The three rare plants in this community are tree māhoe (*Alectryon macrococcus* var. *macrococcus*), kamakahala (*Labordia kaalae*), and the fern pauoa (*Ctenitis squamigera*). This is a rare natural community.

‘Ōhi‘a Lowland Mesic Forest

This community is common on Wai‘anae Mountains ridge crests and is notably well established in southeast MMR above 2,015 feet (614 meters). Rare plants that occur here are *Alsinidendron obovatum*, *Cenchrus agrimonioides* var. *agrimonioides*, *Schiedea nuttallii* and *S. pentamera*, and ‘alani.

Ridge Crest Vegetation Zone

This zone lies above 3,000 feet (914 meters) and covers the cool, wet, windy, and cloud-swept portions of the summit crest of the Wai‘anae Mountains. The dominant vegetation community is ‘ōhi‘a lowland mesic shrubland. These communities are generally found along the southern and southeastern rim of the valley. Rare species that occur in this community include *Sanicula mariversa*, na‘ena‘e (*Dubautia herbstobatae*), loulu, *Tetramolopium filiforme*, halapepe (*Pleomele forbesii*), ‘alani, and nehe (*Lipochaeta tenuifolia*).

Native Shrub on Cliff and Slope Zone

Lowland dry shrubs and mosses that favor this moist habitat generally characterize this zone. These natural communities occur in the range of 1,500 to 2,400 feet (457 to 731 meters) beneath steep cliffs in ridges and slopes. With distance from the summit crest, conditions become much warmer and drier. At MMR, this community is predominantly located on steep vertical cliffs. Over 150 acres (61 hectares) of native grass and shrubland were destroyed in the July 2003 fire (NRS no date). The two plant communities in this zone are described below.

‘A‘ali‘i Lowland Dry Shrubland

This globally secure community type is dominated by ‘a‘ali‘i and includes other common native plants. It is found on moderate slopes. These communities are not particularly diverse, but they do contain native shrubs ‘ilima (*Sida fallax*) and alahe‘e. Rare plants have not been observed here.

Hawaiian Mixed Shrub Lowland Dry Cliff

This community includes the common species ko‘oko‘olau, ‘akoko, and ‘a‘ali‘i. Observed rare plants are the cliff-dwelling nehe, na‘ena‘e, *Tetramolopium filiforme*, *Sanicula mariversa*, pāmakani (*Viola chamissoniana* ssp. *chamissoniana*), ma‘aloha (*Neraudia angulata*), *Silene lanceolata*, kulu‘ī (*Nototrichium humile*), *Lobelia niihauensis*, and *Spermolepis hawaiiensis*.

Alien Grassland/Open Shrubland

Nonnative grass and shrubs compose most of the lowland vegetation structure at MMR. Many of these are aggressive species known to displace native vegetation when not controlled. Guinea grass (*Panicum maximum*) is the dominant species in the low dry areas of MMR and regenerates quickly after fire. Other grasses include natal redtop (*Rhynchelytrum repens*) and molasses grass (*Melinis multiflora*). This community also includes native shrubs such as ‘a‘ali‘i and ‘iliahi (*Santalum ellipticum*), but most of the open shrublands are dominated by koa haole (*Leucaena leucocephala*) and kiawe (*Prosopis pallida*). The majority of damage from the July 2003 fire was to this nonnative community.

Nonnative Forest/Closed Shrubland

About half of the forested area at MMR is dominated by nonnative tree and shrub species, including Java plum (*Syzigium cumini*), Christmas berry (*Schinus terebenthifolius*), and guava (*Psidium cattleianum* and *P. guajava*). Christmas berry is a tree common to dry and moist areas of MMR and threatens native plants and communities by creating a dense canopy, changing the understory composition, and producing chemicals

that inhibit plant growth. Koa haole can create dense thickets on abandoned grazing lands and is one of the more widespread trees on MMR (Wagner et al. 1999). It too regenerates quickly after fire, displacing native plants (R. M. Towill Corp. 1997a). Populations of strawberry guava (*Psidium cattleianum*) are generally found around the lower slopes at the head of the valley, often in single-species stands. Many other nonnative species are present, and several could become serious pests (R. M. Towill Corp. 1997a).

Aquatic Natural Communities

The aquatic natural communities on MMR include intermittent streams and gulches, such as Punapōhaku Stream, Mākua Stream, and Kalena Stream. Although potential estuarine wetlands (*muliwai*) have been noted, there has been no formal identification or designation of them.

Ka'ena Point Natural Area Reserve/Kuaokalā Access Road and Trail

Portions of the Ka'ena Point Natural Area Reserve (NAR) are included within the ROI. The Hawai'i NARS lands are first and foremost areas of refuge and not recreation, so their use is purposely restricted. The areas along the coast are dry and sandy, and the trail, while more inland, is in a dry rocky region. The trail begins outside of the NAR as a network of four-wheel drive roads. Motor vehicles are not permitted within the NAR, and state DLNR personnel randomly monitor the area, which is also critical habitat for the following plant species: 'āwiwi (*Centaurium sebaeoides*), 'akoko (*Chamaesyce celastroides* var. *kaenana*), pu'uka'a (*Cyperus trachysanthos*), mā'oli'oli (*Schiedea kealiae*), 'ohai (*Sesbania tomentosa*), and *Vigna o-wahuensis*.

Kuaokalā Access Road and Trail extends from DMR, along agricultural fields, and up a paved road to a point on the ridge crest along the northern ridgeline of MMR. The low-elevation vegetation communities are predominantly nonnative, mixed with some common native species, such as wiliwili (*Erythrina sandwicensis*), 'a'ali'i, and alahe'e. The vegetation in the upper elevations is more native and is part of the USFWS critical habitat for plants on O'ahu. The paved road provides access to a state endangered plant greenhouse/nursery facility at an old Nike missile site, while the trail branches off onto a dirt road that extends to the ridge crest.

Existing data on sensitive plant species identified in this area within the ROI include *Achyranthes splendens* var. *rotunda*, *Bonamia menziesii*, 'āwiwi, 'akoko, makaloha, *Delissea subcordata*, palapalai, 'ānaunau, kulu'ī, mā'oli'oli, 'ōhi'a, and *Hibiscus brackenridgei* ssp. *mokuleianus*.

Coral/Coastal Communities

Coral reefs are increasingly recognized as important ecological communities and assemblages and are protected by several federal regulations. Institutional significance for coral reefs was established through their formal designation as Special Aquatic Sites under the Clean Water Act (40 CFR Part 230.44/FR v.45 n.249). Special aquatic sites include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes. They are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region. In addition, coral reefs were given protection and status under EO 13089 and EO 13178 (which specifically refers to the Northwest Hawaiian Island corals). Although corals occur in isolated areas of rocky substrate in Mākua Bay, they do not occur in contiguous chains and are not considered coral reefs; therefore, the corals present do not qualify as Special Aquatic Sites under the Clean Water Act.

While there have been surveys of the coastal region (shoreline to 18 feet [5 meters] out from the shoreline) in and adjacent to the ROI, there are few published reports specifically relating to bottom topography or marine fauna right at Mākua Beach. However, there are surveys that have been done for the general Wai‘anae coast that includes Mākua Beach. According to work done by the Wai‘anae Ecological Characterization, the area off Mākua Beach consists predominantly of uncolonized hardbottom and macroalgae (Wai‘anae Ecological Characterization 2005). Coral cover is low along the Wai‘anae coast (one to two percent of bottom area), a condition typical of shallow, flat low-relief bottoms in this area (Wai‘anae Ecological Characterization 2005). Surveys have also found that the sandy beach is affected by substantial wave energy, especially through the winter due to its north-facing orientation (Dollar 1999; Wai‘anae Ecological Characterization 2005). Below the waterline, sand does not continue; instead, there is a limestone platform that extends several meters offshore. This platform was found to be “barren of macroinvertebrates or macroalgae (frondose) algae [leafy ‘sea weeds’] due to the concussive impact of the breakers” (Dollar 1999), though some short turf algae occurs. Macroalgae represent over 50 percent of the benthic cover in the Hawaiian coral reef ecosystem (Wai‘anae Ecological Characterization 2005). Red algae are the most common in Hawai‘i, representing four of the five most common species. Green and brown algal species are found in most reefs in smaller numbers (Wai‘anae Ecological Characterization 2005).

There were few if any unattached benthic invertebrates, such as sea urchins, with the exception of the short-spined sea urchin (*Tripneustes gratilla*), which is not found in the nearshore sandy area but more along the boulder zone south of Punapuhaku Stream. The inshore flat portion of the limestone platform is devoid of benthic organisms (Dollar 1999). Beyond 30 to 60 feet (10 to 15 meters) from the shoreline, the limestone platform drops off abruptly. Although the upper part of the platform is relatively bare, the deeper vertical portion contains reef corals, such as cauliflower coral (*Pocillopora meandrina*), lobe coral (*Porites lobata*), and crust coral (*Lepastrea purpurea*).

The Wai‘anae coast has few locations with complex habitat (areas providing shelter and nooks) that reef fish prefer. Most of the reef along the coast has low species diversity and biomass. However, the deeper vertical portion of Mākua Beach that contains reef corals also creates a shelter for some reef fish, most commonly kala (*Naso unicornis*), maikoiko (*Acanthurus leucopareius*), manini (*A. triostegus*), adult (weke) and juvenile (oama) ta‘ape (*Mulloidichthys flavolineatus* and *Lutjanus kasmira*). Less common but potentially present are the mamo (*Abudefduf abdominalis*), lau wiliwili (*Chaetodon miliaris*), and hinalea (*Thallosoma duperrey*). Living corals were limited to depths below 6 feet (2 meters). The only marine algae noted in the area were common brown algae (*Padina* spp.) and red algae (*Liagora* spp.). It is possible that other species of algae are present in the summer, when the wave impacts lessen. Unattached benthic invertebrates (living on or in the sea bottom), such as sea urchins, were rare (Dollar 1999). There is no living coral seaward of the limestone platform found south of Punapuhaku Stream; the entire offshore area consists of sandy bottom past this platform.

Invasive Species and Disturbed Habitat

Executive Order (EO) 13112, Invasive Species (February 3, 1999), requires that where feasible, federal agencies should use their authorities to prevent the introduction of invasive species, to detect invasive species, and to eradicate and control such species in a cost-effective and environmentally sound manner. This EO also limits the ability of federal agencies to authorize or fund activities that are believed to introduce and spread invasive species in the United States, unless the benefits of the proposed activity clearly outweigh the harm and all feasible and prudent measures to minimize the harm are implemented. This order, along with the State of Hawai‘i Noxious Weed Rules, which require that noxious weeds be controlled (USDA no date), and which is supported by AR 200-5 Pest Management have guided Army environmental management actions. Army actions include those outlined in the INRMP and the MIP.

Invasive and noxious weeds that are not yet widespread on MMR are black wattle (*Acacia mearnsii*), weeping grass (*Ehrharta stipoides*), fire tree (*Morella faya*), perfumed passionflower (*Passiflora suberosa*), and prickly Florida blackberry (*Rubus argustus*). Current control efforts target West Indian raspberry (*Rubus rosifolius*), oi (*Stachytarpheta dichotoma*), cathedral bells (*Kalanchoe pinnata*), daisy fleabane (*Erigeron karvinskianus*), strawberry guava, Christmas berry tree (*Schinus terebenthifolius*), kukui (*Aleurites moluccana*), ti plant (*Cordyline fruticosa*), silk oak (*Grevillea robusta*), chinaberry tree (*Melia azedarach*), lākana (*Lantana camara*), tree daisy (*Montanoa hibiscifolia*), and koa haole (*Leucaena leucocephala*). These and other widespread weed species will be controlled where they threaten native plants and communities.

Populations of feral pigs (*Sus scrofa*) and goats (*Capra hircus*) have directly affected native plants and contributed to numerous ecological problems (Juvik and Juvik 1998). These wild pigs and goats trample and graze the native plants and advance erosion and landslides (USARHAW and 25th ID[L] 2001b; PCSU 1999, 2000, 2001). Water collects in the rutted ground, providing a perfect breeding place for mosquitoes, which can carry avian malaria (HINHP no date b) and have devastated native bird populations. Browsing and destroyed native vegetation has encouraged nonnative plants to become established, severely affecting the habitat. Fencing prevents additional pigs and goats from moving into MMR from the south and east, and trapping removes the smaller pests, such as feral cats, mongooses, and rats. Approximately 5,577 feet (1,700 meters) of this fencing was burned in the July 2003 fire. Fire ruins the galvanized coating on the wire, so this fencing will need to be replaced to ensure continued protection from pigs and goats (NRS no date). Since 2006, no goats have been observed at MMR.

A threat to māhoe (*Alectryon macrococcus* var. *macrococcus*) and mehamehame (*Flueggea neowawraea*) is the nonnative black twig borer (*Xylosandrus compactus*), which burrows into branches and introduces a pathogenic fungus that often kills the host.

Nonnative snails and slugs pose a threat to rare Hawaiian plants by preying on the seedlings' stems and fruit. This reduces regeneration of the host. Rats (*Rattus rattus* and *R. exulans hawaiiensis*) are also known to eat the fruit and strip bark from certain species of native plants, seriously affecting the reproduction of loulou and plants in the Campanulaceae and Gesneriaceae families. Rats also eat 'elepaio eggs and chicks.

Fires have occurred in the past at MMR. There are eight vegetative fuel classifications at MMR, and management of the threats to the natural

resources of the installation from wildfire are included in the Army's IWFMP. A thorough discussion of the threat of wildfire is presented in Section 3.14, Wildfires.

Pōhakuloa Training Area

PTA is on the Island of Hawai'i on the west side of Humu'ula Saddle, a plateau formed by Mauna Kea and Mauna Loa. The surrounding lands are mostly designated as conservation district and are managed or leased by a variety of private landowners and the State of Hawai'i. There are 24 vegetation communities on PTA (Shaw and Castillo 1997). Numerous introduced plant species make up a significant portion of many of these habitats, and introduced plants are components in all habitats on PTA. About 62 percent of the plants found at PTA are introduced species. Barren lava covers 25 percent of the installation. Lichens, such as *Stereocoulon vulcani*, and ferns, such as *Pella ternifolia*, are the first colonizers of these flows, though fountain grass is invading barren areas. Figure 3.8-6 shows the distribution of vegetation communities in the ROI (Shaw and Castillo 1997).

There are four types of *Metrosideros* treeland, ranging from sparse to mixed intermediate. The dominant canopy vegetation in these areas is generally 'ōhia. There are three types of *Dodonaea* shrubland: open, dense, and mixed. 'A'ali'i (*Dodonaea viscosa*) is the dominant plant in each community, along with other native species, including 'ilima (*Sida fallax*), 'aheahea (*Chenopodium oahuense*), and naio. *Leptecophylla* occurs either as a mixed shrubland community or as a component of *Leptecophylla-Dodonaea* shrubland. *Chamaesyce* treeland is generally found hosting native species of *Chamaesyce olowaluana* (a species of concern), 'ilima, 'aheahea, and 'a'ali'i. *Chenopodium* shrubland and *Eragrostis aptopioides* grassland are similar communities with different dominant species. The remainder of the native natural communities is a combination of *Chamaesyce*, *Myoporum*, and *Sophora* species, with divisions based on the densities of species. (US Army and USAEC 2008)

The information below was obtained from Appendix E of Hawai'i Stryker BA: Plant Communities, SBCT--Island of Hawai'i; and Pōhakuloa Training Area Community Types (Shaw and Castillo 1997).

Twin Pu'u Area

Pennisetum Grassland (area within Pu'u footprint) occurs frequently in burned areas in the impact area and in Kīpuka Kālawamauna. Woody vegetation is sparse, not surviving frequent and intense fires. An occasional *Dodonaea viscosa*, *Myoporum sandwicensis*, or *Sida fallax*

may be present. For the most part, these grasslands are monocultures of *Pennisetum setaceum* (fountain grass).

Open *Metrosideros* Treeland with sparse shrub understory (east side bordering Pu‘u and to the south) has an overstory of *Metrosideros polymorpha*, and an understory of *Dodonaea viscosa*, *Styphelia tameiameia*, and *Osteomeles anthyllidifolia*. *Dubautia linearis* may also be present.

Open *Dodonaea* Shrubland (within the northwest area of Pu‘u, just a finger coming in on a northwest-southwest angle; and alongside the west side of Pu‘u footprint) is found predominantly on older Mauna Kea substrates located on the northern and western parts of the installation. *Dodonaea viscosa* is the dominant taxon with *Sida fallax* and *Chenopodium oahuense* as co-dominants. Herbaceous cover is primarily *Eragrostis atropioides*.

Myoporum Shrubland (just offsite footprint to the southwest and south of footprint on eastern half) is scattered across the northern part of PTA, along the margins of Kīpuka Kālawamauna and in an isolated kīpuka on the western boundary. *Myoporum sandwicensis* shrubs are the characteristic overstory species. Other species include *Dodonaea viscosa* and *Chenopodium oahuense*. Herbaceous species tend to be alien in origin.

Myoporum-Dodonaea Shrubland (to north of Pu‘u area) has a similar distribution to the *Myoporum* Shrubland, but three times the shrub density. *Myoporum sandwicensis* is a dominant overstory species with an occasional, larger *Dodonaea viscosa*. Smaller *Dodonaea viscosa* and *Chenopodium oahuense* shrubs characterize the understory. Most of the herbaceous species are alien in origin.

Dodonaea Mixed Shrubland (just south of Pu‘u footprint on western side and a sliver on the eastern Pu‘u) is the most dense shrubland type. Found on Kīpuka Kālawamauna on very old lava flows, the *Dodonaea viscosa* is the dominant taxon. Other shrub species include *Bidens menziesii*, *Chenopodium oahuense*, and *Chamaesyce multiformis*, along with less common plants of *Sida fallax* and *Dubautia linearis*. Herbaceous cover is dominated by *Eragrostis atropioides*.

Invasive Species and Disturbed Habitat

EO 13112, Invasive Species (February 3, 1999), requires that, where feasible, federal agencies should use their authorities to prevent the introduction of invasive species, to detect invasive species, and to

eradicate and control such species in a cost-effective and environmentally sound manner. This EO also limits the ability of federal agencies to authorize or fund activities that are believed to introduce and spread invasive species in the US, unless the benefits of the proposed activity clearly outweigh the harm and all feasible and prudent measures to minimize the harm are implemented. This order, along with the State of Hawai‘i Noxious Weed Rules, which require that noxious weeds be controlled (USDA no date), and which is supported by AR 200-1 Pest Management chapter, have guided Army environmental management actions.

PTA has federal and state listed noxious weeds. Though kikuyu grass (*Pennisetum clandestinum*) is included in this category, it is exceptional at PTA and is not invasive at high-elevation dry ecosystems (US Army and USACE 2004; Shaw and Castillo 1997). Invasive and noxious weeds that are targeted for control on PTA include banana poka (*Passiflora mollissima*), fountain grass (*Pennisetum setaceum*), and Russian thistle (*Salsola kali*). Other widespread weed species are controlled where they threaten native plants and communities.

Of all the nonnative, invasive species affecting PTA, fountain grass is the most troublesome. Fountain grass is a highly aggressive, fire-adapted species that readily outcompetes native plants and rapidly reestablishes after burning. It is one of the few nonnative plants to invade young lava flows and disrupt primary succession at an early stage. This grass also alters the natural fire regime in Hawai‘i and is a major threat to native plants and natural communities. It raises fuel loads, which increases the intensity and spread of a fire, and results in severe impacts to native, dry forest species that are not adapted to such altered fire regimes (Plant Conservation Alliance’s Alien Plant Working Group fact sheet May 05).

3.9.5 Wildlife

Mākua Military Reservation

Regular biological surveys have been conducted at MMR that focus on special status invertebrates, birds, and mammals; information on the general wildlife is provided as well. No specific reptile or amphibian surveys have been conducted because there are no native terrestrial reptiles and amphibians on the Hawaiian Islands. Natural resource surveys conducted by Walker (USARHAW and the 25th ID(L) 2001b; Cooper et al. 1996), University of Hawai‘i, Bishop Museum Hawaiian Heritage Program, and HINHP (no date a) are cited in the paragraphs below. These natural resource surveys were used in preparing the following resource assessments:

- *Biological Inventory and Management Assessment at MMR for USARHAW* (HINHP no date a);
- *Endangered Species Management Plan Report, O'ahu Training Areas* (R. M. Towill Corp. 1997a);
- *O'ahu Training Areas Natural Resource Management Report* (PCSU 2001); and
- *O'ahu Training Areas INRMP* (USARHAW and 25th ID(L) 2001b).

The following sections describe general invertebrate, amphibian, reptile, terrestrial mammal, bird, fish, and marine wildlife species in the ROI. Special status species are discussed in Section 3.9.6.

Invertebrates

The native and endemic invertebrates at MMR include the O'ahu tree snail (*Achatinella mustelina*), six achatinellid land snail species (*Acuriculella ambusta*, *A. spp. aff. castanea*, *A. spp. aff. perpusilla*, *Elasmuius spp.*, *Partulina dubia*, and *Tornatellides spp.*), and two amastrid land snail species (*Amastra rubens* and *Leptachatina spp.*). Three other native species, the endodontid land snail (*Cooke concha spp.*), a helicarionid land snail (*Philonesia spp.*), and succineid land snail (*Succinea spp.*), were also observed at MMR (HINHP no date a; R. M. Towill Corp. 1997a; USARHAW and 25th ID(L) 2001b). Hawai'i Natural Heritage Program surveys of MMR in 1993 detected the following nonnative snails: giant African snail (*Achatina fulica*), bradybaenid land snail (*Bradybaena similaris*), cannibal snail (*Euglandina rosea*), and zonitid land snail (*Hawaiiia minuscula*). Humans have purposely or accidentally introduced these species to O'ahu, and they now threaten the native snail species through competition for resources, predation, and the spread of disease.

Amphibians

There have been no specific amphibian surveys at MMR. Nonnative amphibians found on O'ahu include the bullfrog (*Rana catesbeiana*), wrinkled frog (*R. rugosa*), giant toad (*Bufo marinus*), Cuban tree frog (*Osteopilus septentrionalis*), greenhouse frog (*Eleutherodactylus planirostris*), and coqui frog (*E. coqui*). These species were introduced into O'ahu from other countries and have inhabited areas where adequate aquatic habitat and surrounding vegetation exist. However, the coqui frog is not restricted to areas near aquatic habitat (surface water) as it does not require this habitat type to complete its life cycle.

Reptiles

There have been no specific reptile surveys at MMR. There are no native terrestrial reptiles on the Hawaiian Islands. Nonnative reptiles found on O‘ahu include the green anole (*Anolis carolinensis*), mourning gecko (*Lepidodactylus lugubris*), stump-toed gecko (*Gehyra mutilata*), tree gecko (*Hemiphyllodactylus typus*), Indo-Pacific gecko (*Hemidactylus garnotii*), house gecko (*H. frenatus*), metallic skink (*Lampropholis delicata*), and gold dust day gecko (*Phelsuma laticauda laticauda*). There is only one known terrestrial snake occurring on the Hawaiian Islands, the island blind snake (*Ramphotyphlops braminus*), which can be found on O‘ahu.

Terrestrial Mammals

The Hawaiian hoary bat (*Lasiurus cinereus semotus*) was last observed at MMR in 1998 (USARHAW and 25th ID(L) 2001b). However this sighting is believed to have been a transient bat, and no resident or individuals are thought to occur on O‘ahu. Through the 1999 and current ESA Section 7 consultations, the USFWS determined that the Army was not required to consult on the Hawaiian hoary bat because the single sighting in 1998 was considered to be most likely transient and not representative of a resident population. The hoary bat is the only native terrestrial mammal on the Hawaiian Islands. The following nonnative species may occur on MMR: feral pigs, feral goats, feral cats (*Felis catus*), feral dogs (*Canis familiaris*), Norway rats (*Rattus norvegicus*), black rats (*R. rattus*), Polynesian rats (*R. exulans hawaiiensis*), and the house mouse (*Mus musculus*). Pigs have been observed throughout the moderately moist areas of the Mākua and Kanahāiki Valleys, and goats have been known to use the southern side of Mākua Valley and adjacent Mākaha and Makaleha Valleys (USARHAW and 25th ID(L) 2001a).

Birds

The following indigenous forest bird species have been recorded at MMR: O‘ahu ‘elepaio (*Chasiempis sandwichensis ibidis*), O‘ahu ‘amakihi (*Loxops virens chloris*), white-tailed tropical bird (*Phaethon lepturus dorotheae*), Pacific golden-plover (*Pluvialis fulva*), and pueo or Hawaiian short-eared owl (*Asio flammeus sandwichensis*). Seabird nesting has increased dramatically at Ka‘ena Point NAR over the past decade. Most of these nesting seabirds are the wedge-tailed shearwater (*Puffinus pacificus*) and Laysan albatross (*Phoebastria immutabilis*). Both are pelagic (open water) species that come to land to breed. The wedge-tailed shearwater nests in burrows (NatureServe 2002). There are almost a thousand shearwater burrows in the Ka‘ena Point NAR, and, as predator control increases, the populations are expanding (Liesemeyer 2003). Laysan albatross, a ground-nesting species, has recently begun breeding again on

O‘ahu, at Ka‘ena Point NAR. Both species feed on fish and squid and can be found foraging offshore of the NAR.

The Albatross diet appears to consist mostly of fish, fish eggs, fisheries offal, and especially squid, foraging in both the day and night (Fernandez et al. 2001)

Nonnative bird species known to occur on MMR include the red-billed leiothrix (*Leiothrix lutea*), white-rumped shama (*Copsychus malabaricus*), Japanese bush warbler (*Cettia diphone*), rock dove (*Columbia livia*), spotted dove (*Streptopelia chinensis*), zebra dove (*Geopelia striata*), common myna (*Acridotheres tristis*), red-vented bulbul (*Pycnonotus cafer*), and Japanese white-eye (*Zosterops japonicus*). The nutmeg manikin (*Lonchura punctulata*), red-crested cardinal (*Paroaria coronata*), barn owl (*Tyto alba*), Erchel’s francolin (*Francolinus erckelii*), ring-necked pheasant (*Phasianus colchicus*), and northern cardinal (*Cardinalis cardinalis*) are also species that have been introduced by humans to O‘ahu.

Freshwater Fish

No fish data have been gathered from MMR streams (USARHAW and 25th ID(L) 2001b), and no formal surveys of the intermittent streams at MMR have been conducted, so little information is available (Kawelo 2003).

Marine Fauna

The project ROI includes a small segment of beachfront and a nearshore coastal area (part of the Wai‘anae coast) that extends approximately 0.5 mile (0.8 kilometer) out into the waters adjacent to this portion of the beach. The Mākua Beach and nearshore environment are included in the ROI to encompass potential project impacts on marine biological resources.

There are no specific coral reef areas of management concern in the ROI (CRAMP 2003). The closest coral assemblages that have designated concern status by the state is several miles south, at the nearshore area of Kahe Point (CRAMP 2003).

The Pacific waters and coastlines of the Hawaiian Islands provide habitat for a variety of marine wildlife. Numbers and types of animals are not consistent, as the distribution and abundance of both marine mammals and sea turtles in Hawaiian waters vary seasonally, from nearshore to offshore, and spatially (i.e., from island to island and between different sides of the islands) (Calambokidis et al. 1998; Mobley et al. 2001a; NOAA Fisheries 2000a, 2000b).

The portion of the Wai‘anae coast adjacent to MMR faces west-southwest. This side of O‘ahu is protected (in the lee) from prevailing northeasterly trade winds. Thus, the waters are generally calmer on this side than on the other sides of the island, providing for a preferential habitat for certain kinds of behaviors (e.g., resting, nursing) with certain species (e.g., spinner dolphins). The shore area adjacent to MMR provides suitable beach habitat for some marine wildlife that exit the water, such as sea turtles or monk seals. The nearshore coastal waters along Mākua Beach provide habitat for several marine wildlife species. These waters are not included in the Hawaiian Islands Humpback Whale National Marine Sanctuary. Most of the marine mammals and sea turtles known to occur in Hawaiian waters are not considered likely to occur in the ROI. The ones that are considered likely are detailed in the next section below (if only MMPA-protected) or under in Section 3.9.6 (if ESA-listed). The other species known, but not expected, in the ROI are discussed in Appendix H-2.

All marine mammal species are protected under the MMPA, regardless of whether they have additional protection under the ESA. MMPA-protected and ESA-listed marine wildlife species that may occur in the ROI seasonally, regularly, or as transients are listed in Table 3.9-1. Most of marine mammal species in the ROI are transient, occurring with unpredictable frequency and staying in the area only in the short-term. Humpback whales (*Megaptera novaeangliae*) in the Hawaiian islands may occur with increasing frequency as their season progresses, beginning in mid-December and continuing into January, when they first arrive and their numbers are low, through their peak in mid-February and March, to late April when their numbers decline again as they begin their migration northward. For the Wai‘anae Coast, anecdotal data suggest that humpback whales are visible almost daily earlier in the season, from mid-December through mid-January. Spinner dolphins (*Stenella longirostris*) do occur regularly in the ROI and can be considered “residential” (i.e., staying in the area); residential individuals are expected to occur daily or frequently for consistent periods of times.

Five species of sea turtles inhabit waters of the Hawaiian Islands: green (*Chelonia mydas*), loggerhead (*Caretta caretta gigas*), leatherback (*Dermochelys coriacea schlegelii*), hawksbill (*Eretmochelys imbricata*), and olive ridley (*Lepidochelys olivacea*). They are all listed under the ESA and are discussed further in Section 3.9.6; the monk seal is also discussed in that section.

Table 3.9-1
Sensitive Marine Wildlife Occurring or Potentially Occurring in Hawaiian Waters Near the Region of Influence ***

Scientific Name	Common Name	¹ Federal Status	² State Status	Habitat	Likelihood of Occurrence in ROI	Notes
<i>Cetaceans and Pinnipeds</i>						
<i>Balaenoptera acutorostrata</i>	Minke whale	*	-	May occur in nearshore or offshore waters	U	Most common northwest of the main seven-island chain or on leeward side of islands. May be incidentally sighted in waters adjacent to MMR.
<i>B. borealis</i>	Sei Whale	E*	-	Most likely in deeper offshore waters	U	Rarely sighted in Hawaiian waters.
<i>B. edeni</i>	Bryde's whale	*	-	May occur in nearshore or offshore waters	U	Most common northwest of the main seven-island chain. May be incidentally sighted in waters adjacent to MMR.
<i>B. musculus</i>	Blue whale	E*	-	Most likely in deeper offshore waters	U	Heard in Hawaiian waters.
<i>B. physalus</i>	Fin whale	E*	-	Most likely in deeper offshore waters	U	Heard but rarely sighted in Hawaiian waters.
<i>Berardius bairdii</i>	Baird's whale	*	-	Most likely in deeper offshore waters	P	May be incidentally sighted in waters adjacent to MMR.
<i>Delphinus delphis</i>	Common dolphin	*	-	Most likely in deeper offshore waters	U	May be incidentally sighted in waters adjacent to MMR.
<i>Eubalaena glacialis</i>	Pacific right whale	E*	-	Unknown if depth is a criteria	U	Most likely stray individuals from more northern population.
<i>Feresa attenuata</i>	Pygmy killer whales	*	-	May occur in nearshore or offshore waters	C	Occasionally seen in the channels between the main islands. Has been documented off the coast of O'ahu.
<i>Globicephala macrorhynchus</i>	Short-finned pilot whale	*	-	May occur in nearshore or offshore waters	C	Occasionally seen in the channels between the main islands. Common in nearshore or offshore areas in waters adjacent to MMR.
<i>Grampus griseus</i>	Risso's dolphin	*	-	Most likely in deeper offshore waters	U	More common sighted offshore. May be seen in offshore areas in waters adjacent to MMR
<i>Kogia breviceps</i>	Pygmy sperm whale	*	-	Most likely in deeper offshore waters	P	Prefers deeper waters but occasionally seen in the channels between the main islands. May be incidentally sighted in waters adjacent to MMR.

**Table 3.9-1
Sensitive Marine Wildlife Occurring or Potentially Occurring in Hawaiian Waters Near the ROI**

Scientific Name	Common Name	¹ Federal Status	² State Status	Habitat	Likelihood of Occurrence in ROI	Notes
<i>K. simus</i>	Dwarf sperm whale	*	-	Most likely in deeper offshore waters	P	Prefers deeper waters but occasionally seen in the channels between the main islands. May be incidentally sighted in waters adjacent to MMR.
<i>Monachus schauinslandi</i>	Monk seal	E*, CH, D	-	More common in nearshore waters or hauled out on the coast.	C	Most common northwest of the main seven-island chain. Incidental individuals may haul out along the coast of the islands' north shores. Anecdotal sighting on MMR beach.
<i>Megaptera novaeangliae</i>	Humpback whale	E*	-	May occur in nearshore or offshore waters	C	Occurs throughout the main seven-island chain January through April. Occurs in waters adjacent to the islands' north shores.
<i>Mesoplodon densirostris</i>	Blainsville's whale	*	-	Most likely in deeper offshore waters	C**	Prefers deeper offshore waters but has been sighted off coast of O'ahu.
<i>Orcinus orca</i>	Killer whale	*	-	May occur in nearshore or offshore waters	C**	Occasionally seen, especially in the channels between the main islands and at the northwest island chain. May be incidentally sighted in nearshore or offshore waters adjacent to MMR.
<i>Peponocephala electra</i>	Melon-headed whale	*	-	May occur in nearshore or offshore waters	C**	Occurs especially in the channels between the main islands and at the northwest island chain. May also occur in nearshore or offshore areas adjacent to MMR.
<i>Physeter macrocephalus</i>	Sperm whale	E*	-	Most likely in deeper offshore waters	U	Most common off the north and eastern shores of the main seven islands. May be sighted in waters adjacent to the islands' north shores.
<i>Pseudorca crassidens</i>	False killer whale	*	-	May occur in nearshore or offshore waters	C**	Occasionally seen in the channels between the main islands. May be sighted in nearshore or offshore waters adjacent to MMR.
<i>Stenella attenuate</i>	Spotted dolphin	*	-	Most likely in nearshore, leeward coastal waters	C	Common along the coastline, especially on the leeward sides of the island. Occurs in nearshore or offshore areas in waters adjacent to MMR.
<i>S. coeruleoalba</i>	Striped dolphin	*	-	May occur in nearshore or offshore waters	P	More strandings sighted than live individuals.
<i>S. longirostris</i>	Spinner dolphin	*	-	Most likely in nearshore, leeward coastal waters	C	Common along the coastline. Occurs in nearshore or offshore areas in waters adjacent to MMR.
<i>Steno bredanensis</i>	Rough toothed dolphin	*	-	Most likely in deeper offshore waters	C**	Prefers deeper offshore waters but has been sighted off coast of O'ahu.

**Table 3.9-1
Sensitive Marine Wildlife Occurring or Potentially Occurring in Hawaiian Waters Near the ROI**

Scientific Name	Common Name	¹ Federal Status	² State Status	Habitat	Likelihood of Occurrence in ROI	Notes
<i>Tursiops truncatus</i>	Bottlenose dolphin	*	-	May occur in nearshore or offshore waters	C	Common along the coastline. Occurs in nearshore or offshore areas in waters adjacent to MMR. Also common offshore in project area waters.
<i>Ziphius cavirostris</i>	Cuvier's beaked whale	*	-	Most likely in deeper offshore waters	C**	Most common of the beaked whales in project area waters. Prefers deeper offshore waters but can be common in nearshore or offshore areas in waters adjacent to MMR.
<i>Caretta caretta</i>	Loggerhead turtle	T	-	In project area; prefers nearshore waters	U	Considered uncommon in MMR waters.
<i>Chelonia mydas</i>	Green turtle	T	-	In project area; prefers nearshore waters	C	Nests annually on Hawaiian beaches; common in nearshore areas of any of the main seven islands; most abundant sea turtle in MMR waters.
<i>Dermochelys coriacea</i>	Leatherback turtle	E	-	In project area; prefers offshore waters	C	Primarily occurs over deep oceanic waters; sighted equally as frequently off any of the main seven islands.
<i>Eretmochelys imbricate</i>	Hawksbill turtle	E	-	In project area; prefers nearshore waters	U	Considered uncommon; a small number nest on the Island of Hawai'i.
<i>Lepidochelys olivacea</i>	Olive ridley turtle	T	-	In project area; prefers offshore waters	U	Infrequently seen in Hawaiian offshore waters.

Sources: NOAA Fisheries 2000a-bb; ONR 2002

Status:

¹Federal:

E = Endangered

T = Threatened

* = Protected under MMPA

D = Depleted under the MMPA

CH = Critical habitat designated

** = presence confirmed from aerial surveys but found at a distance offshore from the MMR coastline, so discussed in appendix rather than text.

*** = All species listed in table have been observed at least once in the nearshore or offshore Pacific waters of the Hawaiian Islands at some point in the last decade.

²State

/-/ = No Status

Likelihood of occurrence in the project site

C = Confirmed

P = Potentially may occur

U = Unlikely to occur

Spinner Dolphins

The Hawaiian Islands group of spinner dolphins is a distinct stock, with an overall population estimate of approximately 4,000 animals (Lammers et al. 2000; Mobley et al. 2001a). Spinner dolphins are very common and abundant, and they occur year-round in Hawaiian waters (NOAA Fisheries 2000q). They are often seen in large groups of over 400 animals (Dollar 1999), although there may be seasonal changes in abundance. The group's movement pattern around the islands has been well documented and is considered predictable and cyclical (Norris 1991; Lammers et al. 2000; Lammers 2003a). Spinner dolphins typically occupy shallow inshore waters in the morning and afternoon then move farther offshore in the late afternoon or early evening to forage. They tend to rest on the leeward sides of the islands, especially in nearshore or offshore areas with sandy bottoms. This period of rest is considered very important for tissue regeneration and overall health and also appears to be important in establishing or reaffirming social relationships (Lammers 2003a). Spinner dolphins in general show a strong preference for waters both inside or near the 10-fathom (60-foot) isobath between the early morning and late afternoon periods (Dollar 1999; Pickering 2003; Lammers 2003a).

Local subpopulations are often residential to the various islands (NOAA Fisheries 2000q) or to parts of the islands (Lammers 2003a). Along the western coastline of O'ahu, spinner dolphins are found mainly at three general shallow water (less than 10 fathoms) sites (Lammers et al. 2000; Lammers 2003a). One of these is located adjacent to MMR and is known as the northern Wai'anae site. The population that is found here, within the ROI, is considered residential and is part of the Wai'anae spinner dolphin group (Lammers 2003a). Ninety-five percent of the time surveyed, spinner dolphins were sighted in front and just north of Mākua Beach at this site (Lammers 2003a). Numbers near MMR do vary seasonally, but typically the MMR pod group size ranges from between 35 and 200 animals (Pickering 2003; Lammers 2003a). The number varies depending on which of the "subpods" appear, as well as on the varying formations of groups that may occur at one time. The dolphins occur throughout the day and night near MMR, but typically peak concentrations are when the animals are resting. Spinner dolphins typically occupy shallow inshore waters in the morning and afternoon, then move farther offshore in the late afternoon or early evening to forage (Lammers 2005). Recent studies (Benoit-Bird and Au 2003, 2004) show that prey of the resident spinner dolphins (and other marine mammals) show a distinctive movement pattern (diurnal migration). The prey moves within the water column so that it is usually in deeper water by day and in the midwater or surface waters by night. In addition, there is a horizontal component of movement by this foraging layer of prey. It moves nearshore, coming

within 0.6 mile (1 kilometer) of the shoreline during the middle of the night (Benoit-Bird and Au 2004).

Preferred locations of the Wai‘anae spinner dolphin group are shown on Figure 3.9-1.

As evidenced by their frequent sightings, the shallow location at Mākua Beach is preferred habitat by the spinner dolphins. It provides excellent resting habitat due to several factors. This site is the most protected from trade winds; thus, the waters are often calm and more sheltered than adjacent areas (Lammers 2003a; Dollar 1999). The area also is adjacent to dolphin foraging grounds near Ka‘ena Point. The site is thought to afford protection from sharks due to the sandy bottom, which allows for excellent visibility and avoidance of attacks (the bottom substrate consists mainly of large stretches of white sandy bottom). The animals have been documented resting in the early mornings through early afternoon, recovering from the long feeding bouts that they engage in farther offshore at night. In the late afternoon, usually sometime after 3:00 PM and sometimes as late as 5:00 PM, the dolphins come out of their resting and milling mode to move into deeper waters to feed. At this time they commence a period of renewed social activity, moving rapidly and “spinning” (leaping) out of the water (Lammers et al. 2000; Lammers 2003a) while they gather in preparation of foraging. The animals move out of the bays in the late afternoon to feed in water at depths of 600 to 6,000 feet (180 to 1,800 meters) (Dollar 1999; Norris 1994). Lammers (2003a) surmises that “the ability to rest while minimizing predation risks is undoubtedly the primary reason spinner dolphins occupy the nearshore habitat during daylight hours.”

Hawaiian waters in general have been identified as “acoustic hot spots” (NRDC 1999); that is, the habitat is considered to be both of ecological significance and yet currently acoustically impacted (i.e., it is considered to be exposed to high levels of human-made noise). A number of existing factors may be placing marine wildlife in Hawaiian waters under some degree of existing stress that is impossible to quantify; these factors include the acoustic status of the waters, the increasing numbers of tour operations and programs where people swim with dolphins, and other invasive human practices. Spinner dolphins are known to react to swimmers (Richardson et al. 1995, p. 410; MMPA Bulletin 1999) and have been documented to be sensitive, possibly more than other dolphin species, to aircraft (Richardson et al. 1995, p. 248).

The Wai‘anae dolphin group is the focus of approximately four to six boat operators daily (Lammers 2003a), and the public and tourists frequently approach them for “swim with” programs, even though it is illegal. No studies have been published assessing what limits this group has in terms of their adaptability to disturbance from humans, and no published studies

have assessed what the current or near-term costs may be to them (e.g., increased predation, reduced reproductive fitness, increased levels of stress) from existing human interaction.

Figure 3.9-7 shows sensitive wildlife species in the ROI (MMR). Figure 3.9-8 shows sensitive wildlife species in the ROI (PTA).

Pōhakuloa Training Area

Zoological field surveys that have been conducted on PTA include those by Shallenberger (1977), David (1995), and Freed (1991). More recent surveys targeting native rare invertebrates, mammals, and birds were also conducted (Gon et al. 1993; HINHP 1998; USARHAW and 25th ID [L] 2001b; CEMML and PTA NRS 2005, 2006, and 2007), as were entomology surveys of the PTA lava tubes (Garcia and Associates 2003). There have been no specific reptile surveys on PTA because there are no native terrestrial reptiles and amphibians on the Hawaiian Islands. Surveys of PTA were conducted by the University of Hawai‘i, the Bishop Museum Hawaiian Heritage Program, the HINHP, and PTA NRS, which are cited in the following section. These natural resource surveys have been used for resource assessments, to include the PTA INRMP, the 2003 Biological Assessment, and the PTA Implementation Plan. The following section describes the general presence of invertebrate, mammal, bird, and fish species.

Invertebrates

Native and endemic invertebrates on PTA include the Hawaiian heliconid moth (*Heliconia confusa*) and the Giffards rhyncogonus weevil (*Rhyncogonus giffardi*). Snails documented at PTA are *Letachatina* spp., *Euconulus gaetanoi*, *Nesopupa subcentralis*, *Nesovitrea hawaiiensis*, *Striatura* spp., and *Vitrina tenella*. The helicarionid land snail (*Philonesia* spp.) and succineid land snail (*Succinea konaensis*) were also observed on PTA (HINHP 1998; R. M. Towill Corp. 1997a; USARHAW and 25th ID [L] 2001b). Some underground caves can contain standing water and may support species of arthropods. Howarth et al. (1996) found at least 90 species of arthropods (at least 60 native) and six other invertebrates (including a rare native snail, *Leptachatina* sp.), in PTA caves and lava tubes. Three endemic caterpillar species, *Schrankia* sp., were noted during recent surveys for native invertebrates at PTA lava tubes (Garcia and Associates 2003). Surveys of PTA by HINHP in 1993 detected the following nonnative snails: giant African snail, bradybaenid land snail, cannibal snail, and the zonitid land snail. Humans have purposely or accidentally introduced these species to the Island of Hawai‘i. They now threaten the native snail species through competition for resources, predation, and the spread of disease (PCSU 1999).

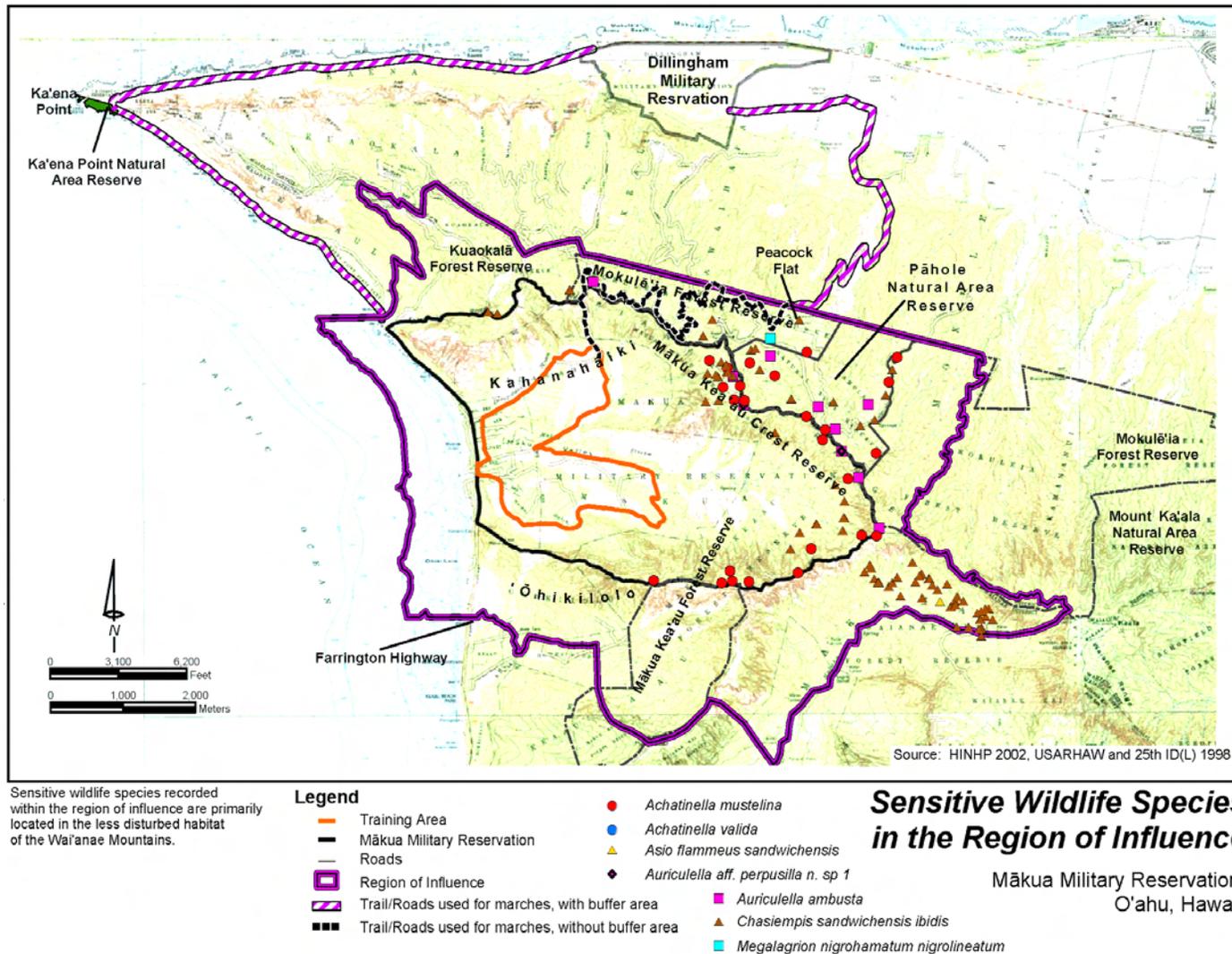
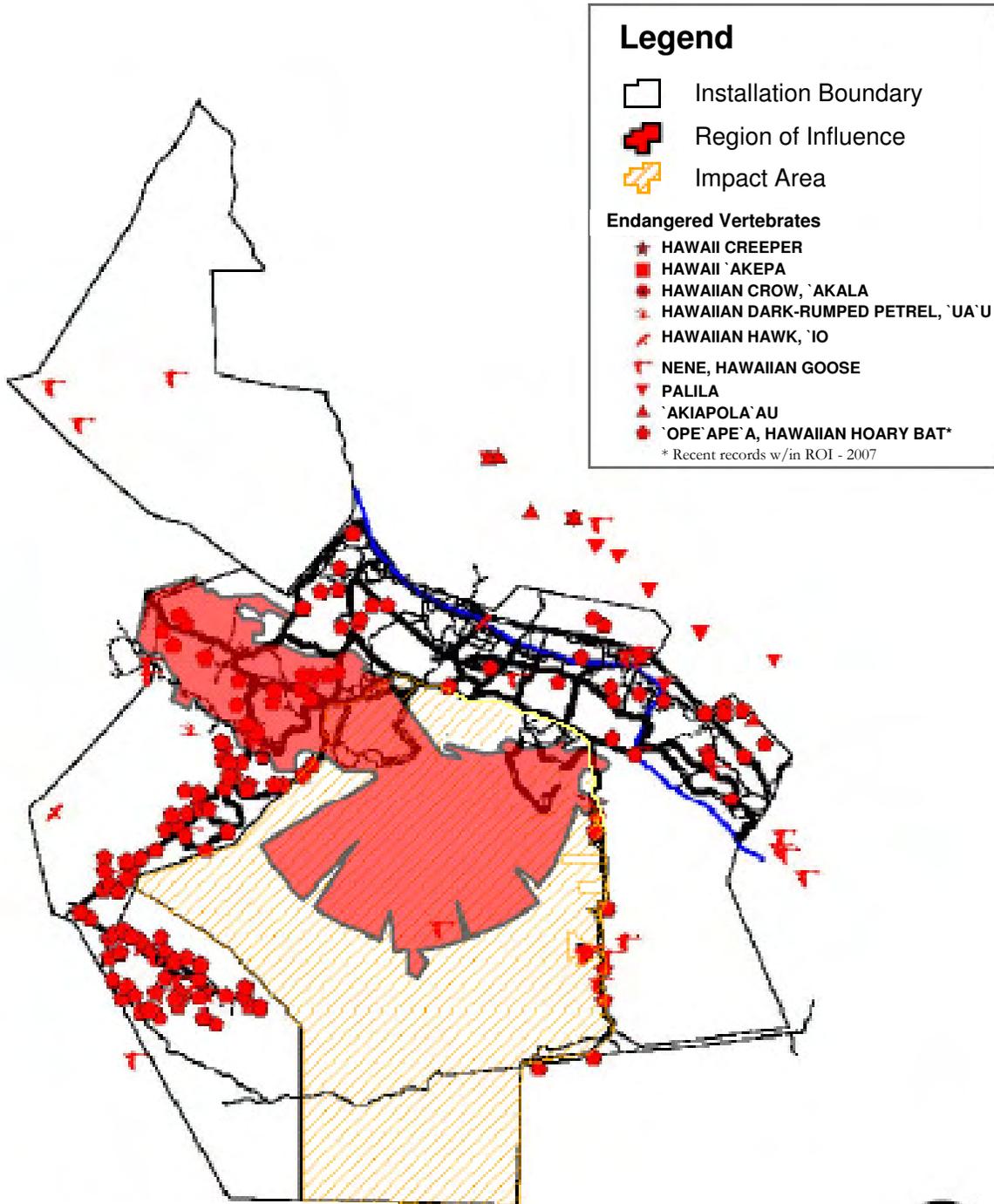


Figure 3.9-7 Sensitive Wildlife Species in the Region of Influence, MMR



**Pōhakuloa Training Area
Endangered Animal Sightings
In the Past 20 Years**



Figure 3.9-8 Sensitive Wildlife Species, PTA Terrestrial Region of Influence

Amphibians

There are no native terrestrial amphibians on the Hawaiian Islands. Nonnative amphibians found on the Island of Hawai‘i include bullfrog, wrinkled frog, coqui frog, giant toad, and Cuban tree frog. These species were introduced into Hawai‘i from other countries and have inhabited areas of adequate aquatic habitat and surrounding vegetation. To date, no amphibians have been found at PTA.

Reptiles

There are no native terrestrial reptiles on the Hawaiian Islands. Nonnative reptiles found on the Island of Hawai‘i include the green anole, mourning gecko, stump-toed gecko, tree gecko, Indo-Pacific gecko, house gecko, metallic skink, and gold dust day gecko. Sometime in the 1980's the blind snake was introduced to the islands of Hawaii in potting soil from plants (probably from the Philippines). These small snakes with tiny eye-spots, eat small termites, ants and other arthropods. As termites and ants are also introduced animals, these snakes pose no great threat to ecosystems in Hawaii. To date, none of these species have been found at PTA.

The following nonnative species have been documented as occurring on PTA: feral pig, feral goat, feral cat, feral dog, Norway rat, black rat, feral sheep (*Ovis aries*), mouflon sheep (*O. musimon*), mongoose (*Herpestes auropunctatus*), and house mouse. The Polynesian rat may occur on PTA. The only native terrestrial mammal found on PTA is the Hawaiian hoary bat (*Lasiurus cinereus semotus*), which is a species listed as endangered under the ESA.

Birds

Endemic species fairly common to PTA are apapane and Hawaiian amakihi. Endemic species with declining populations less common to, but identified on, PTA are ‘i‘iwi, and ‘ōma‘o (*Myadestes obscurus*) (USARHAW and 25th ID [L] 2001b). The dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*) is a federally listed endangered species that may occur on PTA. A survey to determine presence of the dark-rumped petrel was conducted in 2007 (CEMML and PTA NRS 2008). No birds were seen or heard during the monitoring period; however, because of the difficulty in detecting the petrel, surveys will continue. The ‘elepaio is native, but only two individuals are known at PTA. The ‘io (*Buteo solitarius*) is occasionally seen on PTA and the nēnē (*Branta sandvicensis*) is seasonally observed on PTA. Up to 20 nēnē were seen in Range 1 in 2007, but the area of the sighting is outside the ROI for this proposed Alternative. Nonnative bird species known to occur on PTA include lavender waxbill (*Estrilda caerulescens*), Erchel’s francolin (*Francolinus erckelii*), black francolin (*F. francolinus*), California quail

(*Callipepla californica*), and Japanese quail (*Coturnix japonica*). The house finch (*Carpodacus mexicanus*) and Eurasian sparrow (*Paser domesticus*) are also species that have been introduced by humans on the Island of Hawai‘i.

Migratory Birds

A minimum of eleven species of migratory bird species have been observed at PTA. These birds are protected by the Migratory Bird Treaty Act (MBTA) and EO 13186. Under the MBTA (16 U.S.C. 703), unless permitted by regulation (i.e., waterfowl hunting, incidental taking during DoD training and testing), it is illegal to “take” migratory birds, their eggs, feathers or nests. “Take” includes by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing or transporting any migratory bird, nest, egg, or part thereof. Under the MBTA, only the direct “take” of migratory birds requires authorization by USFWS. Actions that may adversely impact or indirectly “take” birds such as habitat destruction or manipulation are not a violation of the MBTA unless migratory birds are killed or wounded during the activity. However, the MOU between the DoD and the USFWS to promote the conservation of migratory birds that was developed pursuant to EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, address’ both direct and indirect take of migratory birds. The MOU identifies specific activities where cooperation between USFWS and DoD will contribute substantially to the conservation of migratory birds and their habitats. This MOU does not authorize the take of migratory birds.

On February 28, 2007, the USFWS published the final rule on the take of migratory birds by the Armed Forces. This rule authorizes and explains the conditions for which the Armed Forces, and contractors performing a military readiness activity in association with the Armed Forces, can unintentionally take migratory birds during military readiness activities (USFWS 2007c). If the Armed Forces determine that a proposed or an ongoing military readiness activity may result in a significant adverse effect on a population of a migratory bird species, then they must confer and cooperate with the USFWS to develop appropriate and reasonable conservation measures to minimize or mitigate identified significant adverse effects. Under certain circumstances, such unintentional take authorization is subject to withdrawal to ensure consistency with the provisions of the migratory bird treaties.

Fish

The semi-arid climate and permeable soils of PTA support no standing or running surface water; thus, no natural aquatic systems occur on PTA (USARHAW and 25th ID [L] 2001b). Although Wai‘ula‘ula Gulch and

Makeahua Stream cross the proposed PTA Trail alignment, no fish data are available for the PTA ROI.

Marine Biological Resources

The near-shore and offshore Pacific waters between O‘ahu and the Island of Hawai‘i, the Pearl Harbor area of O‘ahu, the Kawaihae Harbor area of the Island of Hawai‘i, and coastlines adjacent to the harbors were included in the PTA SBCT ROI. These areas were considered to be included in the ROI for this PTA action alternative; however, there would be no increase in the frequency of vessel transport of troops for this action. Soldiers that would be transported to PTA for SBCT or other training, would also undergo their required CALFEX training, which would limit the need and frequency for vessel transportation between O‘ahu and the Island of Hawai‘i.

As discussed in the PTA SBCT FEIS, some of the transit areas for the vessels between the two islands are within or in close proximity to the Hawaiian Islands Humpback Whale National Marine Sanctuary waters. Designated sanctuary waters surround the entire western portion of the Island of Hawai‘i and include waters just outside and surrounding Kawaihae Harbor. Designated sanctuary waters also occur outside of O‘ahu at Penguin Banks, which would be part of the transit route for crew-transporting vessels. Any adjacent coastline areas in the ROI may provide shore habitat for some marine wildlife, such as sea turtles, monk seals, and spinner dolphins.

There is a coral reef area of management concern (known as a “hot spot”) in the PTA SBCT ROI. Located at Kawaihae Harbor, this reef is identified as at risk both from extensive development at the commercial harbor and from recent and continued development at the small boat harbor. While the main issue affecting this reef is harbor construction, other causes of decline for this reef system include interruption of long-shore transport due to harbor development, consequent siltation of Pelekane Bay, and close proximity to important cultural sites (i.e., Pu‘u Kohola Heiau) that causes increased recreational use and human presence (CRAMP 2003).

In addition to this reef identified as a management concern, there were other coral reefs identified in the coastal waters of the PTA SBCT ROI. One that is well known is Puako reef, approximately 8 to 10 miles (12.9 to 16.1 kilometers) from Kawaihae Harbor. There are no coral reef areas of management concern outside Pearl Harbor on O‘ahu (CRAMP 2003). Marine wildlife occurs in the PTA SBCT ROI in both the near-shore and offshore regions of Pacific waters. The harbor areas and adjacent coastline areas also provide habitat for marine wildlife. Kawaihae Harbor is on the

leeward side of the island, where waters are calmer and more protected. These waters provide good habitat for humpback mother and calf pods and for resting dolphin pods as well as sea turtles, potentially monk seals, and other marine wildlife.

Distributions and abundance of marine mammals and sea turtles in Pacific waters vary seasonally and spatially; that is, numbers and types of animals may vary in the near-shore versus offshore regions, as well as by the time of year (Calambokidis et al. 1997; Leatherwood et al. 1982; Mobley et al. 1999, 2000; NOAA Fisheries 2000x through 2000bb). Many marine mammal species occur year-round in Pacific waters.

All marine mammal species are protected under the MMPA, regardless of whether they have additional protection under the ESA. Informal consultation with NOAA Fisheries was initiated for marine mammals in the SBCT ROI. NOAA Fisheries concurred with the Army that slow speeds (less than 11 knots) of the logistic support vessels (LSV) would make collisions with protected species unlikely, and therefore, not likely to adversely impact such species. Both MMPA and ESA protected marine wildlife species that may occur in the PTA SBCT ROI seasonally, permanently, or as transients, are detailed in US Army and USACE 2004.

3.9.6 Sensitive Status Species and Habitats Mākuā Military Reservation

Sensitive species include special status, or regulated, species, such as ESA-listed species, USFWS- or State of Hawai‘i-listed endangered, threatened, candidate, or proposed species, MMPA species, federal and state species of special concern, and locally regulated species. Species that have had rapid population decline or whose habitat has markedly decreased in recent years are also considered sensitive.

The vast majority of the terrestrial sensitive species found within the ROI inhabit the Wai‘anae Mountains that border MMR. Coastal habitats, including portions of the Ka‘ena Point Trail, also offer important habitat to sensitive species discussed in this section. ESA Section 7 consultation for routine training at MMR covered 46 listed plant species identified at MMR, the O‘ahu tree snail, the O‘ahu creeper, the O‘ahu ‘elepaio and its critical habitat (proposed at the time), and the Hawaiian hoary bat (USARHAW and 25th ID(L) 1998; USFWS 1999a, 2001a and 2001b). The 1999 BO, 2001 supplemental BO, and 2007 BO cover all the federally listed species discussed in this section, with the exception of marine mammals and marine reptiles. The 2007 BO provides an updated and more comprehensive status review of each threatened and endangered species

addressed in the consultation; that level of review is required by the ESA and is above and beyond the scope (or “exceeds the requirements”) of an EIS. For additional information, the corresponding pages within the 2007 BO that address a species are provided.

Sensitive Vegetation Species

Presented below is the natural history information for sensitive status vegetation species known or considered likely to occur in the ROI that could be affected by Army activities. Species location is provided when known, and all species are represented in genetic storage facilities with cuttings or seeds unless otherwise noted. An extensive key to status codes is provided in Appendix H-2, along with sensitive status vegetation identified as occurring only historically in the ROI and those sensitive species that are considered unlikely to occur. Briefly, the status information included below indicates the level of federal protection (FE = endangered, T = threatened, C = candidate for federal listing as an endangered species) and the Heritage Ranking (G1-G6), which is a rarity rating developed by The Nature Conservancy. The table indicates whether or not critical habitat has been designated for the individual species. The ROI identified for most species refers to the training portion of the ROI unless noted otherwise.

Table 3.9-2 contains a list of these plant species and associated level of regulation, habitat preferences, and likelihood of occurrence in the ROI. Figure 3.8-7 shows the locations of sensitive plant species confirmed within the ROI. Figure 3.9-9 shows the designated critical habitat in the ROI (MMR). Figure 3.9-10 shows the designated critical habitat in the ROI (PTA).

Table 3.9-2
Sensitive Plant Species Occurring or Potentially Occurring in the Region of Influence

Scientific Name	Hawaiian Name/Common Name	Federal¹ Status	Global³ Status	Habitat	Date Last Surveyed	Likelihood of Occurrence
<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	‘Ala ‘alahua, māhoe	E, CH	G2	Native-dominated moist forest and gulch slopes	2005	C
<i>Alsinidendron obovatum</i>	NCN	E, CH	G1	Lowland diverse moist forest	2005	P
<i>Bobea sandwicensis</i>	‘Ahakea	-	G2	Gulch slopes in dry to moist forest	2005	C
<i>B. timonioides</i>	‘Ahakea	-	G2	Ridges and gulch slopes of dry to moist forest	2000	C
<i>Bonamia menziesii</i>	NCN	E, CH	G2	Dry to moist forest	2005	C

Table 3.9-2
Sensitive Plant Species Occurring or Potentially Occurring in the Region of Influence

Scientific Name	Hawaiian Name/Commo n Name	Federal ¹ Status	Global ³ Status	Habitat	Date Last Surveyed	Likelihood of Occurrence
<i>Cenchrus agrimonioides</i> var. <i>agrimonioides</i>	NCN	E, CH	G1	Ridges and slopes of dry to moist forest	2005	C
<i>Centaurium sebaeoides</i>	‘Āwiwi	E, CH	GH	Coastal, dry rocky substrates	1976	U
<i>Chamaesyce celastroides</i> var. <i>kaenana</i>	‘Akoko	E, CH	-	Coastal dry shrubland	2006	C
<i>Ctenitis squamigera</i>	Pauoa	E, CH	-	Moist forest understory	2002	C
<i>Cyrtandra dentata</i>	Ha‘iwale	E, CH	G1	Moist to wet forests	2005	C
<i>Cyperus trachysanthos</i>	Pu‘uka‘a	E	-	Mud flats, wet cliff seeps, coastal cliffs	1999	U
<i>Cyanea superba</i> spp. <i>suberba</i>	Hāhā	E, CH	G1	Moist to wet forest slopes	2005	U
<i>Delissea subcordata</i>	NCN	E, CH	G1	Moist forest understory	2005	C
<i>Diellia falcata</i>	Palapalai lau li‘i	E, CH	G1	Deep shade in dry forest	2005	C
<i>Dubautia herbstobate</i>	Na‘ena‘e	E, CH	-	Dry coastal ridges	2005	C
<i>D. sherffiana</i>	Na‘ena‘e	-	G1	Moist inland ridges	2005	C
<i>Euphorbia haeleeleana</i>	‘Akoko	E, CH	-	Lowland moist to dry forest slopes	2005	C
<i>Flueggea neowawraea</i>	Mehamehame	E, CH	-	Dry forest	2005	C
<i>Abutilon sandwicense</i>	NCN	E, CH-	G1	Dry to mesic lowland forest	2005	C
<i>Chamaesyce herbstii</i>	‘Akoko	E,CH	G1	Mesic <i>Acacia koa</i> - <i>Metrosideros polymorpha</i> lowland forests or diverse mesic	2005	C
<i>Colubrina oppositifolia</i>	Kauila	E, CH	G1	Lowland dry and mesic forests dominated by <i>Diospyros sandwicensis</i>	2005	C
<i>Cyanea grimesiana</i> ssp. <i>obatae</i>	Hāhā	E, CH	G1	Mesic to wet lowland forests	2005	C

Table 3.9-2
Sensitive Plant Species Occurring or Potentially Occurring in the Region of Influence

Scientific Name	Hawaiian Name/Commo n Name	Federal ¹ Status	Global ³ Status	Habitat	Date Last Surveyed	Likelihood of Occurrence
<i>Cyanea longiflora</i>	Hāhā	E, CH	G1	Mesic <i>Acacia koa</i> - <i>Metrosideros</i> <i>polymorpha</i> lowland forest	2005	C
<i>Gouania vitifolia</i>	NCN	E, CH	G1	Dry to mesic forests	2005	C
<i>Hesperomannia arbuscula</i>	NCN	E, CH	G1	Dry to wet forest dominated by <i>Acacia koa</i> and <i>Metrosideros</i> <i>polymorpha</i>	2005	C
<i>Isodendrion laurifolium</i>	Aupaka	E, CH	G1	Diverse mesic or dry forest dominated by <i>Metrosideros</i> <i>polymorpha</i> , <i>Eugenia</i> <i>reinwardtiana</i> , or <i>Diospyros</i> <i>sandwicensis</i>	2005	C
<i>Isodendrion longifolium</i>	Aupaka	T, CH	G2	Mixed mesic or lowland wet <i>Metrosideros</i> <i>polymorpha</i> - <i>Dicranopteris</i> <i>linearis</i> forest	2005	C
<i>Isodendrion pyrifolium</i>	Kula wahine noho	E, CH	G1	Bare rocky hills and in wooded ravines in dry shrublands	2005	C
<i>Mariscus pennatiformis</i>	NCN	E, CH	G1	Mesic and wet <i>Metrosideros</i> <i>polymorpha</i> forest and <i>Metrosideros</i> <i>polymorpha</i> - <i>Acacia koa</i> forest	2005	C
<i>Melicope pallida</i>	Alani	E, CH	G1	Steep rock faces in lowland dry or mesic forests	2005	C
<i>Neraudia angulata</i> <i>var. angulata</i>	NCN	E, CH	G1	Lowland mesic or dry forest	2005	C
<i>Peucedanum sandwicense</i>	Makou	T, CH	G2	<i>Metrosideros</i> <i>polymorpha</i> lowland mesic forest	2005	C

Table 3.9-2
Sensitive Plant Species Occurring or Potentially Occurring in the Region of Influence

Scientific Name	Hawaiian Name/Commo n Name	Federal ¹ Status	Global ³ Status	Habitat	Date Last Surveyed	Likelihood of Occurrence
<i>Phyllostegia kaalaensis</i>	NCN	E, CH	G1	Mesic forest or <i>Sapindus oahuensis</i> forest	2005	C
<i>Schiedea kaalae</i>	NCN	E, CH	G1	Diverse mesic and wet forests	2005	C
<i>Solanum sandwicense</i>	‘Aiakeakua, popolo	E, CH	G1	Talus slopes and streambeds in open, sunny areas	2005	C
<i>Hedyotis degeneri</i> var. <i>degeneri</i>	NCN	E, CH	-	Moist forest understory and upper elevation shrublands	2005	C
<i>H. parvula</i>	NCN	E, CH	-	Exposed ridges	2005	C
<i>Hibiscus brackenridgei</i> ssp. <i>mokuleianus</i>	Koki‘o, ke‘oke‘o, Ma‘o hau helema‘o hau hele	E, CH	G1	Lowland dry areas	2006	C
<i>Lepidium arbuscula</i>	‘Ānaunau, naunau, kūnānā	E, CH	G1	Open dry ridges and cliffs	2005	C
<i>Lipochaeta tenuifolia</i>	Nehe	E, CH	-	Multiple habitat types, from dry coastal cliffs to moist forest understory	2005	C
<i>Lobelia niihauensis</i>	Kuhi‘aikamo‘ow ahie	E, CH	G2	Exposed dry cliffs	2005	C
<i>Melicope makahae</i>	‘Alani	C	G1	Moist forest	2005	C
<i>M. sandwicensis</i>	‘Alani	-	G2	Moist forest	2005	C
<i>Neraudia angulata</i>	Ma‘aloha, ma‘aloha, ‘aloha	E, CH	G1	Dry forest and shrubland	2005	C
<i>N. angulata</i> var. <i>dentata</i>	Ma‘aloha, ma‘aloha, ‘aloha	E, CH	G1	Diverse forest	2005	P
<i>Nothocestrum latifolium</i>	‘Aiea	C	-	Mesic and diverse mesic forests	1999	P
<i>Nototrichium humile</i>	Kulu‘ī	E, CH	G2	Dry forest understory and dry cliffs	2005	C
<i>Plantago princeps</i> var. <i>princeps</i>	Ale, laukahi kuahiwi	E, CH	-	Moist cliffs	2005	C
<i>Platydesma cornuta</i> var. <i>decurrens</i>	Pilo kea	C	G2	Mesic forests	2005	C

Table 3.9-2
Sensitive Plant Species Occurring or Potentially Occurring in the Region of Influence

Scientific Name	Hawaiian Name/Common Name	Federal ¹ Status	Global ³ Status	Habitat	Date Last Surveyed	Likelihood of Occurrence
<i>Pleomele forbesii</i>	Halapepe	C	G1	Dry and moist forests	2005	C
<i>Pritchardia kaalae</i>	Loulu	E	G1	Moist valley floors and windswept moist forest	2005	C
<i>Pteralyxia macrocarpa</i>	Kaulu	C	G2	Diverse moist forests	2005	C
<i>Sanicula mariversa</i>	NCN	E, CH	/-	Moist sites in deep soil	2005	C
<i>Schiedea hookeri</i>	Mā'oli'oli	E, CH	G1	Moist forest understory	2005	C
<i>S. nuttallii</i> var. <i>nuttallii</i>	Mā'oli'oli	E, CH	G1	Moist forest understory	2005	C
<i>S. kealiae</i>	Mā'oli'oli	CH	-	Moist forest understory	Unknown	P
<i>Silene lanceolata</i>	Lanceleaf catchfly	E, CH	G1	Dry to moist shrubland	2001	C
<i>Spermolepis hawaiiensis</i>	NCN	E, CH	G1	Lowland dry shrubland	2004	C
<i>Tetramolopium filiforme</i>	NCN	E, CH	-	Seaward cliffs	2005	C
<i>Viola chamissoniana</i> spp. <i>chamissoniana</i>	'Olopū, pāmakani	E, CH	G3	Moist cliffs	2005	C

Sources: USFWS 2002a, 2002b; USARHAW and 25th ID (L) 2001b; Kawelo 2003

NCN = No common name

Status:

¹**Federal:**

E = Endangered

C = Candidate species for listing

CH = Critical habitat designated

²**State**

/-/ = No Status

Likelihood of occurrence on the project site

C = Confirmed

P = Potentially may occur

U = Unlikely to occur

³**Heritage Global Rank:**

G1 = Species critically imperiled globally (typically 1-5 current occurrences)

G2 = Species imperiled globally (typically 6-10 current occurrences)

G3 = Species very rare with restricted range

/-/ = No Status

Abutilon sandwicense (FE/G1) (2007 BO, pp.110 and 526 [USFWS 2007b]; 2008 BO, pp. 16 and 39 [USFWS 2008])

This shrub typically grows on steep slopes in dry forests between 1,000 and 2,000 feet (300 and 600 meters) elevation. The species is endemic to O'ahu, and there are 14 occurrences with approximately 400 individuals on federal, state, private, city, and county lands. The unique threats to *A. sandwicense* are the black twig borer (*Xylosandrus compactus*) and the

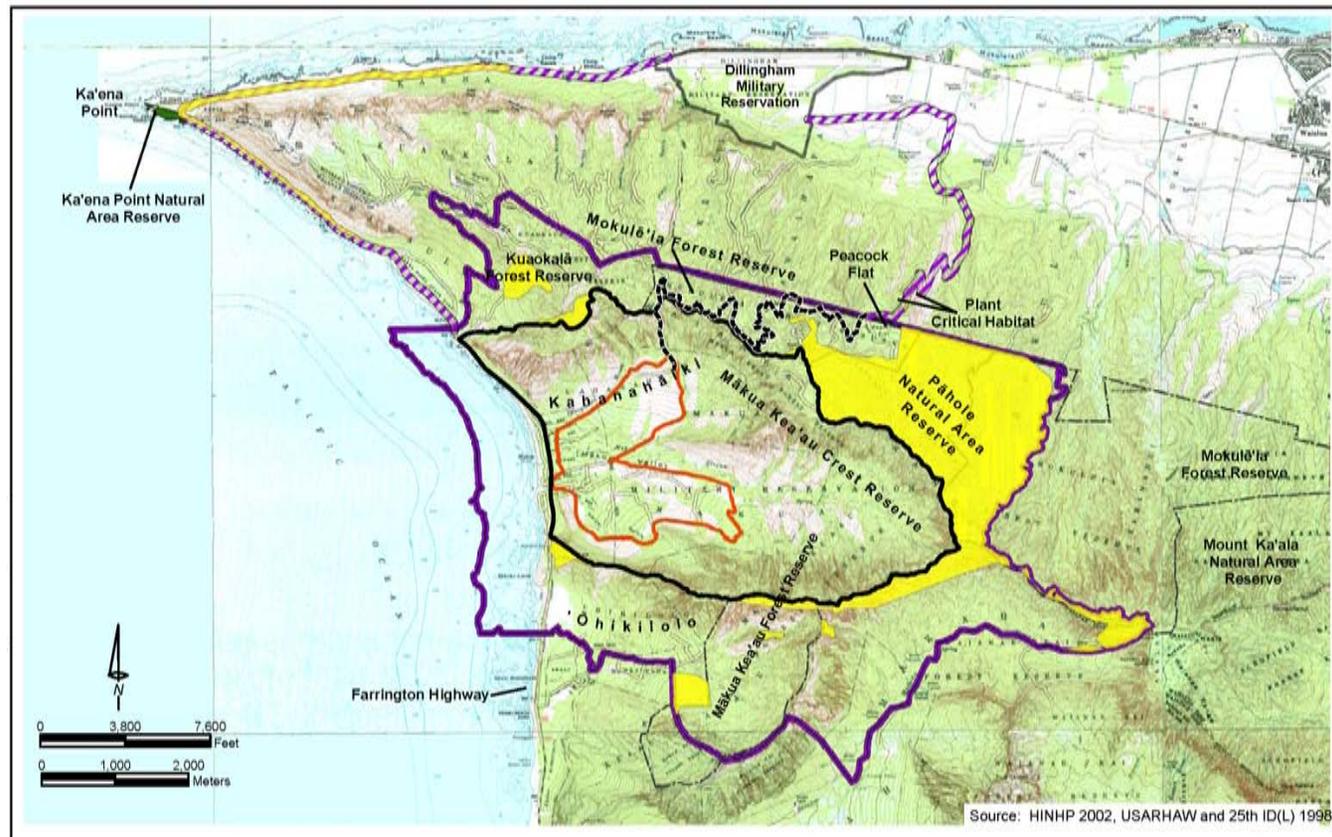
Chinese rose beetle (*Adoretus sinicus*). Less than 10 percent of the total number of individuals occurs within the training portion of the ROI. All the individuals of *A. sandwicense* within the training portion of the ROI are at risk from training-related wildfires. Approximately 4 acres (1.6 hectares) (less than 1% of the critical habitat in unit A) occurs within the Puulu to Alaiheihe fuelbreak area of the ROI.

Alectryon macrococcus var. *macrococcus* (FE/G2) (2007 BO, pp. 113 and 388)

This species is generally found in native moist forest in gulches and on lower gulch slopes. It is known to occur at lower Mākuā Valley, Kahanahāiki Valley, and on the east rim of MMR. Populations on O‘ahu grow at numerous sites in the Wai‘anae Mountains and rarely in the Ko‘olau Mountains. The number of plants in the Wai‘anae Mountains is estimated at 300 (MIT et al. 2003). The greatest threat is the black twig borer, which affects all trees of the species to varying degrees (MIT et al. 2003). Other threats include feral pigs and goats, which disturb habitat, and rats that prey on the seeds. Alien grasses also change the species’ habitat, ultimately increasing the frequency and size of fires (Wagner et al. 1999).

Alsinidendron obovatum (reclassified as *Schiedea obovata*) (FE/G1) (2007 BO pp. 273 and 517)

This erect subshrub (stems woody at the base) is a short-lived perennial that grows up to 3.3 feet (1 meter) tall. It occurs on ridges and slopes in lowland diverse mesic forests dominated by *Acacia koa* and *Metrosideros polymorpha*, at elevations of 1,837 to 2,494 feet (560 to 760 meters). Plants generally flower after two years of growth and are normally self-fertilizing. Population units in the wild have been known to disappear for a number of years and then reappear after large rainfall events, apparently owing to persistence of seeds in the soil seed bank. Most of the known individuals of this species occur within the ROI in zones of low and very low fire risk. *Schiedea obovata* is particularly vulnerable to predation by nonnative slugs and snails. Most importantly, population units of *S. obovata* are vulnerable to extirpation from naturally occurring events, such as rockslides, and by reduced reproductive vigor due to small population size and limited distribution. The population is being managed for stabilization as specified by the MIP.



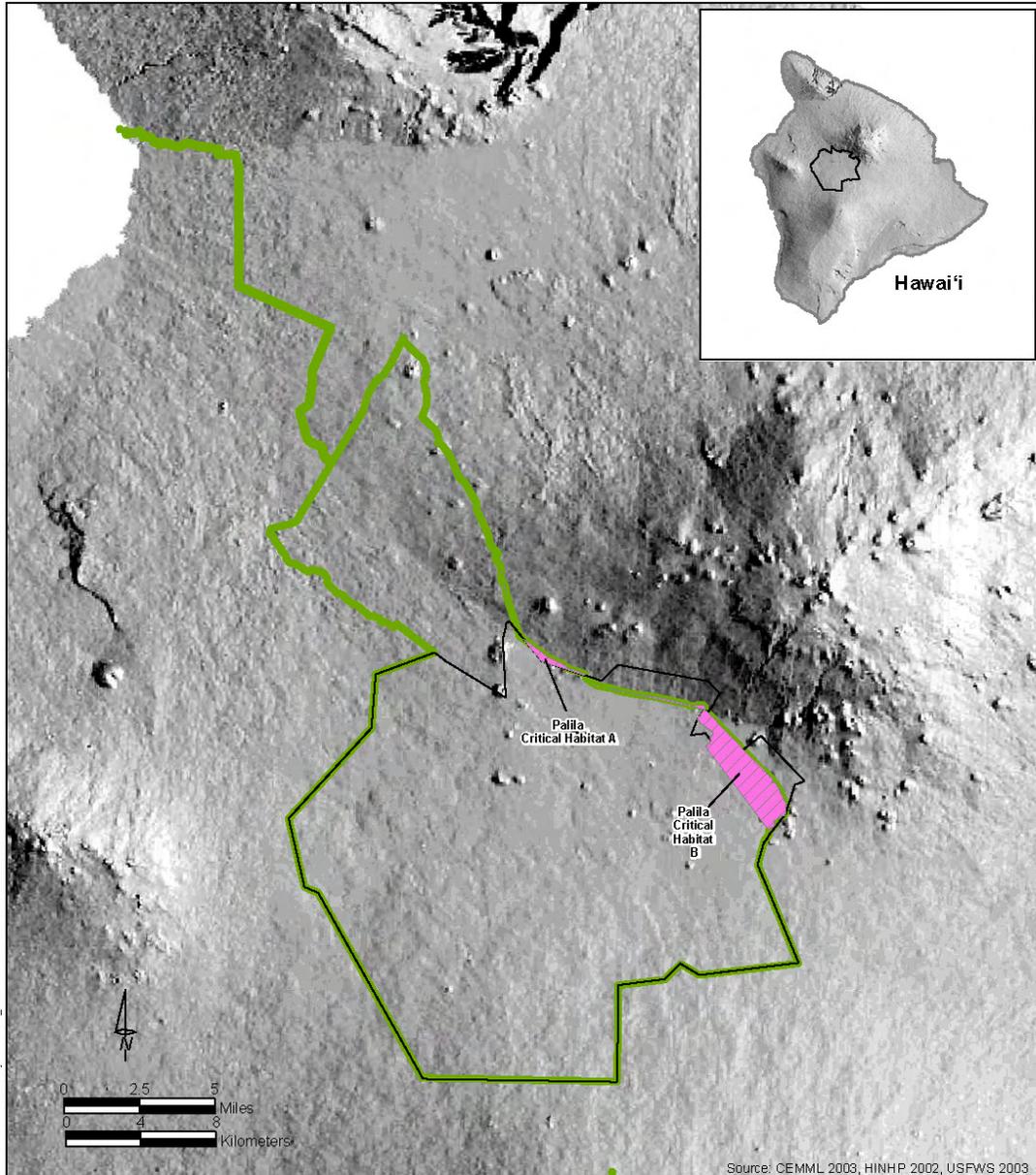
There are 2,128 acres (861.17 hectares) of plant critical habitat within the region of influence.

- Legend**
- Training Area
 - Mākua Military Reservation
 - Roads
 - Plant Critical Habitat
 - Region of Influence
 - Trail/Roads used for marches, with buffer area
 - Trail/Roads used for marches, without buffer area

**Designated Plant Critical Habitat
in the Region of Influence**

Mākua Military Reservation
O'ahu, Hawai'i

Figure 3.9-9 Designated Critical Habitat in the Region of Influence, MMR



There are 2,669 acres of Palila critical habitat within the Pōhakuloa Training Area Region of Influence.

**Federally Designated Palila Critical Habitat
in the Pōhakuloa Training Area
Terrestrial Biological Region of Influence**

Legend

-  Pōhakuloa Training Area Boundary
-  Region of Influence
-  Federally Designated Palila Critical Habitat

Island of Hawai'i, Hawai'i

Figure 3.9-10 Designated Palila Critical Habitat, PTA Terrestrial Biological Region of Influence

Bobea sandwicensis ('ahakea) (G2)

The 'ahakea tree grows in dry to moist forests, generally on gulch slopes, ridges, or old lava flows. It is represented on MMR by 25 individuals in 'Ōhikilolo (the southernmost ridge), Kaluakauila (the northern ridgeline), and lower Mākua Valley. This species can grow to nearly 33 feet (10 meters) (Wagner et al. 1999). Two trees were destroyed in the July 2003 fire.

B. timonides (G2)

This tree can grow to 33 feet (10 meters) high. It is found in dry to occasionally moist forest and benefits from weed removal in its habitat. There are currently only two individuals in Kahanahāiki Valley.

Bonamia menziesii (FE/G2) (2007 BO, pp. 117 and 529; BO, pp. 18 and 40)

This woody-stemmed vine inhabits dry to moist forest. There is one known documented species at Kaluakauila on MMR. This species has several thousand individuals at different locations throughout the state. O'ahu has no more than 60 individuals, on MMR, Lualualei Naval Reservation, and private and state land. The greatest threat to this species is fire. Four percent (69 acres [28 hectares]) of all *B. menziesii* critical habitat designated on the Island of Oahu is located in two units located entirely within the training portion of the ROI. Approximately one percent (14 acres [6 hectares]), of its designated critical habitat in Unit C is located in the proposed Pu'ulu to Ala'ihe'ihe fuelbreak portion of the ROI.

Cenchrus agrimonioides var. *agrimonioides* (FE/G1) (2007 BO, pp. 122 and 391)

'Ume'alu is a perennial bunchgrass generally inhabiting ridges and upper gulch slopes. Populations of this species occur in Kahanahāiki Valley. Longevity in the wild is undocumented. There are approximately 700 plants in four populations on O'ahu. Threats include predation and associated habitat degradation by wild and feral hoofed animals, alien plant competition for light, water, and nutrients, and the spread of alien grasses that increase the risk of wildfires. Human trampling is an additional threat to one of the Wai'anae populations, which is at the side of an often-used trail. The July 2003 fire burned within 49 feet (15 meters) of a population of this species.

Chamaesyce celastroides var. *kaenana* (FE) (2007 BO, pp. 126 and 395)

This endangered species of 'akoko grows generally in coastal dry shrubland and on slopes covered with rock debris. Populations are known from Ka'ena Point and within MMR (MIT et al. 2003). This beach

shrub/small tree fruits throughout the year, and individuals live from 5 to 10 years. The ten remaining known populations are on federally and state-owned land and contain fewer than 600 plants. Major threats include damage from coastal recreational activities, fire, and alien species, particularly koa haole. Current management has included restricting off-road vehicle access to sensitive areas; also, the National Tropical Botanical Garden collects seeds and propagates the plants (USFWS 1998b; Wagner et al. 1999). Thirty-seven plants from two populations were destroyed in the July 2003 fire; that represents nine percent of the population within MMR.

C. herbstii (FE/G1) (2007 BO, pp. 132 and 464)

This small tree grows only to a height of 9.8 to 26.2 feet (3 to 8 meters). It typically grows in gulch bottoms and slopes at elevations between 1,420 and 3,044 feet (433 and 928 meters). It usually occurs in mesic forests dominated by a diverse mix of tree species. All known individuals of *C. herbstii* are within the ROI. About 41 percent of the critical habitat for this species is in areas at risk of training-related wildfires. Because all known individuals occur within the action area, *C. herbstii* has a very high background risk of species extinction, and any additional threats would eliminate the expectation of its long-term persistence. This population unit of *C. herbstii* is being managed for stabilization, as specified by the MIP. Army Natural Resources staff and state biologists bag fruits and collect seed for use in augmenting sites in the Pāhole portion of the Kapuna to Pāhole population unit. The Army also assists with weed control in the Pāhole portion.

Colubrina oppositifolia (FE/G1) (2007 BO, pp. 136 and 574)

Less than one percent of the total state-wide critical habitat for *C. oppositifolia* is within the ROI. The critical habitat is in the northeastern portion of the action area and is in an area of low fire risk. The threats to the primary constituent elements are habitat degradation and predation by feral goats and pigs, damage from the black twig borer and Chinese rose beetle, and potential impacts from military activities. This critical habitat is also threatened by the nonnative plant species *Aleurites moluccana*, *Lantana camara*, *Pennisetum setaceum*, *Psidium cattleianum*, *Schinus terebinthifolius*, and *Syzygium cumini*, which compete with associated native plants. The Army is controlling ungulates and nonnative plant species within the area.

Ctenitis squamigera (FE) (2007 BO, pp. 137 and 534)

This is a fern with a short, slow-growing horizontal stem. It is known to occur at Makaleha, lower Ka'ala NAR, and lower Mākua Valley, where it

is represented by four individuals. Large populations of this fern are located elsewhere on O‘ahu.

Cyanea grimesiana ssp. obatae (FE/G1) (2007 BO, pp. 140 and 469)

This single-stemmed or sparingly branched shrub grows to 3.3 to 10.5 feet (1 to 3.2 meters) and is typically found on steep, moist shaded slopes in diverse mesic to wet lowland forests at elevations between 1,325 and 3,528 feet (404 and 1,075 meters). *C. grimesiana ssp. obatae* plants in the Pāhole to West Makaleha population unit are in an area at very low fire risk zone for training-related wildfires. Within the ROI, this species is particularly vulnerable to predation by rats and slugs. Critical habitat in the area is at high, low, and very low risks of training-related wildfires. *C. grimesiana ssp. obatae*, is being managed for stabilization as specified by the MIP. These individuals are located within the Pāhole and West Makaleha Management Units. The Pāhole Management Unit is fenced and a small enclosure in the West Makaleha Management Unit protects the plants there. As of 2005, genetic storage goals were about eight percent complete. In addition, there were 15 plants growing in the Army nursery.

C. longiflora (FE/G1) (2007 BO, pp. 146 and 474)

C. longiflora is a short-lived perennial shrub that grows to 3.3 to 9.8 feet (1 to 3 meters). It usually grows below ridge crests and on upper gulch slopes in mesic *Acacia koa-Metrosideros polymorpha* forests at elevations between 479 and 3,906 feet (146 and 1,191 meters). This shrub and its critical habitat within the ROI are in zones that are at low and very low risks of training-related wildfire. *C. longiflora* in the ROI is particularly vulnerable to slug predation. None of the naturally occurring plants in the Kapuna to West Makaleha population unit are within fences and are at risk of habitat degradation by feral pigs and ungulates. The Kapuna to West Makaleha, and Pāhole population units are being managed for stabilization as specified by the MIP. In 2005, genetic storage goals were about 21 percent complete, with 31 plants from the three existing population units combined meeting the goals outlined in the MIP. In addition, there were five plants growing in the Army nursery.

Cyanea superba ssp. superba (FE/G1) (2007 BO, pp. 151 and 479)

This plant is considered to be critically globally imperiled. The last wild individual was extirpated, but over 200 plants have been planted within the training area at Kahanahāiki Gulch. Feral pigs degrade its habitat by rooting, alien plants compete for light, water, and nutrients, the increased risk of wildfires in the habitat area threatens it, and rats, slugs, and snails eat its seeds.

Cyrtandra dentata (FE/G1) (2007 BO, pp. 157 and 401)

This shrub is found in moist to wet forests in the Wai‘anae and Ko‘olau Mountains and has been observed flowering and fruiting from May to November. Ninety-seven plants are known from Kahanahāiki Gulch on MMR. The primary threats to this species are feral pigs and goats and the associated habitat degradation, competition for light, space, and nutrients with aggressive alien plants, and fruit and seed predation by slugs, snails, and rats. Seeds or cuttings of this species have not been stored to preserve genetic integrity. Coordination must be made with the State of Hawai‘i.

Delissea subcordata (FE/G1) (2007 BO, pp. 161 and 483)

This is a small shrub, with few plants remaining. Suitable habitat exists in the training area and Wai‘anae Mountains, and one individual exists at Kahanahāiki Gulch. It grows in moist forest, either under tree canopy or in sunny spots and is often found growing with *Cyanea* species. Only approximately 185 plants remain.

Diellia falcata (FE/G1) (2007 BO, pp. 166 and 537)

This is a terrestrial fern that is found generally in deep shade or open understory in dry forest. It can be found on the east rim of Mākua Valley and in Kahanahāiki Valley within the ROI.

Dubautia herbstobatae (na‘ena‘e) (FE) (2007 BO, pp. 170 and 405)

This small spreading shrub flowers from May to July and is found on dry ridge tops. Threats to this Hawai‘i native include its very restricted habitat, fires, and damage from feral hoofed animals. The vast majority of the remaining population is found on ‘Ōhikilolo Ridge (MIT et al. 2003).

D. sherffiana (G1)

This species overlaps the range of *D. herbstobate* slightly and seems to have broader range through the Wai‘anae Mountains than does *D. herbstobate*. It is found mostly on wetter inland ridges. There are two populations on MMR, on ‘Ōhikilolo Ridge. Threats from feral ungulates have been almost completely eliminated on ridge tops and within fenced areas, although after 20 years of impacts, the habitat has degraded from alien species invasions, and the threat and damage from wildfires has greatly increased.

Euphorbia haeleeleana (FE) (2007 BO, pp. 173 and 541)

This small tree is considered to be critically globally imperiled. It is found in the northern Wai‘anae Mountains, mostly on lowland moist or dry forest slopes. One population is documented in the Kaluakauila Gulch area of MMR. Individuals of this species total approximately 100 on O‘ahu. Threats from feral ungulates are no longer an issue at this

population site, as extensive fencing protects it. The July 2003 fire burned within 98 feet (30 meters) of this species. The primary constituent elements of critical habitat on Oahu include dry forest dominated by *Diospyros* sp. and containing one or more of the following associated native plant species: *Dodonaea viscosa*, *Erythrina sandwicensis*, *Pleomele* sp., *Psyrax odorata*, *Reynoldsia sandwicensis*, or *Sapindus oahuensis*; and elevations between 512 and 1,725 feet (156 and 526 meters).

Flueggea neowawraea (FE) (2007 BO, pp. 177 and 410)

Mehamehame is a tree that can grow to almost 100 feet (30 meters) tall. Flowering appears to depend on weather patterns and is not necessarily synchronized. Almost half of the O'ahu population is in the ROI, in Kahanahāiki Valley (MIT et al. 2003). It grows in low-moisture forests, although some remaining trees are mostly found on north-facing gulch slopes and bottoms. Threats include the black twig borer, which introduces pathogens, weakens the tree, and causes premature death; Chinese rose beetles can reduce the leaves to skeletons. Other threats include farming, ranching, development, alien plants, and feral goats and pigs.

Gouania vitifolia (FE/G1) (2007 BO, pp. 183 and 487)

This species is a climbing shrub or woody vine that occurs on the sides of ridges and gulches in dry to mesic forests at elevations of 128 to 3,208 feet (39 to 978 meters). Plants tend to occur in patches, which may consist of clones of a single or few individuals. Over 95 percent of all the known individuals of this species are within the ROI in the Kea'au population unit. This unit is in the very low fire risk zone on private land in the southeastern part of the area; however, this species requires expedited stabilization due to its restricted distribution (i.e., only or mostly on O'ahu), low numbers, and limited reproduction. The Army and the USFWS are developing a draft stabilization plan for *G. vitifolia*. General stabilization goals to improve the status of this species include management to attain three stable population units, each with a minimum of at least 50 mature, reproducing individuals (the general criterion for short-lived perennials).

Hedyotis degeneri var. *degeneri* (FE) (2007 BO, pp. 188 and 415)

This shrub has been reported to flower and fruit at various times throughout the year. It is native to the northern Wai'anae Mountains, primarily on the windward side. There are 280 individuals left, 160 of which are in the ROI (MIT et al. 2003). With additional discoveries made since 2003, there are now 322 known individuals of this shrub. Eleven individuals are known in Kahanahāiki Valley. It frequently grows in the understory of moist forests and also in areas where upper gulch slope scrub forest changes to shrubland on ridges. Major threats include habitat

disturbance and browsing by feral goats and pigs. Other threats include alien plant invasions, erosion, and increased risk of impacts from wildfire.

H. parvula (FE) (2007 BO, pp. 192 and 419)

An erect to sprawling shrub that grows typically on exposed ridges or cliff faces, it is native to the Wai‘anae Mountains. The three populations total approximately 418 plants, with about 40 percent of them on MMR on ‘Ōhikilolo Ridge. Feral pigs and goats are a major threat. Alien plants alter the habitat, compete for valuable nutrients and light, and increase the incidence of wildfires.

Hesperomannia arbuscula (2007 BO, pp. 196 and 423)

A long-lived perennial shrub that grows to 6.6 to 10.8 feet (2 to 3.3 meters) tall and may reach up to 25 feet (7.6 meters). In the Wai‘anae Mountains, this shrub typically grows in mesic forest on upper gulch slopes and ridge tops at elevations of 1,960 to 3,000 feet (597 to 914 meters). Only one mature plant, representing about four percent of all known individuals on O‘ahu, is within the ROI on state land in the Kapuna population unit. The ROI contains a total of 527 acres (213 hectares), or 12 percent of this species’ total critical habitat. This shrub has a very high background risk of extinction due the extremely low number of known individuals. Genetic storage goals are about three percent complete, with six plants meeting the goals outlined in the MIP. In addition, there are eight plants growing in the Army nursery.

Hibiscus brackenridgei ssp. *mokuleianus* (*ma‘o hau hele*) (FE/G1) (2007 BO, pp. 200 and 492)

MMR has burned twice in the last 10 years, but this population survives. There are currently 16 individuals found at ‘Ōhikilolo Ridge. At the start of summer, this shrub goes dormant. New growth appears at the onset of the wet season. This species was previously more widespread in lowland dry areas, but habitat has been disturbed from centuries of habitation and agriculture. Primary threats include damage by the introduced Chinese rose beetle, habitat degradation, and increased threat of wildfire from encroachment of nonnative grasses, such as molasses grass (USFWS 2007b). A 2007 fire within the Waialua area killed over 95 percent of the *H. brackenridgei* ssp. *mokuleianus* and impacting approximately 85 percent of the species on O‘ahu. In the Waialua area, the plant occurs in dry gulches, gulch bottoms, and lower to middle gulch slopes in mixed and native dry forest. The primary constituent elements for two of the critical habitat units on O‘ahu include slopes, cliffs, or arid ledges in lowland dry forest or shrubland at elevations 105 to 1,607 feet (of 32 to 490 meters).

Isodendron laurifolium (Aupaka) (E/G1) (2007 BO, pp. 207 and 577)

This plant occurs in Diverse mesic or dry forest dominated by *Metrosideros polymorpha*, *Eugenia reinwardtiana*, or *Diospyros Sandwicensis* at elevations between 590 and 3,146 feet (180 and 959 meters). The critical habitat identified within the northeastern area is a low fire risk area. Threats to the critical habitat include military training, habitat degradation and destruction by feral goats and pigs, and competition from nonnative plant species, such as *Aleurites moluccana*, *Cordyline fruticosa*, *Grevillea robusta*, *Psidium cattleianum*, *Schinus terebinthifolius*, and *Toona ciliata*. In addition, rats, slugs, the black twig borer, and the Chinese rose beetle impact native habitat. Nonnative plants and ungulates are controlled within a portion of the area.

I. longifolium (Aupaka) (FT/G2) (2007 BO, pp. 208 and 580)

The habitat for this species is mixed mesic or lowland wet *Metrosideros polymorpha-Dicranopteris linearis* forest. Critical habitat for this plant occurs within the northeastern area of the ROI and is a low fire risk area. The primary threats to the critical habitat include habitat degradation or destruction by feral goats and pigs, a risk of habitat degradation from naturally occurring unforeseen events, and fire caused by military training activities. Fencing is planned for the area where the critical habitat is located.

I. pyrifolium (Aupaka) (FE/G1) (2007 BO, pp. 209 and 583)

The habitat for this species is bare rocky hills and wooded ravines in dry shrublands and elevations from 121 to 2,270 feet (37 to 692 meters). Only a very small percentage of this species' critical habitat is within the area, and primary threats to the critical habitat are believed to be feral ungulates, nonnative plant species, and fire. A small portion of this critical habitat is within a fenced area, and the Army is working to control nonnative plants to reduce the risk of fire.

Lepidium arbuscula (FE/G1) (2007 BO, pp. 210 and 545)

This plant is commonly found in the Wai'anae Mountains, on exposed ridges and cliffs. It occurs at Kahanahāiki Gulch and 'Ōhikilolo Ridge.

Lipochaeta tenuifolia (*Melanthera tenuifolia*) (nehe) (FE) (2007 BO, pp. 217 and 427)

This perennial herb is found only in the northern Wai'anae Mountains. There are an estimated 3,250 individuals, of which MMR contains approximately 1,500. Habitat extends from very dry seaward cliffs to mesic forests. It is most often on rocky ridge sides and cliff faces on north-

facing slopes. Twenty-nine plants were destroyed in the July 2003 fire, which is one percent of the total population within MMR.

Lobelia niihauensis (FE/G2) and *L. oahuensis* (FE) (2007 BO, pp. 213 and 548)

L. niihauensis occurs rarely on moist to dry cliffs in the northern Wai‘anae Mountains and is known to occur on MMR. It is a sparingly branched shrub, federally listed as an endangered species.

Mariscus pennatiformis (2007 BO, pp. 216 and 586)

The primary constituent elements of this species’ critical habitat units on O‘ahu include mesic and wet *Metrosideros polymorpha* forest and *M. polymorpha*-*Acacia koa* forest and elevations between 1,391 and 3,385 feet (424 and 1,032 meters). Approximately 410 acres (166 hectares) of the designated critical habitat is in one unit in the northeastern portion of the ROI. The major threats to the primary constituent elements of the critical habitat include habitat degradation by feral pigs and wildfire from military training activities. However, critical habitat is entirely in an area of low fire risk. Ninety-six percent (344 acres [139 hectares]) of the critical habitat in the ROI is within management units where the MIP is being implemented.

Melicope makahae (alani) (FC)

This shrubby tree grows in moist forests in the Wai‘anae Mountains. The plants that occur within the ROI account for around five percent of the statewide population.

Melicope pallida (Alani) (FE/G1) (2007 BO, pp. 222 and 589)

A very small percentage of critical habitat for this species occurs within the northeastern portion of the ROI. The primary constituent elements of critical habitat include steep rock faces in lowland dry or mesic forests, elevations between 768 to 2,758 feet (234 to 841 meters), and one or more of the following associated native plant species: *Abutilon sandwicense*, *Acacia koa*, *Alyxia oliviformis*, *Bobea elatior*, *Cibotium* sp., *Dryopteris* sp., *Metrosideros polymorpha*, *Pipturus albidus*, *Psychotria mariniana*, *Sapindus oahuensis*, *Syzygium sandwicensis*, *Tetraplasandra* sp., *Wikstroemia oahuensis*, and *Xylosma hawaiiense*. The major threats to the primary constituent elements of the critical habitat include the black twig borer, fire from military training activities, habitat degradation by feral pigs, and unforeseen events. Nonnative plants, especially *Andropogon virginicus*, *Clidemia hirta*, *Psidium cattleianum*, *Pterolepis glomerata*, and *Toona ciliata*, compete with associated native plants for light, space, and nutrients. In addition, predation of associated native plants by rats, slugs, and the Chinese rose beetle threaten critical habitat.

Neraudia angulata (FE/G1) (2007 BO, pp. 223 and 497)

Ma'aloa is an upright shrub recorded throughout the Wai'anae Mountains. The current population contains about 90 plants, with 30 in the ROI (MIT et al. 2003). Fires at MMR have damaged the habitat of this species. It is typical in dry forests and shrublands and occasionally in mesic areas. Some can be found on gulch slopes and others on nearly vertical cliff faces. The range of this plant extends to lower elevation lands, which are no longer used for grazing, but on other lands, cattle still pose a threat.

Nototrichium humile (kulu'i) (FE/G2) (2007 BO, pp. 229 and 430)

Kulu'i is a basal-branching perennial shrub with its heaviest flowering in summer and spring. Of the remaining 1,250 plants on O'ahu, 700 to 900 are in the Mākua ROI (MIT et al. 2003). It is found throughout the Wai'anae Mountain range on windward and leeward sides on gulch slopes and bottoms in understory of dry forests or on sparsely vegetated dry cliff faces and ledges. These plants are more susceptible to fire damage, as their habitat extends to the lower drier reaches of the Wai'anae Mountains. Major threats include feral goats and pigs and associated habitat destruction. Alien grasses that are highly flammable contribute to the habitat degradation and possible wildland fire damage to *N. humile*. Five plants were impacted in the July 2003 fire, which is less than one percent of the total MMR population. The primary constituent elements of critical habitat units on O'ahu include cliff faces, gulches, stream banks, or steep slopes in dry or mesic forests often dominated by *Diospyros sandwicensis* or *Sapindus oahuensis*, at elevations between 607 and 2,644 feet (185 and 806 meters).

Peucedanum sandwicense (Makou) (FT/G2) (2007 BO, pp. 234 and 551)

This herb is a short-lived perennial that grows in cliff habitats from sea level to above 3,000 feet (900 meters) and is associated with native species such as *Artemisia australis*, *Chamaesyce* sp., *Diospyros sandwicensis*, *Eragrostis variabilis*, and *Metrosideros polymorpha*. Little is known about the life history of *P. sandwicense*. The primary threats to *P. sandwicense* are habitat degradation and browsing by feral ungulates, trampling by hikers, and landslides. Nonnative plants compete with *P. sandwicense* for light, space, and nutrients.

Phyllostegia kaalaensis (FE/G1) (2007 BO, pp. 237 and 502)

Phyllostegia kaalaensis is a short-lived perennial herbaceous plant in the *Lamiaceae* (mint family). Currently, there is one population unit, with only two augmented immature plants. This is on state land in the Keawapilau to Pāhole population unit, within the ROI and the Schofield Barracks Military Reservation action area, respectively, where they are in zones of

very low risk to training-related wildfire. *P. kaalaensis* typically was found in mesic to dry-mesic areas in gulch bottoms and upper gulch slopes at elevations of 1,610 to 2,500 feet (490 to 760 meters). It occurred most commonly in forests dominated by the native trees *Diospyros sandwicensis* and *Sapindus oahuensis*, or in forests containing a mix of several tree species, under forest canopy and in sunny openings. Flowering and fruiting occur from January to June. Populations of *P. kaalaensis* in rocky gulch slopes and bottoms are vulnerable to trampling because of the plant's extensive rhizome growth. The species is also particularly vulnerable to extirpation from naturally occurring events, such as rockslides, and by reduced reproductive vigor due to small population size and limited distribution.

Plantago princeps var. *princeps* (kuahiwi laukahi) (FE) (2007 BO, pp. 241 and 436)

This woody shrub lives in mesic cliff habitat in the Wai‘anae Mountains. Known individuals total about 350 plants, about 42 of which are found on ‘Ōhikilolo and Pāhole in the ROI. Feral pigs and alien plant species are the major threats to these plants.

Platydesma cornuta var. *decurrens* (pilo kea) (FC/G2)

This erect palm-like shrub is found only in the mesic forests of the Wai‘anae Mountains. Populations can be found on ‘Ōhikilolo in the ROI.

Pleomele forbesii (halapepe) (FC/G1))

These trees occur on O‘ahu, mainly in dry and diverse mesic forests. Although statewide estimates of the population numbers are very low, over 100 are known to live in the ROI.

Pritchardia kaalae (loulou) (FE/G1) (2007 BO, pp. 247 and 441)

This plant is a rare fan palm, reaching up to 33 feet (10 meters) tall and found only in the northern Wai‘anae Mountains. About 475 exist on ‘Ōhikilolo in MMR. It is found in moist to dry zones, on moderately to very steep cliffs. Four populations totaling fewer than 100 plants currently exist on MMR, at Mount Ka‘ala.

Pteralyxia macrocarpa (kaulu) (FC/G2)

Known only from the two mountain ranges on O‘ahu, this plant is scattered in valleys and on slopes in moist forests. It is found throughout MMR.

Sanicula mariversa (FE) (2007 BO, pp. 252 and 507)

This plant is considered to be critically globally imperiled. A perennial herb with a thick underground storage root, this species generally grows on

moist sites on north slopes, usually in deep soil. The vast majority of these plants occur in the training area on Ōhikilolo Ridge and in the nearby Kea‘au Valley (MIT et al. 2003). The plants are dormant through summer, with new growth appearing with the onset of the wet season. Goats are a major threat, mainly because they degrade the slopes where the plants grow and hasten erosion. Alien shrubs and trees are a threat to the livelihood of *S. mariversa*, but the shorter alien grasses do not seem to have serious negative impacts.

Schiedea hookeri (FE/G1) (2007 BO, pp. 257 and 553)

S. hookeri is found in diverse moist forest in the north and central Wai‘anae Mountains. It will often grow alongside koa and ‘ōhi‘a. There are five individuals in one population of *S. hookeri* on MMR. *S. hookeri* is found at Kaluakauila Gulch. Feral pigs and goats are a major threat, as is the habitat disturbance associated with these invaders. Alien plants alter the habitat and compete for valuable nutrients and light. The increased incidence of wildfires is also associated with alien grasses, and snails and slugs destroy seedlings and immature plants. The July 2003 fire burned within 66 feet (20 meters) of this species.

S. kaalae (2007 BO, pp. 262 and 444)

This short-lived perennial is consistently found on steep slopes and shaded sites in the understory of diverse mesic forest and wet forest, usually in gulch bottoms or low to mid gulch slopes, at elevations between 689 and 2,592 feet (210 and 790 meters). It often grows on slopes with sparse groundcover and occasionally in cracks in rock embankments. A total of 2,726 acres (1,103 hectares) in six separate units was designated as critical habitat, some of which is located in the ROI. *S. kaalae* is found in the Pāhole Natural Area Reserve.

S. nuttallii (FE/G1). (2007 BO, pp. 267 and 512)

This is an erect subshrub in diverse moist forest, scattered through exterior valleys of the Wai‘anae Mountains. There are 33 individuals on MMR in the Kahanahāiki Valley.

Silene lanceolata (FE/G1) (2007 BO, pp. 278 and 558)

This plant is considered to be critically globally imperiled. It is a small sprawling shrub with smooth leaves found rarely in dry to moist shrubland areas. One of the two O‘ahu populations exists on MMR. Feral pigs and goats are a major threat to this plant, as is the habitat disturbance associated with these invaders. Alien plants alter the habitat and compete for valuable nutrients and light. Fire has had a negative impact on the populations, and increased incidence of wildfires is associated with alien grasses.

Solanum sandwicense (Popolo aiakeakua) (FE/G1) (2007 BO, pp. 281 and 592)

Critical habitat for this species occurs within the northeastern portion of the ROI. The ROI contains the primary constituent elements of talus slopes or streambeds at elevations between 1,545 and 3,300 feet (471 and 1,006 meters), which occur in open sunny areas that contain the associated native plant species *Pisonia* sp. and *Psychotria* sp. Threats to primary constituent elements of the critical habitat in the area include habitat degradation by feral pigs, competition from nonnative plant species, and fire from military training activities. This critical habitat unit provides habitat for the conservation of one population of *S. sandwicense*.

Spermolepis hawaiiensis (FE/G1) (2007 BO, pp. 282 and 561)

This plant is a slender herbaceous annual found in 'Ōhi'a forests and lowland dry shrubland and occasionally in cultivated fields at lower elevations. Approximately 350 plants exist on the lower portions of 'Ōhikilolo Ridge on MMR. There is little information about the life history of this species. Major threats are habitat degradation by feral goats, competition with alien plants, and fires.

Tetramolopium filiforme (FE/-) (two varieties) (FE/-) (2007 BO, pp. 286 and 448)

This dwarf shrub is considered to be critically globally imperiled. It usually flowers in late winter and spring. It is native to the northern Wai'anae Mountains, and its center of abundance is on 'Ōhikilolo Ridge. Over 2,500 total individuals are present on MMR (USFWS 2007b). Its habitat occupies the low, dry, seaward end of the ridge, generally on rocky ridges and on sparsely vegetated cliff faces, but sometimes in cracks in the rocks. This species is one of the most threatened by increased potential for wildfire. Weeds and erosion from hoofed animal habitat degradation can cause landslides, which further reduce the habitat area. The July 2003 fire burned within 66 feet (20 meters) of this species.

Viola chamissoniana ssp. chamissoniana (FE/G3) (2007 BO, pp. 290 and 451)

This is a woody shrub found on both the windward and leeward sides of the Wai'anae Mountains. Over two-thirds of the 600 remaining individuals are on 'Ōhikilolo Ridge (USFWS 2007b). It is generally found in moist habitats on cliffs and cliff faces with sparse to moderate vegetative cover. It usually grows in association with other natives. Alien plants alter the habitat and compete for valuable nutrients and light. The increased incidence of wildfires is also associated with alien grasses.

Sensitive Wildlife Species

Several sensitive terrestrial wildlife species have been observed or have the potential to occur in the ROI. The HINHP and natural resources staff described sensitive animal locations on MMR (HINHP no date a; USARHAW and 25th ID(L) 2001b). Table 3.9-3 lists sensitive terrestrial wildlife species and their likelihood of occurrence in the ROI. Figure 3.8-6 shows the locations of sensitive wildlife confirmed within the ROI.

Discussed below is the natural history information of sensitive status wildlife species known or considered likely to occur in the ROI or that potentially would be affected by MMR activities, as well as the location of these species (when known). Sensitive status wildlife identified as occurring only historically in the ROI and those species that are considered unlikely to occur are identified in Appendix H-2.

Invertebrates

Achatinella mustelina (FE/SE/G1) (2007 BO, pp. 295 and 595)

O‘ahu tree snails, also known as pūpū kani‘oe, are native to O‘ahu. They live in trees and bushes and feed on fungi found on the surface, primarily that growing on native plants (HINHP no date a). *Achatinella* snails are active during the night and remain sealed in leaves during the day. The breeding season is not known. Although this species is limited to the Wai‘anae Mountains, it is believed to have historically occurred from sea level on O‘ahu’s windward coast to the uppermost reaches of the Ko‘olau Mountains (HINHP no date b). The presence of this species at MMR was confirmed when 171 live *A. mustelina* individuals were discovered in 1982. The Army Natural Resources field crew marked 412 *A. mustelina* in a mark/recapture study at MMR (PCSU 2001). This species also has been seen in the southeastern corner of Mākua Valley, in the easternmost tip of MMR, in the divide between MMR and the Pāhole Natural Area Reserve, and within the Mokulē‘ia Forest Reserve and the Mākua-Kea‘au Ridge (HINHP no date c). Some of the greatest threats to this species are introduced plants and animals, habitat degradation, fire, and collection. The July 2003 fire burned within 492 feet (150 meters) of this species.

Table 3.9-3
Sensitive Terrestrial Wildlife Species Occurring or Potentially Occurring in the Region of Influence

Scientific Name	Hawaiian Name/Common Name	Federal ¹ Status	State ² /Global ³ Status	Habitat	Date Last Observed	Likelihood of Occurrence
Invertebrates						
<i>Achatinella mustelina</i>	Pūpū kuahiwi, pūpū kanioe, kāhuli/O‘ahu tree snail	E	E/G1	Native Hawaiian shrublands, forests, and bogs above 1,000 feet.	2006	C
<i>Amastra rubens</i>	-/Amastrid land snail	-	-/G1	Areas with native vegetation; specific preferences not available.	1983	P
<i>Auriculella ambusta</i>	-/Achatinellid land snail	-	-/G1	Areas dominated with native vegetation.	1993	P
<i>A. spp. aff. castanea</i>	-/Achatinellid land snail	-	-/G1	Areas dominated with native vegetation.	1982	C
<i>A. spp. aff. perpusilla</i>	-/Achatinellid land snail	-	-/G1	Areas dominated with native vegetation.	1985	C
<i>Cookeconcha spp.</i>	-/Endodontid land snail	-	-/G1	Areas with native vegetation; specific preferences not available.	1980s	C
<i>Leptachatina spp.</i>	-/Amastrid land snail	-	-/G1	Areas with native vegetation; specific preferences not available.	1988	P
<i>Partulina dubia</i>	-/Achatinellid land snail	-	-/G1	Areas dominated with native vegetation.	1983	C
<i>Pleuropoma sandwichiensis</i>	-/Helicinid land snail	-	-/G1	Areas with native vegetation; specific preferences not available.	1983	C
Birds						
<i>Asio flammeus sandwichensis</i>	Pueo/Hawaiian short-eared owl	-, +, ^	E*/G5T3	Pastures, grasslands, dry and wet forests that are dominated by either native or nonnative vegetation; sea level to 7,900 feet.	2005	C

**Table 3.9-3
Sensitive Terrestrial Wildlife Species Occurring or Potentially Occurring in the Region of Influence**

Scientific Name	Hawaiian Name/Common Name	Federal ¹ Status	State ² /Global ³ Status	Habitat	Date Last Observed	Likelihood of Occurrence
<i>Chasiempis sandwichensis ibidis</i>	O'ahu 'elepaio/-	E, CH	E/G4T1	Native Hawaiian forest.	2005	C
<i>Paroreomyza maculata</i>	'Alauahio/O'ahu creeper	E	E/G1	Native Hawaiian shrublands, forests, and bogs.	1976	C
<i>Phoebastria immutabilis</i>	Laysan albatross	+, ^	-/G3	Pelagic, nests on ground in sheltered areas and open grassy areas of islands.	2002	C
<i>Puffinus pacificus</i>	'Ua'u kani/ Wedge-tailed shearwater	+, ^	-/G4	Pelagic, nests in burrow, crevice, sometimes on ground surface on islet, atoll, barren headland.	2004	C
Mammals						
<i>Lasiurus cinereus semotus</i>	-/Hawaiian hoary bat	E	E/G5T2	Bare rock, cliff, hardwood forest, grassland/herbaceous, hardwood woodland, riparian habitats.	1998	U**

Sources: USARHAW and 25th ID (L) 2001b; DLNR 2002; HINHP, no date a; R. M. Towill Corp. 1997a; NatureServe 2001; Virginia Tech 1998

NCN = No Common Name

*The state endangered listing refers only to the populations on O'ahu, Lanai, and Moloka'i.

**Contemporary sightings are limited to transient individuals, no residence or breeding population is thought to be extirpated from O'ahu

Status:

¹Federal:

E = Endangered

CH = Critical habitat designated

+ = Birds of conservation concern

^ = MBTA species

³Heritage Global Rank:

G1 = Species critically imperiled globally (typically 1-5 current occurrences)

G4 = Species apparently globally secure

G5 = Species demonstrably globally secure

T1 = Subspecies critically imperiled globally (typically 1-5 current occurrences)

T2 = Subspecies imperiled globally (typically 6-10 occurrences)

T3 = Subspecies either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range, or because of other factors making it vulnerable to extinction throughout its range (21-100 occurrences).

²State: E = Listed as endangered /-/ = No Status

Likelihood of occurrence on the project site: C = Confirmed P = Potentially may occur U = Unlikely to occur

Amastra rubens and *Leptachatina* sp. (G1)

Amastrid land snails are native to the Hawaiian Islands. The historical distribution of *A. rubens* includes Ka‘ala, Kukui‘ula, Mokulē‘ia, Mākaha, and Hale‘au‘au within the Wai‘anae Mountains (HINHP no date b). This species is confirmed within the ROI. Individuals and shells of *A. rubens* were observed during MMR surveys in 1982 and 1983 (USARHAW and 25th ID(L) 2001b). Amastrid land snails are likely threatened by habitat loss and introduced predators that compete for resources and spread disease.

Auriculella ambusta (G1), *A. sp. aff. castanea* (G1), *A. sp. aff. perpusilla* (G1), and *Partulina dubia* (G1)

Achatinellid land snails are endemic to the Hawaiian Islands. They live in trees and shrubs, primarily on native vegetation (R. M. Towill Corp. 1997a; HINHP no date b). Current life history information is not well studied or understood for these species. Achatinellid land snails are known to feed on leaf fungi. The three *Auriculella* species and *Partulina dubia* have been observed at MMR. *A. castanea* was found at the easternmost part of MMR, along the summit ridge trail in 1982 (HINHP no date a). Two sightings of *A. sp. aff. perpusilla* were recorded at Pāhole Natural Area Reserve at MMR in 1983 and 1985 (HINHP no date a). These species are expected within the ROI, based on availability of suitable habitat. Achatinellid land snails are likely threatened by habitat loss and introduced species that prey on them, compete for resources, and spread disease.

Cookeconcha sp. (endodontid land snail) (G1)

This snail is most likely threatened by habitat loss and introduced predators that compete for resources and spread disease. Species were identified at MMR from 1983 to 1989 at the Pāhole Natural Area Reserve (HINHP no date a). Although no individuals or shells were discovered during a 1993 survey of MMR, endodontid land snails could occur in the project ROI, based on the presence of suitable habitat.

Pleuropoma sandwichiensis (G1)

The helicimid land snail is native to the Hawaiian Islands, historically found on all eight Hawaiian Islands. *P. sandwichiensis* was observed at the northeastern corner of Mākua Valley in 1983 and at the head of Kaiahi Gulch in 1993 (HINHP no date a). This species is expected to occur within the ROI, based on availability of suitable habitat. Helicimid land snails are likely threatened by habitat loss and introduced species that prey on them, compete for resources, and spread disease.

Birds

Chasiempis sandwichensis ibidis (FE/SE/G4T1) (O'ahu 'elepaio) (2007 BO, pp. 301 and 600)

This subspecies is endemic to O'ahu, where it inhabits native Hawaiian forest and forests dominated by nonnative plants. It is most common in riparian habitats, in moist forests with tall canopy and an extensive understory (Shallenberger and Vaughn no date; USFWS 2001b). The 'elepaio appears to tolerate introduced vegetation and disturbed environments, as demonstrated by its use of such environment. However, it is estimated to inhabit less than eight percent of its former range and is now confined to the Ko'olau and Wai'anae Mountains (USFWS 2001b). The July 2003 fire burned within 230 feet (70 meters) of an area known to be used by individual males of this species.

Critical habitat has been designated for the O'ahu 'elepaio within the ROI (USFWS 2001b), and this species is known to occur on MMR. In 1993, at least nine individuals were observed in the area, seven of which were in the southeastern portion of MMR (HINHP no date a). 'Elepaios were also at the head of the Kahanahāiki Valley near a plateau (HINHP no date a). Approximately 150 acres (61 hectares) of O'ahu 'elepaio critical habitat burned in the July 2003 fire.

Generally the 'elepaio breeds from January to June, building nests on native and nonnative plants. It feeds on insects and spiders. Threats to this species include habitat loss, predation, and spread of disease. Nonnative species, such as black, Norway, and Polynesian rats, cats, and mongooses, are believed to be a significant cause of predation to this species (USFWS 2000). The transmission of avian pox by mosquitoes is a major cause of lowered survivorship in adult 'elepaio (USFWS 2000).

At MMR, 'elepaio are known from Kahanahāiki, Kaluakauila, and Lower Mākua MUs and the East Rim Ungulate Control Area. The population of 'elepaio in Kaluakauila was comprised of two unpaired males, which were monitored biannually. NRS have been unable to relocate these birds since 1999 and believe that they may have perished (PCSU 2004). In 2004, a pair in Kahanahāiki had at least two nesting attempts. The first nest appeared to have failed, with no subsequent activity observed at this nest after numerous checks and a second nest was found with 2 nestlings were observed being fed in the nest by both parents on 28 June (PCSU 2004). In 2001, NRS initiated predator control efforts for the pair that was known from the Lower Mākua MU and in 2002 a new pair was discovered. No pairs were observed in East Rim Ungulate Control Area, though this area

was partially restricted during the time of the surveys, so all suitable habitat has not been surveyed (PCSU 2004).

Phoebastria immutabilis (MBTA, BCC/-/G3)

The Laysan albatross, a native Hawaiian migratory bird, is a pelagic species that nests in grassy areas on islands. It breeds on most northwestern Hawaiian Islands in the fall and winter and feeds primarily on squid (NatureServe 2002). Long-line fisheries, lead contamination, and loss of nesting habitat threaten this species (NatureServe 2002). The Laysan albatross has nested in the grassy areas along Ka'ena Point and alongside the Ka'ena Point Trail in recent years. Banding efforts in 2004 demonstrated that there are at least 130 albatross using Ka'ena Point. Laysan albatross use this area as part of the breeding cycle from November to July (Hoffman 2003). Adults generally arrive in November to prepare for nesting. Egg laying begins in December. The last to leave are the young, which disperse to a pelagic habitat in July. This species is considered confirmed within the ROI.

Asio flammeus sandwichensis (MBTA/SE/G5T3)

Pueo, also known as the short-eared owl, is a native Hawaiian species. It is found in a range of habitats, such as pastures, grasslands, and dry or wet forests, with either native or nonnative dominated vegetation and up to 7,900 feet (2,408 meters) above sea level (HINHP no date a). Pueo feed heavily on introduced mammals, such as house mice and rats. They are active during the day, which is unusual for most owl species. Pueo nest on the ground, usually on grass (HINHP no date a). Young pueo have been observed in nests from March to November. Threats to this species include habitat loss and introduction of large mammals, such as mongooses, that prey on their eggs. This species is believed to forage the grasslands in the lower elevations of the training area and may nest in the northern section of MMR identified as the C-9 Management Unit, based on pueo behavior and vocalizations observed in the area (PCSU 2002).

Puffinus pacificus (MBTA/G4G5)

The wedge-tailed shearwater is a pelagic bird that nests in burrows and crevices along coasts and cliffs. In Hawai'i, migrants begin to arrive in nesting areas in March. One egg is laid, usually in June, although nesting success is often reduced by introduced predators (mongoose, dogs, cats, common myna). This species is common in the Ka'ena Point NAR, where they have been known to burrow along the trail. There is believed to be more than 2,000 wedge-tailed shearwater pairs in this area. The dramatic improvement in breeding success is due to improved habitat protection, specifically predator control, exclusion of off-road vehicles, signs that

have been put up, and patrols of the area to deter people from straying from the trails and crushing burrows or nests.

Pluvialis fulva (MBTA, BCC/-/G5)

The Pacific golden plover, a native migratory bird, winters in Hawai‘i and breeds in Alaska and other more northern areas. It spends August through April in the Hawaiian Islands, where it inhabits short-grass prairie, pastures, mudflats, sandy beaches, and flooded fields (NatureServe 2002). Because this species is likely to occur in the open areas of the Ka‘ena Point Trail, it is expected to occur within the ROI. The Pacific golden plover is an insectivore, eating beetles and other ground-dwelling insects, along with worms, some small mollusks, and crustaceans. Threats to this species include collisions with human-made structures and predation by owls (NatureServe 2002).

Marine Fauna

Whales and Seals

Six species of endangered whales are known to occur in the Pacific tropical waters around the Hawaiian islands. This includes five types of baleen whales, including the humpback (*Megaptera novaeangliae*), fin (*Balaenoptera physalus*), blue (*B. musculus*), sei (*B. borealis*), and Pacific right (*Eubalaena glacialis*). The other type of whale is a toothed whale, the sperm whale (*Physeter macrocephalus*). The only seal that occurs is the federally listed endangered monk seal (*Monachus schauinslandi*). This species has critical habitat in the northwestern portion of the Hawaiian Island chain.

Of these marine mammals, the only occurrences considered possible in the ROI would be the humpback whale or the monk seal. All of the other species are highly unlikely. Table 3.9-1 lists the likelihood of occurrence of these species within the project area. Associated habitat information can be found in Appendix H-2.

Humpback Whale (FE, MMPA)

The waters off the coasts of the Hawaiian Islands are known for their seasonal population of humpback whales, which are also the most abundant marine mammal throughout the Hawaiian waters (Mobley et al. 2001a). The Hawaiian Islands serve as an important breeding ground for this species (Calambokidis et al. 1997). The humpback whale is the only one of the five endangered baleen whales potentially occurring in Hawaiian waters that is known to be present in reasonably large numbers. The International Whaling Commission and NOAA Fisheries consider the Hawaiian population of humpbacks to be a separate stock (NOAA

Fisheries 2000a). Humpback whales are found throughout the island chain and are most abundant in coastal waters of the main Hawaiian Islands, including Hawai'i and O'ahu, from November through April, with peak abundance occurring from late February through mid-March (Baker and Herman 1981). Approximately two-thirds of the entire North Pacific humpback whale population (approximately 4,000 to 5,000 whales) migrate to Hawaiian waters to breed, calve, and nurse (NOAA Fisheries 2000a). These whales are generally found in shallow waters shoreward of the 600-foot (183-meter) depth contour (ONR 2000).

Humpback whale mothers and calves prefer the calmer shallower waters often found on the leeward sides of the islands (Smultea 1992), and they prefer very shallow water of less than 60 feet (18 meters) (ONR 2000; Smultea 1992). Some results suggest that habitat use patterns of females and calves in nearshore areas may decrease as a result of increasing vessel traffic and human activities (ONR 2000). Humpback whales are vulnerable to human disturbance in Hawaiian waters and possibly to vessel strikes. Hawai'i regulations prohibit boats from approaching within 100 yards (91 meters) of adult whales and within 300 yards (274 meters) of mother/calf pairs. Humpback whales (of varying pod sizes and types, including mother and calf pods) are commonly sighted off the O'ahu coast and are confirmed in project area waters, with unknown frequency, from January through April (Pickering 2003; Dollar 1999; Clark and Tyack 1998). Mother/calf pods are known in the MMR beach area (Dollar 1999; Pickering 2003).

Monk Seal (FE, MMPA, D)

The monk seal is the only pinniped (seal species) known to occur in the Hawaiian archipelago, and it is endemic. This species may occasionally occur in the waters or shore of the ROI. However, it is more common in the northwestern Hawaiian Islands. Incidental transients are known to be present at all of the main seven islands, and there is a small uncounted population on the Island of Ni'ihau (NOAA Fisheries 2000w). The species was designated as depleted under the MMPA in 1976, following a large decline in animal counts from the late 1950s through the mid-1970s. The monk seal was also listed as endangered under the ESA in 1976. In 1988, NOAA Fisheries designated critical habitat for the Hawaiian monk seal; this area is not near the ROI. It is designated in 10 areas of the northwestern Hawaiian Islands, extending from shore to a distance offshore to 20 fathoms (180 feet [55 meters]) of depth. The species is managed as one stock, although each island may in fact have its own subpopulations (NOAA Fisheries 2000w). Virtually nothing is known about its distribution and movement patterns when it is at sea. Current estimates indicate that the monk seal population is declining and is

believed to include approximately 1,000 animals. Hawaiian monk seals breed primarily at Laysan Island, Lisianski Island, and Pearl and Hermes Reefs but also are known to use the Midway Islands, among other northwest Hawaiian Islands (NOAA Fisheries 2000w).

Sea Turtles

Five species of ESA-listed sea turtle species occur in Hawaiian waters and occasionally on the shorelines: green (*Chelonia mydas*), loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and olive ridley (*Lepidochelys olivacea*). Of these marine reptiles, the only likely occurrence in the ROI would be the green sea turtle and, rarely, the leatherback turtle (although this species is much more common offshore). Table 3.9-1 lists the likelihood of occurrence of these species within the project area. Associated habitat information can be found in Appendix H-2.

Both green turtles and hawksbills nest annually on Hawaiian beaches (ONR 2000), although no nests have been documented in the ROI. Hawksbills are considered uncommon in Hawaiian waters, although a small number nest on Hawai'i and Moloka'i each year (NOAA Fisheries 2000y). Loggerheads and olive ridleys are known to occur in Hawaiian waters, as they are found as bycatch in the longline fishery. Loggerheads are known to spend 40 percent of their time at the surface; olive ridleys are only at the surface 20 percent of the time and tend to be found in shallower waters than loggerheads (Polovina et al. 2000). Olive ridleys are the most abundant sea turtles in the world (Polovina et al. 2000), although they are less common than green sea turtles in Hawaiian waters. Most records of olive ridley turtles are from entanglements and strandings (NOAA Fisheries 2000aa). Adult leatherbacks are commonly sighted in the waters off the outer Hawaiian Islands (NOAA Fisheries 2000z).

Green sea turtle (FT)

The green sea turtle is considered the most abundant turtle in Hawaiian waters (Zug et al. 2002; ONR 2000; NOAA Fisheries 2000x-z, 2000aa, 2000bb). The Hawaiian population of nesting green sea turtles makes up a distinct genetic unit (Zug et al. 2002). Except during their post-hatching pelagic phase, this species spends the majority of time in coastal waters, shallow bays, and nearshore areas, where foraging is optimal (Brill et al. 1994; Zug et al. 2002). Juvenile and subadult green turtles are especially abundant in the nearshore areas. These turtles have nested on all of the seven main islands (Dollar 1999). The most accurate abundance estimates for adult female green turtles that nest annually on Hawaiian beaches are from 450 to 475 animals, with the majority of reproduction taking place at the French Frigate Shoals (Balazs 1980; NOAA Fisheries 2000x, 2000y).

Submergence intervals vary by behavior. When the animals are resting, they have regular, long submergence intervals. When they are feeding, submergence intervals are short and irregular (Brill et al. 1994). In Hawai‘i, 40 to 60 percent of immature green sea turtles suffer from fibropapillomatosis, a disease that causes tumor growth (Work et al. 2003). Studies are currently ongoing to assess the impacts of these tumors on the animals’ behavior.

Green sea turtles are expected to occur in the ROI in waters off MMR or on the beach. This species is known to feed on marine plants that occur in the ROI and in the nearshore areas at MMR. The ROI could serve as sea turtle foraging and resting areas. Green sea turtles in some Hawaiian areas have been shown to remain within a small portion of a habitat area if foraging and rest habitat is optimal there, and to have short submergence intervals (Brill et al. 1994)

During the breeding season, adult green sea turtles undertake long-distance oceanic migrations from feeding areas throughout the Hawaiian archipelago to nesting beaches at French Frigate Shoals, Laysan Island, Lisianski Island, Pearl Reef and Hermes Reef, Cure Atoll, and Midway Island. It is hypothesized that green turtles in the Hawaiian archipelago could be a genetically distinct subpopulation (NOAA Fisheries 2000x). The majority (90 percent) of green turtle nesting in the Hawaiian Islands occurs a far distance from the ROI at the French Frigate Shoals, the portion of the islands that are 800 miles (1,482 kilometers) northwest of the main Hawaiian Islands, consisting of a string of 11 small island regions.

Leatherback sea turtle (FE)

Leatherbacks do not nest regularly or in great numbers in the Hawaiian Islands (NOAA Fisheries 2000x, 2000aa). Adult leatherbacks are commonly sighted in the Pacific Ocean near the Hawaiian archipelago, primarily over deep oceanic waters. Leatherbacks could occur equally as frequently off any of the main seven islands, but they are often sighted off the north shores of both O‘ahu and the Island of Hawai‘i (NOAA Fisheries 2000z; ONR 2000). They are considered unlikely in ROI waters, as they are more typically sighted along the north shore or in offshore waters (NOAA Fisheries 2000z). However, transients could occur in the waters off MMR and, rarely, on the coastline.

Sensitive Habitats

Ecologically Sensitive Areas

As described in Section 3.9.4, three ecological zones have been designated for MMR, based on climate, topography, and elevation, as follows:

- Lowland Native Forest zone occurs between 1,000 and 2,700 feet (300 and 823 meters). Both the O‘ahu Diverse Lowland Mesic Forest and the Loulu Lowland Mesic Forest have Natural Heritage Foundation Global Ranking of G1.
- Ridge Crest Vegetation zone lies above 3,000 feet (914 meters) and covers the cool, wet, windy and cloud-swept portions of the summit crest of the Wai‘anae Mountains.
- Lowland dry shrubs and mosses that favor this moist habitat generally characterize Native Shrub on Cliff and Slope zone. These natural communities occur in the range of 1,500 to 2,400 feet (457 and 732 meters) beneath steep cliffs in ridges and slopes. With distance from the summit crest, conditions become much warmer and drier.

Plants

Plant critical habitat was determined for 1,079 acres (437 hectares) within the ROI (USFWS 2007b). This is outside the boundary of MMR but within the action area determined by USFWS for plant stabilization. The Army reinitiated ESA Section 7 consultation with USFWS on potential effects on the designated critical habitat within the ROI but outside MMR. The plants for which critical habitat is designated in the ROI are described in Section 3.9.6 and are shown in Figure 3.9-5. For the plant critical habitat designated for O‘ahu in 2003, the USFWS determined that lands under Army jurisdiction on O‘ahu do not meet the definition of critical habitat under the ESA based on the Army’s continuing commitment to management and stabilization of sensitive species and that, according to ESA Section 4(b)(2), the benefits of excluding Army lands from critical habitat outweigh the benefits of inclusion (USFWS 2003a). Because areas of critical habitat that could be affected by training activities are within the ROI but outside MMR, the Army is responsible for addressing potential impacts on those areas. For the proposed training activities, the USFWS concluded that implementing the proposed action would not adversely modify or destroy the designated critical habitat addressed in the 2007 BO. The Army has completed the INRMP, the IWFMP, the Ecosystem Management Plan, and the Endangered Species Management Plan. These documents outline specific strategies and programs in place to stabilize species and habitats on its land. These management activities in some

cases surpass management by other federal, state, and private landowners (USFWS 2003a). Should the status of Army commitment to these resources change, the USFWS will reconsider whether these lands meet the criteria for critical habitat. It is important to note that the number of populations of target species on installations is applied to the overall conservation goal for each species because management of lands under the INRMP is consistent with USFWS recovery goals. Approximately 6 acres (2.4 hectares) of designated plant critical habitat were burned in the July 2003 fire at MMR. This critical habitat was on adjacent state reserve land and was designated for *Schiedea hookeri*, *Bonamia mensezii*, *Neraudia angulata* var. *dentata*, *Nototrichium humile*, *Euphorbia haeleeleana*, and *Gouania vitifolia*.

Wildlife

The USFWS designated critical habitat at MMR for the O‘ahu ‘elepaio on December 10, 2001 (USFWS 2001b) (Figure 3.9-1). There are 2,734 acres (1,106 hectares) of federally designated critical habitat for the O‘ahu ‘elepaio within the ROI. In the July 2003 fire, 150 acres (61 hectares) of ‘elepaio critical habitat were burned. NOAA Fisheries designated critical habitat for the Hawaiian monk seal in May 1988. The habitat was designated in 10 areas of the northwestern Hawaiian Islands and extended from the shore out to a distance offshore where the water depth is 20 fathoms (180 feet [55 meters]) of depth (NOAA Fisheries 2000w).

Biologically Significant Areas

The Hawai‘i Natural Heritage Program has defined three types of biologically significant areas (BSAs) for managing the important natural communities. There are 868 acres (351 hectares) of BSAs within the MMR ROI, divided into the following categories:

- BSA1 contains a high density of federally listed species. It totals approximately 778 acres (315 hectares), has the most endangered species, and includes globally imperiled ecological communities, the O‘ahu diverse lowland moist forest, and loulou lowland moist forest (Figure 3.8-5). It extends around the rim of the Mākua Valley and part of Kahanahāiki Valley, from approximately the 800-foot (244-meter) elevation to the ridge crest (over 3,000 feet or 314 meters).
- BSA2 contains all or some of the following:
 - Lower densities of federally listed endangered or proposed endangered species;

- Candidate species or other species of concern that are expected to be upgraded to federal protected status within the next few years; and
- Areas judged likely to contain high densities of federally listed species, based on habitat assessment, despite the lack of any record of such occurrence to date.

BSA2 is near the front of Mākua Valley, near Farrington Highway. It contains four rare plants and is thought to have been at one time connected to the BSA1 area on its southwest. Separation was probably the result of repeated wildfires in the area, which destroyed vegetation and allowed introduced alien plant species a competitive edge.

- BSA3 represents stands of intact native vegetation with few or no known occurrences of rare species. MMR contains no BSA3 areas.

Also found within the ROI is sensitive snail habitat. Although this habitat has not been federally designated or proposed as critical habitat, it has been identified as containing the habitat requirements necessary for supporting the federally listed snail species of concern on O‘ahu. This area is shown with the BSAs in Figure 3.9-2.

Figure 3.9-11 shows O‘ahu ‘elepaio Federally designated critical habitat in the ROI and Figure 3.9-12 shows biologically sensitive snail habitat in the ROI.

Pōhakuloa Training Area

On PTA, there are 17 federally listed species recorded as onsite and 12 of these have been recorded within the ROI for this Alternative (Tables 3.9-4 and 3.9-5). One federally listed species, the Palila, is recorded as contiguous but 4,957 acres (2,006 hectares) of critical habitat for this species has been designated on the northeast side of the installation. Within the ROI, there are eight federally listed plant species and two federally endangered animal species (Table 3.9-4). An area including Pu‘u Kapele was fenced in 1981, and a 111-acre (45-hectare) area within the fencing is managed as a sensitive plant area, with significant concentrations of *Haplostachys haplostachya*.

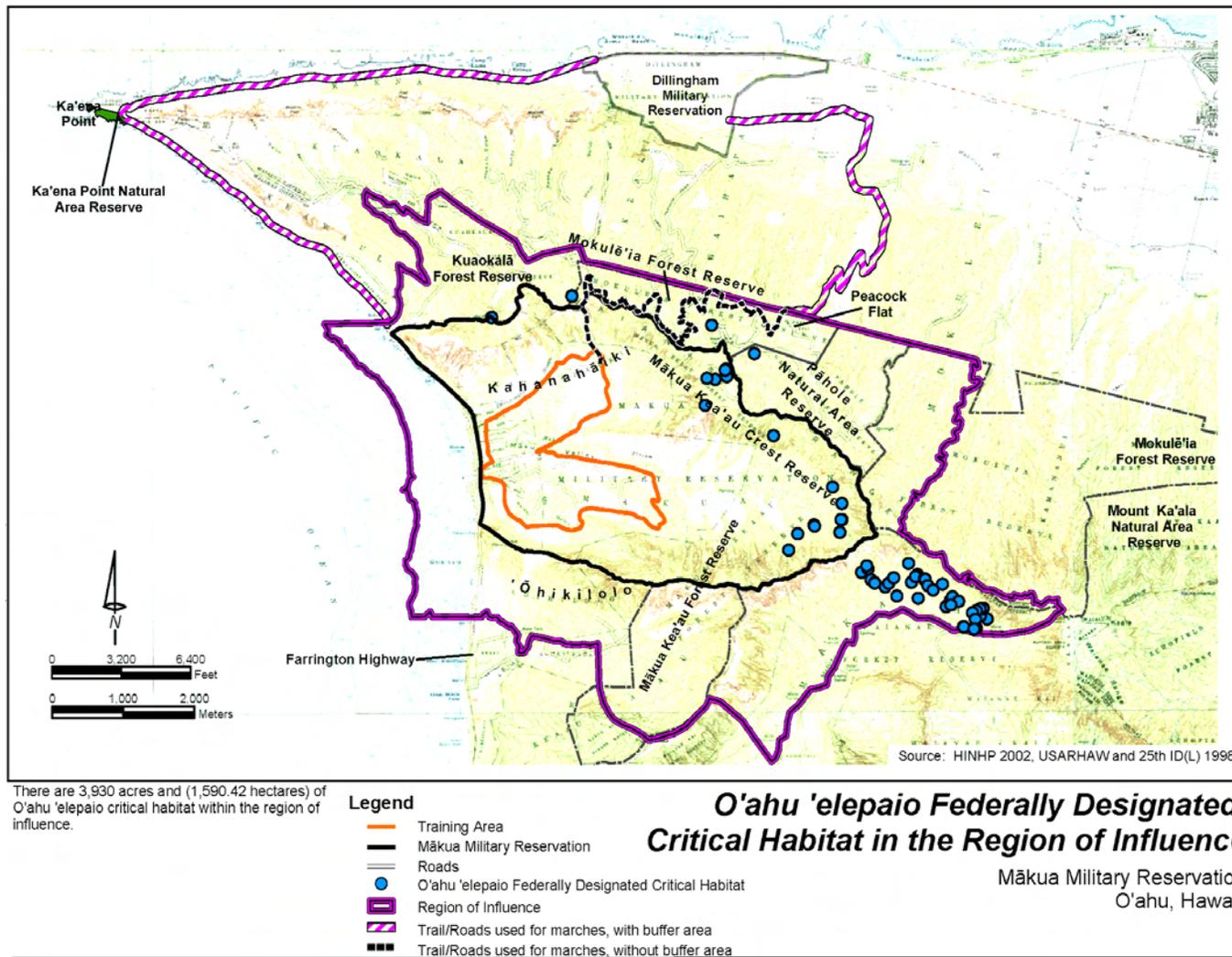
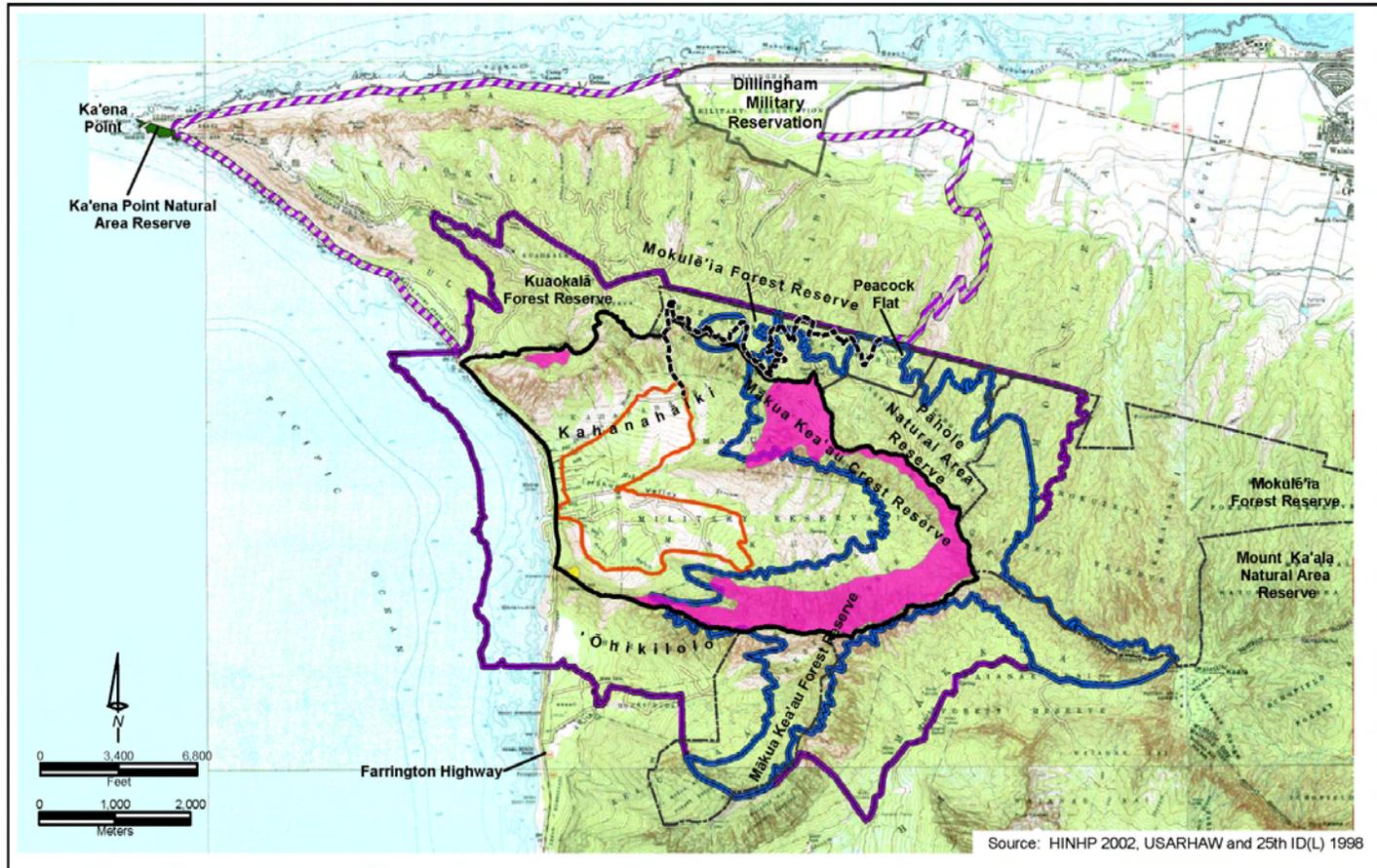


Figure 3.9-11 O'ahu 'elepaio Federally Designated Critical Habitat in the Region of Influence, MMR



There are 868 acres of Biologically Sensitive Areas and 3,456 acres of sensitive snail habitat within the region of influence.

Legend

- Training Area
- Mākuia Military Reservation
- Roads
- Region of Influence
- Trail/Roads used for marches, with buffer area
- Trail/Roads used for marches, without buffer area
- Sensitive Snail Habitat
- Biologically Sensitive Areas**
- BSA1
- BSA2

Biologically Sensitive Areas and Sensitive Snail Habitat in the Region of Influence
Mākuia Military Reservation
O'ahu, Hawai'i

Figure 3.9-12 Biologically Sensitive Snail Habitat in the Region of Influence, MMR

**Table 3.9-4
Federally Endangered and Threatened Plant Species Within the PTA ROI**

Scientific Name	Hawaiian Name/Common Name	Federal Status	PTA Plant Management Priority*	Critical Habitat
<i>Asplenium fragile</i> var. <i>insulare</i>	None	E	PS2	ESA 4(b)(2) Exclusion**
<i>Haplostachys haplostachya</i>	Honohono / Hawaiian mint	E	PS4	No CH
<i>Hedyotis coriacea</i>	Kio‘ele / Leather-leaf sweet-ear	E	PS1	4(b)(2) Exclusion
<i>Neraudia ovata</i>	None	E	PS1	4(b)(2) Exclusion
<i>Silene hawaiiensis</i>	None	T	PS4	4(b)(2) Exclusion
<i>Silene lanceolata</i>	None	E	PS2	4(b)(2) Exclusion
<i>Solanum incompletum</i>	Popolo ku mai	E	PS1	4(b)(2) Exclusion
<i>Stenogyne angustifolia</i>	None	E	PS4	No CH
<i>Tetramolopium arenarium</i> ssp. <i>arenarium</i>	Mauna Kea pamakani	E	PS1	4(b)(2) Exclusion
<i>Zanthoxylum hawaiiense</i>	A‘e / Hawaiian yellow wood	E	PS2	4(b)(2) Exclusion

* Priority Species 1 (PS1) - < than 500 individuals and/or five or fewer populations remaining statewide; Priority Species 2 (PS2) - 500 to 1,000 individuals and/or six to 10 populations remaining statewide; Priority Species 3 (PS3) - 1,000 to 2,000 individuals and/or 10 to 20 populations remaining statewide; Priority Species 4 (PS4) - 2,000 to 5,000 individuals and/or 20 to 40 populations remaining statewide; Priority Species 5 (PS5) - >5,000 individuals and/or >40 populations remaining statewide.
** ESA 4(b)(2) – The USFWS may exclude any area from critical habitat if they determine that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless they determine, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species.

**Table 3.9-5
Federally Endangered Wildlife Species Found Within or Potentially Within the PTA Region of Influence**

Scientific Name	Hawaiian Name/Common Name	Federal Status	Date Last Observed	Recent Observed Location(s) on PTA	Likelihood of Occurrence in ROI*
<i>Branta sandvicensis</i>	Nēnē / Hawaiian Goose	E	2008	South of ROI and southeastern PTA; Ke‘āmuku parcel	C**P
<i>Buteo solitarius</i>	‘Io / Hawaiian Hawk	E	2005	Training Area 23	P
<i>Chaseimpis sandwichensis</i>	‘Elepaio	-	2005	One in Kīpuka ‘Alalā area	U
<i>Hemignathus munroi</i>	Akiapola‘au / Honeycreeper	E	1984	Northeast PTA by Palila CH	U
<i>Loxioides bailleui</i>	Palila / Honeycreeper	E	1990	Northeast PTA by Palila CH	U
<i>Petrodroma phaeopygia sandwichensis</i>	‘Ua‘u / Dark-rumped Petrel	E	1990	South of ROI in Training Area 22	P
<i>Lasiurus cinereus semotus</i>	‘Ōpe‘ape‘a / Hawaiian hoary bat	E	2005	Within ROI	C
<i>Rhyncogonus stellaris</i>	Rhyncogonus weevil	-	2004	Within ROI, Training Area 19	C

*Likelihood of occurrence in ROI: C = Confirmed; P = Potentially may occur; U = Unlikely to occur

** A 2007 incidental, seasonal sighting within ROI

Kīpuka Kālawamauna Endangered Plants Habitat is located in the northwest corner of PTA between the impact area and the historic boundary in portions of Training Areas 18, 19, 20, and 22. It was designated by the Army in 1997 with the discovery of the federally listed endangered plants, *Haplostachys haplostachya* and *Stenogyne angustifolia*. The area also contains other rare plants. While not federally identified as critical habitat, the Army recognized the biological significance of the area and manages (e.g., protective fencing, weed control, training restrictions, etc.) for the preservation of the ecosystem and the federally listed species present on the 7,854 acres (3,178 hectares).

Approximately 1,863 acres (754 hectares), or 24 percent, of the kīpuka is fenced. The southern section is pāhoehoe with an Open *Metrosideros* Treeland and a dense understory. Threats to the area include fire, feral ungulates in the unfenced portion, and the remaining ungulates in the fenced area. Other endangered species identified in the area include *Asplenium fragile* var. *insulare*, *Hedyotis coriacea*, *Silene lanceolata*, *Tetramolopium arenarium* var. *arenarium*, and *Zanthoxylum hawaiiense*. (USFWS 2003c)

Sensitive Vegetation Species

Presented below is the natural history information for listed plant species known to occur in the ROI (Figure 3.9-5) that could be affected by Army activities. Species location is provided when known, and all species are represented in genetic storage facilities with cuttings or seeds, unless otherwise noted. An extensive key to status codes is provided in Appendix H-2. The table indicates whether or not critical habitat has been designated for the individual species on the installation. For additional information, the corresponding pages within the 2003 BO and/or the 2006 to 2007 PTA Report for the Ecosystem Management Program that address a species are provided.

Asplenium fragile var. *insulare* (E)(2003 BO, pp 52; PTA 2006 Report, pp. 2-16; and PTA Draft 2007 Report, pp. 1-3)

This small to medium-sized fern is found within streamside hollows and grottoes that occur in mesic to dry subalpine shrubland dominated by *Leptecophylla tameiameia* and *Sadleria cyatheoides*, with scattered *Metrosideros polymorpha*. On the Island of Hawai'i, this fern grows in moist and dark areas in large lava tubes, pits, and deep cracks on varying ages of lava that have moderate soil or ash accumulation, and is associated with mosses and liverworts. There are between 626 and 1,071 individuals of this fern found on the Island of Hawai'i; there are 34 known locations on PTA with varying number of individuals. Within the ROI, the fern is located in the Kīpuka Kālawamauna area approximately 4.5 miles west of the northern point of the Twin Pu'u range footprint. Within the ROI, threats to this species include fire, browsing by feral sheep and goats,

competition with *Pertnisetum setaceum* (fountain grass), and habitat degradation or destruction of lava tubes.

Haplostachys haplostachya (Honohono) (E) (2003 BO, pp 56; PTA 2006 Report, pp. 2-19; and PTA Draft 2007 Report, pp. 1-6)

This short-lived subshrub of the mint family grows in dry exposed areas on ash-veneered lava, very stony, shallow soils, and lava outcrops. It often establishes in large cracks on rocky ridges and on pu'us. Currently, the species is found in six different Intensive Management Units (IMUs) totaling over 20,000 individuals on the Island of Hawai'i and all these occurrences are located in PTA. Within the ROI, they are located 1 mile (1.6 kilometers) to the west and northwest side of the Twin Pu'u range footprint and stretch to the northwest in Training Areas 17, 18, 19, and 20. Part of the population unit within in the Kīpuka Kālawamauna area is also within the ROI. The primary threats to this species are feral sheep and goats that browse on the flowers; rooting by feral pigs; competition for light, space, and nutrients by fountain grass and other nonnative plants; and invasion by and conversion of habitat to a fire-based vegetation community.

Hedyotis coriacea (Kio'ele) (E) (2003 BO, pp 60; PTA 2006 Report, pp. 2-26; and PTA Draft 2007 Report, pp. 1-16)

This small shrub is in the coffee family and occurs on pāhoehoe lava flows in sparse *Metrosideros* treelands and open *Metrosideros* treelands with sparse to dense shrub understories. It is found at elevations from 4,921 to 5,577 feet (1,500 to 1,700 meters) at PTA. One individual plant is currently known on the Island of Maui, and the remaining occur on PTA, approximately 175 to 225 individuals. Within the ROI, the species is found to the west of the Twin Pu'u range footprint. The threats to this species include browsing pressure from feral sheep and goats; habitat degradation; introduction and expansion of invasive plant populations; military exercises that ignite fires which degrade habitat and subsequent invasion by nonnative plants; and due to the very limited distribution of this species, a single natural or human-caused environmental disturbance could be catastrophic.

Neraudia ovata (E) (2003 BO, pp 67; PTA 2006 Report, pp. 2-35; and PTA Draft 2007 Report, pp. 1-22)

A member of the nettle family, this species is a sprawling shrub that can develop into a small tree. This shrub occurs in dry forests, on open lava flows, and in subalpine forests on the leeward side of the Island of Hawai'i at elevations from 377 to 4,987 feet (115 to 1,520 meters). At PTA, the species grows in Open *Metrosideros* Treelands with a sparse shrub understory and in *Myoporum* Shrublands. Over 90 percent (161 individuals) of the total *N. ovata* population occurs on PTA. The remaining individuals occur on State land adjacent to the installation.

Outplantings of the species in the Kīpuka Kālawamauna area occur within the ROI approximately one mile to the west of the proposed Twin Pu‘u range footprint. Threats to this species include grazing pressure from ungulates, competition from invasive species, impacts of military training due to increased risk of wildfire, and the possibility of a natural or human-caused disturbance that could be catastrophic.

Silene hawaiiensis (T) (2003 BO, pp 71; PTA 2006 Report, pp. 2-44; and PTA Draft 2007 Report, pp. 1-30)

This species is a sprawling, short-lived shrub that typically grows in montane and subalpine dry shrublands on decomposed lava and ash, as well as on all ages of lava and cinder substrates at elevations from 2,953 to 4,265 feet (900 to 1,300 meters). The species has also been documented to resprout following fire. There are approximately 1,903 to 2,872 individuals of *S. hawaiiensis* distributed throughout the installation, but mainly on the eastern side in Training Area, 21BAAF. These occurrences represent approximately 71 percent of all naturally occurring individuals State-wide. The population unit in the Kīpuka Kālawamauna area to the west of Twin Pu‘u range footprint is within the ROI. Records of *S. hawaiiensis* on the east side of the impact area (area E), west of the northern portion of Red Leg Trail, are within the ROI of the proposed range. The major threats to this species in the ROI include ungulate browse and increased risk of fire from mounted and dismounted maneuvers and bivouac. Military actions can also result in habitat fragmentation, dispersal of alien plant seeds, and increased potential for trampling of plants.

Silene lanceolata (E) (2003 BO, pp 73; PTA 2006 Report, pp. 2-49; and PTA 2007 Draft Report, pp. 1-34)

A member of the Pink family, this perennial shrub is recorded on the Islands of Molokai, O‘ahu and Hawai‘i. On the Island of Hawai‘i, this species grows on rocky tumuli or outcrops, on ‘a‘ā lava, in deep ash deposits over pāhoehoe lava, and in Mauna Kea substrate in dry montane shrubland at elevations between 4,111 and 4,331 feet (1,253 and 1,320 meters). PTA estimates that there are over 10,000 individuals of the species found onsite. This clearly represents the majority of the species known to exist. A large portion of the population unit in the Kīpuka Kālawamauna area is within 1.5 miles (2.4 kilometers) to the west of the Twin Pu‘u range footprint within the ROI. A few records of the species are also within the ROI extending to the northwest of the range footprint. *Silene lanceolata* is extremely susceptible to ungulate browsing and trampling. At PTA, military training activities increase the risk of fires due to live-fire training, bivouac and mounted and dismounted off-road activities. Other threats include trampling, dust, spread of invasive nonnative plants, and fragmentation of remaining habitat.

Solanum incompletum (Popolo ku mai) (E) (2003 BO, pp 76; PTA 2006 Report, pp. 2-56; and PTA Draft 2007 Report, pp. 1-40)

This plant is a member of the nightshade family that typically occurs as a woody shrub growing to 10 feet (3 meters) tall. On Army lands at PTA, the species is found on lava flows of various ages in Sparse *Metrosideros* Treelands and *Myoporum* Shrublands at an elevation of 4,675 feet (1,425 meters). The only natural occurrence of this species is at two disjunct sites at PTA that totals approximately 66 individuals. There have been over 1,100 outplantings of the plant on the installation. Outplantings of the species in the Kīpuka Kālawamauna area occur within the ROI approximately one mile to the west of the proposed Twin Pu‘u range footprint. Threats to the species include habitat degradation, browsing by feral ungulates, competition with non-native plant species, reduced reproductive vigor (e.g., limited gene pool), and the potential for a single catastrophic environmental event. The primary threat from military activities is the increased risk of fire.

Stenogyne angustifolia (E) (2003 BO, pp 80; PTA 2006 Report, pp. 2-64; and PTA 2007 Draft Report, pp. 1-47)

This plant in the mint family grows on relatively flat, ash-veneered lava and shallow soils in semi-arid shrublands and *Metrosideros* Woodlands at an elevation of 5,102 feet (1,555 meters). The species also occurs at an elevation of 3,396 feet (1,035 meters) in the transition zone between pastureland and the Ke‘āmuku lava flow. Between 1,864 and 1,936 individuals of *S. angustifolia* have been recorded in PTA at 545 locations and these individuals represent 100 percent of the naturally occurring individuals known statewide. Within the ROI, a large number of occurrences of the species are recorded to the west and northwest of the Twin Pu‘u range footprint in Training Areas 18, 19, and 20, and within the Kīpuka Kālawamauna area. Threats to the species include habitat competition from nonnative plants, particularly fountain grass; and conversion of habitat to a fire-based vegetation community. Army training such as mounted and dismounted off-road maneuvers, bivouac, and live-fire training increase the risk of fire, habitat fragmentation and alien plant seed spread.

Tetramolopium arenarium ssp. arenarium (Mauna Kea pamakani) (E) (2003 BO, pp 83; PTA 2006 Report, pp. 2-68; and PTA 2007 Draft Report, pp. 1-50)

This shrub species is in the sunflower family and grows up to 4.3 feet (1.3 meters) tall. At PTA the species is found in the *Dodonaea* Mixed Shrubland at elevations between 4,265 and 5,577 feet (1,300 and 1,700 meters). All of the approximately 577 individuals of the species occur within a 40-acre (16.2-hectare) area located within the ROI. The primary threats to this species are feral ungulates that browse on the plant; rooting

by feral pigs; competition from nonnative plant species such as fountain grass; and conversion of habitat to a fire-based vegetation community. Army training such as mounted and dismounted off-road maneuvers, bivouac, and live-fire training, increase the risk of fire, habitat fragmentation and alien plant seed spread. Due to the very limited distribution of this species, a single natural or human-caused environmental disturbance (i.e., fire) could be catastrophic.

Zanthoxylum hawaiiense (A'e) (E) (2003 BO, pp 87; PTA 2006 Report, pp. 2-77; and PTA 2007 Draft Report, pp. 1-57)

This tree species is a member of the citrus family and at PTA, it is found on lava and in a variety of plant community types including sparse *Metrosideros* Treelands, Open *Metrosideros* Treelands with dense shrub understory, Intermediate *Metrosideros* Mixed Treelands, *Myoporum* Shrublands, and *Myoporum-Dodonaea* Shrublands. Between 72 and 86 percent of State wide population of this tree species occurs on PTA. The records of the species within 1 mile (1.6 kilometers) to the northwest (Training Area 18) of the Twin Pu'u range footprint and portions of the population unit 3 miles (4.8 kilometers) to the west of the footprint (Training Area 22) are within the ROI. In addition, one recorded individual in the northern portion of Area E (Range 11) appears to be within the ROI. Threats to species include habitat degradation and browsing by feral and domestic animals, competition from nonnative plant species, seed predation by rodents, fire; trampling, and effects of military activities (i.e., dismounted maneuvers and bivouac increase the risk of fire, promote habitat fragmentation, disperse alien plant seeds, and increase potential trampling of seedlings and young plants).

Sensitive Wildlife Species

Several sensitive terrestrial wildlife species have been observed or have the potential to occur in the ROI. The HINHP and natural resources staff described sensitive animal locations on PTA. Table 3.9-5 lists sensitive terrestrial wildlife species and their likelihood of occurrence in the ROI. Figure 3.9-6 shows the locations of sensitive wildlife confirmed within the ROI.

Discussed below is the natural history information of sensitive status wildlife species known or considered likely to occur in the ROI or that potentially would be affected by CALFEX activities, as well as the location of these species (when known).

Branta sandvicensis (Nēnē) (E) (2003 BA, pp 293; PTA 2007 Draft Report, pp. 2-61; and 2008 draft Section 7 reinitiation document for PTA)

This ground-nesting goose occurs on the Islands of Hawai'i, Maui, and Kaua'i composing an estimated 349, 251, and 620 wild individuals,

respectively (USFWS 2004 draft recovery plan). Nēnē have between six and seven different populations on the Island of Hawai‘i that are actively managed and supplemented with captive bred individuals.

Nēnē have adapted to a terrestrial life and as such, do not need wetlands in their habitat. Their preferred habitat includes grasslands, shrub lands and dryland forests. Nēnē mate for life and remain close to each other throughout the year. They are known to have high nest site fidelity, meaning that they return to the same area to nest from year to year. The average lifespan of a nēnē is thought to be in excess of 10 years. Typically, birds will pair up for breeding between October and March in their second year. After breeding, nēnē will rejoin with larger family groups during flocking season. The flocking season is primarily from April through September. During flocking season (March to September), individuals from the above identified breeding populations migrate to areas of higher elevation and areas of greater food availability. It is during this time that individuals from the Pu‘u Wa‘a Wa‘a, Hakalau National Wildlife Refuge, and Keauhou populations have been seen on PTA in large numbers, specifically at Range one.

On the main portion of the installation, nēnē have been reported for years during flocking season (March through September) primarily on the ground at Range one. In addition to those found on the main installation, several pairs of nēnē were sighted in the Ke‘āmuku parcel during the 2007-2008 breeding season (October through March), including one pair with an active nest. In August 2007, 18 Nēnē were reported at range 1, which is on the eastern side of the installation outside of the ROI.

The historic decline of the species was probably caused by hunting during breeding season, the capture of birds and eggs, flushing and frightening birds, ranching activities, introduced predators, competition from introduced bird species, and changes to habitat by introduced plants. Rarely observed on the installation, the Hawaiian Goose does not appear to be a resident species on PTA. The action’s effects on the species are not expected and would be coincidental, especially since there are no records of the goose within the ROI for this action.

Buteo solitarius (‘Io) (E) (2003 BA, pp 293; PTA 2008 Draft Report, pp. 2-63)

The ‘Io is a small, broad-winged raptor endemic to the Hawaiian Islands. The taxon occupies a variety of habitats, including lowland agricultural areas and forests dominated by alien plant species to mid-elevation pasture lands and native rain forests. Birds probably mate around 3 to 4 years of age. Mated pairs tend to use the same nest multiple years. The species is somewhat monogamous and demonstrates fidelity to breeding sites for multiple years. Hatching occurs from late May to late June and fledging

occurs in mid-August. The 'io nests in six different tree species, suggesting tree type may be unimportant in nest-site selection. A combined home range for a pair is 1,500 to 2,128 acres (607 to 861 hectares), and overlapping home ranges are possible. Modified and nonnative habitats may not provide adequate perching and nesting sites.

The USFWS estimated 1,400 to 2,500 individuals present on the Island of Hawai'i. The 'Io has been sporadically recorded on PTA since the 1980s. In 1992, an 'io was recorded approximately 2 miles (3.2 kilometers) to the northeast of the Twin Pu'u range footprint. Per the requirements of the 2003 BO, surveys have been conducted for the 'io on PTA in Training Areas 22 and 23. In December 2003, an 'io was seen three straight days in Training Area 23. From 2004 through 2006, PTANRS conducted systematic 'Io surveys at PTA in an effort to determine 'Io presence, abundance and habitat use. No 'Io sightings have ever been reported on these surveys, leaving incidental sightings as the only record of 'Io presence on PTA. However, in November 2005, a juvenile hawk was seen in Training Area 23, but not during the survey period. Survey efforts continue, but the 'Io is a rare and sporadically observed species on PTA.

The principal threat to the species is the conversion of forests to pastures and urban development. The necessity of a year-round food supply, small clutch size, long incubation and nesting periods, and prolong-fledgling dependency compared to temperate raptors are concerns. On PTA and within the ROI, the 'Io does not appear to be a resident species and effects of the Proposed Action are not expected and would be coincidental.

Petrodroma phaeopygia sandwichensis ('Ua'u) (E) (2003 BA, pp 293; PTA 2007 Draft Report, pp. 2-68)

On the Island of Hawai'i, this pelagic bird is currently found at Mauna Kea, Mauna Loa, and Kilauea at elevations from 6,562 to 9,842 feet (2,000 to 3,000 meters). The total population of 'ua'u is estimated to be from several thousands to 34,000 birds. In 1995, 48 active nests were documented on the southeastern side of Mauna Loa, Island of Hawai'i. The species is known to nest in sparsely vegetated sites and in dry environments. Nesting burrows are commonly located among large rock outcrops, talus slopes, or along the edges of lava flows. Birds excavate tunnels between 3 to 6 feet (1 to 2 meters) deep. Nests are used from March to November, multiple years. The species is monogamous, generally pairs for life, and shows a high degree of nest-site fidelity. 'Ua'u exhibits a conservative reproductive strategy marked by late maturity, low replacement rates, and a long life span. As such, the species is unable to respond quickly to changing environmental conditions.

It is believed that the 'ua'u feeds primarily at night, catching its prey near the surface or by scavenging. Crustacean egg cases appear to be an important source of stomach oil for the dark-rumped petrel.

Other than a 1994 radar survey detecting three dark-rumped petrels flying over the eastern portion of PTA, surveys conducted on PTA have not detected the species. However, in 2002 in the southern portion of TA 23, three human-modified pits were discovered that may have historically been used by the dark-rumped petrel as burrows. An additional burrow with two nests from a previous nesting year was also found (Evans et al. 2002b). Limited nights were monitored during the 2007 'Ua'u breeding season, which extends from April through August, but no birds were seen or heard. Although no 'Ua'u were recorded, the effort was not adequate to make conclusions about the status of this species on PTA at this time.

Predation is the single greatest threat to the taxon. The demise of the species on the Islands of Hawai'i, Maui, and Molokai is attributed to *Herpestes auro-punctatus* (mongoose), *Sus scrofa* (pig), *Felis catus* (cats), and possibly humans on O'ahu. On PTA and within the ROI, the 'ua'u does not appear to be a resident species. However, the size of potential available nesting habitat at PTA makes the area attractive for petrels, and, although no birds have been sighted recently at PTA, their burrowing behavior and the discovery of previously used nesting sites suggest small undetected populations are possible. These areas of potential use by the 'Ua'u are quite a distance from the ROI and effects of the proposed action on the species are not expected and would be coincidental.

Lasiurus cinereus semotus ('Ōpe'ape'a) (E) (2003 BO, pp 293; PTA 2007 Draft Report, pp. 2-64)

The 'ōpe'ape'a is endemic to the State of Hawai'i and is the only native terrestrial mammal in the state. It is one of three recognized subspecies of hoary bats, one of which (*L.c. cinereus*) is a very common and widespread bat in North America. The 'ōpe'ape'a is resident to only Hawai'i, Maui, and Kaua'i, with the largest populations probably on Hawai'i and Kaua'i. 'Ōpe'ape'a are thought to be most numerous on the Island of Hawai'i, where they are uncommon but fairly widespread. There are no population estimates for the Hawaiian hoary bat and few historical or current records. Unsubstantiated population estimates across the State have ranged from hundreds to a few thousand (USFWS 1998a, 1999b). Data are limited because no feasible method currently exists for surveying the abundance and distribution of solitary, tree-roosting bats. Bats have been observed year-round in a wide variety of habitats and elevations.

A lot of key information is lacking or otherwise unknown about the 'ōpe'ape'a's such as average life span, age at first reproduction, breeding biology, survivorship, how age and reproductive condition affect its food

habits, habitat selection, home range size, movement patterns, roost tree selection, etc. Hawaiian hoary are known to forage in a variety of open and vegetated habitats, including open fields, lava flows, open ocean in bays near shore, and streams and ponds. Bats on Hawai'i forage in both relatively closed habitats near vegetation (such as clearings in lowland mesic 'ōhia forest or town parks) as well as in open habitats and forest edges (Jacobs 1993a; Tomich 1974).

Preliminary evidence indicates that pregnant and lactating female Hawaiian hoary bats on Hawai'i may prefer roosting in lowland areas rather than in the cooler highlands, perhaps because the warmer lowland environment promotes faster juvenile growth (or, alternatively, because insect food sources may be more readily available).

PTA comprises about seven percent of the 'ōpe'ape'a's current range and about 13 percent of its range on Hawai'i. The Island of Hawai'i is thought to have the largest existing population of Hawaiian hoary bats and for that reason, PTA is important to the survival and recovery of the subspecies. Based on the limited information available, it appears that Hawaiian hoary bats are present in low numbers throughout PTA year-round and have been detected in a wide variety of habitat types, from barren lava to open 'ōhia forests (Cooper *et al* 1996). Presence/absence surveys conducted on PTA in May-June and November-December 2005 detected bats throughout the installation with the summer survey showing the bat's preference for dense woodland habitat types.

In 2006, automated bat detectors were used to detect bats before sunset and into the evening. Bats were detected at sites within the ROI to the west and far west of the Twin Pu'u range footprint. During 2007, a full scale, year-round, installation-wide Hawaiian hoary bat monitoring program was instituted at PTA to determine distribution and habitat use of the 'ōpe'ape'a. There was a fairly high estimate of bat occupancy throughout the survey sites. Low sample size combined with low detectability resulted in biased finding for habitat preference. The data obtained has not confirmed the presence of roosting or breeding bats on the installation.

The major threats to the 'ōpe'ape'a on PTA are habitat loss and degradation, primarily the destruction and disturbance of available roosting sites. The primary threat to roosting and foraging habitat for the Hawaiian hoary bat in the ROI is the risk of wildfire resulting from military training. Direct injury or death of Hawaiian hoary bats in the ROI resulting from live-fire exercises is less likely, although still a threat. Mitigation actions described in the 2004 SBCT FEIS and the required efforts to minimize take as described in the terms and conditions of the

2003 BO would all substantially reduce impacts of the proposed action on the 'ōpe'ape'a.

Rhyncogonus stellaris (*rhyncogonus weevil*) (2003 BA, pp 293; PTA Report, pp)

This flightless weevil was historically found in the North Kona and South Kohala districts along the coastal lowlands. It's range is now believed to be restricted to PTA and they are only known from the Kīpuka Kālawamauna Endangered Plant Habitat. They are closely associated with a narrow range of plants, such as the 'aheahea shrub. The adults are leaf chewers and the larvae are associated with the roots of their host plants.

From March 2004 to September 2005, eight study sites of *C. oahuensis* and *Dodonaea viscosa* were surveyed early morning or at dusk to locate the rhyncogonus weevil. A total of 18 individuals were found August through September 2004 within the proposed ROI (TA 19). All were found amongst the crown of *C. oahuensis* and were exposed and easily visible.

Threats to the weevil include replacement of native plant hosts by the widespread occurrence of forage plants or escaped exotic grasses; also possible predation by ants or rodents. Its limited distribution within fire prone habitat on PTA is a management concern for this species. Also of concern are an introduced weevil (*Asynonychus godmanii*) that may be a potential threat or competitor with the rhyncogonus weevil, and the Argentine ant (*Linepithema humile*), which is known to be an aggressive predator of native insects, is a potential predator of the weevil.