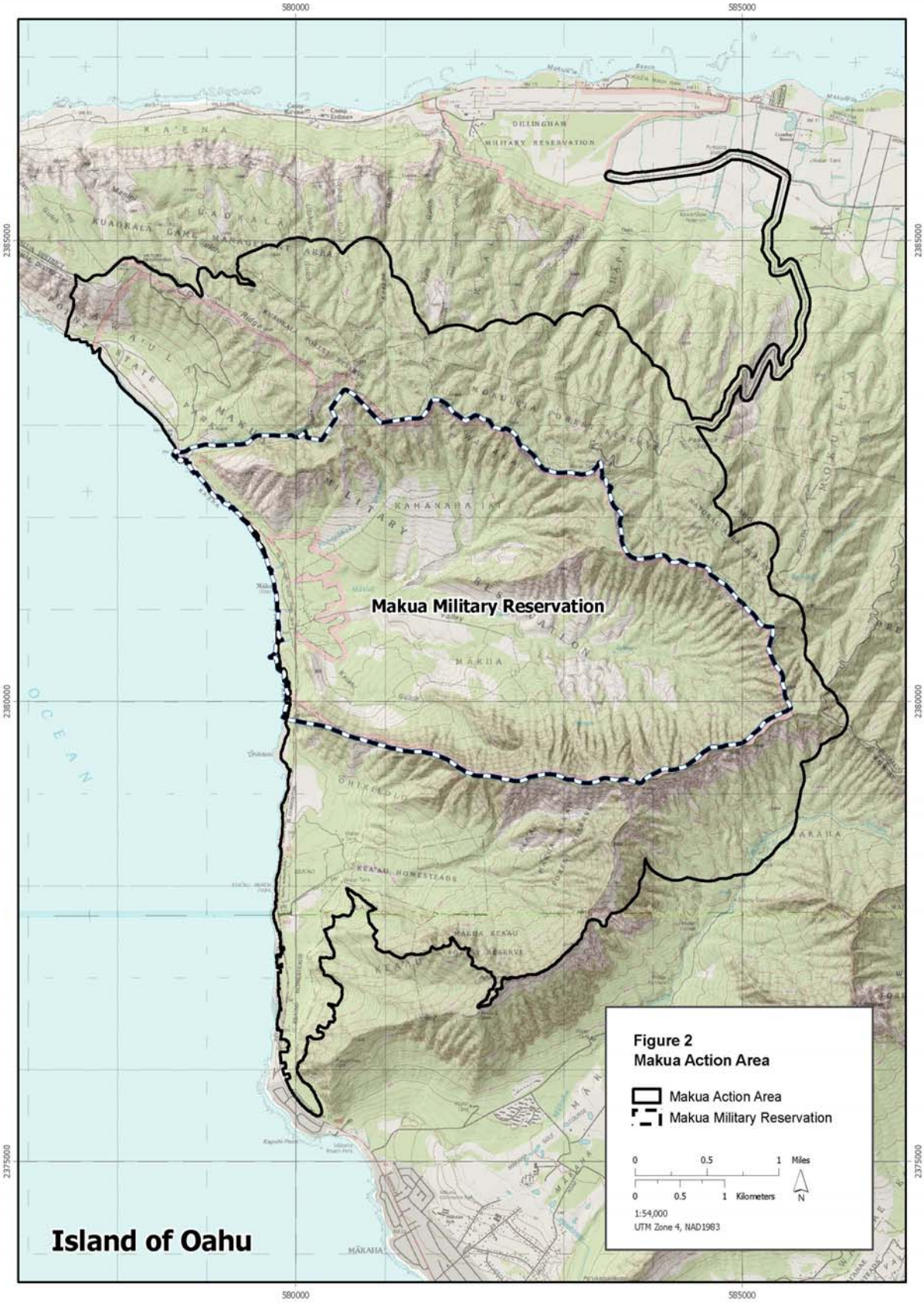
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Makua Military Reservation
Island of Oahu
Figure 2
Makua Action Area
Makua Action Area
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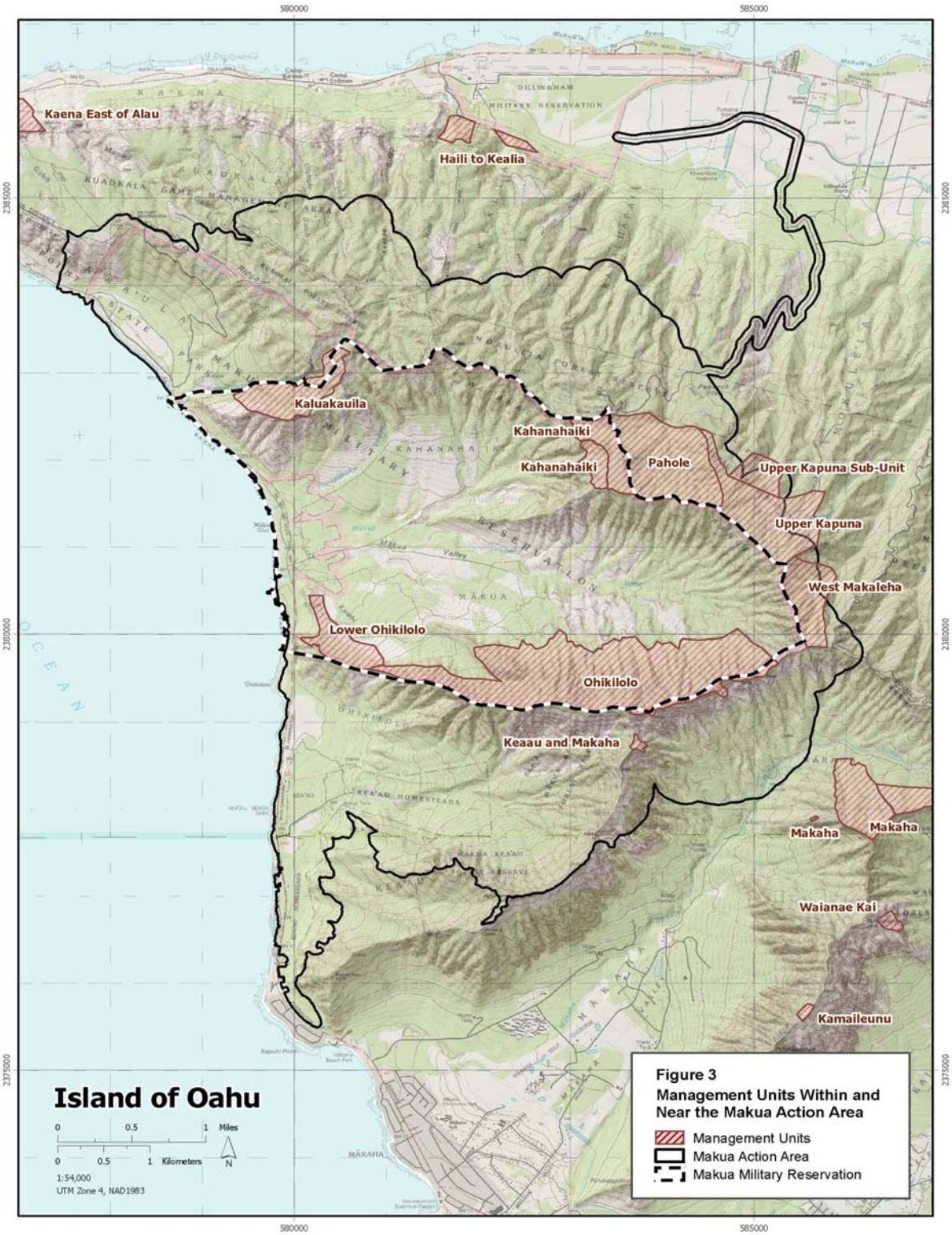
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Kaena East of Alau
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Kaluakauila
Kahanahaiki
Kahanahaiki
Pahole
Upper Kapuna Sub-Unit
Upper Kapuna
West Makaleha
Lower Ohikilolo
Ohikilolo
Keaau and Makaha
Makaha
Makaha
Waianae Kai
Kamaileunu
Island of Oahu
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Figure 3
Management Units Within and Near the Makua Action Area
Management Units
Makua Action Area
Makua Military Reservation

This Biological Opinion will supersede all previous biological opinions and incorporate all modifications to training and natural resources activities that will occur within the action area. For our analysis we have incorporated the Wildland Fire Management Plan, the Makua Implementation Plan Addendum, plus relevant portions of the Makua Implementation Plan for our analysis. A complete administrative record of this consultation is on file at our office.

This reinitiated Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in *Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service* (No. 03-35279) to complete the following analysis with respect to critical habitat.

## CONSULTATION HISTORY

See Appendix B for a complete list of list of individuals mentioned below and their positions within their respective organizations.

July 26, 2005: The Service received a letter of reinitiation outlining proposed changes to training actions at Makua. The Army requested the addition of tracers, illumination munitions, Javelins, inert TOW missiles, 60 mm short-range training ammunition, 155 mm High Explosive (HE) artillery simulators, 2.7-caliber rockets shot from helicopters, training on C-ridge, training with ball ammunition without helicopter support, demolition without helicopter support, and night training. The reinitiation package also included a proposed reduced action area.

August 5, 2005: We received the biological information (companion document to the reinitiation letter) for the plant and animal species that will be affected by the Army's increased training activities at Makua. This was the start date for the reinitiation.

September 20, 2005: The U.S. Department of the Interior submitted a 15-page comment letter on the "Draft Environmental Impact Statement on Military Training Activities at Makua Military Reservation, Hawaii." (ER05/0631)

October 3, 2005: Representatives from the Service (Patrice Ashfield, Stephanie Bennett, Patty Walcott, and Jenness McBride) met with Tom Huseman (Makua Range Manager) for a tour of Makua. We also discussed the use of certain weapons at Makua and Mr. Huseman agreed that use of illumination rounds and the Javelin would be inappropriate at a range the size of Makua.

October 14, 2005: Patrice Ashfield, Gina Shultz, Steve Miller, Jenness McBride, Patty Walcott (Service), met with Michelle Mansker, Peter Yuh, Joel Godfrey, Jason Greenlee, Susan Ching (Army) to present our action area that differed from the proposed action area submitted by the Army with the reinitiation package. Our determination increased the action area due to our understanding of the proposed action (long-range, incendiary weapons) and the potential for fire spread due to disturbed grassy vegetation in and adjacent to Makua. We also presented a risk analysis for the endangered plant, *Schiedea nuttallii* outlining our concern that the action as proposed could result in a jeopardy determination for this species. We recommended the removal of tracers, 155 mm artillery, illumination rounds, 2.75-caliber rockets and Javelins from the proposed action.

November 14, 2005: The Service detailed a National Park Service Fire Management Officer (Dawn Greenlee) to assist with the fire related issues pertaining to the Makua consultation.

November 17, 2005: Michelle Mansker, Environmental Resource Manager, relayed to Patrice Ashfield (Service) that Colonel Killian agreed to remove illumination rounds from the list of training weapons at Makua.

December 6, 2005: Without notifying the Service, the Army placed a wooden bridge on the Kaena Trail to allow troop movement on the trail. We notified the Army that construction and use of the bridge was inappropriate prior to completion of the consultation since Kaena Trail was part of the new action.

December 8, 2005: Army biologists (Kapua Kawelo, Susan Ching, and Michelle Mansker) met with Service representatives (Patrice Ashfield, Charmie Dang, Jenness McBride, Stephanie Bennett, and Patty Walcott) for a day to work through problems associated with the data base and to ensure we are using the best available information on species abundance and distribution.

December 15, 2005: Service representatives, Patrice Ashfield, Gina Shultz, Dawn Greenlee met with Army representatives, Michelle Mansker, Gayland Enriques (Army Fire Chief), Jason Greenlee, and Susan Ching to discuss the draft fire suppression helicopter staffing guidelines that could enable fires to be contained under various live herbaceous fuel moisture and weather conditions.

December 27, 2005: The Service received a request from the Army to conduct a prescribed burn outside of the firebreak road in order to fulfill their Settlement Agreement and Stipulated Order to allow concerned citizens access to archaeological sites at Makua. The Army was concerned this type of prescribed burn would be too risky for species and fire fighting personnel.

January 3, 2006: The Service replied to the Army's letter concurring that a "hot" burn outside of the firebreak road was a problem and would require extensive minimization measures.

January 25, 26 and 27, 2006: The annual Makua Implementation Team meetings to discuss the Army's progress implementing the Makua Implementation Plan occurred. Team members represented included: Department of Land and Natural Resources Division of Forestry and Wildlife, Board of Water Supply, The Nature Conservancy, University of Hawaii, U.S. Geological Survey Biological Resources Discipline, the Service, and the Army.

January 30, 2006: The Service received a letter from the Army requesting our review of the Prescribed Burn Plan MMR 06-01, to ensure that the proposed plan was not likely to adversely affect listed species or critical habitat. The burn was proposed for periods of time when the grass in the valley, outside the burn unit, was green, and adequate fire suppression helicopter staffing was proposed so that a spot fire could be contained before listed plants could burn.

February 9, 2006: Andy Beavers (Center for Environmental Military Managed Lands; CEMML), Kapua Kawelo (Army Environmental), Jason Greenlee (Army Wildland Fire Management Officer), Dawn Greenlee (Service) took a field trip to the Kahanahaiki weather station fuelbreak area and the Kaluakauila firebreak site. They later visited the Army wildland

fire crew, led by Scott Yamasaki, completing guinea grass cutting work below the Hibiscus patch in the Lower Ohikilolo Management Unit. They discussed fuelbreak needs for these three areas.

February 24, 2006: The Service (Jenness McBride, Gina Shultz and Patrice Ashfield) presented "expedited stabilization" to Army representatives, Michelle Mansker, Joel Godfrey, and Elena Onaga (Army solicitor) for 12 plant species at risk of extirpation due to increased training activities.

March 1, 2006: At the request of Jason Greenlee and Dawn Greenlee, Nezette Rydell (Warning Coordination Meteorologist, National Weather Service, Honolulu) and Jeffrey Powell (Fire Weather Focal Point, National Weather Service, Honolulu) developed a spot weather forecast system to provide fire weather forecast variables for all individual hours, and a narrative description of any expected diurnal wind shifts for all future prescribed burns at Makua. These new spot fire weather forecasts met the National Weather Service spot fire weather forecast standards.

March 1, 2006: Service representatives Jenness McBride and Patrice Ashfield met with Army biologists (Susan Ching, Kapua Kawelo, and Michelle Mansker) to discuss expedited stabilization as a methodology to allow incendiary weapon use without extirpating plant species from Makua from training related wildfires.

March 8, 2006: A prescribed burn was attempted at Makua when live herbaceous fuel moisture was 122 percent. The Army determined the grass was too green to get a clean burn within the burn unit, so herbicide was sprayed on the grass in the unit to decrease moisture and allow the grass to go brown. Rainfall the night before the burn prevented the burn from being completed.

April 18, 2006: Dawn Greenlee (Service) met with Michelle Mansker and Jason Greenlee (Army) to discuss alternative systems for protecting the Kaluakauila and Kahanahaiki management areas perimeters from fire, shrub restoration test sites, and prescribed burn prescription parameters.

April 27, 2006: Jason Greenlee (Army) and Dawn Greenlee (Service) met with Nezette Rydell (Warning Coordination Meteorologist, National Weather Service) and Jeffrey Powell (Fire Weather Focal Point, National Weather Service), to confirm that the local National Weather Service Office could develop the capability to input "F" type forecast observations into the Makua WIMS weather station for hours when training would be occurring at Makua.

April 27, 2006: LTC Sal Petrovia (Army G3 training), Elena Onaga (Army Solicitor), Joel Godfrey, Michelle Mansker, and Jason Greenlee (Army) met with Gina Shultz, Patrice Ashfield, and Dawn Greenlee (Service) to discuss issues with the proposed Project Description. As a result of the meeting, the use of tracers from helicopters was removed from the Project Description; the Army agreed that only pilots qualified in the use of 2.75-caliber rockets would fire this weapon at Makua; and the Service agreed that maintenance of grass height to one foot or less within 60 m (197 ft) along the inside edge of the south lobe of the firebreak road would provide adequate firebreak protection.

May 3, 2006: Michelle Mansker, Kapua Kawelo, Jason Greenlee, Scott Yamasaki Army), eight members of the Army wildland fire crew, Colleen Bergmannis (Army ITAM), and Dawn

Greenlee (Service) took a field trip to the Kahanahaiki weather station fuelbreak area, the Kahanahaiki Management Unit, and the Makua valley overlook at the southwest corner of the Pahole Management Unit to discuss various systems to protect the management unit perimeters from fire. A combination of fuelbreaks and firebreaks was selected.

June 1, 2006: Bill Boulet (Installation Safety Office), Elena Onaga (Army Solicitor), Tom Piskel (Army contractor), Jason Greenlee, Peter Yuh, LTC Sal Petrovia, and Michelle Mansker (Army) met with Patrice Ashfield, Jenness McBride and Dawn Greenlee (Service) to discuss weapon firing points and potential ignition areas. A list of weapons was proposed for firing from a point within the north lobe of the firebreak road. An increase in size of the action area was discussed, given the request by the Army to use Javelin and TOW weapons at Makua. As a result of this meeting .50 caliber tracers were removed from the Project Description.

June 21, 2006: Dawn Greenlee (Service) attended a demonstration mortar shoot at Schofield Barracks with Army personnel including the Makua Range Control Supervisor Bert Borja, Tom Piskel (Army contractor), Sammy Houseberg and Jason Greenlee (Army Fire and Safety).

August 17, 2006: Dawn Greenlee (Service) and Andy Beavers (CEMML) complete an updated fuel model map for the Makua area, extending the area covered, refining the accuracy of the polygons, and incorporating the new fuel models published in 2005 by Scott and Bergen.

September 21, 2006: A draft Project Description was sent to the Army for review.

November 2, 2006: The Service received the 2006 Status Reports for the Makua Implementation Plan and the Draft Oahu Implementation Plan prepared by the Army's Environmental Division.

October 18, 2006: Boone Kauffman (Director and Research Ecologist, Institute of Pacific Islands Forestry, USDA Forest Service, Pacific Southwest Research Station, Hilo), Pat Costales (Oahu District Manager, Division of Forestry and Wildlife, DLNR), Francis M. Fujioka (Research Meteorologist, U.S. Forest Service, Pacific Southwest Research Station, Riverside, CA), Andy Beavers (CEMML), Sammy Houseberg (Army Fire and Safety Office), Eric Moller (Army Fire Chief), Jason Greenlee and Michelle Mansker (Army), and Dawn Greenlee (Service) met to discuss updates to the guinea grass fuel model and helicopter staffing requirements made as a result of rates of spread and helicopter productivity on fires observed during the 2006 fire season. Future guinea grass and molasses grass fuel model rate of spread and live herbaceous fuel moisture work, and habitat restoration projects within the Kahanahaiki, Kaluakauila and Lower Ohikilolo management units were discussed.

December 6, 2006: A successful prescribed burn was completed within the south lobe of the firebreak road. The Army followed all of the requirements specified by Prescribed Burn Plan MMR 06-01. Live herbaceous fuel moisture was 163 percent outside the burn unit, and the area inside the burn unit had been browned by herbicide.

December 7, 2006: Patrice Ashfield and Dawn Greenlee (Service) met with Ray Rubinoff (Army, Washington Office) and Michelle Mansker (Army) to discuss various aspects of the Army's proposed project.

January 22, 23, and 24, 2007: The Makua Implementation Plan Team met to discuss progress of Army Natural Resources endangered species conservation efforts pursuant to the Makua Implementation Plan Addendum.

February 1, 2007: The Army provided the Service with written comments on hard copies of the Project Description. Dawn Greenlee (Service) met with Michelle Mansker and Kapua Kawelo (Army) to discuss changes to the Project Description, including the removal of the Kaena point trail from the project, the addition of language that permits future updates to the guinea grass fuel model with subsequent updates to fire suppression helicopter staffing requirements, and provision for the detonation of unexploded ordinance outside the firebreak road.

April 16, 2007: The Service provided the Army with two compact disks containing the draft Project Description. Comments from Army reviewers (Michelle Mansker, Jason Greenlee, Elena Onaga, and G3 trainers) were incorporated the Project Description.

May 3, 2007: Scott Yamasaki (Army Wildland Fire Management Officer) emailed the Service requesting wildland fire related modifications to the Project Description.

May 4, 2007: Dawn Greenlee (Service) met with Scott Yamasaki and Michelle Mansker (Army) to negotiate changes to the Project Description recently proposed by both agencies.

May 15, 2007: Gina Shultz and acting Deputy Field Supervisor Steve Oberholtzer (Service) met with Colonel Killian to discuss the use of tracers from helicopters, the guinea grass fuel model, and helicopter fire suppression. The Army followed up with an email to Gina Shultz that included a written review of their issues and concerns pertaining to the Project Description on May 17, 2007.

May 24, 2007: The Service emailed a response to the May 17, 2007, Army email. The Service agreed to allow small caliber tracers to be shot from helicopters and a reduction in helicopter staffing.

June 4, 2007: Patrice Ashfield (Service) and Michelle Mansker (Army) discussed the problem pertaining to five plant species that are located in a high fire risk area and thus in need of some additional fire minimization measure. It was decided that this measure would be finalized at a later date with the assistance of the Makua Implementation Team.

June 13, 2007: The Service received additional comments on the final Project Description and finalized the last outstanding concerns with Michelle Mansker on June 15, 2007.

For ease of reference, all species (native and non-native) discussed in this Biological Opinion, are listed in Appendix C.

# PROJECT DESCRIPTION

## 1. Introduction

This Project Description outlines the Army's training and land management actions at the Makua Military Reservation (Makua). This Project Description incorporates pertinent information from the following documents:

- 1999 Makua Biological Opinion
- 2001 Supplement
- 2004 Critical Habitat Reinitiation
- Draft Environmental Impact Statement 2005
- 1998 Biological Assessment
- 2005 Reinitiation Package
- Standard Operating Procedures (SOPs)
- Integrated Wildland Fire Management Plan
- Makua Implementation Plan
- Makua Implementation Plan Addendum

Due to the risk of wildfire from incendiary munitions, avoidance and minimization measures have been included to reduce training-related impacts to listed species and critical habitats. The aforementioned documents, along with additional avoidance and minimization measures, taken together, provide a complete description of the proposed action. The following is a consolidation of the complete Project Description for the current proposed actions at Makua for the next 30 years.

### 1.1 Objective and Scope

The proposed action is to conduct military training, operations and maintenance at Makua. This Project Description differs from past actions we consulted on in that the Army is increasing its training activities at Makua and modifying its resource management, or "stabilization" activities, for 28 listed plants and the Oahu tree snail. Stabilization will be discussed in more detail in Section 7, but, in brief, stabilization criteria include the establishment and maintenance of a minimum number of mature, naturally reproducing individuals within a set number of populations where all major threats are controlled and fulfillment of specified genetic storage goals with *ex situ* representation of the taxon.

Fire suppression responsibilities and Army commitments in this discussion will further reduce the risk of training-related wildfire impacts to endangered species and critical habitats. This Project Description reintroduces the use of high explosive, long-range weapon systems eliminated in the 2001 consultation and includes several new weapons not previously used at Makua. Training and maintenance activities at Makua will have both direct and indirect effects to the species and critical habitat within the action area. Although training activities will only be conducted within a designated impact area, there is the risk of fire spreading to areas beyond the impact area due to the surrounding flammable fuels, strong winds, and topography. Therefore, incorporated into this action are updated weapons restrictions, new prescribed fire guidelines,

new fuelbreaks and firebreaks, and updated fire suppression staffing measures to minimize the risk of a fire igniting outside of the firebreak road. It is anticipated that fires will occur within the south lobe of the firebreak road during training. It is also anticipated that most fires will not spread outside of the firebreak road area due to the weapons restriction and suppression measures incorporated into this Project Description. If fires do ignite outside the firebreak road, fire suppression helicopter staffing requirements and fuelbreaks have been designed to minimize the risk of fire to endangered species, management units, and areas of designated critical habitat. Indirect effects from training at Makua will include increased invasive plant seed dispersal, dust, noise, invasive vertebrate activity associated with humans such as rodents, mongoose, and pigs, and lighting (nighttime training).

In summary, the following actions are detailed in this Project Description: (1) expanded training actions, (2) live-fire and long-range weapon use, (3) minimization measures to reduce the inherent risk of fire ignition from live-fire weapon training, and (4) measures to ensure populations of endangered species and critical habitat will not be permanently lost as a result of training-related fires in the Makua action area.

## 1.2 Project Site and Management Description

Makua valley is approximately 1,696 hectares (ha) (4,190 acres (ac)) in size and is located on the northwest leeward side of Oahu (Figure PD 1). The Makua action area is 4,243 ha (10,486 ac) in size. Makua is bowl-shaped with steep, precipitous valley walls 640 to 884 meters (m) (2,100 to 2,900 feet (ft)) on the north, east and south sides of the valley floor. The Pacific Ocean borders on the western side of the valley. The mouth of the valley is dry, with less than 38 centimeters (cm) (15 inches (in)) of precipitation. Annual precipitation increases to 127 cm (50 in) towards the head of the valley (U.S. Army Garrison 1998). A firebreak road surrounds the active training area, or impact area, and all activities and weapon target practice occurs within this area (see Figure PD 1). The Army trains primarily within the Private First Class or PFC Pililaau Range Complex that is a 185-ha (457-ac) training course in the southwestern portion of the impact area. Makua is used for both live-fire and non-live-fire maneuver training exercises. Training activities are conducted only within the impact area or within the firebreak road.

The Kuaokala Trail, northeast of Makua, will be used for forced marches by troops. It begins at Dillingham Airfield and terminates at the upper rim of the Makua valley. This trail may be used for marches twice a month by a company of Soldiers (150 Soldiers). Smoking will not be allowed on the trail, and troops will be trained to clean equipment and shoes in order to limit the spread of exotic, invasive plant seeds. The action area associated with the trail is 100 m (328 ft) wide, spanning 50 m (164 ft) from the center of the trail.

Lower elevation areas of the action area are dominated by non-native grasslands, and intact native shrub and forest vegetation remains on higher elevation ridgelines (see Figure PD 1). The Service and Army collaborated to develop an updated fuel model map for the Makua area (Figure PD 2). Fuels were classified based on the type of vegetation fire ecologists anticipated would carry the fire under high wind and low fuel moisture conditions.

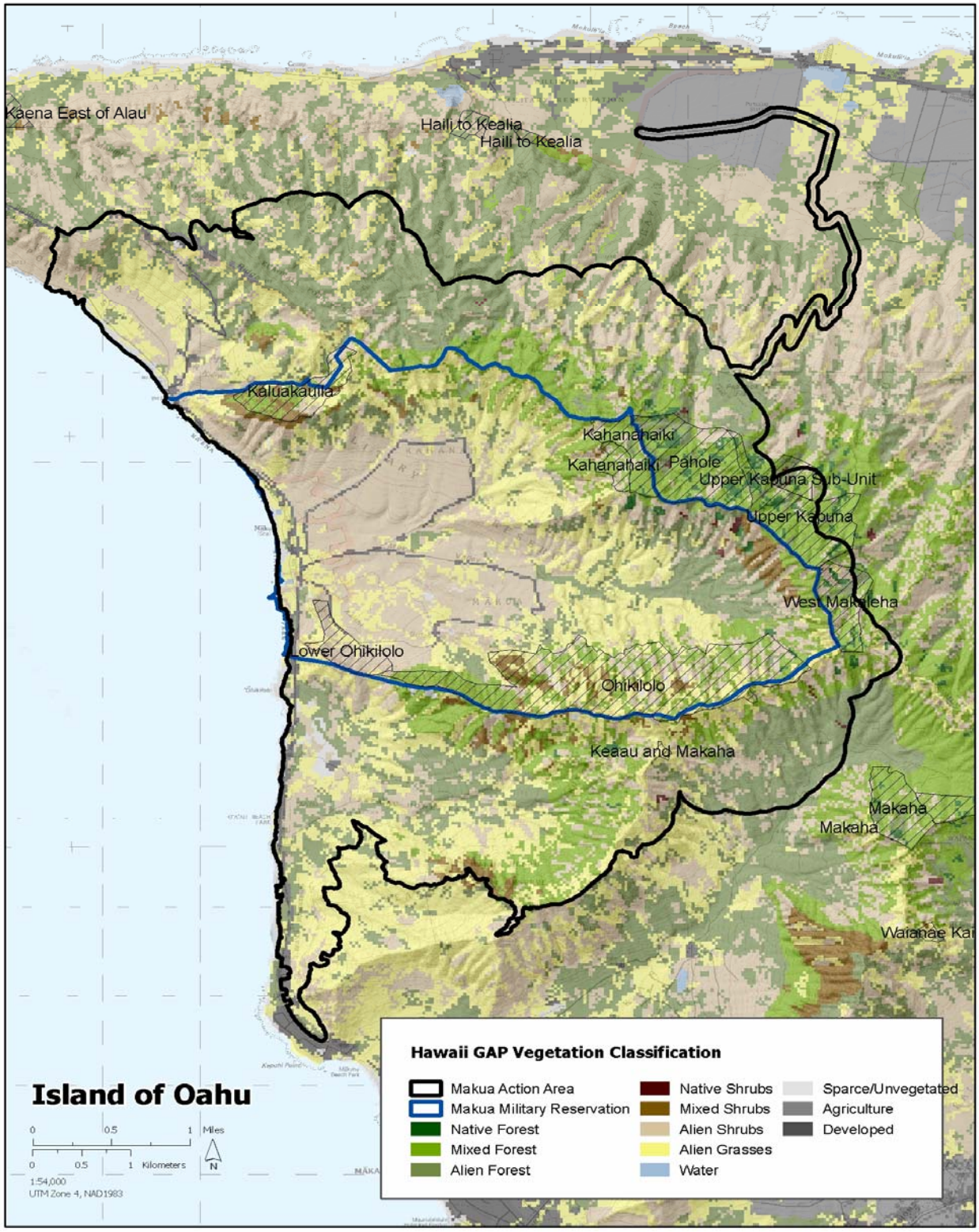


Figure PD 1. Hawaii GAP land cover map.

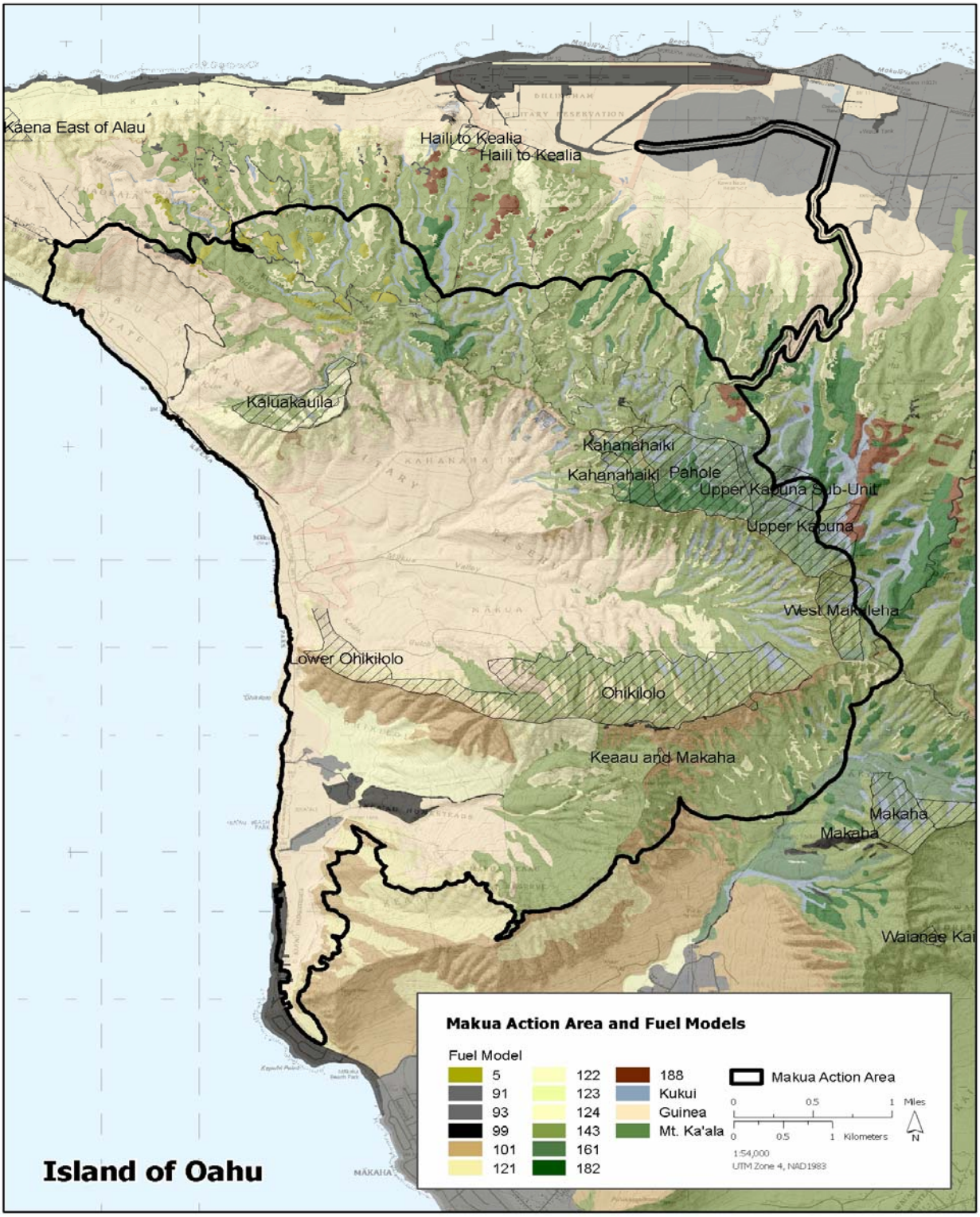


Figure PD 2. Fuel model map.

Standard fuel models (Scott and Burgan 2005) were used to classify much of the landscape. Custom fuel models were used to classify guinea grass (Beavers 2001, with fuel bed depth modified as described in Project Description Section 9) and kukui forests (Beavers unpublished). The Makua action area contains 1,514 ha (3,741 ac) of area mapped as guinea grass fuel model, 781 ha (1,930 ac) of other grass fuels, 1,441 ha (3,560 ac) of low and mid-elevation shrub and forest fuels, and 371 ha (917 ac) of forest fuels with light understory fuel loading.

## 2. General Description of Training Activities

Makua is used for both live fire and blank ammunition training. Military units travel to the training area by both surface and air. All types of units, including field artillery, air defense artillery, engineer, infantry, military intelligence, military police, transportation, quartermaster (supply), signal (radio communication), chemical (smoke screen generation), and aviation, use Makua. The maximum training level at Makua would include 300 Soldiers (combination of Battalion Headquarters or command and control, force multipliers (e.g., artillery, Kiowas, and howitzers), and a company (80 to 150 persons) with a total of approximately 150 Soldiers training with live fire at any one time. In addition, training will include squad (5 to 10 persons) and platoon-level (20 to 40 persons) scenarios.

Other non-Army military units will also use Makua for training. In the past, the U.S. Marine Corps, U.S. Navy, U.S. Coast Guard, Army Reserve, and Hawaii Army National Guard have trained at Makua. It is likely that forces from other countries hosted by the Army as part of the U.S. Pacific Command Theater Security Cooperation Plan would use this training resource from time to time. These military units would be limited to company-level Combined Arms Live-Fire Exercises (CALFEX) as the maximum level of training and would be required to adhere to all Makua-specific training constraints. The Army will be responsible for ensuring that all users of Makua adhere to the specifications in this Project Description.

Training will be conducted on the 186-ha (459-ac) impact area situated inside the south firebreak road. Some weapons may be fired from the designated mowed, irrigated firing point in the north lobe of the firebreak road (north lobe firing point). No weapon will be fired from any location outside the south lobe of the firebreak road or the north lobe firing point. All training scenarios are coordinated and synchronized so that all ammunition is aimed to land within the confines of the southern training lobe or impact area (Figure PD 3). Indirect fire weapons such as mortars and artillery have a potential range that is farther than the limits of the firebreak road. However, the direction and angle at which they are fired, and amount of powder bags that are used for each shot, are precautions used to limit the range of these weapons.

Training at Makua may take place for up to 242 days per year and activities may occur during the day or night. To minimize fire risk, full CALFEX activity will be limited by live herbaceous fuel moisture weapons restrictions to periods when grass fuels in the valley are relatively green and to periods when winds are lighter and fuel moisture is higher. Certain weapons will not be used until new firebreaks and fuelbreaks are installed and the expedited stabilization of particular species is completed. No live-fire training will occur until the on-site fire suppression helicopters have their fire suppression water buckets attached and successfully tested, and they

are able to safely conduct fire suppression missions. Current flight limitations preclude the use of fire suppression helicopters prior to early twilight, approximately 30 minutes prior to sunrise. Night live-fire training will not be conducted until helicopters are authorized for night fire suppression.

## 2.1 Training Areas

Training exercises are staged in the impact area in eight areas that are referred to as objectives (see Figure PD 3). Maneuver training is conducted at five of the eight objectives: Deer, Fox, Coyote, Wolf, and Badger. Units are authorized to enter Objective Badger and set up fire support when attacking the final objective. Objective Deeds is used for support-by-fire and long-range (sniper) shooting. While Objectives Elk and Buffalo are closed for maneuver training due to the proximity of cultural resources, Objective Buffalo is used as a firing point. In addition to the established objectives, the Army can also create new objectives for training exercises as long as they are in conformance with this Biological Opinion and approved by the Service.

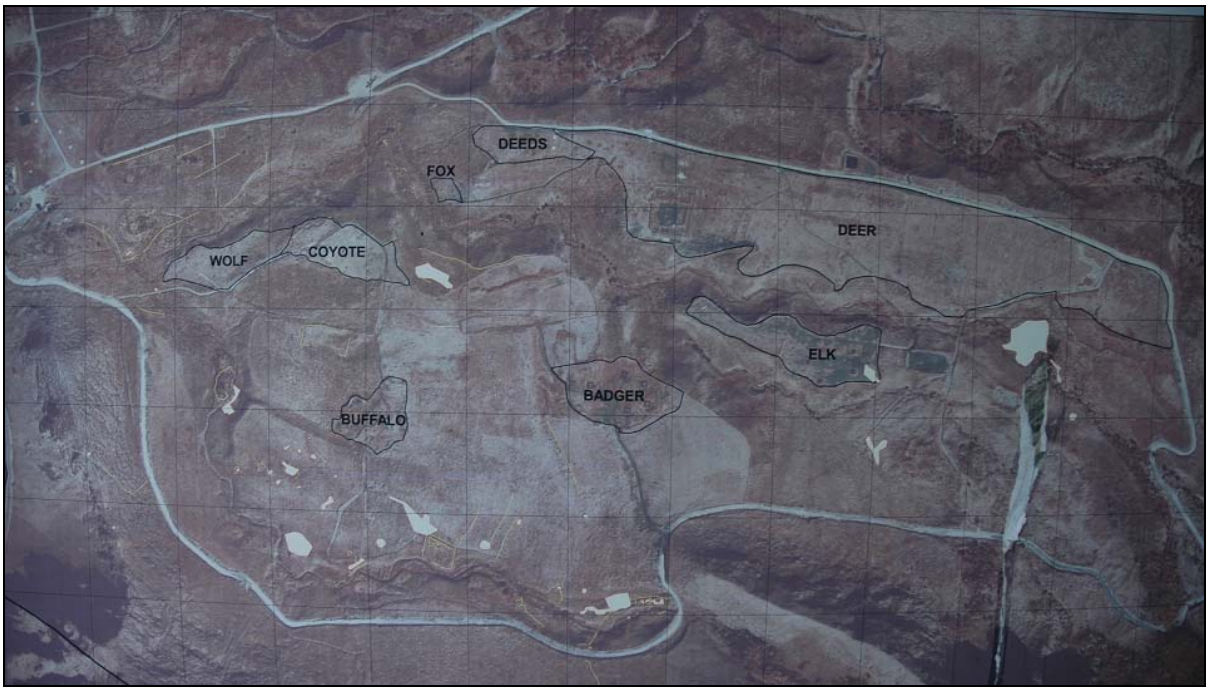


Figure PD 3. Objectives currently used as firing points and target areas.

In accordance with the 25th ID and U.S. Army Hawaii (USARHAW) Regulation 210-6, *Installation Ranges and Training Areas*, planning a typical training exercise at Makua begins at least eight weeks prior to the event. The Unit Commander provides a detailed written plan of the exercise scenario, which includes a maneuver and fire support plan; weapons, ammunition, and targets to be used; control measures and method of communication; limits of advance; and surface danger zones for all weapons systems. The Unit Commander also provides a risk assessment for the exercise. The risk assessment provides analysis of safety threats to Soldiers in combat situations. The Unit Commander's superiors (the Battalion and Brigade Commander, a

Lieutenant Colonel and Colonel, respectively), the Division Commander's Range Safety supervisors, and Range officer must approve the exercise plan.

## 2.2 Surface Danger Zones

The Makua Range Office or Officer in Charge develops a surface danger zone for each training event (in accordance with AR 385-64, *Ammunition and Explosives Safety Standards*) to determine the potential range and angle of a particular weapon. Surface danger zones delineate the impact area and additional buffer area where fragments from exploding rounds could land. They are developed to specify the area that would contain all but one in one million rounds fired and are used to ensure personnel safety. Firing point location, direction of fire, left and right limits of fire, powder bag settings, fragment dispersion, and firing angle are among the variables that may be used to develop the surface danger zone.

Surface danger zones are established through in-depth ricochet trials conducted at the Aberdeen Proving Ground and Yuma Proving Ground and analyzed by the Aeroballistics Division at the Armament Research, Development and Engineering Center. Surface danger zone development also takes into consideration the Army's range safety regulation and is incorporated into the Army's regulations (DA PAM 385-63).

The company provides the Range Office with the training scenario, including firing points and targets in accordance with the U.S. Army Hawaii and 25$^{th}$ ID Regulation 210-6, *Installation Ranges and Training Areas* (U.S. Army Garrison 1999b) and the Makua standard operating procedures. All targets are within the confines of the southern firebreak road. The Makua Range Office builds a surface danger zone to fit each training scenario and gives the unit a safety card. The safety card specifies the right and left firing limits for weapons as well as the minimum and maximum range for firing to ensure that the ordinance falls within the impact area.

Weapons surface danger zones consist of the following danger areas (Figure PD 4):

1) Target. This is the location where the weapon is to be fired. For demolitions, the target area is the point on location at which the demolition charge is placed.

2) Impact area. This is the primary danger area for indirect fire weapons established for the impact of all rounds. When applied to direct fire weapons, it is the area located between established range limits. The impact area is within the approved surface danger zone.

3) Dispersion area. This is a measure of the impact distribution in the dispersion pattern around the center of impact, dimensionally expressed in firing tables as one interval of the dispersion rectangle.

4) Area A. This is the secondary danger area which parallels the impact area laterally and which is provided to contain fragments from items exploding or ricocheting on the right or left edge of the impact area.

5) Area B. This is the secondary danger area situated on the down-range side of the impact area and Area A. It is designed to contain fragments from items exploding on the far edge of the impact area.

6) Area C. This is the secondary danger area situated on the up-range side of the impact area and parallel to Area B. It is intended to contain fragments from items exploding at the near edge of the impact area.

7) Area D. This is the area considered a safe area for troop occupation for training purposes.

8) Area E. This is the area between Area D and the firing position, which may be impacted by muzzle debris, overpressure, and injurious noise levels. Area E may be occupied only by weapon crews firing from an approved tactical configuration.

9) Area F. This is the area immediately to the rear of a weapon or group of weapons and may be impacted by the backblast effects of the weapon being fired.

10) Distance X. This is the maximum range of the weapon, given specific firing angle.

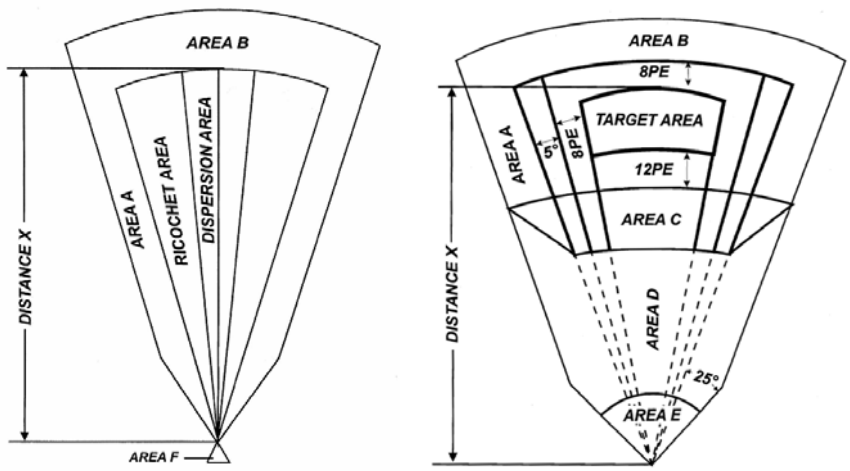


Figure PD 4. Examples of surface danger zone danger areas.

## 2.3 Firing Points

The designated North Firing Point (Figure PD 5), located within the north lobe of the firebreak road, will either be maintained bare of vegetation or it will be mowed and irrigated so that live herbaceous fuel moisture (of the grass over the entire area) is above 200 percent when in use. The firing point will be bounded directly along its north and east edges by a new improved firebreak road, 469 m (1,539 ft) long and following the route of an area historically used as an access road, maintained with bare ground to a width not less than 6 m (20 ft) (see Figure PD 5). An approximate 2.8-ha (7-ac) area will be cleared of unexploded ordinance, a new sprinkler system will be installed, and grass will be mowed so that live herbaceous fuel moisture is 200 percent or higher whenever the firing point is being used. The TOW, AT-4, and artillery will only be fired from the North Firing Point, and the Javelin may also be fired from this firing point.

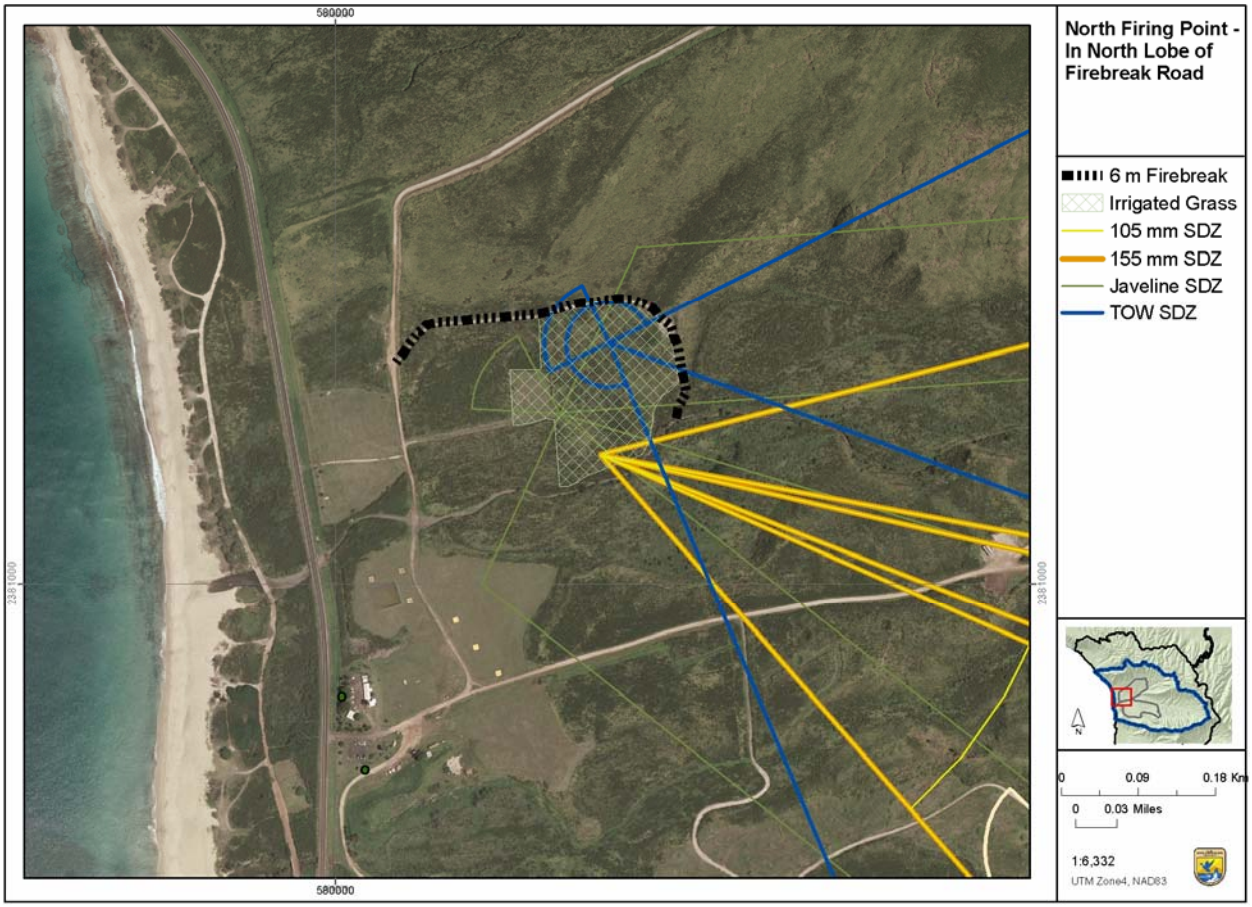


Figure PD 5. Designated 2.8-ha (7-ac) firing point in north lobe of firebreak road.

Blanks will generally be fired from designated mowed areas which are separated from patches of tall grass by a bare mineral soil firebreak, wide enough to stop a fire burning in the mowed grass fuels. This firebreak will be maintained with the application of herbicide or by mechanical means.

## 2.4 Weapons

Table PD 1 depicts the weapons and ammunition proposed for use at Makua. Weapons proposed for continued use at Makua, which are similar to those used from 2001 through 2004, include small arms ball ammunition, demolitions, grenades, mines, simulators, mortars, artillery, and anti-tank weapons. In addition, training at Makua will now include: tracers, 155 mm artillery, Javelin and TOW missiles, and 2.75-caliber rockets shot from helicopters.

Table PD 1. List of Weapons and Ammunition to be Used Under Certain Conditions at Makua.

| Weapon | Ammunition or Charge |
|---|---|
| Small arms: | Ball bullets |
| Rifles | 5.56 mm, 7.62 mm |
| Pistols | 9 mm, .45-caliber, .38-caliber, .22-caliber |
| Machine guns | 5.56 mm, 7.62 mm, .50-caliber, 40 mm target |
| | practice (TP) |
| Shotguns | 12 gauge shotgun (00) |
| Helicopter guns | 7.62 mm, .50-caliber |
| Tracer ammunition | 5.56 mm, 7.62 mm, .50-caliber |
| Green ammunition | 5.56 mm and 7.62 mm* |
| Short-range training ammunition (SRTA) | 5.56 mm and .50-caliber |
| Mortars and artillery | 60 mm HE and 60 mm SRTA (mortar) |
| | 81 mm HE and 81 mm TP (mortar) |
| | 105 mm HE (artillery) |
| | 120 mm HE (mortar)* |
| | 155 mm HE (artillery)* |
| | Artillery simulators |
| Anti-tank weapons | AT-4/M 136 (84 mm HE anti-tank rocket) SMAW |
| | Javelin* |
| | 2.75-caliber rocket* |
| Shoulder-launched multipurpose assault weapon (SMAW) | Launcher assault rockets SMAW practice round |
| Inert TOW missile launcher | Inert TOW missile blast effect simulator |
| Smoke grenades | Colored, hexachloroethane smoke, white smoke, and target acquisition smoke practice |
| Grenades | Fragmentation, offensive, practice, simulators |
| Demolitions | Limit 300-pound (136-kilogram) net explosive weight, including bangalore torpedoes |
| Mines | Claymore antipersonnel, inert antipersonnel (volcano delivery device or modular packed mine system delivered), anti-tank |

Notes: *With the exception of the green ammunition, 120 mm mortar, 155 mm artillery, 2.75-caliber rockets, and the Javelin, weapons listed in Table PD 1 have either been used in the past or are used currently for training at Makua. The Javelin would be phased in to replace the previously used Dragon, a similar weapon system.

## 2.5 Weapons Restrictions

Table PD 2 outlines the use of weapons at Makua and the restrictions of weapon use based on the following factors: (1) stabilization status of certain endangered species, (2) seasonal variability in grass greenness, and (3) hourly fire danger rating. Weapons that are likely to ignite wildland fires outside the firebreak road are not proposed for use until after the expedited stabilization of endangered plant species located near high fire risk zones is completed and new fuelbreaks and firebreaks are established to protect the Makua Implementation Plan management units. It is estimated that expedited stabilization for these species and fuelbreak establishment will take approximately five to 15 years to complete. Weapons with the greatest potential to ignite fires outside the firebreak road will not be used when live herbaceous fuel moisture, a measure of grass greenness, is lower than 100 percent. Only ball ammunition will be permitted when live herbaceous fuel moisture is less than 60 percent. Available historic fire weather data indicate that live herbaceous fuel moisture falls below 100 percent in the spring (between February 20 and May 7) and remains below 100 percent until the fall (between October 1 and November 10).