DRAFT-FINAL

FEASIBILITY STUDY REPORT

PALI TRAINING CAMP
OAHU, HAWAII

FUDS Project Number H09HI027701
FUDS Property Number H09HI0277
Contract: W912DY-10-D-0053
Task Order: 0003

United States Army Corps of Engineers, Honolulu District

and

United States Army Engineering and Support Center, Huntsville

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Acronyms and Abbreviations

APCT	armor piercing capped tracer
APT	armor piercing tracer
ARAR	Applicable or Relevant and Appropriate Requirement
C&C	City and County
CEPOH	United States Army Corps of Engineers, Honolulu District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
COPC	contaminant of potential concern
CSM	conceptual site model
DD	Decision Document
DEM	Department of Emergency Management
DERP	Defense Environmental Restoration Program
DLNR	Department of Land and Natural Resources, State of Hawaii
DMM	discarded military munitions
DOD	Department of Defense
DPP	Department of Planning and Permitting
EAL	environmental action level
EPA	Environmental Protection Agency, United States
ESQD	explosive safety quantity distance
°F	degrees Fahrenheit
FS	feasibility study
FUDS	Formerly Used Defense Sites
GIS	geographic information system
GRA	general response actions
HA	Hazard Assessment
HARC	Hawaii Agriculture Research Center
HDOH	State of Hawaii, Department of Health
HE	high explosive
HEAT	high explosive anti tank
HFD	Honolulu Fire Department
HPD	Honolulu Police Department
IA	Institutional Analysis

INPR	Inventory Project Report
LTM	long-term management
LUC	land use control
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
MPPEH	material potentially presenting an explosive hazard
MRA	munitions response area
MRS	munitions response site
MSL	mean sea level
MTC	Maunawili Training Course
MVIA	Maunawili Valley Impact Area
MVTC	Makalii Valley Training Course
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PDSQ	point detonating super quick
PP	Proposed Plan
PTC	Pali Training Camp
RAO	remedial action objectives
RDX	research development explosive
RI	remedial investigation
SUXOS	senior UXO supervisor
Tech	technician
TSQ	time super quick
TO	task order
USACE	United States Army Corps of Engineers
USAESCH	United States Army Engineering and Support Center, Huntsville
USC	United States Code
UTC	Ulumawao Training Course
UU/UE	unlimited use and unrestricted exposure
UXO	unexploded ordnance
UXOQCS	UXO quality control specialist
UXOSO	UXO safety officer

WERS	Worldwide Environmental Remediation Services
§	Section

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1.0 Executive Summary

This Feasibility Study (FS) Report was prepared for the United States Army Corps of Engineers (USACE), Honolulu District (CEPOH) and United States Army Engineering and Support Center, Huntsville (USAESCH) under Contract No. W912DY-10-D-0053, Task Order (TO) 0003 to address contamination at Formerly Used Defense Sites (FUDS) Project Number H09HI027701 (FUDS Property Number H09HI0277), also known as the former Pali Training Camp (PTC), Oahu, Hawaii in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Title 42 United States Code [USC] Sections 9601–9675). A FS is a mechanism for developing, screening, and evaluating remedial alternatives to address unacceptable hazards and risks identified during a remedial investigation (RI) under CERCLA. Specifically, the purpose of this FS Report is to evaluate remedial alternatives to address potential explosive hazards posed to humans from munitions and explosives of concern (MEC) identified during the RI at the PTC and documented in the "Final Remedial Investigation Report, Pali Training Camp, Oahu, Hawaii" (USACE, 2014). This FS has been developed as a separate document from the RI.

1.1 Site History and Description

1.1.0.1 The PTC was established in 1943 as a regimental combat training center emphasizing the use of and familiarity with modern arms and field weapons, in addition to providing rugged terrain for jungle and ranger training. Troops were housed in a sprawling tent city at the base of Nuuanu Pali capable of supporting 3,000 to 5,000 individuals. Camp training aids consisted of 200- and 300-yard rifle ranges, a 1,000-inch range, four obstacle courses, an infiltration course, a combat in cities course, a close combat course, and a 400-yard long jungle firing course. The specific locations of these ranges and courses, however, are not documented and any evidence of these training aids are no longer present at the site. An artillery impact area was also established in the rear of Maunawili Valley (USACE, 1994). In October 1945, G-3 Headquarters ordered the release of the PTC. The encampment was abandoned by the end of 1945. Although the PTC's impact area was reportedly cleared of ordnance by the 212th ordnance disposal squad and the 18th engineer search team prior to property disposal in 1945, a warning to the public was issued in June 1948 by the Commanding Officer of Army Ordnance Services. The impact area in Maunawili Valley was one of several sites in which the public was advised to exercise caution when entering the area due to the potential presence of dud ordnance rounds (USACE, 1994).

1.1.0.2 The former PTC is located at the base of the Koolau mountain range, near Kailua on the southeast side of the island of Oahu (Appendix A, Figure A1-1). The former PTC, as currently reported in the FUDSMIS, consists of four non-contiguous parcels, totaling 4,378 acres[1] located

[1] *Site acreage calculated with geographic information system (GIS) is 3,590.3 acres. The acreages reported in the document and on maps are based on FUDSMIS acreages, unless otherwise noted.*

in portions of the Maunawili and Makalii Valleys. Each parcel is considered a munitions response area (MRA) containing one munitions response site (MRS).

1.1.1 Maunawili Valley Impact Area

1.1.1.1 The Maunawili Valley Impact Area (MVIA) (MRA Number H09HI027701R01-1) is the largest MRS and encompasses approximately 3,432 acres in FUDSMIS (2,719.3 acres GIS) of Maunawili Valley. The MRS was subdivided into three distinct areas during the RI Report based on topographical features, cumulative investigation findings, and land use. The three sections are MVIA – West, MVIA – Central, and MVIA – East.

1.1.1.2 MVIA – West (1,096 acres GIS) is primarily owned and managed by the State of Hawaii Department of Land and Natural Resources (DLNR). The land is zoned as Preservation and is mostly undeveloped with rugged terrain and dense vegetation. Portions are used for recreational activities such as hiking, biking, or horseback riding. Extensive agricultural activities are also conducted by the Hawaii Agriculture Research Center (HARC) and Luluku Banana Farmers.

1.1.1.3 MVIA – Central (951.5 acres GIS) is largely undeveloped forest owned and managed by DLNR. However, the Royal Hawaiian Golf Club operates on approximately 40 acres in this subarea.

1.1.1.4 MVIA – East (671.8 acres GIS) is also primarily owned and managed by the DLNR, though there is a residential subdivision being developed near the northeastern boundary

1.1.1.5 The future uses of the MRS subdivisions are not expected to change.

1.1.2 Maunawili Training Course

The Maunawili Training Course (MTC) MRS (MRA Number H09H1027702R02-2) encompasses approximately 400 acres in FUDSMIS (333 acres GIS). MTC is located on the western edge of the Maunawili Valley and south of the Pali Highway. MTC is owned by private landowners with a small section in the south/southwest corner owned by the State of Hawaii. Right-of entry could not be obtained from the private landowners after multiple discussions with the property owner during the RI and no additional information was gathered. As a result, a feasibility study was not performed for this MRS.

1.1.3 Makalii Valley Training Course

The Makalii Valley Training Course (MVTC) MRS (also previously referred to as the Maunawili Stream Area) (MRA Number H09H1027703R03-3) is the smallest, encompassing approximately 46 acres in FUDSMIS (29 acres GIS). MVTC is located on the northern ridge of Mount Olomana and was a suspected observation point. It is privately owned and primarily undeveloped. The access road to the Royal Hawaiian Golf Club cuts across the MRS. Additionally, portions of the Olomana Trail are within the MRS boundary. The future use of this MRS is not expected to

change. Neither MEC nor MD have been found in this MRS so there is no complete exposure pathway to human and ecological receptors. Therefore no known MEC hazards are suspected. A feasibility study was not performed since no further Department of Defense (DOD) action is recommended at this MRS.

1.1.4 Ulumawao Training Course

The Ulumawao Training Course (UTC) MRS (MRA Number H0H1027704R04-4) encompasses approximately 500 acres in FUDSMIS (509 acres GIS) and is a documented encampment or cantonment. UTC is located outside the Maunawili Valley, north of the Pali Highway. The MRS is primarily owned by private landowners. Hawaii Pacific University and Le Jardin Academy are educational facilities located within the UTC MRS. The Hawaiian Memorial Park, Hawaii State Veterans Cemetery, and Ameron Quarry are commercial enterprises that are partially located in the MRS. The City and County of Honolulu operates the municipal Pali Golf Course in the western portion of the MRS. The future use of UTC is not expected to change. MEC and MD have not been observed in UTC during previous investigations or land development activities. A feasibility study was not performed since no further DOD action is recommended at this MRS.

1.2 Environmental Setting

1.2.1 These four MRSs are mostly undeveloped, rugged, and densely forested land with mixed residential, agricultural, occupational, and recreational uses. Each parcel contains shallow to deep gulches and moderate to steep slopes. Elevation ranges from approximately 50 feet mean sea level (MSL) to over 2,000 feet MSL at the Koolau range ridge line. Runoff is slow to rapid, and the erosion hazard is slight to severe.

1.2.2 Most of the area is dominated by introduced plant species; however native tree species, (ohia lehua [*Metrosideros polymorpha* var. *glaberrima*], hala [*Pandanus tectorius*], papala kepau [*Pisonia umbellifera*], ulei [*Osteomeles anthyllidifolia*], palaa fern [*Odontosoria chinesis*], ekaha or birds nest fern [*Asplenium nidus*], uluhe [*Dicranopteris linearis*], ama [*Diospyros sandwicensis*], and four endemic species (koa [Acacia koa], ohia lehua [*Metrosideros polymorpha* var. *incana*], uki [*Machaerina mariscoides* ssp. *Meyenii*], and hapuu [*Cibotium chamissoi*]) have been observed.

1.2.3 A portion of the critical habitat unit designated for the Oahu `Elepaio (*Chasiempis sandwichensis ibidis*) falls within the project area. Although the ‘Elepaio was not observed during the RI, one migratory shorebird, the Pacific Golden-Plover or Kolea (*Pluvialis fulva*) was observed. The Kolea is not a threatened or endangered species; however they are protected by Federal law under the Migratory Bird Treaty Act and by State law under Hawaii Administrative Rules Title 13 Chapter 124.

1.2.4 Additional information on the environmental setting of the project site is presented in Section 2.3.4 of this FS report.

1.3 Nature And Extent of Contamination

1.3.1 The RI report identified the nature and extent of contamination within the four MRSs as follows:

- Thirty-three MEC items and approximately 1,233 pounds of munitions debris (MD) were located in MVIA – West. The MEC items were located on the surface and less than two feet subsurface.
- The lengths of the Maunawili Falls and Maunawili Demonstration trails contained within the MVIA MRS were 100 percent geophysically mapped and investigated for subsurface anomalies. Four MEC items were located on or immediately adjacent to the trail sections in MVIA – West.
- Ninety-four MD items were located in MVIA – Central. No MEC items were found.
- No MD or MEC were found in MVIA – East.
- Small arms debris, foxholes, and C-ration residue were the only indication of troop maneuvering in the MTC. No other data was collected in the MTC because right-of-entry was not granted. The nature and extent of contamination cannot be determined or delineated.
- No MEC, MD, or other features that would indicate the possible presence of MEC were identified in the MVTC MRS.
- No MEC, MD, or other features that would indicate the possible presence of MEC were identified in the UTC MRS.
- Soil samples for analysis of munitions constituents (MC) (i.e., antimony, chromium, copper, lead, and zinc] and explosive compounds) were collected. Four or more metals were detected in all samples though below their respective State of Hawaii, Department of Health (HDOH) Tier 1 environmental action levels (EAL). Explosives were also detected in surface soil but at concentrations below their respective HDOH Tier 1 EALs. MCs do not pose a risk to human health or the environment.

1.3.2 Based on the collective data from the historical investigations and subsequent RI, the potential for MEC is confined to the MVIA – West. Feasibility studies were not performed for MVIA – Central and MVIA – East.

1.4 Baseline Risk Evaluation

1.4.1 A MEC Hazard Assessment (HA) for MVIA – West was performed as part of the RI to assess the hazard to humans from MEC, specifically the acute hazard posed by the explosive

components of MEC, assuming no response action was taken at the site. The MEC HA evaluated current and future human receptors within MVIA – West which consisted of recreational users, agricultural workers, and occupational workers (i.e., DLNR and construction workers). It evaluated the potential exposure pathway to MEC, which included direct contact with MEC present on the surface and subsurface. Because the majority of the MVIA – West is heavily vegetated or steep and rugged terrain, the potential exposure pathways to MEC are predominantly limited to the highly accessible areas adjacent to existing and well trafficked trails. MEC items may be located in other inaccessible areas but are less likely to lead to human interaction with MEC. The baseline MEC HA score for the MVIA – West is 925 (minimum possible score of 125 and maximum possible score of 1,000) with a MEC HA hazard level of 1 (1 being the highest hazard and 4 being the lowest hazard) based on current conditions (i.e., no response actions conducted to remove potential MEC).

1.4.2. The MEC HA does not directly address the environmental or ecological risks that might be associated with the chemical components of MEC (i.e., MC). These risks, when present, are generally addressed in separate human health and ecological risk assessments. However, because MC did not exceed HDOH Tier 1 EALs, they do not pose a risk to human health or the environment. Therefore, human health and ecological risk assessments were not performed and no response action is required to address these contaminants.

1.5 Remedial Action Objectives

The remedial action objectives (RAOs) for the MVIA – West are based on the results of the RI, including the results of the MEC HA. The RAO identified for MVIA – West is to reduce recreational user and worker exposure to explosive hazards associated with munitions items varying in size from fuzes up to 105-mm projectiles present on the surface or subsurface down to two feet below ground surface within the 1,096 acres defined as MVIA – West to acceptable hazard levels. Acceptable hazard is defined such that exposure to MEC can be considered an "unlikely" or a "negligible" hazard to the public.

1.6 General Response Actions, Remedial Technologies, and Process Options

1.6.1 General response actions (GRAs) were developed based on professional engineering judgment and experience with response actions proven successful for MEC at other MRSs. In general, remedial alternatives are being considered for MVIA – West. Because no unacceptable hazards have been identified, no further action is required for the MVIA – Central, MVIA – East, MVTC, and UTC. The following GRAs, include associated technologies and, processes, were identified:

- Land Use Controls (LUCs) – Includes land use and access restrictions implemented through administrative/legal mechanisms, engineering controls, and educational programs to reduce the potential for human interaction with MEC and associated unintentional

detonation, which may result in injury or death to humans. Processes for implementation of LUCs include legal and administrative mechanisms (e.g., permitting to restrict land use and/or specific site) and engineering and educational controls (e.g., warning signs and, community outreach and visitor education)

- Removal of MEC – Includes surface and subsurface clearance of MEC using various technologies to assist with locating items. The technology used for surface and subsurface removal of MEC includes analog detection methods (i.e., metal detectors) to detect the presence of MEC and MD. Reduction of MEC volume includes demilitarization of MEC by detonation in place or, if deemed acceptable to move, in a consolidated point, and disposal of MD in 55-gallon drums to an authorized munitions recycler.

1.6.2 The associated process options, including technologies and treatment, identified for each GRA were screened using the following three criteria: (1) effectiveness; (2) implementability; and (3) cost. Section 3.3 provides the detailed analysis of each GRA and its associated process options. All three GRAs and their process options were retained for further evaluation in the FS.

NATIONAL CONTINGENCY PLAN EVALUATION CRITERIA

Threshold Criteria

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements

Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of mobility, toxicity, or volume
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

1.7 Development of Remedial Alternatives

The retained process options were combined into remedial alternatives to meet RAOs and to satisfy applicable or relevant and appropriate requirements (ARARs). The remedial alternatives were derived using experience and engineering judgment to formulate process options into the most plausible site-specific response actions. The following four remedial alternatives were selected for the detailed and comparative analysis. Section 5.2 provides detailed descriptions of each alternative.

- Alternative 1 – No Action. Required by CERCLA for comparison purposes.

- Alternative 2 – LUCs. LUCs, such as leasing conditions to restrict specific site activities, installation of warning signs, and community outreach/visitor education, would be implemented to reduce the probability of a human encounter with MEC and the potential for unintentional MEC detonation, which may result in injury or death to humans.

- Alternative 3 –Removal of MEC in Highly Accessible Areas and LUCs. Alternative 3 is a combination of LUCs (Alternative 2) with a limited surface and subsurface removal (i.e., 3 acres) of MEC in highly accessible areas. Specifically, this includes surface and subsurface clearance of approximately 3 acres within the MVIA – West (1 acre with a

contingency of 2 acres) to remove MEC from ancillary trails branching off of the Maunawili Falls and Maunawili Demonstration Trails and accessible areas adjacent to those trails. The Maunawili Falls and Maunawili Demonstration Trails were previously investigated as part of the RI. By clearing the highly accessible areas, the potential for human interaction with MEC and associated unintentional detonation, which may result in injury or death to humans, is significantly reduced.

- Alternative 4 – Complete Removal of MEC in High Density Areas. Under Alternative 4, a complete removal in areas identified as impact and target areas (i.e., 96 acres) would be performed within MVIA – West, and would result in unlimited use and unrestricted exposure (UU/UE).

1.8 MEC Hazard Assessment of Alternatives

1.8.1 As part of the FS, the MEC HA for MVIA – West was updated to evaluate hazards to humans under three remedial alternative scenarios: LUCs, LUCs with removal in highly accessible areas, and a complete removal in high density areas. The MEC HA was performed in accordance with the U.S. Environmental Protection Agency's (EPA) "Munitions and Explosives of Concern Hazard Assessment Methodology" guidance (EPA, 2008). Under the MEC HA methodology, sites are scored based on a variety of input parameters and are ultimately ranked according to hazard levels. Hazard levels ranging from 1 to 4 with a hazard level of 1 corresponding to the highest potential explosive. Results of the MEC HA by remedial alternative scenario are as follows:

- Scenario 1: No Action. Score = 925, Hazard Level 1
- Scenario 2: LUCs. Score = 925, Hazard Level 1
- Scenario 3: Removal of MEC in Highly Accessible Areas and LUCs. Score = 490, Hazard Level 4
- Scenario 4: Complete Removal in High Density Areas. Score = 490, Hazard Level 4

1.8.2 Section 5.1 provides detailed information on the MEC HA input parameters. Appendix C includes the MEC HA worksheets.

1.9 Detailed Analysis of Alternatives

Each remedial alternative was evaluated in comparison to the two threshold and five balancing evaluation criteria established in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The two modifying criteria, state and community acceptance, will be assessed after the Proposed Plan (PP) public comment period and documented in the Decision Document (DD) following comment on the FS Report and the PP. A comparative analysis was then conducted to evaluate the relative performance of the remedial alternatives. Section 5.2 summarizes the detailed analysis.

1.10 Comparative Analysis of Alternatives

1.10.1 Alternative 3 received an overall rating of very good because it significantly reduces, for a moderate cost, both the probability of a human encounter with MEC and the probability that such an encounter would result in an unintended detonation of MEC leading to injury or death to humans. Alternative 4 would remove the potential explosive hazard posed to the public and environment by MEC; however, the costs are significantly higher than Alternative 3 for minimal additional reduction in hazard levels. Therefore, Alternative 4 received an overall rating of good, slightly below Alternative 3. Alternative 2 would reduce the probability of a human encounter with MEC and the probability that such an encounter would result in an unintended detonation of MEC; however, highly frequented areas would not be cleared of MEC, resulting in a greater potential hazard to the public and environment than under Alternative 3. Therefore, Alternative 2 received an overall rating of good. Alternative 1 does not reduce hazard to the public or the environment; therefore, it received an overall rating of not acceptable.

1.10.2 The remedy for MVIA – West will be selected in the DD following comment on this FS Report and the PP.

2.0 Introduction

This FS was performed for the former Pali Training Camp, FUDS Project Number H09HI027701 (FUDS Property Number H09HI0277). This FS Report was prepared on behalf of the CEPOH and USAESCH under Contract No. W912DY-10-D-0053, TO No. 0003.

2.1 Purpose and Scope

2.1.1 The purpose of this FS Report is to develop and evaluate remedial alternatives applicable at the former PTC based on the findings of the "Final Remedial Investigation Report, Pali Training Camp, Oahu, Hawaii" (USACE, 2014). Specifically, this FS Report evaluates remedial alternatives to address potential explosive hazards from potential MEC at the MVIA MRA (H09HI027701R01-1) that pose a threat to humans and ecological (i.e., wildlife, native and endemic plants) and cultural resources within the MRA boundaries. This FS has been developed as a separate document from the RI.

2.1.2 This FS Report was prepared in accordance with the following regulations and guidance:

- National Oil and Hazardous Substances Pollution Contingency Plan (Title 40 Code of Federal Regulations [CFR] Part 300)
- "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA, 1988)
- Engineer Pamphlet 1110-1-18, "Ordnance and Explosives Response" (USACE, 2006)
- Worldwide Environmental Remediation Services (WERS) Data Item Description 010.02, "EE/CA, RI, and FS Reports" (USAESCH, 2012)

2.1.3 The NCP states that remediation should be accomplished through the use of cost-effective remedial alternatives that effectively lessen threats to and provide adequate protection of public health, welfare, and the environment (55 Federal Register 8850, March 8, 1990). Remedial alternatives that are protective of human health and the environment are evaluated in this FS report.

2.1.4 During the FS process, general remedial actions and technologies are evaluated and grouped into remedial alternatives, which are further evaluated. The process consists of the following general steps:

- Establish RAOs specifying the chemicals and media of concern, exposure pathways, receptors and potential receptors, and preliminary remediation goals that permit a range of alternatives to be developed. The RAOs are developed based on specific ARARs and the risk evaluation results included in the RI Report.

- Develop GRAs for each medium defining containment, removal, treatment, or other actions (such as LUCs,), singly or in combination, that may be taken to satisfy the RAOs for the site. Identify volumes or areas to which GRAs would apply.

- Identify and screen remedial technologies for each GRA to determine which technologies could be implemented technically and cost effectively at the site.

- Identify and screen process options for each remedial technology that are most appropriate for use at the site.

- Develop remedial alternatives by combining retained process options.

- Evaluate the alternatives against the evaluation criteria established by the NCP and against each other.

2.2 Report Organization

2.2.1 This FS Report is organized as follows:

- Section 1.0 – Executive Summary, provides a brief summary of the RI and an overview of the results of the development and analysis of remedial alternatives.

- Section 2.0 – Introduction, summarizes the purpose of the FS; provides key site information for the former PTC including (1) site description, (2) site history, (3) environmental setting, (4) previous investigations, (5) nature and extent of contamination, (6) conceptual site model (CSM), and (7) risk assessment results.

- Section 3.0 – Identification and Initial Screening of Technologies, presents RAOs and ARARs for the former PTC based on previous investigation results. GRAs are then identified that address the RAOs and ARARs. Process options associated with each GRA are screened for technical effectiveness, implementability, and cost.

- Section 4.0 – Development and Description of Remedial Alternatives, presents a detailed description of the remedial alternatives that were developed based on the retained process options in Section 3.0 that will satisfy the RAOs. Process options recommended for consideration are assembled, singularly or in combination, to create the remedial alternatives.

- Section 5.0 – Detailed and Comparative Analysis of Remedial Alternatives, presents the MEC HA for each remedial alternative and the evaluation of each remedial alternative developed in Section 4.0 against the NCP's evaluation criteria and against each other to evaluate their relative advantages and disadvantages with respect to the nine evaluation criteria.

- Section 6.0 – References, presents a list of documents and supporting material used to generate this report.

2.2.2 In addition, evaluations and supplemental information for this FS Report are presented in the following appendices:

- Appendix A – Figures
- Appendix B – Tables
- Appendix C – MEC HA Worksheets
- Appendix D – Remedial Alternatives Cost Estimates, presents detailed costs and associated assumptions for each alternative that were used to support the evaluation of the cost criterion in Section 5.0.
- Appendix E – Institutional Analysis Report

2.3 Site Background

This section summarizes background information for the former PTC. Background information includes the site description and a summary of the site history, environmental setting, previous investigations, nature and extent of contamination, CSM, and risk assessments.

2.3.1 Site Description

The former PTC is located at the base of the Koolau mountain range, near Kailua on the southeast side of the island of Oahu (Appendix A, Figure A1-1). The former PTC, as currently reported in the FUDSMIS, consists of four non-contiguous parcels, totaling 4,378 acres[2] located in portions of the Maunawili and Makalii Valleys. Each parcel is considered a MRA containing one MRS.

2.3.1.1 Maunawili Valley Impact Area

2.3.1.1.1 The MVIA MRS (MRA Number H09HI027701R01-1) is the largest MRS and encompasses approximately 3,432 acres in FUDSMIS (2,719.3 acres GIS) of Maunawili Valley. The MRS can be accessed by foot, bicycle, or horse via the private roads or from the trails connected to the Maunawili neighborhood. There are approximately 10 miles of well-used public trails that pass through the MRS. The MRS was subdivided into three distinct areas during the RI Report based on topographical features, cumulative investigation findings, and land use. The three sections are MVIA – West, MVIA – Central, and MVIA – East.

[2] *Site acreage calculated with GIS is 3590.3 acres. The acreages reported in the document and on maps are based on FUDSMIS acreages, unless otherwise noted.*

2.3.1.1.2 The State of Hawaii owns and manages the majority of the land within the MRS boundary, including MVIA – West (1,096 acres GIS). The land is zoned as Preservation and is primarily undeveloped dense vegetation with rugged terrain. Portions of the State of Hawaii-owned land are used for recreational activities such as hiking, biking, or horseback riding. The Maunawili Falls and Maunawili Demonstration Trails are two trails that are heavily trafficked by recreational users. Extensive agricultural activities are also conducted in MVIA – West by the HARC and Luluku Banana Farmers.

2.3.1.1.3 MVIA – Central (951.5 aces GIS) is largely undeveloped forest owned and operated by DLNR though the Royal Hawaiian Golf Club operates on approximately 40 acres.

2.3.1.1.4 MVIA – East (671.8 acres GIS) is also primarily owned and managed by DLNR. However, a residential subdivision is currently being developed near the northeastern boundary (Appendix A, Figure A1-1). The State of Hawaii also leases a portion of their land to a community organization.

2.3.1.1.5 DLNR workers perform periodic maintenance on the various trails throughout the MRS. Occasionally, occupational workers from public utilities require access to the MRS to perform maintenance on power line infrastructure that runs along mountain ridgelines or on irrigation water lines/ditches/tunnel that are found throughout the site.

2.3.1.1.6 The future use of the MVIA MRS is not expected to change.

2.3.1.2 Maunawili Training Course

2.3.1.2.1 The MTC MRS (MRA Number H09H1027702R02-2) encompasses approximately 400 acres in FUDSMIS (333 acres GIS). MTC is located on the western edge of the Maunawili Valley and south of the Pali Highway. The Maunawili Demonstration Trail (publically accessible) crosses the southern portion of the MRS.

2.3.1.2.2 MTC is owned by private landowners with a small section in the south/southwest corner owned by the State of Hawaii. One end of the Maunawili Demonstration Trail is located in this section. Most of the MRS is undeveloped. St. Stephan's Seminary partially overlaps the boundaries of the MRS.

2.3.1.2.3 Right-of-entry was not granted by the private landowners. As a result, there was insufficient data to conduct the RI and characterize the MRS though further evaluation was recommended in the RI Report given the close proximity of the MTC to MVIA – West. A FS was not conducted for MTC.

2.3.1.3 Makalii Valley Training Course

2.3.1.3.1 The MVTC MRS (also previously referred to as the Maunawili Stream Area) (MRA Number H09H1027703R03-3) is the smallest, encompassing approximately 46 acres in FUDSMIS (29 acres GIS). MVTC is located on the northern ridge of Mount Olomana and was a suspected observation point. It can be accessed via a public hiking trailhead off of the Golf Club road. The trail runs up to and along a ridge that defines the MRS's eastern boundary.

2.3.1.3.2 The MVTC MRS is privately owned and primarily undeveloped. The access road to the Royal Hawaiian Golf Club transects the MRS. Additionally, portions of the Olomana Trail are within the MRS boundary. The future use of this MRS is not expected to change.

2.3.1.3.3 Neither MEC nor MD have been reported or found during previous investigations; therefore, no explosive hazard is suspected or indicated in this MRS. A feasibility study was not performed since no further DOD action is recommended for MVTC.

2.3.1.4 Ulumawao Training Course

2.3.1.4.1 The UTC MRS (MRA Number H0H1027704R04-4) encompasses approximately 500 acres in FUDSMIS (509 acres GIS). UTC is located outside the Maunawili Valley, north of the Pali Highway. It can be accessed via the municipal Pali Golf Course, Hawaii Pacific University property, and the Hawaii State Veterans Cemetery.

2.3.1.4.2 The UTC MRS is primarily owned by private landowners. Hawaii Pacific University and Le Jardin Academy are educational facilities located within the UTC MRS. The Hawaiian Memorial Park, Hawaii State Veterans Cemetery, and Ameron Quarry are commercial enterprises that are partially located in the MRS. The City and County of Honolulu operates the municipal Pali Golf Course in the western portion of the MRS. The future use of UTC is not expected to change.

2.3.1.4.3 It is unlikely that munitions usage occurred in the UTC since the area was used as an encampment or cantonment. No explosive hazard is suspected or indicated at UTC. A feasibility study was not performed since no further DOD action is recommended at this MRS.

2.3.2 Site History

2.3.2.1 The former PTC was established in 1943 as a regimental combat training center emphasizing the use of and familiarity with modern arms and field weapons, in addition to providing rugged terrain for jungle and ranger training. Troops were housed in a sprawling tent city at the base of Nuuanu Pali capable of supporting 3,000 to 5,000 individuals. In addition to barracks, the encampments also contained latrines, showers, mess halls, administration buildings, and motor pools. Additional barracks, an ice plant, a bakery, and gun pits were situated within MVTC. A field hospital was erected where Maunawili Park now resides. Although records indicate a list of these uses/structures, their specific locations are unknown. Camp training aids

consisted of 200- and 300-yard rifle ranges, a 1,000-inch range, four obstacle courses, an infiltration course, a combat in cities course, a close combat course, and a 400-yard long jungle firing course. An artillery impact area was also established in the rear of Maunawili Valley (USACE, 1994).

2.3.2.2 On 8 October 1945, G-3 Headquarters ordered the release of the PTC. The encampment was abandoned by the end of 1945. By the end of 1946, military-erected structures at PTC were subsequently sold as surplus by bid sale. Although the PTC's impact area was reportedly cleared of ordnance by the 212th ordnance disposal squad and the 18th engineer search team prior to property disposal in 1945, a warning to the public was issued in June 1948 by the Commanding Officer of Army Ordnance Services. The impact area in Maunawili Valley was one of several sites in which the public was advised to exercise caution when entering the area due to the potential presence of dud ordnance rounds (USACE, 1994).

2.3.2.3 Valley residents report that artillery rounds were fired into Maunawili Valley from firing points at the mouth of the valley or from other locations within Kailua. A ranch manager reported a "155-mm round" in the Maunawili Valley and a few claims have been made by local residents about finding duds and .30-caliber blanks. It is also reported by local residents that mortar rounds and machine gun bullets were frequently turned over in plowed fields. As of 1994, no anecdotal reports of material potentially presenting an explosive hazard (MPPEH) in Maunawili or Makalii Valleys have been substantiated (USACE, 1994). In March 2002, a worker on a movie set within the MVIA reported that a 20-millimeter (mm) projectile was found (Zapata, 2008).

2.3.3 Formerly Used Defense Site Eligibility

In 1943, Kaneohe Ranch granted a lease or license to the Army for training purposes and the establishment of a troop encampment. G-3 Headquarters officially released PTC in October 1945. The camp was abandoned by the end of 1945 and all Army-constructed buildings were sold for salvage value in 1945. The land was reverted to Kaneohe Ranch at that time, prior to the FUDS eligibility date of 1986. In the Findings and Determination of Eligibility included in the Inventory Project Report (INPR) dated May 1994, the PTC was used for regimental combat training, including an artillery impact area, that ostensibly was the source of World War II-era US-made munitions and munitions fragments recovered in the area. PTC was deemed to be eligible for the Defense Environmental Restoration Program – Formerly Used Defense Sites as presented in the Findings and Determination of Eligibility and signed by Brigadier General Henry S. Miller, Jr. (USACE, 1994).

2.3.4 Environmental Setting

The following sections summarizes the environmental setting of Maunawili and Makalii Valleys, including topography, climate, geology, hydrogeology, ecology, and cultural and ecological resources.

2.3.4.1 Topography

These four MRSs are mostly undeveloped, rugged, and densely forested land with mixed residential, agricultural, occupational, and recreational uses. Each parcel contains shallow to deep gulches and moderate to steep slopes. The MVIA ranges in elevation from approximately 200 feet MSL near the Golf Club to over 2,000 feet MSL at the Koolau range ridge line. MTC ranges in elevation from approximately 400 to 1,200 feet MSL. MVTC ranges in elevation from approximately 50 to 200 feet MSL. UTC ranges in elevation from approximately 250 to 1,000 feet MSL at Ulumawao peak (Zapata, 2008)

2.3.4.2 Climate

Due to the location of the Hawaiian Islands in the northern tropics, Oahu's climate is mild and pleasant, primarily due to the presence of cooling trade winds. Average temperatures in the lowlands are approximately 72.5 degrees Fahrenheit (°F), with decreasing temperatures in higher elevations. Temperatures are coolest in January (59°F) and warmest in August (89°F). Relative humidity on Oahu ranges from 30 to 90% per month. The main mechanism for rainfall is warm, moist ocean air rising and cooling as it passes over the mountains causing precipitation. This results in higher rainfall in the windward and mountain areas, and little in the leeward and coastal zones. The climate at the site is warm with moderate rainfall. Approximate temperatures for the project area range from 60°F to 85°F year. Approximate median annual rainfall for the area is between 24 to 47 inches per year (Wil Chee, 2009).

2.3.4.3 Geology

2.3.4.3.1 The four non-contiguous MRSs include portions of Maunawili and Makalii Valleys. The rocks of the Koolau mountain range are comprised chiefly of thin basalt flows with small amounts of ash. The Koolau volcanic series is comprised of lavas and dikes lying outside Koolau caldera and are altered only rarely by hydrothermal action. These lavas were erupted from two main rift zones in Pliocene time and a third southwest rift zone passing through Diamond Head (Wil Chee, 2009).

2.3.4.3.2 Soil conditions within the former PTC vary from the steep terraced areas of the Koolau mountain range, to the uniform sloping areas at the base of the mountain range. Found on the steep sloping areas (45-55% slope) are soils of both the Waikane Silty Clay and Alaeloa Silty Clay series. Soils from the Waikane Silty Clay series are found on steep terraces and alluvial fans. The surface layer is dark brown silty clay approximately 8 inches thick. The subsoil is about 52 inches thick and is dark reddish brown silty clay. Runoff is medium to rapid, and the erosion hazard is moderate to severe. These soils are commonly found in pastures. Soils from the Alaeloa Silty Clay series are found in sloping areas of 45 to 55%. The surface layer is dark reddish brown silty clay approximately 10 inches thick. The subsoil, about 48 inches thick, is dark red and red

silty clay. Runoff is rapid to very rapid and the erosion hazard is severe. These soils are commonly found in pastures and wildlife habitats (Wil Chee, 2009).

2.3.4.3.2 Soils found in the lower lying, uniformly sloping areas of the site are predominantly of the Kaneohe Silty Clay series. These soils are reddish and dark brown soils that formed in gravelly alluvium. Permeability is moderately rapid, runoff is slow to medium, and the erosion hazard is slight. These soils are commonly found in pastures and golf courses (Wil Chee, 2009).

2.3.4.4 Site Hydrogeology

The project site overlies the Waimanalo aquifer system (Windward Oahu Aquifer Sector), which extends from the ridgeline of the Koolau Mountains to the northeast facing shores of Oahu, and from Makapuu Point in the southeast to Kahuku Point in the northwest. An unconfined flank aquifer overlies a basal groundwater system. Water in the upper flank aquifer is currently used, ecologically important, has low salinity (between 250 and 1,000 milligram per liter chloride ion), is replaceable, and has a high vulnerability to contamination. The basal aquifer is currently used for drinking water, has very low salinity (less than 250 milligram per liter chloride ion), is replaceable, and has a low vulnerability to contamination (Mink and Lau, 1990).

2.3.4.5 Biological and Ecological Resources

2.3.4.5.1 Most of the area is dominated by introduced plant species; however native tree species, (ohia lehua [*Metrosideros polymorpha* var. *glaberrima*], hala [*Pandanus tectorius*], papala kepau [*Pisonia umbellifera*], ulei [*Osteomeles anthyllidifolia*], palaa fern [*Odontosoria chinesis*], ekaha or birds nest fern [*Asplenium nidus*], uluhe [*Dicranopteris linearis*], ama [*Diospyros sandwicensis*], papala kepau [*Pisonia umbellifera*]), and four endemic species (koa [Acacia koa], ohia lehua [*Metrosideros polymorpha* var. *incana*], uki [*Machaerina mariscoides* ssp. *Meyenii*], and hapuu [*Cibotium chamissoi*]) have been observed (USACE, 2014).

2.3.4.5.2 A portion of the critical habitat unit designated for the Oahu `Elepaio (*Chasiempis sandwichensis ibidis*) falls within the project area. Although the ‘Elepaio was not observed during the RI, one migratory shorebird, the Pacific Golden-Plover or Kolea (*Pluvialis fulva*) was observed. The Kolea is not a threatened or endangered species, however they are protected by Federal law under the Migratory Bird Treaty Act and by State law under Hawaii Administrative Rules Title 13 Chapter 124 (USACE, 2014).

2.3.4.6 Cultural Resources

There are multiple archaeological features and areas of cultural significance within the former PTC boundaries. These features have been documented in a separate Archaeological Monitoring Report due to the sensitive nature of this information.

2.3.5 Previous Investigations

2.3.5.1 The previous investigations summarized below have been conducted for the former PTC.

- 1994 Inventory Project Report (USACE, 1994):
    - Established the former PTC as an eligible property under the FUDS program.
    - Established the acreage, preliminary site boundaries.
    - Summarized the historic military usage and investigations at the former training area.
    - Identified munitions historically detected at the site including: 75-mm high explosive (HE) projectile; 60-mm HE mortar, a 37-mm HE projectile, 2.36- and 3.5-inch high explosive anti-tank (HEAT) rockets.
- 2008 Engineering Evaluation/Cost Analysis (Zapata, 2008):
    - Conducted digital geophysical mapping of 5.7 acres in the MVIA.
    - Conducted visual and surface sweep reconnaissance of 26.3 acres within the MVIA, the MTC, and the MVTC MRSs.
    - No MEC items were found.
    - Found 103 MD items including 75-mm HE, 75-mm shrapnel, and 37-mm projectiles in MVIA.
    - Defined a new impact area in a bowl-shaped section of the Maunawili Valley.
    - Found evidence of troop maneuvering (foxholes, small arms debris, and C ration residue) in MTC MRS. No MEC or MD items were found.
    - Found two large holes in MVTC that may have been observation points to view impacts from firing into the MVIA. No MEC or MD items were found.
    - The UTC MRS was not investigated based on historical information designating this area as an encampment or cantonment.
- 2009 Site Investigation (Wil Chee, 2009):
    - Collected soil, surface water, and sediment samples from the MVIA MRS and analyzed for metals and explosive residues.
    - Did not detect explosive compounds and white phosphorous at concentrations exceeding the project action level in any of the soil or sediment samples.

- Detected aluminum, arsenic, chromium, cobalt, iron, nickel, and vanadium at concentrations exceeding the respective project action levels in the soil samples.
- Screened soil results against the 95th percentile estimated background concentrations for major Oahu soil groups and identified five metals as contaminants of potential concern (COPC). These COPCs include aluminum, arsenic, chromium, iron, and vanadium.
- Detected two metals (cobalt and mercury) and one explosive compound (research development explosive [RDX]) at concentrations exceeding their respective project action levels in the surface water samples collected from Maunawili Stream. Based on these results, cobalt, mercury, and RDX were identified as COPC for the Maunawili Stream.
- Detected six metals including aluminum, chromium, cobalt, iron, nickel, and vanadium were detected at concentrations exceeding their respective project action levels in both the upstream and downstream sediment samples collected from Maunawili Stream.
- Screened sediment results against the 95th percentile estimated background concentrations for major Oahu soil groups. Based on those results, iron was identified as a COPC for sediment present in Maunawili Stream.
- No environmental samples were collected in the MTC, MVTC, or UTC MRSs.

- 2012 Removal Action at Maunawili Valley Impact Area (Environet, 2012):
  - Removed and disposed of all MEC and MD on 40 acres within the MVIA.
  - Removed approximately 1,067 pounds of MD and 26 MEC items located during fieldwork.
  - MEC items included: 60-mm HE mortar, M49A2; 37-mm HE projectile, M63; 75-mm shrapnel projectile, MK1; fuze of a projectile Time Super Quick (TSQ); fuze of a projectile Point Detonating Super Quick (PDSQ); 57-mm Armor Piercing Tracer (APT) projectile, M70; 37 mm Armor Piercing Capped Tracer (APCT) projectile, M59; 2.36-inch rocket motor; 81 mm HE mortar, M43A1; and fuze of a projectile, M1907M.
  - Depth of MEC items was less than two feet below ground surface.
- 2014 Remedial Investigation (USACE, 2014):
  - Investigated 36.11 miles (14.36 acres) of parallel and meandering transects and an additional 10.30 miles (8.45 acres) of public trails transects

- Found seven MEC items, less than two feet below ground surface, in the western portion of the MVIA MRS.
- Found 1,346 MD items in the western and central portions of the MVIA MRS.
- Identified seven new munition types.
- No MEC or MD items were found in the portion of the MRS east of the Aniani Nui/Olomana ridgeline.
- Detected four or more metals in all surface soil samples though below their respective HDOH Tier 1 EALs.
- Detected explosives in surface soil but at concentrations below their respective HDOH Tier 1 EALs.
- Subdivided the MVIA MRS into three distinct areas based on topography, land use, and cumulative findings: MVIA – West (1,096 acres), MVIA – Central (951.5 acres), and MVIA – East (671.8 acres).
- Identified a target area in MVIA – West in the vicinity of the Maunawili Falls Trail.
- Confirmed the presence of an impact area in MVIA – West.
- Recommended that an FS be prepared to evaluate potential future response actions to address MEC in MVIA – West shown on Figure A2-1.
- Determined that there are no explosive hazards in MVIA – Central, MVIA – East, MVTC, and UTC and no further action is being considered for these areas.

2.3.5.2 Appendix A, Figure A2-1 shows the location of MD and MEC identified at the project site during previous investigations including the 2014 RI (USACE, 2014).

2.3.6 Nature and Extent of Contamination

This section summarizes the nature and extent of MEC, MD, and MC at the project site based on the results of the nature and extent evaluation in the Final RI Report (USACE, 2014).

2.3.6.1 Nature and Extent of MEC

Cumulatively, 33 MEC items have been identified in MVIA – West at the locations shown on Appendix A, Figure A2-1. All of the MEC items were located less than two feet below ground surface. No MEC items have been documented within MVIA – Central, MVIA – East, MVTC, or UTC.

2.3.6.2 Nature and Extent of MD

2.3.6.2.1 The presence of MD is an indicator of potential MEC contamination; where high concentrations of MD exist, MEC may be more likely found in this area. A total of 103 MD items were identified in MVIA during the EE/CA (Zapata, 2008), including 37-mm, 75-mm HE, and 75-mm shrapnel projectile parts and fragments, fuze parts and fragments, mortar fins, and small arms debris, were identified at the locations shown on Appendix A, Figure A2-1. During the 2012 Removal Action, 1,067 pounds of MD were removed from MVIA. A total of 1,346 MD items were removed from MVIA during the RI.

2.3.6.2.2 Seven areas of elevated or high anomaly density were identified in MVIA – West. One area was identified as a disposal location of discarded military munitions (DMM), two were identified as target areas, and the remaining four areas surround the 2012 Removal Action area. Seven MEC items and 1,252 MD items were located in MVIA – West. Five areas of elevated anomaly density were identified in MVIA – Central. None were determined to be target areas. Only 94 MD items were located in MVIA – Central. No MEC items were found. Therefore, potential MEC or MD is more likely to be present in the MVIA – West region.

2.3.6.3 Nature and Extent of MC

MCs were not identified at concentrations exceeding the HDOH Tier 1 EALs. Per the HDOH, concentrations of chemicals below the HDOH Tier 1 EALs do not pose a risk to human health or the environment. Therefore, human health and ecological risk assessments were not performed and no response action is required to address these contaminants.

2.3.7 Conceptual Site Model

This section summarizes the conceptual site model (CSM) developed for MEC in MVIA – West. There are no complete exposure pathways from humans to MEC in MVIA – Central, MVIA – East, MVTC, or UTC. Further, MD does not present an explosive hazard to humans or the environment. MCs are not considered potential concerns and have been eliminated from further consideration. The purpose of the CSM is to identify the potential sources of contamination, potentially affected media, migration and exposure pathways, and possible receptors based on available site information. The CSM is not intended to provide details or quantification of the potential sources and pathways. However, it is intended to provide the framework for characterizing site contamination and assessing risks.

2.3.7.1 Potential Sources of Contamination

Potential sources of contamination include MEC on the ground surface and subsurface in MVIA – West. Although MEC may contain explosive compounds or metals that may be released into site media over time as the munitions degrade, MCs were not found at concentrations exceeding the HDOH Tier 1 EALs during the RI.

2.3.7.2 Potentially Affected Media

Based on physical characteristics and historical uses and the previous investigations at MVIA – West, potentially media affected by MEC include surface and subsurface soil and sediment.

2.3.7.3 Migration Pathways

2.3.7.3.1 The migration pathways identified for MEC includes movement of MEC by naturally occurring events and human activity. It is possible that MEC within the MVIA – West will migrate from its original site of deposition (i.e., target areas) due to naturally occurring events (storm water runoff, landslides) and the steep terrain. It is also possible that MEC could be disturbed by human activity. Recreational users and occupational workers using paths and trails could possibly disturb MEC or collect MEC as a souvenir. Most of the munition items found are relatively lightweight and could be hand-carried without much difficulty. The heaviest item found, the 105-mm HE projectile, M1, weighs approximately 40 pounds and is less likely to be moved.

2.3.7.4 Potential Receptors and Exposure Pathways

Current and future human receptors at the MVIA – West consist of recreational users (visitors, hikers), agricultural workers, and occupational workers (utility and trail maintenance). The potential exposure pathway to MEC is through direct contact with MEC present on the surface. Contact with subsurface (two feet below ground surface) MEC is possible for agricultural workers while excavating plots and for occupational workers performing subsurface infrastructure maintenance.

2.3.8 Hazard and Risk Assessment Summary

A baseline MEC HA for MVIA – West was performed as part of the RI to evaluate explosive hazards to humans from MEC assuming no response action was taken at the site. As mentioned previously, a baseline risk assessment was not required because MC concentrations did not exceed the HDOH Tier 1 EALs. The MEC HA evaluated current and future human receptors at the project site and consisted of recreational users, agricultural workers, and occupational workers (i.e., trail maintenance and construction). It evaluated the potential exposure pathways to MEC, which included direct contact with MEC present on the surface and subsurface in accessible areas. The MEC HA score for the MRS is 925 (minimum possible score of 125 and maximum possible score of 1,000) with a MEC HA hazard level of 1 (1 being the highest hazard and 4 being the lowest hazard) based on current conditions (i.e., no response actions conducted to remove potential MEC). Section 5.1 provides detailed information on the MEC HA input parameters and scoring.

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3.0 Identification and Initial Screening of Technologies

This section (1) presents the site-specific RAOs, (2) identifies ARARs, and (3) presents a range of GRAs and process options that will satisfy the RAOs. The GRAs and process options retained through the screening process are used in later sections of this FS Report as the basis for developing remedial alternatives.

3.1 Remedial Action Objectives

3.1.1 RAOs are goals specific to a type of media for protecting human health and the environment. The RAO evaluation for this FS Report is based on the results of the previous investigations identified in Section 2.3.5 and the results of the MEC HA (Section 5.1).

3.1.2 An important component of developing RAOs is the determination of future land use. According to EPA's land use directive (EPA, 1995), RAOs "should reflect the reasonably anticipated future land use or uses...," thereby allowing for the development of "alternatives that would achieve cleanup levels associated with the reasonably anticipated future land use..." of the site. The EPA land use directive states that "in cases where future land use is relatively certain, the remedial action objective generally should reflect this land use..." and "...need not include alternative land use scenarios..." (EPA, 1995). RAOs developed for the PTC are based on (1) the MEC contamination being confined to the MVIA – West (2) the current use of the land in MVIA – West (i.e. recreational, agricultural) does not change in the future, and (3) no further action at MVIA – Central, MVIA – East, MVTC, and UTC.

3.1.3 The RAO identified for MVIA – West is to reduce recreational user and worker exposure to explosive hazards associated with munitions items varying in size from fuzes up to 105-mm projectiles present on the surface and down to two feet below ground surface within the 1,096 acres defined as the MVIA – West (Appendix A, Figure A2-1) to acceptable hazard levels. Acceptable hazard is defined such that exposure to MEC can be considered an "unlikely" or a "negligible" hazard to the public. This RAO is based on (1) the majority of the for MVIA – West being inaccessible due to terrain and vegetation and (2) the current and future use of the land is limited to recreational and agricultural purposes.

3.2 Applicable or Relevant and Appropriate Requirements

3.2.0.1 CERCLA Section (§) 121(d)(l) states that remedial actions on CERCLA sites must attain (or the DD must justify the waiver of) any ARARs, which include environmental regulations, standards, criteria, or limitations promulgated under federal or more stringent state laws. An ARAR may be either applicable, or relevant and appropriate requirements.

3.2.0.2 Per the NCP (40 CFR § 300.5), applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a

hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site.

3.2.0.3 Likewise, per the NCP (40 CFR § 300.5), relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. A requirement must be determined to be both relevant and appropriate (using the criteria identified in the NCP, specifically 40 CFR § 300.400[g][2]) in order to be considered an ARAR.

3.2.0.4 To qualify as a state ARAR under CERCLA and the NCP, a state requirement must be (1) a standard, requirement, criterion, or limitation under a state environmental or facility siting law; (2) promulgated (of general applicability and legally enforceable); (3) substantive (not procedural or administrative); (4) more stringent than the federal requirement; (5) identified by the state in a timely manner; and (6) consistently applied.

3.2.0.5 CERCLA § 121(e) exempts on-site response actions from having to obtain a federal, state, or local permit when the action is carried out in compliance with § 121. In general, on-site actions need only comply with ARARs, which include only the substantive part of the requirements, not with the corresponding administrative procedures, such as administrative reviews and recording and record-keeping requirements. Off-site actions must comply with all legally applicable requirements, both substantive and administrative.

3.2.0.6 ARAR identification considers a number of site-specific factors, including potential remedial actions, compounds at the site, site physical characteristics, and the site location. ARARs are usually divided into three categories: chemical-specific, location-specific, and action-specific.

3.2.0.7 This section summarizes state and federal ARARs for MEC at PTC. Appendix B, Table 3-1 presents the complete ARARs evaluation.

3.2.1 Chemical-Specific ARARs

Chemical-specific ARARs are health- or risk-based numerical values that, when applied to site-specific conditions, results in the establishment of numerical cleanup values. These values are protective of human health and the environment and establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment. MC sampling was only conducted within the MVIA MRS. Since no MCs were detected above the HDOH Tier 1 EALs for surface soil, the potential for adverse risks to human health or ecological receptors from exposure to MCs is negligible. Therefore, no chemical-specific ARARs were developed for the MVIA MRS.

3.2.2 Location-Specific ARARs

Location-specific requirements are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations. For example, location-specific ARARs might focus on wetland or floodplain protection areas or on archaeologically significant areas. Potential location-specific ARARs were identified for PTC relating to ecological resources (Section 2.3.4.5). Appendix B, Table 3-1 provides detailed information on each of the location-specific ARARs.

3.2.3 Action-Specific ARARs

Action-specific ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of response activities. For example, action-specific ARARs may include restrictions that define acceptable procedures for detonation or open burning of explosives. Appendix B, Table 3-1 provides detailed information on the action-specific ARARs.

3.3 General Response Actions

GRAs are categories of actions that are made up of technologies. Multiple process options may be available for each technology. GRAs are responses or remedies that would meet the RAOs to protect human health and the environment from MEC at MVIA – West. GRAs were developed based on professional engineering judgment and experience with response actions proven successful for MEC at other MRSs. The following GRAs were identified for MVIA – West:

- LUCs – Includes land use and access restrictions implemented through administrative/legal mechanisms, engineering controls, and educational programs to reduce the potential for human interaction with MEC and associated unintentional detonation, which may result in injury or death to humans and/or to damage ecological and cultural resources

- Removal of MEC – Includes surface and subsurface clearance of MEC using various technologies to assist with locating items. The technology used for surface and subsurface removal of MEC includes analog detection methods (i.e., metal detectors) to detect the presence of MEC and MD. Reduction of MEC volume includes demilitarization of MEC by detonation in place or, if deemed acceptable to move, in a consolidated point, and disposal of MD in 55-gallon drums to an authorized munitions recycler.

3.4 Identification And Initial Screening of Technologies and Process Options

Technologies and process options identified for each of the GRAs selected for this FS Report underwent an initial screening. The goal of screening process options is to provide a "toolbox" of available technologies that can be applied as needed in the selected remedial alternative presented in the DD to best achieve the RAOs. During the initial screening, a range of technology types and

process options were evaluated in terms of technical implementability, effectiveness, and cost. The following subsections and Appendix B, Table 3-2 summarize the results of the initial screening.

3.4.1 Land Use Controls

3.4.1.1 LUCs are mechanisms that protect property owners and the public from hazards contained on a site by limiting the access or use of a property or by warning of the hazard. LUCs may take the form of legal and administrative mechanisms, engineering controls, and educational controls. Examples of legal and administrative mechanisms are restrictions on the land such as zoning and permitting. Engineering controls either limit the public's access to a site or limit the public's exposure to the residual contamination (in this case MEC) to an acceptable level. Examples of engineering controls include physical barriers and warning signs. Educational controls focus on educating the public on the hazards associated with a site and appropriate response actions to avoid exposure to site contaminants (in this case MEC).

3.4.1.2 The following LUCs were considered for MVIA – West:

1. Administrative mechanisms such as permitting and leasing conditions to restrict land use and/or specific site activities (i.e., requiring unexploded ordnance [UXO] support for all intrusive activities).

2. Engineering controls, including limiting public access to designated trails and installation of warning signs notifying the public of the potential presence of MEC

3. Educational controls, including community outreach and visitor education to increase awareness of MEC hazards at the site and appropriate response actions if a MEC item is identified as well as providing MEC-related educational materials in conjunction with issuing lease agreements.

3.4.1.3 The overall purpose of the LUCs is to prevent potential human exposure to MEC and associated unintentional detonation that may result in injury of death to humans, thus meeting the RAOs. The DLNR has indicated that as the landowner they are willing to participate in the LUC planning process and the maintenance of LUCs. The indicated LUCs are easily implemented by the DLNR. This GRA would include initial capital costs for engineering and educational controls, as well as recurring long-term management (LTM) costs. Overall costs for this GRA are considered moderate. This GRA was retained for further evaluation as a remedial alternative or combined with other process options as part of a remedial alternative.

3.4.2 MEC Removal

A remedial action would include identification and removal of surface and subsurface MEC (and incidental MD, if found) and could be performed over the entire site or within designated areas. The proposed technology to assist with the remedial action includes analog detection methods (i.e.,

metal detectors) to detect the presence of MEC and MD. Appendix B, Table 3-3 provides a summary of detection technologies available. Treatment includes demilitarization of MEC by detonation in place or, if deemed acceptable to move, in a consolidation point; and disposal of MD in 55-gallon drums to an authorized munitions recycler. The overall purpose of this GRA is to remove MEC from MVIA – West, significantly reducing, if not eliminating, the probability of a human encounter with and possible unintentional detonation of MEC, which may result in injury or death to humans. Implementing this GRA is considered moderately difficult to difficult (depending on the scope of the remedial action [i.e., limited or completed]) for the following reasons: equipment and personnel would need to be mobilized to the site for several months of work in dense vegetation and rugged terrain; however, the equipment and trained personnel would be readily available. Costs for this GRA are considered low to high (depending on the scope of the MEC removal area [i.e., limited or completed]) and would include labor, equipment, and materials.

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4.0 Development and Description of Remedial Alternatives

This section presents remedial alternatives developed for MEC at MVIA – West based on the technologies and process options retained in Section 3.0. The NCP states that development and analysis of remedial alternatives will reflect the scope and complexity of the response actions under consideration based on the environmental issues defined at the site. The number and types of alternatives to be analyzed were identified by considering the scope and characteristics of environmental issues at MVIA – West.

4.1 Development of Remedial Alternatives

GRAs and process options were developed and screened as described in Section 3.0. Except for the no-further action alternative, all of the alternatives are designed to address explosive hazard associated with MEC. The retained process options were combined into remedial alternatives to meet RAOs and to satisfy ARARs. The remedial alternatives were derived using experience and engineering judgment to formulate process options into the most plausible site-specific response actions. The following sections describe the alternatives developed for further analysis to address MEC.

4.2 Description of Remedial Alternatives

4.2.0.1 The following four remedial alternatives were developed for MVIA – West MRS based on a combination of the process options retained in Section 3.0:

- Alternative 1 – No Action
- Alternative 2 – LUCs
- Alternative 3 –Removal of MEC in Highly Accessible Areas and LUCs
- Alternative 4 – Complete Removal of MEC in High Density Areas

4.2.0.2 The following sections describe the four remedial alternatives.

4.2.1 Alternative 1 – No Action

Under Alternative 1, no response action would be taken. Potential MEC would be left in place as-is, without implementing any LUCs or remedial actions. The no-action alternative is not considered an effective response action that meets the requirements of CERCLA because it does not address the explosive hazard posed to humans or the environment by potential MEC at the site. However, the no-action alternative is retained throughout the evaluation process as required by the NCP to provide a baseline for comparison with other alternatives.

4.2.2 Alternative 2 – Land Use Controls

4.2.2.0.1 Under Alternative 2, LUCs would be implemented to meet the RAOs by restricting public access to the site and/or by reducing the probability of a human encounter with MEC and the potential for unintentional MEC detonation, which may result in injury or death to humans. The LUCs will include a combination of administrative mechanisms, engineering controls, and educational controls as described below. The Institutional Analysis (IA) (Appendix E) identified government stakeholders that are willing and able to participate in the implementation and management of LUCs. The LUCs alternative includes ongoing LTM of engineering and educational controls.

4.2.2.0.2 In addition to implementing LUCs, five-year reviews are a requirement for alternatives not allowing for UU/UE in accordance with 40 CFR 300.430(f)(4)(ii). Under this option, five-year reviews would be required because MEC remains on the site above levels that allow for UU/UE.

4.2.2.1 Description of Land Use Controls

4.2.2.1.1 **Administrative Mechanisms**: MVIA –West is located within state-owned land, controlled and managed by the DLNR. There are no plans to change the site use from recreational and agricultural use. While it is possible to add deed restrictions related to the potential hazards attributed to the munitions at the site, this course of action is deemed unnecessary because it is highly unlikely that the property will change from its current use as public lands maintained under the DLNR.

4.2.2.1.2 Portions of the MVIA – West are leased from the State of Hawaii to entities performing agricultural activities. Special conditions to the lease can be appended to the lease agreement prior to issuance or renewal to inform the lessee of the potential hazards related to the munitions items on the site. Additionally, right-of-entry permits may be granted to entities performing infrastructure maintenance or construction activities. It must be recognized that lease activities, right-of-way, permits, and similar activities can only be enacted by the State and/or local government activities and not USACE. Special conditions can also be appended to the right-of-entry permits. These conditions could include informational material regarding the presence of munitions debris, safety precautions, and necessary procedures, as well as define areas unavailable for use and direct users away from potentially MEC-contaminated sites.

4.2.2.1.3 **Engineering Controls**: Engineering controls that would be implemented under this alternative consist of restricting public access within MVIA – West to designated trails marked at periodic intervals with warning signs notifying the public to stay on the designated trails because of the potential presence of an explosive hazard. Enforcement of this restriction would be carried out by DLNR staff. DLNR is authorized to enforce State laws and rules involving State-owned lands.

4.2.2.1.4 **Educational Controls**: Educational controls, including community outreach, visitor education, and safety and awareness training of DLNR staff, would be implemented under this alternative. The IA indicates the DLNR is willing to assist with the occasional maintenance of LUCs, maintaining a centrally-located community information board with postings regarding recommended safety precautions for munitions debris, participating in community and visitor outreach, and training. In addition, as mentioned previously, educational material could be appended to each lease agreement or right-of-entry permit to inform users of the potential presence of munitions at the site, provide safety precautions, and explain appropriate procedures in the event a suspected munitions item is discovered.

4.2.2.1.5 Visitor education would include installation of educational signs at key locations such as publically-accessible trailheads throughout the MVIA – West. A large educational sign, similar to those found in national parks, could be installed at a community information board designated by the DLNR. The sign would summarize key safety and access limitation information. In addition, the feasibility and effectiveness of outreach to the tourism bureau and local resorts may also be evaluated and considered as additional educational controls. Educational signs would be constructed by USACE and maintained by DLNR.

4.2.2.1.6 Community outreach activities would include community meetings and possibly outreach events at schools and community functions such as farmer's markets and fairs. Outreach activities would focus on educating the public access restrictions as well as the presence and dangers of MEC. Discussion topics would include, but not necessarily be limited to:

- Site history
- Presence and identification of MEC at MVIA – West
- Safety considerations and the importance of staying on managed trails that are open for public access
- Response actions if MEC are identified (i.e., recognize, retreat, and report [3Rs])

4.2.2.1.8 As indicated in the IA, by the DLNR; the C&C of Honolulu, Department of Emergency Management (DEM); C&C of Honolulu, Honolulu Fire Department (HFD); and C&C of Honolulu, Honolulu Police Department (HPD), MEC hazard awareness training of the staff would be supported by these agencies. Training could be provided through videos or other computer-based training mechanisms. The training would be a more detailed version of the community outreach presentations and would include additional information on recognizing the type of MEC items that may be present in the MVIA – West and response actions if a MEC item is found. Copies of the training video/presentation would be provided to various agencies for as-needed training of new staff or refresher training for existing staff. In addition, quick reference books would be prepared for agencies that include pictures and descriptions of the MEC items anticipated to potentially be present at the project site.

4.2.2.2 Land Use Control Assumptions

A cost estimate for Alternative 2 was developed based on the following assumptions:

- The most commonly accessed public trails would be identified. The areas for placement of signage would be finalized by the DLNR, CEPOH, and USAESCH.
- Up to 50 aluminum warning signs, containing text similar to "Danger Explosive Hazard – Stay on Marked Trail," would be installed along designated trails. Signs would be replaced as needed based on absences or sign legibility, up to a maximum of 300 signs over a 30-year period.
- A total of four community outreach events would be held during the first year of LUC implementation with the target of reaching up to 400 residents. No subsequent outreach activities would be conducted. Outreach events would be publicized via appropriate media, including newspaper notices.
- Educational signs would be placed at each of five locations along trails and replaced as needed based on absence or legibility, up to a maximum of 30 signs over a 30-year period.
- Two in-person training events would be held for various agencies over a 30-year period. Staff training during the intervening years would be performed using the training videos filmed during the two in-person training events. Five copies of the training video would be provided annually to agencies.
- DLNR staff would assist with inspection, repair, and replacement of signs.

4.2.3 Alternative 3 – Removal of MEC in Highly Accessible Areas and LUCs

4.2.3.1 Under Alternative 3, LUCs (similar to those described for alternative 2) would be combined with a limited removal of surface and subsurface MEC in highly accessible areas to more significantly reduce the probability of a human encounter with MEC and the potential for unintentional MEC detonation, thus more effectively meeting the RAOs. Five-year reviews will also be conducted, as described under Alternative 2, since Alternative 3 does not allow for UU/UE. Under Alternative 3, a limited removal of surface and subsurface MEC by UXO-trained personnel would be performed at up to 3 acres (1 acre with a contingency of 2 acres) using visual and analog methods to identify and remove MEC (and MD, if identified) from these locations. The limited removal would be performed in high-traffic areas, specifically ancillary trails and areas adjacent to the Maunawili Falls and Maunawili Demonstration hiking trails within MVIA – West. The Maunawili Falls and Maunawili Demonstration Trails were 100 percent geophysically mapped and investigated during the RI. MEC was only encountered in the area west of the Pikoakea Spring and is not likely present in the area to the east.

4.2.3.2 The Alternative 3 cost estimate was developed based on the following assumptions:

- All of Alternative 2 assumptions apply.
- The 3 acres identified by CEPOH and USAESCH in coordination with DLNR were selected for a limited remedial action based on the distribution of MEC and MD found during the previous investigations and areas that are publically accessible. These areas were selected for the purpose of the remedial alternatives analysis in this FS Report and do not represent all areas that are open to public access. The actual locations and acreages ultimately selected for a remedial action may vary from those indicated below. The MEC removal areas are identified on Appendix A, Figure 4-1 and described below.
    - → Three ancillary trails branching off of the Maunawili Falls Trail.
    - → Three accessible areas adjacent to the Maunawili Falls Trail, including the Maunawili Falls area. Areas range in size from approximate 0.10 to 0.25 acres.
    - → Three accessible areas adjacent to the Maunawili Demonstration Connector Trail, including an area used by the Boy Scouts. Areas range in size from 0.03 to 0.215 acres.
    - → Up to 2 additional acres of undefined accessible areas along the Maunawili Falls and Maunawili Demonstration Trails.
- The clearance of surface and subsurface MEC would be performed by a team consisting of 10 qualified UXO personnel, including a project manager, 1 senior UXO supervisor (SUXOS), 1 UXO quality control specialist (UXOQCS), 1 UXO safety officer (UXOSO), 2 UXO Technician (Tech) IIIs, 2 UXO Tech IIs, and 2 UXO Tech Is. The estimated time to complete the surface and subsurface clearance is 12 days assuming a clearance rate of 0.25 acres per day.
- MEC identified during the removal would be demilitarized by blowing in place or by consolidated shots if multiple MEC items are found and are determined to be acceptable-to-move. No demolition explosives would be stored on-site. Demolition explosives would be delivered to the site from Oahu on an as-needed basis. Identified MEC would be guarded 24 hours per day after discovery until demolition could be performed.
- MD identified during the surface removal would be containerized and shipped off-island for disposal by an authorized munitions recycler. The estimate assumes a maximum of two 55-gallon drums of MD will be recovered.

4.2.4 Alternative 4 – Complete Removal of MEC in High Density Areas

4.2.4.1 Under Alternative 4, a removal of surface and subsurface MEC would be performed to identify and remove MEC from 96 acres of high density areas identified as impact and target areas, (Appendix A, Figure 4-2) using visual and analog methods. Alternative 4 would remove explosive hazards from MEC.

4.2.4.2 Alternative 4 was developed based on the following assumptions:

- The clearance of surface and subsurface MEC would be performed by a team consisting of 29 qualified UXO personnel including 1 project manager, 1 SUXOS, 1 UXOQCS, 1 UXOSO, 4 UXO Tech IIIs, 5 UXO Tech IIs, and 16 UXO Tech Is. The estimated time to complete the surface clearance is 96 days assuming a clearance rate of 1.0 acres per day. Areas previously cleared during the RI may be cleared again.

- MEC identified during the removal would be demilitarized by blowing in place or by consolidated shots if multiple MEC items are found and are determined to be acceptable-to-move. No demolitions explosives would be stored on site. Demolition explosives would be delivered to the site from Oahu on an as-needed basis. Identified MEC would be guarded 24 hours per day after discovery until demolition could be performed.

- MD identified during the surface removal would be containerized and shipped off-island for disposal by an authorized munitions recycler. The estimate assumes a maximum of 20 55-gallon drums of MD will be recovered.

5.0 Detailed and Comparative Analysis of Remedial Alternatives

5.0.1 This section provides the MEC HA and a detailed and comparative analysis of each remedial alternative developed in Section 4.0. This information will be used to help select a final remedy for MVIA – West at the former PTC. The alternatives developed in Section 4.0 are evaluated using criteria based on statutory requirements of CERCLA as amended by the Superfund Amendments and Reauthorization Act, Section 121; the NCP; and "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA, 1988).

5.0.2 The NCP specifies nine criteria to be used in the detailed analysis. The first two criteria are threshold criteria that must be satisfied for a remedy to be eligible for selection. The next five criteria are balancing criteria used to evaluate the comparative advantages and disadvantages of the remedial alternatives. The final two criteria are modifying criteria generally considered after comments are received from the regulatory agencies and the public on the PP. The nine criteria are listed below.

Threshold Criteria

1. Overall Protection of Human Health and the Environment: This criterion describes how each alternative, as a whole, protects human health and the environment and indicates how each hazardous substance source is to be removed, reduced, or controlled.

2. Compliance with ARARs: This criterion evaluates each alternative's compliance with ARARs, or, if an ARAR waiver is required, how the waiver is justified. ARARs consider chemical-specific, location-specific, and action-specific concerns.

Balancing Criteria

3. Long-Term Effectiveness and Permanence: This criterion evaluates the effectiveness of each alternative in protecting human health and the environment after the response action is complete. Factors considered include magnitude of residual hazards and adequacy and reliability of release controls.

4. Reduction of Toxicity, Mobility, or Volume: This criterion evaluates the anticipated capability of each alternative's specific technology to reduce the toxicity, mobility, or volume of hazardous substances.

5. Short-Term Effectiveness: This criterion addresses the effectiveness of each alternative in protecting human health and the environment during the implementation and/or construction phase. Factors considered include:

    - Exposure of the community during implementation
    - Exposure of the workers during construction

- Effects to the environment
- Time required to meet the RAOs

6. Implementability: This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of the required services and materials during its implementation. Factors considered include:

   - Ability to perform the response action
   - Reliability of the response action
   - Monitoring considerations
   - Availability of equipment and specialists

7. Cost: This criterion evaluates the costs for each alternative. Cost estimates are order-of-magnitude-level estimates and have an expected accuracy of minus 30 to plus 50 percent (EPA, 2000).

Modifying Criteria

8. Community Acceptance: This criterion evaluates issues and concerns the public may have regarding each alternative. This criterion will be assessed following receipt of public comments on the FS Report and the PP.

9. State Acceptance: This criterion evaluates technical and administrative issues and concerns the state regulatory agencies may have about each alternative. This criterion will be assessed following receipt of regulatory agency comments on the FS Report and the PP.

5.0.3 In the following sections, each remedial alternative is compared with the two threshold and five balancing NCP criteria, and subsequently compared with the other alternatives to assess their relative performance with respect to the NCP criteria. Comparison with the two modifying criteria of community and state acceptance will be based on comments provided during the PP public review period; further discussion of these criteria is not included in this FS Report. Section 5.2 provides a detailed analysis of each remedial alternative. Section 5.3 provides a comparative analysis of the remedial alternatives.

5.1 MEC Hazard Assessment of Alternatives

5.1.0.1 As part of the FS, the MEC HA for MVIA – West was updated to evaluate hazards to humans under three remedial alternative scenarios: LUCs, removal of MEC in highly accessible areas, and a complete removal of MEC in high density areas. Section 5.2 describes in detail each remedial alternative.

5.1.0.2 The MEC HA addresses human health and safety concerns associated with potential exposure to MEC. Specifically, it assesses the acute hazard posed by the explosive components of MEC. The MEC HA does not directly address the environmental or ecological risks that might be associated with the chemical components of MEC. These risks, when present, are generally addressed in separate human health and ecological risk assessments. Because MCs were found to be below the HDOH Tier 1 EALs in the MVIA MRS, human health and ecological risk assessments were not performed (USACE, 2014).

5.1.0.3 The MEC HA for MVIA – West was prepared in accordance with EPA's "Munitions and Explosives of Concern Hazard Assessment Methodology (Interim)" (EPA, 2008). The MEC HA was designed to be used as the CERCLA hazard assessment methodology for a MRS where an explosive hazard from the known or suspected presence of MEC exists (EPA, 2008). An explosive hazard exists at a site if a potentially complete exposure pathway to MEC exists. A potentially complete exposure pathway to MEC is present any time a receptor can come near or into contact with MEC and interact with the item in a manner that might result in its detonation. A potentially complete exposure pathway to MEC has the following three components: (1) a source of MEC, (2) a receptor, and (3) the potential for interaction between the MEC source and the receptor. All three of these elements must be present for a potentially complete MEC exposure pathway to exist.

5.1.0.4 The MEC HA is structured around three components of a potential explosive hazard incident, as discussed below.

- Severity, which is the potential consequences (e.g., death, severe injury, property damage, etc.) of a MEC item detonating.
- Accessibility, which is the likelihood that a receptor will be able to come in contact with a MEC item.
- Sensitivity, which is the likelihood that a receptor will be able to interact with a MEC item such that it will detonate.

5.1.0.5 The MEC HA assesses each of these components by input factors. The sum of the input factor scores falls within one of four defined ranges, called "hazard levels." Each of the four hazard levels reflects site attributes that describe groups of sites and site conditions ranging from highest to lowest hazards. The MEC HA hazard levels are summarized below.

- Hazard Level 1 (Score 840–1,000): Sites with the highest potential explosive hazard. There may be instances where an imminent threat to human health from MEC exists.
- Hazard Level 2 (Score 725–835): A site with surface MEC or intrusive activities that would encounter MEC in the subsurface and the site has moderate or greater accessibility by the public.

- Hazard Level 3 (Score 530–720): A site that would be considered safe for the current land use without further munitions responses, although not necessarily suitable for reasonable anticipated future use. Level 3 sites generally have restricted access and a low number of contact hours and MEC is typically only in the subsurface.

- Hazard Level 4 (Score 125–525): A site compatible with current and determined or reasonably anticipated future use. A MEC cleanup has typically been performed at Level 4 sites.

5.1.0.6 A qualitative evaluation of the potential MEC hazards within MVIA – West was conducted for the following four remedial alternative scenarios, which are described in detail in Section 5.2:

- Alternative 1: No Action. In this alternative, no remedial action is conducted at the site and no land use controls are implemented.

- Alternative 2: LUCs. In this alternative, LUCs are implemented to reduce the potential for human interaction with MEC and associated unintentional detonation

- Alternative 3: Removal of MEC in Highly Accessible Areas. In this alternative, the LUCs from Alternative 2 are combined with removal of surface and subsurface MEC in highly frequented areas of the site to further reduce the potential for human interaction with MEC and associated unintentional detonation.

- Alternative 4: Complete Removal of MEC in High Density Areas. In this alternative, a removal of surface and subsurface MEC is performed in areas identified as impact and target areas to remove the explosive hazard and would result in UU/UE at the site.

5.1.0.7 The following sections summarize the details for the seven MEC HA input factors and the results of the MEC HA for each scenario.

5.1.1 Energetic Material Type

The MEC items known or suspected to be present within MVIA – West include projectiles (105-mm HE, 75-mm shrapnel, 57-mm, and 37-mm HE), mortars (60-mm and 81-mm HE), 2.36-inch rockets, and fuzes. Based on these findings, the energetic material type selected for the site is determined to be “high explosives and low explosive filler in fragmenting rounds,” which is the most potentially hazardous of the available selections. This factor applies to all four alternatives evaluated.

5.1.2 Location of Additional Human Receptors

Within the MVIA – West, there are multiple public hiking trails, access roadways, an agricultural research center, agricultural fields, an irrigation waterline, and utilities. Additionally, there is a residential area and a water tower outside of the MRS boundary but within the 2,111-foot

Explosive Safety Quantity Distance (ESQD) arc. Even if LUCs are implemented, recreational users and agricultural/occupational workers will continue to access MVIA – West. Because of this, the location of additional human receptors is assessed to be "inside MRS or inside the ESQD arc". This factor applies to all four alternatives evaluated.

5.1.3 Site Accessibility

MVIA – West contains multiple public hiking trails that are easily accessible by receptors. Additionally, portions of the area are actively used as an agricultural research center and for farming. Occupational workers occasionally access the area to maintain hiking trails and public utilities. Therefore, under all alternatives, the site was assessed at "Moderate Accessibility." Accessibility was assumed to be the same for all alternatives.

5.1.4 Potential Contact Hours

The Potential Contact Hours factor is evaluated by estimating both the number of users per year and the number of hours that each user engages in activities that may result in encounters with MEC. The MVIA – West is accessed daily by residents and visitors using the Maunawili Demonstration Trail and the Maunawili Falls Trail, by workers at an agricultural research center and by farmers. Occupational workers maintaining trails or infrastructure also access the area on a less frequent basis. Potential contact hours are not expected to change regardless of the alternative selected. The Potential Contact Hours input factor was assessed as "Some Hours (100,000 to 999,999 receptor-hours/year) for all four alternatives"

5.1.5 Amount of MEC

The potential MEC presence within MVIA – West is likely given the MEC items located during the RI, previous investigations, and the historic use of the site as an impact area. For this reason, a classification of "Target Area" is considered most appropriate for the site and was applied to all alternatives evaluated.

5.1.6 Minimum MEC Depth Relative To The Maximum Receptor Intrusive Depth

The MEC and MD found were located on the ground surface and subsurface. The maximum receptor intrusive depth at the site is anticipated to be two feet, in agricultural fields and infrastructure repair areas. Based on this information, the minimum MEC depth relative to the maximum receptor intrusive depth is assessed to be "Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC." This factor is applied to alternatives 1 and 2. For alternatives 3 and 4, both surface and subsurface removal will be performed, resulting in a rating of "After Cleanup: Intrusive depth does not overlap with subsurface MEC."

5.1.7 Migration Potential

Migration Potential has been rated as "Possible" because migration can occur via natural forces such as erosion caused by overland water flow or landslides along steep slopes.

5.1.8 MEC Classification

The MVIA – West was used as an impact area, where MEC, including projectiles, mortars, and fuzes, have been detected. The MEC HA guidance suggests that assessment teams should assume UXO is present in former target areas (EPA, 2008c). The MEC Classification input factor for this site is assessed as "UXO Special Case" for all four alternatives due to the presence of mortars and fuzes in the impact area.

5.1.9 MEC Size

The items known or suspected to be present within the MVIA – West vary in size from fuzes up to 105-mm projectiles. A potential receptor is more likely to pick up or interact with a smaller item, such as fuzes than a heavy bomb. The possible exposure to an explosive hazard is greater for smaller items as a result. Therefore, the MEC Size classification for this site is conservatively assessed as "Small" for all four alternatives.

5.1.10 MEC HA Results

MEC HA results by remedial alternative scenario are as follows:

- Scenario 1: No Action. Score = 925, Hazard Level 1
- Scenario 2: LUCs. Score = 925, Hazard Level 1
- Scenario 3: Removal of MEC in Highly Accessible Areas and LUCs. Score = 490, Hazard Level 4
- Scenario 4: Complete Removal of MEC in High Density Areas. Score = 490, Hazard Level 4

5.2 Detailed Analysis of Alternatives

This section compares each alternative with the two threshold and five balancing NCP evaluation criteria. Appendix B, Table 5-1 summarizes the comparison of each alternative to the seven NCP criteria evaluated. The ranking categories used in Appendix B, Table 5-1 and in the discussion of the alternatives are (1) protective or not protective, and meets ARARs or does not meet ARARs, for the two threshold criteria; and (2) excellent, very good, good, poor, and not acceptable for the five balancing criteria. Appendix B, Table 5-2 summarizes the costs for each alternative. Appendix D provides the cost analysis, including the detailed cost information.

5.2.1 Alternative 1 – No Action

Under Alternative 1, no remedial action would be taken. Potential MEC within MVIA - West would remain in place as-is, without implementing any LUCs or remedial actions.

5.2.1.1 Alternative 1: Overall Protection of Human Health and the Environment

MEC pose a potential hazard to human health and the environment. Alternative 1 would not address these hazards; therefore, the rating for Alternative 1 for the overall protection of human health and the environment is not protective.

5.2.1.2 Alternative 1: Compliance with ARARs

There is no need to identify ARARs for the no-action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action. CERCLA § 121 (42 USC § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no-action alternative (EPA, 1988). Therefore, a discussion of compliance with ARARs is not applicable for this alternative.

5.2.1.3 Alternative 1: Long-Term Effectiveness and Permanence

Under the no-action alternative, potential MEC would remain in place. No LUCs would be implemented to further restrict public access or reduce the probability of a human encounter with MEC and the potential for unintentional MEC detonation, which may result in injury or death to humans. Based on this evaluation and the accessibility of the site to the public, the overall rating for Alternative 1 for long-term effectiveness and permanence is not acceptable.

5.2.1.4 Alternative 1: Reduction of Mobility, Toxicity, or Volume

Alternative 1 does not provide a reduction in volume of MEC. Therefore, the overall rating for reduction in the mobility, toxicity, or volume of MEC is poor.

5.2.1.5 Alternative 1: Short-Term Effectiveness

Under Alternative 1, no remedial action would occur. As a result, the public would not be exposed to additional hazards from a remedial action but would remain exposed to MEC currently on site. The overall rating for Alternative 1 for short-term effectiveness is not acceptable.

5.2.1.6 Alternative 1: Implementability

Implementability includes technical and administrative feasibility and availability of required resources. No action would be required to implement this alternative; therefore, Alternative 1 would be very easy to implement and the overall rating for implementability is excellent.

5.2.1.7 Alternative 1: Cost

No costs are associated with Alternative 1; therefore, the overall rating for Alternative 1 for cost is excellent.

5.2.1.8 Alternative 1: Summary

Alternative 1 is not acceptable because it fails to meet one or more of the threshold criteria that is protectiveness of human health and the environment.

5.2.2 Alternative 2 – Land Use Controls

Alternative 2 includes implementation of LUCs to reduce the probability of a human encounter with MEC and the potential for an unintentional MEC detonation. LUCs include engineering controls consisting of restricting site access and posting of warning signs and educational controls such as community outreach; visitor education, and safety and awareness training for DLNR, DEM, HFD, and HPD staff; and inclusion of MEC-related educational materials with lease agreements and right-of-entry permits. LUCs would also include administrative mechanisms such as limiting access to only those areas addressed by any future remedial action and prohibit access to areas deemed to still potentially pose a hazard. Because this alternative will not reach UU/UE, statutory five-year reviews are required, though not part of the remedy. The cost of 5-year reviews is included in the cost analysis of this remedy.

5.2.2.1 Alternative 2: Overall Protection of Human Health and the Environment

Potential MEC remaining at the site poses an explosive hazard to humans. The implementation of LUCs would reduce the probability of a human encounter with MEC and the potential for an unintended MEC detonation, which could result in injury or death to humans. Alternative 2 would reduce site hazards by preventing visitors from accessing the site and educating the public on MEC awareness, safety, and response. Therefore, the rating for Alternative 2 for the overall protection human health and the environment is protective.

5.2.2.2 Alternative 2: Compliance with ARARs

Action- and location-specific ARARs apply to this alternative and could readily be met during and after implementation. No chemical-specific ARARs were identified for the site. This alternative complies with ARARs.

5.2.2.3 Alternative 2: Long-Term Effectiveness and Permanence

The factors evaluated under long-term effectiveness and permanence are the magnitude of residual hazards, and adequacy and reliability of controls. Under Alternative 2, hazards related to potential MEC on-site would be reduced by educating recreational users and agricultural/occupational workers on the presence and hazards of MEC, and the appropriate response actions if MEC items

are identified. The LUCs would reduce both the probability of a human encounter with MEC and the probability that such an encounter will result in an unintended detonation of MEC, which may result in injury or death to humans. However, under Alternative 2, MEC would remain in-place at the site in accessible areas and could still potentially be encountered by workers and recreational users. The adequacy and reliability of the LUCs depend on monitoring and maintenance of the engineering and educational controls. The overall rating for Alternative 2 for long-term effectiveness and permanence is poor.

5.2.2.4 Alternative 2: Reduction of Mobility, Toxicity, or Volume

Alternative 2 does not provide a reduction in volume of MEC. Therefore, the overall rating for reduction in the mobility, toxicity, or volume of MEC is poor.

5.2.2.5 Alternative 2: Short-Term Effectiveness

Alternative 2 presents minimal hazards to the public or site workers during implementation and would have minimal impact on the environment. Initial implementation of the LUCs (i.e., instituting lease agreement or right-of-entry permit conditions, community outreach events, installation of signs, and training of DLNR, DEM, HFD, HPD staff) would likely be completed within 6 months. However, because the remedial action objective is never fully achieved under this alternative, the effectiveness of this remedy in the short-term is inadequate. The overall rating for Alternative 2 for short-term effectiveness of LUCs is good.

5.2.2.6 Alternative 2: Implementability

Implementability includes technical and administrative feasibility and availability of required resources. Alternative 2 would be technically feasible and implementable because the proposed mechanisms such as providing informational material with lease agreements or right-of-entry permits are easily implemented by DLNR or DPP. The educational controls (e.g., preparation of informational materials, and public education and outreach) are conventional and commonplace activities that are easily implemented. The overall rating for Alternative 2 for implementability is excellent.

5.2.2.7 Alternative 2: Cost

The total cost over 30 years for Alternative 2 is $1,215,704.

5.2.2.8 Alternative 2: Summary

Alternative 2 would reduce potential human interaction with MEC and the probability that such an encounter would result in an unintended detonation of MEC, which may result in injury or death to humans. However, under Alternative 2, MEC would remain in-place at the site and could still potentially be encountered by workers and visitors on approved trails.

5.2.3 Alternative 3 – Removal of MEC in Highly Accessible Areas and LUCs

Alternative 3 is a combination of the LUCs from Alternative 2 with a limited removal of surface and subsurface MEC and MD in highly accessible areas. The limited removal would be performed over 3 acres in high-traffic areas identified by the CEPOH and USAESCH, in coordination with DLNR, specifically, along the Maunawili Falls and Maunawili Demonstration hiking trails. Similar to Alternative 2, statutory five-year reviews are required, though not part of the remedy. The cost of 5-year reviews is included in the cost analysis of this remedy.

5.2.3.1 Alternative 3: Overall Protection of Human Health and the Environment

Potential MEC remaining at the site poses an explosive hazard to humans; therefore, limited removal of MEC from the highly accessible and most frequented areas of the site would significantly reduce, if not eliminate, the potential for human interaction with MEC. Following removal of MEC from these areas, implementation of the indicated LUCs would reduce the probability of a human encounter with MEC and the potential for an unintended MEC detonation, in other areas outside of the limited MEC removal areas by restricting site access and activities as well as educating the public on MEC awareness, safety, and response. The rating for Alternative 3 for overall protection of human health and the environment is protective.

5.2.3.2 Alternative 3: Compliance with ARARs

Action- and location-specific ARARs apply to this alternative and could readily be met during and after alternative implementation. No chemical-specific ARARs were identified for the site. This alternative complies with ARARs.

5.2.3.3 Alternative 3: Long-Term Effectiveness and Permanence

Under Alternative 3, hazards related to potential MEC on-site would be reduced by removing MEC from areas accessible to workers and recreational users and educating residents and visitors on the site access limitations, the presence and hazards of MEC, and the appropriate response actions should MEC be identified. These activities would significantly reduce both the probability of a human encounter with MEC and the probability that such an encounter would result in an unintended detonation of MEC, which may result in injury or death to humans. Under this alternative, MEC could potentially remain in-place in other areas of the MVIA – West that are not readily accessible to the public due to dense vegetation and steep and rugged terrain. However, given the ruggedness of the terrain and the lack of trails, the remaining areas are considered relatively inaccessible for these visitors and site workers and the probability of a human encounter with MEC is low. The overall rating for Alternative 3 for long-term effectiveness and permanence is very good.

5.2.3.4 Alternative 3: Reduction of Mobility, Toxicity, or Volume

Alternative 3 includes reduction of MEC items found in highly frequented areas, by demolition. Treatment by demolition would permanently reduce the mobility and volume from the site in highly frequented areas. The mobility, toxicity, and volume of MEC items in areas of that site that are not cleared will not be reduced. Therefore, the overall rating for reduction of mobility, toxicity, or volume is very good.

5.2.3.5 Alternative 3: Short-Term Effectiveness

Alternative 3 presents no additional hazard to the public during implementation because public access would be prohibited within areas undergoing removal activities in accordance with federal guidance. Alternative 3 presents minimal hazards to site workers during implementation because UXO-trained personnel would perform the removal, which includes removal of surface and subsurface MEC, in accordance with federal safety guidelines. Implementation of LUCs does not present increased hazards to the public or site workers. Alternative 3 would minimally impact the environment because clearance activities (e.g., hiking on the terrain and demilitarization of MEC) would be limited to 3 acres of the site. Initial implementation of the LUCs, including the inclusion of MEC-related educational materials with leases and right-of-entry permits, and educational controls (e.g. community outreach events, and training of DLNR, DEM, HFD, HPD staff) would likely be completed within a 6-month duration. Limited removal activities would likely be completed within a 12-month duration. Furthermore, this alternative achieves the RAO in a reasonable period of time; the exposure to explosive hazards would be reduced to acceptable levels once removal action and LUCs are implemented. The overall rating for Alternative 3 for short-term effectiveness of Removal of MEC in Highly Accessible Areas and LUCs is excellent.

5.2.3.6 Alternative 3: Implementability

Alternative 3 is technically feasible. The LUC portion of this alternative would be easily implemented because the proposed administrative mechanisms and educational controls (e.g., installation of signs, training, and public education and outreach) are conventional and commonplace activities. The removal portion of this alternative would be relatively easy to implement. The trained technical personnel and equipment would be readily available; however, the ruggedness of the site may require more advanced logistical preparation and coordination. The overall rating for Alternative 3 for implementability is excellent.

5.2.3.7 Alternative 3: Cost

The total cost for Alternative 3 is $1,714,668, which is comprised of $584,109 for the capital costs for the removal action and $1,130,559 for the 30 years of LTM of the LUCs.

5.2.3.8 Alternative 3: Summary

Alternative 3 would significantly reduce both the probability of a human encounter with MEC and the unintentional detonation of MEC, which may result in injury or death to humans, particularly in highly frequented areas of the site. Under Alternative 3, MEC would remain in-place in the remaining areas of the site. However, given the ruggedness of the terrain and dense vegetation, the remaining areas are considered relatively inaccessible for these visitors and site workers and the probability of a human encounter with MEC is low.

5.2.4 Alternative 4 – Complete Removal of MEC in High Density Areas

Alternative 4 includes complete removal of surface and subsurface MEC and MD in 96 acres of high density areas identified as impact and target areas.

5.2.4.1 Alternative 4: Overall Protection of Human Health and the Environment

Alternative 4 would remove hazards to humans from MEC by removing surface and subsurface MEC and MD found in impact and target areas. The rating for Alternative 4 for overall protection of human health and the environment is protective.

5.2.4.2 Alternative 4: Compliance with ARARs

Action- and location-specific ARARs apply to this alternative and could readily be met during alternative implementation. No chemical-specific ARARs were identified for the site. This alternative complies with ARARs.

5.2.4.3 Alternative 4: Long-Term Effectiveness and Permanence

Alternative 4 would remove MEC from the impact and target areas, thus permanently removing the explosive hazard to the public from MEC. The overall rating for Alternative 4 for long-term effectiveness and permanence is excellent.

5.2.4.4 Alternative 4: Reduction of Mobility, Toxicity, or Volume

Alternative 4 includes a complete removal of MEC in high density areas identified as impact and target areas, which would remove surface and subsurface MEC and permanently remove the mobility, toxicity, and volume of MEC. Therefore, the overall rating for reduction of mobility, toxicity, or volume through destruction of MEC is excellent.

5.2.4.5 Alternative 4: Short-Term Effectiveness

Alternative 4 presents no additional hazard to the public during implementation because public access would be prohibited within areas undergoing removal activities in accordance with federal guidance. Alternative 4 would present minimal hazard to site workers during implementation because UXO-trained personnel would perform the removal in accordance with federal safety

guidelines. However, Alternative 4 would severely impact the environment because clearance activities (e.g., significant vegetation removal and demilitarization of MEC) would occur possibly denuding large areas of the rainforest. Removal activities would likely be completed within 18 months. This alternative also achieves the RAO in a reasonable period of time because the exposure to explosive hazards would be reduced to acceptable levels once the removal action is complete.

5.2.4.6 Alternative 4: Implementability

Alternative 4 is technically feasible and though relatively difficult to implement. The trained technical personnel and equipment would be readily available; however, the ruggedness of the terrain and dense vegetation impedes the implementation of the remedial action. Additionally, it may require more advanced logistical preparation and coordination. The overall rating for Alternative 4 for implementability is poor.

5.2.4.7 Alternative 4: Cost

The total cost for Alternative 4 is $5,431,686.

5.2.4.8 Alternative 4: Summary

Alternative 4 would permanently remove explosive hazards to the public and environment from MEC within the high density areas by removing MEC. However, the cost for implementation of this alternative is high.

5.3 Comparison of Remedial Alternatives

This section compares the four alternatives with one another. The discussion of each evaluation criterion generally proceeds from the alternative that best satisfies the criterion to the one that least satisfies the criterion. Appendix B, Table 5-3 summarizes the comparison of the four remedial alternatives relative to each other and the seven NCP criteria evaluated.

5.3.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is a threshold criterion. Protection is not measured by degree; rather, each alternative is considered as either protective or not protective. Alternatives 2, 3, and 4 are protective. Alternative 1 is not protective.

5.3.2 Compliance with ARARs

Compliance with ARARs is a threshold criterion. An alternative must either comply with ARARs or provide grounds for a waiver. Alternatives 2, 3, and 4 comply with ARARs. Alternative 1 does not include any response action, thus ARARs are not applicable.

5.3.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternative 4 is rated the highest with a rating of excellent because it would remove surface and subsurface MEC from the high density areas identified as impact or target areas, thereby permanently removing explosive hazards to the public and environment from MEC. Alternative 3 is rated very good because it would significantly reduce the explosive hazard to the public and environment from MEC; however, under Alternative 3, MEC may remain in less accessible areas of the site and present a low but not zero hazard. Alternative 2 is ranked poor because MEC would not be removed. Alternative 1 is rated not acceptable because it does not provide any long-term effectiveness or permanence since no response action would be undertaken.

5.3.4 Reduction of Mobility, Toxicity, or Volume

Alternative 4 is rated highest with a rating of excellent because it would remove surface and subsurface MEC from the high density areas identified as impact or target areas and permanently remove the mobility, toxicity, and volume of MEC through demolition. Alternative 3 is rated very good because it would also reduce the mobility, toxicity, and volume of MEC through destruction, albeit less than the complete removal of MEC in high density areas. Alternatives 1 and 2 are rated poor because neither alternative includes a reduction component for MEC.

5.3.5 Short-Term Effectiveness

Alternative 3 is rated highest with a rating of excellent for short-term effectiveness because the removal action conducted in highly accessible areas and the LUCs could be implemented within 6 to 12 months and would reduce explosive hazards to the public from MEC in the short term. The limited removal actions and LUC implementation in Alternative 3 would not result in increased hazards to the public or site workers and would have minimal impact on the environment. Alternative 3 achieves the RAO in a reasonable period of time. Alternative 2, LUCs, is rated lower than Alternative 3 because while it also can be implemented quickly and reduces the potential for public interaction with MEC in the short-term, it does not achieve the RAOs in a reasonable period of time. Alternative 2 is rated good for this criteria. Alternative 4 is rated good because it would not result in increased hazards to the public or site workers during implementation and it achieves the RAOs in a reasonable period of time, but it takes longer to implement than Alternatives 2 and 3 and would have a significant impact on the environment in the short term. Alternative 1 is rated not acceptable for short-term effectiveness because, by undertaking no response action, explosive hazards to the public would remain from MEC potentially present at the site.

5.3.6 Implementability

Alternatives 1, 2, and 3 were rated excellent for implementability because they are technically feasible; the alternatives are conventional and commonplace; and the technical expertise, labor, equipment, and materials would be readily available. Alternative 4 (Complete Removal of MEC

in High Density Areas) was rated poor because the rugged terrain of the site is difficult to traverse and therefore would be difficult to implement.

5.3.7 Cost

Alternative 1 requires no action; therefore, no costs are associated with this alternative. Alternative 2 is the least cost at a total cost of $1,215,704 because it is limited to LUCs. Alternative 3, which includes a limited removal in addition to LUCs, has a total cost of $1,714,668. Alternative 4, which entails a removal over 96 acres of extremely rugged terrain, is the most expensive alternative at a total cost of $5,431,686.

5.3.8 Overall Summary of Alternatives

5.3.8.1 Alternative 3, Removal in of MEC Highly Accessible Areas and LUCs received the highest rating with an overall rating of very good. This alternative, when compared against the other three alternatives, presents the best alternative for achieving overall protection of human health and the environment in compliance with ARARs. Because MEC hazards will be removed from the ancillary trails and accessible areas adjacent to the trails, which are the areas most frequently accessed, the long-term effectiveness and permanence and reduction of mobility, or volume of the potential hazards criteria for Alternative 3 were rated as very good. The short-term effectiveness and implementability were rated as excellent because this alternative is relatively easy to implement and can be completed within 12 months, with the fieldwork conducted in less than 2 months. It also achieves the RAO within a reasonable amount of time.

5.3.8.2 Alternatives 2 and 4 received overall ratings of good; however, the cost for Alternative 4 is significantly higher than Alternatives 2 and 3 for minimal additional reduction in hazards as demonstrated by the MEC HA. Alternative 4 also presents a significant increase in the impacts to the environment during implementation and is much more difficult to implement than Alternatives 2 or 3.

5.3.8.3 Alternative 2 would reduce the probability of a human interaction with MEC and the probability that such an encounter would result in an unintended detonation of MEC; however, highly frequented areas would not be cleared of MEC, resulting in a greater hazard to the public and environment than under Alternative 3 or 4. The long-term effectiveness and permanence and the reduction of mobility, or volume criteria were rated as poor, resulting in Alternative 2 receiving an overall rating of good.

5.3.8.4 Alternative 1 is not protective of the public or the environment; therefore, it is not eligible for selection as the preferred alternative.

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Appendix A Figures

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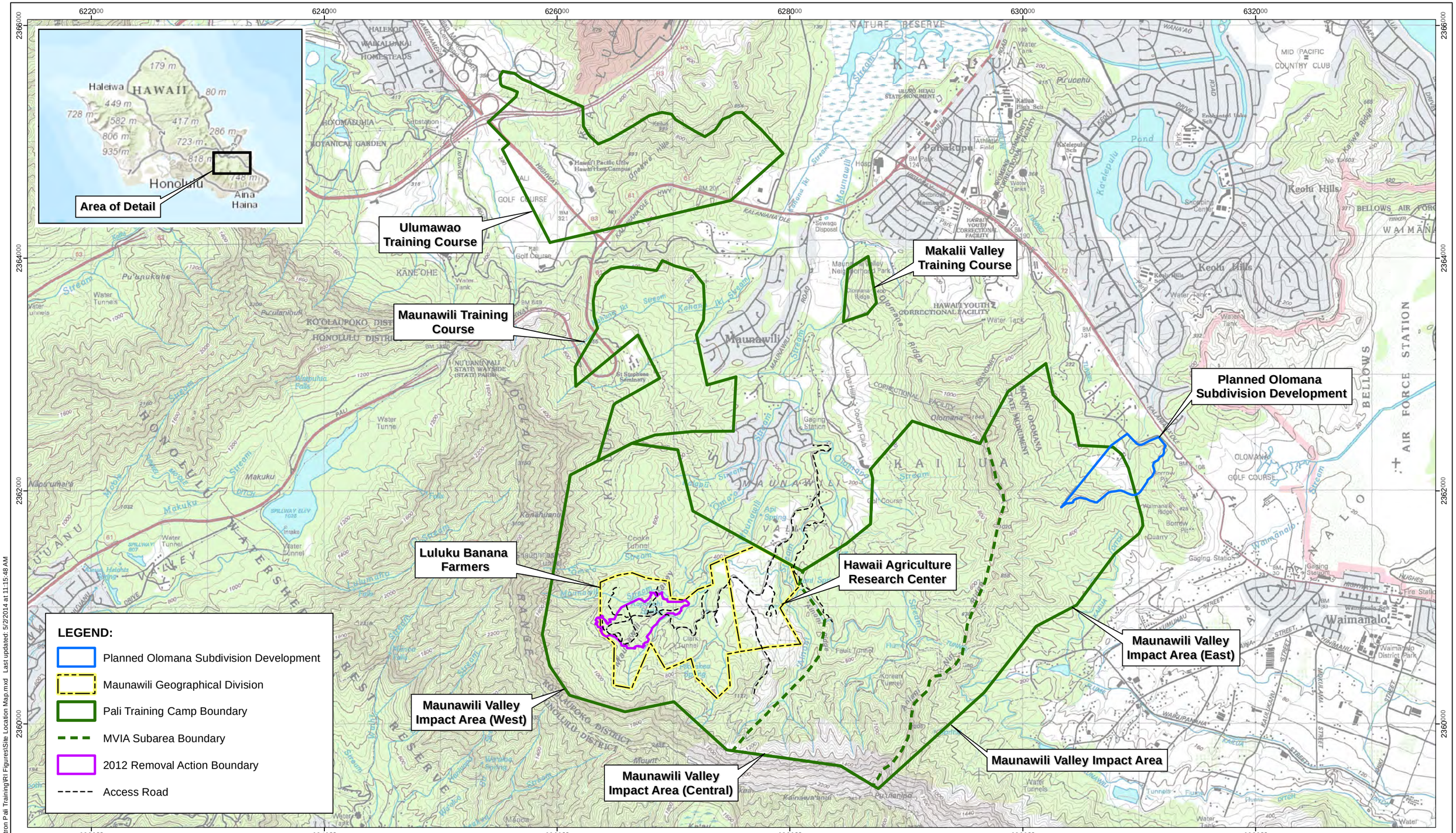

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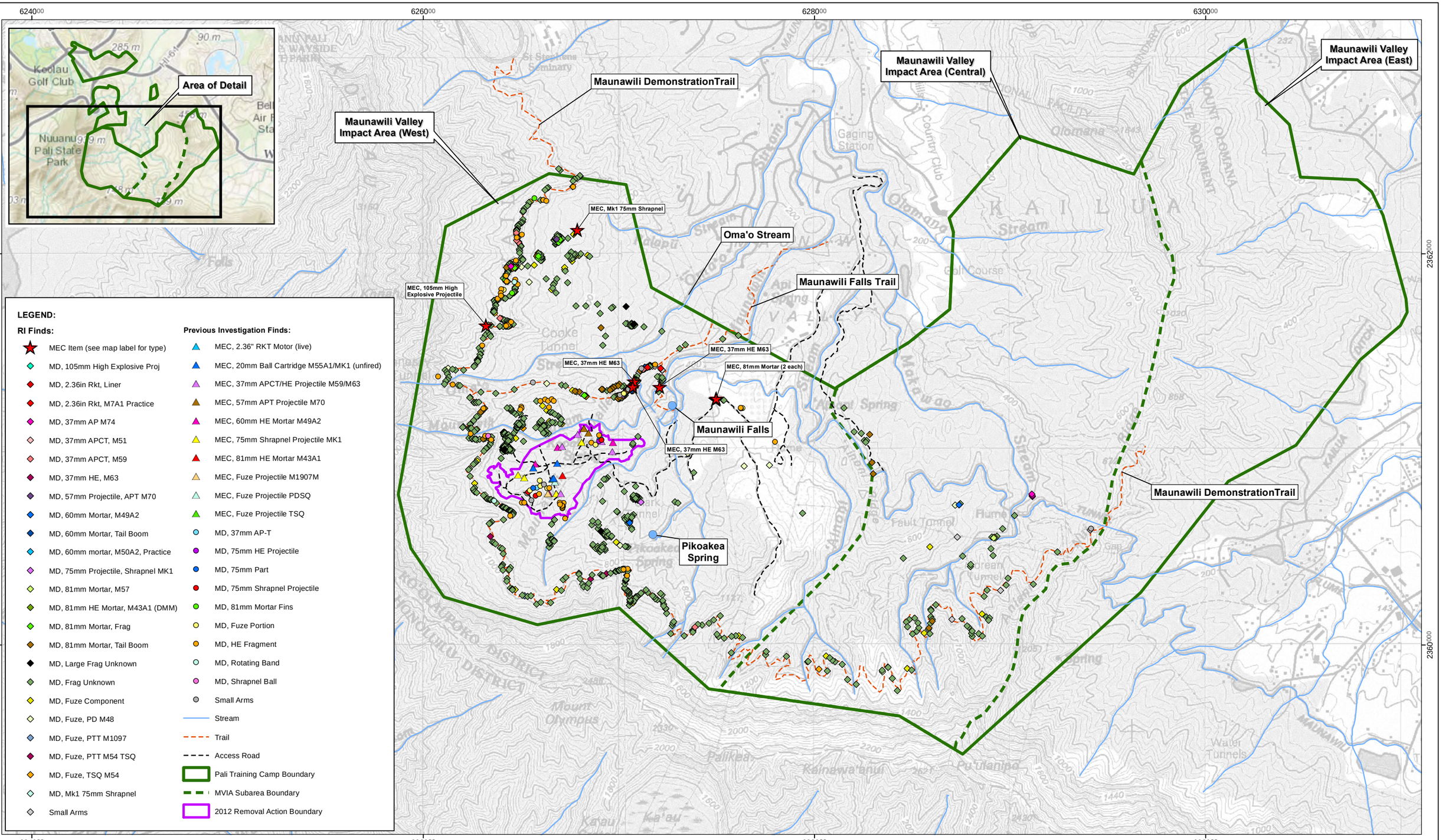
Coordinate System: Universal Transverse Mercator NAD83, Zone 4 North
Sources: U.S. Geological Survey; U.S. Army Corps of Engineers
References: "Site Investigation Report, Pali Training Camp, Heeia Combat Training Area, and Waikane Training Area, Oahu, Hawaii," September 2009, prepared by Wil Chee-Planning, Inc.

N

0 2,500

SCALE: 1" = 2,500'

PROJECT: Pali Training Camp FUDS Project No. H09HI0277	**SITE LOCATION MAP**			
LOCATION: City and County of Honolulu, Hawaii	DRAWN BY: MKH 5/2/2014	CHECKED BY: JC 5/2/2014	PROJECT NO. 2012-128	FIG NO. **A1-1**



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Coordinate System: Universal Transverse Mercator NAD83, Zone 4 North
Sources: U.S. Geological Survey; U.S. Army Corps of Engineers
References: "Site Investigation Report, Pali Training Camp, Heeia Combat Training Area, and Waikane Training Area, Oahu, Hawaii," September 2009, prepared by Wil Chee-Planning, Inc.

PROJECT: Pali Training Camp FUDS Project No. H09HI0277	MVIA WITH RI AND PREVIOUS INVESTIGATION FINDS			
LOCATION: City and County of Honolulu, Hawaii	DRAWN BY: MKH 5/8/2014	CHECKED BY: JC 5/8/2014	PROJECT NO. 2012-128	FIG NO. A2-1

6240000 6260000 6280000

2362000 2360000

Rest Area

Maunawili Falls Trail

Stream Crossing

Scout Area

Maunawili Falls

Base of Waterfall (Approx.)

0 250

SCALE: 1" = 250'

Area of Detail

Maunawili Valley Impact Area (Central)

Maunawili Valley Impact Area (West)

Maunawili DemonstrationTrail

LEGEND:

- Proposed Areas of MEC Removal
- Approximate Area with Slope > 18 Degrees
- Pali Training Camp Boundary
- MVIA Subarea Boundary
- MD/Small Arms
- MEC Item
- MEC Item (From 2012 Removal Action)
- Stream
- Trail

Coordinate System: Universal Transverse Mercator NAD83, Zone 4 North
Sources: U.S. Geological Survey; U.S. Army Corps of Engineers

0 1,000

SCALE: 1" = 1,000'

PROJECT: Pali Training Camp FUDS Project No. H09HI0277	**ALTERNATIVE 3: REMOVAL OF MEC IN HIGHLY ACCESSIBLE AREAS**		
LOCATION: City and County of Honolulu, Hawaii	DRAWN BY: LCV 12/05/2014	CHECKED BY: CAL 12/05/2014	PROJECT NO. 2012-128 / FIG NO. A4-1

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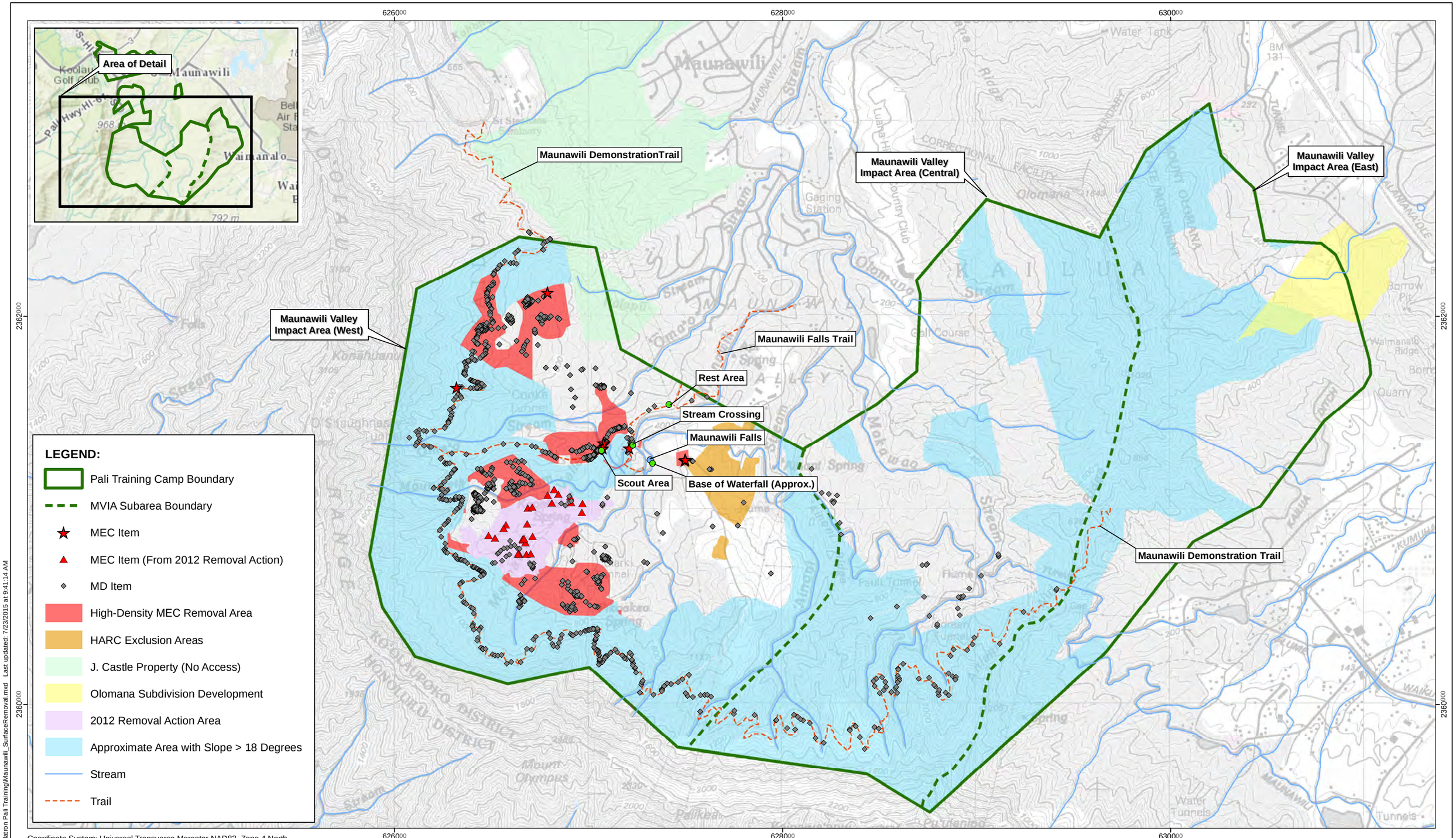

Coordinate System: Universal Transverse Mercator NAD83, Zone 4 North
Sources: U.S. Geological Survey; U.S. Army Corps of Engineers

0 2,000
SCALE: 1" = 1,500'

PROJECT: Pali Training Camp FUDS Project No. H09HI0277	ALTERNATIVE 4: COMPLETE REMOVAL OF MEC IN HIGH DENSITY AREAS			
LOCATION: City and County of Honolulu, Hawaii	DRAWN BY: LCV 12/05/2014	CHECKED BY: CAL 12/05/2014	PROJECT NO. 2012-128	FIG NO. A4-2

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Appendix B Tables

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Table 3-1. ARARs for Remedial Actions within the Maunawili Valley Impact Area – West

Requirement	Citation	Description	Governmental Authority	ARAR/ Information Type	Applicability to Site
MEC Activities					
Detonation	40 CFR § 264.601 (RCRA, Subpart X)	Requires miscellaneous units for the management of hazardous waste, such as open burning/open detonation units, to be located, designed, constructed, operated, maintained, and closed in a manner that will ensure protection of human health and the environment.	Federal	Action-Specific	MEC recovered during a remedial action may need to be detonated or burned before off-site disposal. Permits are not required for on-site response actions conducted under CERCLA. Only the substantive requirements of Subpart X are considered ARARs.
Conservation and Protection of Ecological and Cultural Resources					
Endangered Species Act	16 USC § 1538(a)(1)(B) and 1536(a)(2)	Prohibits the "taking" of any federally listed threatened or endangered species of fish or wildlife. In addition, federal agencies must ensure that their actions will not jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the designated critical habitat of a listed species.	Federal	Location-Specific	Multiple threatened and endangered species are located within the site. Formal consultation is not an ARAR because it is an administrative requirement.
Indigenous Wildlife, Endangered and Threatened Wildlife, and Introduced Wild Birds	Hawaii Revised Statutes Title 12, Chapter 195D-4(e)(2) Hawaii Administrative Rules Title 13, Chapter 124-3(b)(1)	Prohibits the take of any threatened or endangered species of aquatic life, wildlife, or land plant within the State of Hawaii. In addition to species listed under the federal Endangered Species Act, the prohibition on take under the state endangered species law applies to certain other indigenous species identified under state law as endangered or threatened.	State	Location-Specific	Multiple threatened and endangered species are located within the site. Only substantive requirements are considered ARARs.

Table 3-2. Initial Screening of Technologies and Process Options

GRA	Remedial Technology Type	Process Option	Process Option Description	Retained/Eliminated for Further Evaluation	Comments
Land Use Controls	Legal Mechanisms	Restrictive Covenants, Zoning, and Permitting	Restricts use of parcel through environmental restrictive covenants that will run with the land, zoning limitations, or permitting requirements. Addresses land use and restricted activities.	Retained	Easily implemented, effective, low cost
	Educational Controls	Community Outreach and Visitor Education through Installation of Signs	Restrict potential exposure to MEC and unintentional detonation by educating the public and visitors on the presence and identification of MEC and appropriate response actions should MEC be identified with, but not limited to with warning signs.	Retained	Easily implemented, effective, moderate cost
Limited and Complete Removal of MEC	Identification, Demolition (as required), and Off-site Disposal of MEC and MD	Limited Clearance of MEC	Significantly reduce potential exposure to and unintentional detonation of MEC by performing a surface and subsurface clearance and removal of MEC from up to 3 acres. Specifically, in high-traffic areas along selected hiking trails.	Retained	Low to moderately difficult to implement, effective, moderate cost
		Complete Clearance of MEC	Remove the MEC hazard from the site by identifying and removing surface and subsurface MEC and MD 96 acres of high density areas, identified as impact or target areas within MVIA - West.	Retained	Difficult, effective, high cost

Notes:
GRAs = general response actions
MD = munitions debris
MEC = munitions and explosives of concern
NCP = National Oil and Hazardous Substances Pollution Contingency Plan

Table 3-3. Detection Technologies

Technology	MRS	Effectiveness	Implementability	Cost	Representative Systems	Notes	Viability at MRS/Status of Retention
Visual Searching	Land	**Low:** Effective for surface clearance in open areas with little ground cover. However, no surface MEC/MD was identified during the RI. Not appropriate for subsurface clearance.	**Easy:** Easily implemented by qualified UXO Technicians and sweep personnel. Minimal to no impacts to cultural or natural resources.	**Low**	NA	Typically supported with magnetometer or metal detectors	**Low/Not Retained:** Visual detection of MEC/MD as a standalone technology would not be effective since the risk for exposure is subsurface.
Flux-Gate Magnetometers: Fluxgate magnetometers measure the vertical component of the geomagnetic field along the axis of the sensor and not the total intensity of the geomagnetic field.	Land	**Moderate - High:** Flux-gate magnetometers have been used as the primary detector in traditional mag & dig operations. There is a high industry familiarization. Detects ferrous objects only.	**Easy:** Light and compact. Can be used in any traversable terrain. Costs, transportation, and logistics requirements are equal to or less than other systems. Widely available from a variety of sources. Minimal to no impacts to cultural or natural resources.	**Low:** A number of flux-gate magnetometers have a low cost for purchase and operation compared to other detection systems.	Schonstedt GA-52Cx Schonstedt GA-72Cd Foerster FEREX 4.032	Analog output not usually coregistered with navigational data.	**Low /Not Retained:** This technology is not effective due to the volcanic nature of the soil/rocks at PTC.
Proton Precession Magnetometers: Proton precession magnetometers measure the total intensity of the geomagnetic field. Multiple sensors are sometimes arranged in proximity to measure horizontal and vertical gradients of the geomagnetic field.	Land	**Low:** Proton precession systems have similar sensitivities as flux-gate systems, but with a relatively slow sampling rate. There is a high industry familiarization. Detects ferrous objects only.	**Moderate:** Generally is heavier and requires more battery power than flux-gate sensors. Sampling rate is low. Can be used in any traversable terrain. Is widely available from a variety of sources. Minor impacts to cultural or natural resources based on clearing of areas for data collection.	**Moderate:** Costs are higher than flux-gate systems because proton precession systems often acquire digital data.	Geometrics G-856AX GEM Systems GSM-19T		**Low/Not Retained:** Proton precession systems are not viable options as a standalone detection system at the MRSs because of low effectiveness.
Optically Pumped Magnetometers: This technology is based on the theory of optical pumping and operates at the atomic level as opposed to the nuclear level (as in proton precession magnetometers).	Land	**High:** This is the industry standard technology to detect MEC using magnetic data analysis. There is a high industry familiarization. Detects ferrous objects only.	**Moderate to Difficult:** Equipment is digital, rugged, and weather resistant. Common systems weigh more than most flux-gate systems and are affected by heading error. Can be used in most traversable terrain. Widely available from a variety of sources. Processing and interpretation requires trained specialists. Detection capabilities are negatively influenced by iron-bearing soils, which are present in the MRS based on RI findings and known geology. Minor impacts to cultural or natural resources based on clearing of areas for high quality data collection.	**Moderate – High:** Has high purchase cost compared to other technologies. More dependent on terrain than flux-gate magnetometers. Lower costs can be realized when using arrays of multiple detector sensors.	Geometrics G-858 GEM Systems GSMP-40 Scientrex Smart Mag	Digital signal should be coregistered with navigational data for best results.	**Moderate/Not Retained:** While optically pumped magnetometers can be high effective, they are more difficult to use and have a higher cost than flux-gate magnetometers.
Time-Domain Electromagnetic Induction (TDEMI) Metal Detectors: TDEMI is a technology used to induce a pulsed magnetic field beneath the Earth's surface with a transmitter coil, which in turn causes a secondary magnetic field to emanate from nearby objects that have conductive properties.	Land	**High:** TDEMI technology is the industry standard for MEC detection using electromagnetic data analysis. There is a high industry familiarization. Detects both ferrous and non-ferrous metallic objects. Can be limited by terrain.	**Easy - Moderate:** Sensors are typically larger than digital magnetometers. Can be used in most traversable terrain. Most commonly used instrument and is widely available. Processing and interpretation are relatively straightforward. Anomaly classification possibilities exist for multi-channel systems. Minor impacts to cultural or natural resources based on clearing of areas for high quality data collection.	**Moderate – High:** Has higher purchase cost compared to other technologies. Dependent on terrain. Lower costs can be realized when using arrays of multiple detector sensors.	Geonics EM61-MK2, -MK2A, -HH, EM63 G-tek/GAP TM5-EMU Schiebel AN PSS-12	Digital signal should be coregistered with navigational data for best results.	**High/Retained:** This technology was proven effective within the MVIA MRS during the EE/CA and was relatively easy to implement.

Table 3-3. Detection Technologies (continued)

Technology	MRS	Effectiveness	Implementability	Cost	Representative Systems	Notes	Viability at MRS/Status of Retention
Advanced Electromagnetic Induction (EMI) Sensors and Anomaly Classification: Advanced sensors have the ability to precisely capture measurements from enough locations to sample all principal axis responses of an anomaly/item of interest. This provides the necessary information for analysis and classification of hazardous and nonhazardous items.	Land	**Moderate – High:** Some sensors may be used in production mode, but most require target locations from previous DGM survey to navigate to for static measurements. Greatest ability of all sensors for the classification of anomalies as either MEC or non-hazardous items. Detects both ferrous and non-ferrous metallic objects	**Moderate:** Most require the use of a vehicle to tow the sensor to the location of an anomaly, although some smaller, man-portable systems are in development. One-meter-wide coil width (or greater) limits accessibility in forested or steeply sloped areas. Advanced analysis is required to effectively use the data acquired by the sensors and accurately classify detected anomalies as MEC or non-hazardous material that will not be removed.	**High:** Use of the advanced systems often represents additional surveying and processing costs, which may be offset by the decrease in the intrusive investigation costs.	ALLTEM Berkeley UXO Discriminator (BUD) BUD Handheld Geometrics MetalMapper (MM) TEMTADS 2x2 Man Portable Vector (MPV)	Sensors have limited industry availability. Requires advanced training for operation, data processing, and analysis. Government standards for use not yet developed/finalized.	**Low /Not Retained:** This technology has been demonstrated and validated by the DoD's Environmental Security Technology Certification Program (ESTCP). The technology would be generally difficult to implement in areas with vegetation. Only the Metal Mapper is currently commercially available. All other systems are under development or in testing.
Frequency-Domain Electromagnetic Induction (FDEMI) Metal Detectors: FDEMI sensors generate one or more defined frequencies in a continuous mode of operation.	Land	**Moderate - High:** Some digital units have been used as the primary detector in highly ranked systems. Demonstrates capability for detecting small items using handheld units. Is not optimum for detecting deeply buried objects. Detects both ferrous and non-ferrous metallic objects.	**Easy:** Hand-held detectors are generally light and compact. Can be used in any traversable terrain. Most are handheld systems. Widely available from a variety of sources. Minimal to no impacts to cultural or natural resources.	**Low:** Instruments are slow and can detect very small items. Common handheld detectors are much lower cost than digital systems.	White's All Metals Detector Fisher 1266X Foerster Minex 2FD Minelab Explorer SE Minelab E-TRAC Minelab F3 Vallon VMH3		**High/Retained:** FDEMI detects all metals, instead of only ferrous items. The Minelab Explorer SE was proven effective during the RI and 2012 Removal Action.
Sub Audio Magnetics (SAM): SAM is a patented methodology by which a total field magnetic sensor is used to simultaneously acquire both magnetic and electromagnetic response of subsurface conductive items.	Land	**Low:** Detects both ferrous and non-ferrous metallic objects. Capable tool for detection of deep MEC. Low industry familiarization. System has seen limited application.	**Difficult:** High data processing requirements. Available from a few sources. High power requirements. Has longer than average setup times. Minor impacts to cultural or natural resources based on clearing of areas for high quality data collection.	**High:** Has higher than average operating costs and low availability.	G-tek/GAP SAM	Not commercially available. No established track record.	**Low/Not Retained:** Difficult to implement, high cost, not commercially available.
Magnetometer-Electromagnetic Detection Dual Sensor Systems: These dual sensor systems are expected to be effective in detecting MEC as magnetometers respond to large, deep ferrous targets and TDEMI sensors respond to nonferrous metallic targets.	Land	**High:** Collects co-located magnetic and electromagnetic data to differentiate between ferrous and nonferrous metallic objects. Has medium industry familiarization.	**Moderate - Difficult:** Increased data processing requirements. Similar terrain constraints to time-domain electromagnetic systems. Available from few sources. Minor impacts to cultural or natural resources based on clearing of areas for high quality data collection.	**High:** Costs are lower when using a towed array platform. Limited availability.	MSEMS (man-portable EM61-hh & G-822) VSEMS (vehicular EM61-hh & G-822)	Only available from a few sources.	**Low/Not Retained:** Difficult to implement, high cost, only available from a few sources.
Airborne Synthetic Aperture Radar (SAR): This airborne method uses strength and travel time of microwave signals that are emitted by a radar antenna and reflected off a distant surface object.	Land	**Low:** Detects both metallic and non-metallic objects. Only detects largest MEC on or near ground surface. Low industry familiarization. Effectiveness increases when used for wide area assessment in conjunction with other airborne technologies.	**Difficult:** Requires aircraft and an experienced pilot. Substantial data processing and management requirements. Available from few sources. Minimal to no impacts to cultural or natural resources.	**High:** Aircraft and maintenance costs must be included. Processing costs are higher than other methods.	Intermap Technologies Corp., (STAR systems)	Typically not applied to detect MEC.	**Low/Not Retained:** Low effectiveness in clearance activities, difficult to implement, high cost.

Table 3-3. Detection Technologies (continued)

Technology	MRS	Effectiveness	Implementability	Cost	Representative Systems	Notes	Viability at MRS/Status of Retention
Differential Global Positioning System (DGPS): Global Positioning System (GPS) is a worldwide positioning and navigation system that uses a constellation of 29 satellites orbiting the Earth. GPS uses these satellites as reference points to calculate positions on the Earth's surface. Advanced forms of GPS, like DGPS, can provide locations to centimeter accuracy	Land	**High:** Very effective in open areas for both digital mapping and reacquiring anomalies. Very accurate when differentially corrected. Not effective in wooded areas or around large buildings. Commonly achieves accuracy to a few centimeters, but degrades when minimum satellites are available.	**Easy - Moderate:** Easy to operate and set up. Requires trained operators. Available from a number of vendors. Better systems are typically rugged and very durable. However, significant work time can be lost when insufficient satellites are available because of topography and tree canopy. Minor impacts to cultural or natural resources based on clearing of areas for high quality data collection.	**High:** Requires rover and base station units. Survey control points required for high accuracy results.	Leica GPS 1200 Trimble R8 Thales Ashtech Series 6500	Recommended in open areas.	**Moderate-High/Retained:** This technology may not be effective in areas with tree canopy, but was used effectively during the RI.
Robotic Total Station (RTS): RTS is a laser-based survey station that derives its position from survey methodology and includes a servooperated mechanism that tracks a prism mounted on the geophysical sensor.	Land	**Moderate - High:** Effective in open areas for both digital mapping and reacquiring anomalies. Effective around buildings and sparse trees. Is being used in heavily wooded areas with moderate success. Commonly achieves accuracy to a few centimeters.	**Easy - Moderate:** Relatively easy to operate with trained personnel. Requires existing control. Minor impacts to cultural or natural resources based on clearing of areas for high quality data collection.	**High:** Operates as a stand-alone unit. Typically requires survey control points but can be used in a relative coordinate system.	Leica RTS 1100 Trimble Model 5600	Recommended in open areas and in moderately wooded areas. Typically used with TDEMI metal detectors (like Geonics EM61-MK2) and digital magnetometers (like Geometrics G-858).	**Moderate/Retained:** This technology could be effective in open areas but was not used during the RI.
Fiducial Method: The fiducial method consists of digitally marking a data string with an indicator of a known position. Typically, markers are placed on the ground at known positions (e.g., 25 feet).	Land	**Moderate:** Moderate to high effectiveness when performed by experienced personnel. Low effectiveness when used by inexperienced personnel. Commonly achieved accuracy is 15 to 30 centimeters.	**Moderate:** Application requires a constant pace and detailed field notes. Can be used anywhere, with varying degrees of complexity in the operational setup. Minor impacts to cultural or natural resources based on clearing of areas for high quality data collection.	**Moderate:** Minimal direct costs associated with this method; however, poor results may negatively impact costs associated with target resolution.	NA	Requires very capable operators. Useful method if digital positioning systems are unavailable.	**Moderate/ Retained:** Because of the vegetation at the MRS, only a small accessible area remains where the fiducial method could be used.
Odometer Method: This method utilizes an odometer that physically measures the distance traveled.	Land	**Moderate:** Moderate to high effectiveness when performed b experienced personnel. Low effectiveness when used by inexperienced personnel. Commonly achieved accuracy is 15 to 30 centimeters in line and 20 to 80 centimeters on laterals.	**Moderate - Difficult:** Setup and operation affected by terrain/environment. Requires detailed field notes and setup times can be lengthy. Can be used anywhere, with varying degrees of complexity in the operational setup. Minor impacts to cultural or natural resources based on clearing of areas for high quality data collection.	**Low:** Minimal direct costs associated with this method; however, poor results may negatively impact costs associated with target resolution.	NA	Requires very capable operators. Useful method if digital positioning systems are unavailable.	**Low/Not Retained:** This method is impractical for use given the anticipated need for accurate anomaly resolution during a future response action.
Acoustic Method: This navigation system utilizes ultrasonic techniques to determine the location of a geophysical instrument each second. It consists of three basic elements: a data pack, up to 15 stationary receivers, and a master control center.	Land	**Low-Moderate:** Not very efficient in open areas because of substantial calibration and setup time. Effective in wooded areas although less accurate than other methods. Commonly achieves accuracy of 20 to 50 centimeters.	**Difficult:** Difficult to set up and setup requirements are complex. (However, more easily set up and used by trained personnel.) Very little available support. Negatively affected by certain aspects of the environment. Transponders have very limited range, on the order of 75 to 150 feet. Minor impacts to cultural or natural resources based on clearing of areas for high quality data collection.	**High:** Lengthy setup time can be reduced by using trained personnel. Requires more than one operator. Is expensive to purchase or rent.	USRADS	Requires trained operators. Has been used extensively in wooded areas with success.	**Low/Not Retained:** This technology is difficult to implement and has high costs limit.

Table 5-1. Comparison of Remedial Alternatives with CERCLA Criteria

Alternative	Threshold Criteria		Balancing Criteria				
	Overall Protection of Human Health and the Environment	**Compliance with ARARs**	**Long-Term Effectiveness and Permanence**	**Reduction of Mobility, Toxicity, or Volume**	**Short-Term Effectiveness**	**Implementability**	**Cost**
	Parameters considered: Overall protectiveness Adequacy and reliability of controls	Parameters considered: Compliance with ARARs during and following implementation of alternative	Parameters considered: Magnitude of residual risks Adequacy and reliability of controls	Parameters considered: Anticipated capability to reduce toxicity, mobility, or volume of contamination	Parameters considered: Exposure of the community during implementation Exposure of the workers during remedial action, environmental effects Environmental effects Time required to achieve RAOs	Parameters considered: Technical and administrative feasibility of implementing the alternative Availability of required resources and materials Availability of equipment and specialists Reliability of the technology Monitoring considerations	Parameters considered: Capital costs Operations and maintenance costs Periodic costs
Alternative 1: No Action	Not Protective	Not Applicable	Not Acceptable	Poor	Not Acceptable	Excellent	Excellent
	Not protective of human health or the environment	No response action would occur under this alternative; therefore, ARARs do not apply.	Potential exposure to MEC would not be addressed because no response would be taken, therefore the alternative is ineffective and there is no permanent remedial action.	Does not include a destruction component that would reduce the mobility, toxicity, or volume of MEC.	No further action would not pose any additional risks by implementing this alternative in the short-term.	Easily implemented because no action is necessary.	No costs incurred.
Alternative 2: LUCs	Protective	Complies	Poor	Poor	Good	Excellent	Very Good
	LUCs would reduce the probability of a human encounter with MEC and the potential for an unintended detonation by restricting site access and activities and educating the public on MEC awareness, safety, and response.	Action- and location-specific ARARs could readily be met during and after alternative implementation. Chemical-specific ARARs are not applicable.	MEC would remain in-place at the site and could still potentially be encountered by recreational users on trails and areas agricultural/occupational workers. Adequacy of LUCs depends on monitoring and maintenance of educational controls.	Does not include a destruction component that would reduce the mobility, toxicity, or volume of MEC.	LUCs would not result in increased public or site worker exposure during implementation nor impact the environment. Initial implementation of LUCs would likely be completed within 6 months. However, this alternative does not achieve the RAO in a reasonable amount of time, if ever.	Technically feasible and easily implemented because the proposed legal mechanisms and educational controls (e.g., installation of signs, preparation of information materials, and public education and outreach) are conventional and commonplace activities.	$1,215,704

Table 5-1. Comparison of Remedial Alternatives with CERCLA Criteria (continued)

Alternative	Threshold Criteria		Balancing Criteria				
	Overall Protection of Human Health and the Environment	**Compliance with ARARs**	**Long-Term Effectiveness and Permanence**	**Reduction of Mobility, Toxicity, or Volume**	**Short-Term Effectiveness**	**Implementability**	**Cost**
Alternative 3: Removal of MEC in Highly Accessible Areas and LUCs	Protective	Complies	Very Good	Very Good	Excellent	Excellent	Good
	LUCs and a limited removal in highly accessible areas would reduce the probability of a human encounter with MEC and the potential for an unintended detonation by 1) restricting site access and activities and educating the public on MEC awareness, safety, and response. And 2) removing MEC from the most highly frequented areas of the site.	Action- and location-specific ARARs could readily be met during and after alternative implementation. Chemical-specific ARARs are not applicable.	LUCs combined with a limited removal would significantly reduce both the probability of a human encounter with MEC and the probability that such an encounter would result in an unintended detonation of MEC leading to injury, death to humans. Adequacy of LUCs depends on monitoring and maintenance of engineering and educational controls.	Mobility and volume of MEC and toxicity of MC within MEC would be permanently reduced within highly frequented areas of the site through demolition.	LUCs and the limited removal would not present an increased hazard to the public or site workers during implementation. UXO-trained personnel, following federal safety guidelines, would be used during the removal. This alternative would have minimal impact on the environment. Initial implementation of LUCs likely would be completed within 6 months. Limited removal activities would likely be completed within 12 months.	LUCs would be technically feasible and easily implemented because the proposed legal mechanisms and educational controls (e.g., installation of signs, preparation of information materials, and public education and outreach) are conventional and commonplace activities. Limited removal would be technically feasible and relatively easy to implement. Trained technical personnel and equipment would be readily available; however, remoteness and ruggedness of the site would require additional logistical preparation and coordination.	$1,714,668
Alternative 4: Complete Removal of MEC in High Density Areas	Protective	Complies	Excellent	Excellent	Good	Poor	Poor
	Removing surface and subsurface MEC from the high density areas has highest overall protectiveness.	Action- and location-specific ARARs could readily be met during and after alternative implementation. Chemical-specific ARARs are not applicable.	Permanently removes hazard to the public from MEC by removal of MEC.	MEC would be removed from the high density areas through demolition; therefore, mobility, toxicity, and volume of MEC are permanently removed.	The removal would not present an increased hazard to the public or site workers during implementation. UXO-trained personnel, following federal safety guidelines, would be used during the removal. However, this alternative would have an impact on the environment. Removal activities would likely be completed within 18 months.	Removal would technically be feasible but is somewhat difficult to implement because of the rugged terrain. Trained technical personnel and equipment would be readily available; however, remoteness and ruggedness of the site would require additional logistical preparation and coordination.	$5,431,686

Notes:
ARARs = applicable or relevant and appropriate requirements
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
LTM = long term management
LUCs = land use controls
MEC = munitions and explosives of concern
RAOs = remedial action objectives
UXO = unexploded ordnance

Table 5-2. Cost Estimate Summary

Remedial Alternative	Total Cost
1	$0
2	$1,215,704
3	$1,714,668
4	$5,431,686

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Appendix C MEC HA Worksheets

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MEC HA Summary Information

Site ID:	H09HI027701R01-1
Date:	8/13/2015

Please identify the single specific area to be assessed in this hazard assessment. From this point forward, all references to "site" or "MRS" refer to the specific area that you have defined.

A. Enter a unique identifier for the site:

Maunawili Valley Impact Area (West), Oahu, Hawaii

Provide a list of information sources used for this hazard assessment. As you are completing the worksheets, use the "Select Ref(s)" buttons at the ends of each subsection to select the applicable information sources from the list below.

Ref. No.	Title (include version, publication date)
1	CEPOH, 1994. Inventory Project Report
2	Zapata, 2008. Engineering Evaluation/Cost Analysis
3	Wil Chee, 2009. Site Investigation
4	Environet, 2012. Removal Action at Maunawili Valley Impact Area
5	Huikala, 2013. RI Work Plan

B. Briefly describe the site:

1. Area (include units): 1096 acres
2. Past munitions-related use:

Target Area

3. Current land-use activities (list all that occur):

Undeveloped forest, recreational (hiking, horseback riding, biking), agricultural.

4. Are changes to the future land-use planned? No
5. What is the basis for the site boundaries?

The MRS boundaries are based on historical and current real estate records.

6. How certain are the site boundaries?

Former training activities in the area were fairly confined to the western portion of Mauanwili Valley, which naturally bowl-shaped.

Reference(s) for Part B:

CEPOH, 1994. Inventory Project Report
Zapata, 2008. Engineering Evaluation/Cost Analysis
Wil Chee, 2009. Site Investigation
Huikala, 2013. RI Work Plan

C. Historical Clearances

1. Have there been any historical clearances at the site? Yes, subsurface clearance
2. If a clearance occurred:
   a. What year was the clearance performed? 2012
   b. Provide a description of the clearance activity (e.g., extent, depth, amount of munitions-related items removed, types and sizes of removed items, and whether metal detectors were used):

A removal action was conducted on 40 acres located in the southwest portion of the MRS. Approximately 1,067 pounds of MD was removed and 26 MEC items were identified. MEC items included (60-mm HE mortar, M49A2; 37-mm HE projectile, M63; 20-mm ball cartridge, MK1 (unfired); 75-mm shrapnel projectile, MK1; fuze of a projectile TSQ; fuze of a projectile PDSQ; 20-mm ball cartridge, M55A1 (unfired); 57-mm APT projectile, M70; 37-mm APCT projectile, M59; 2.36-inch rocket motor; 81-mm HE mortar, M43A1; and fuze of a projectile, M1907M.

Reference(s) for Part C:

Environet, 2012. Removal Action at Maunawili Valley Impact Area

D. Attach maps of the site below (select 'Insert/Picture' on the menu bar.)

Refer to Appendix A, Figure A1-1

Site ID: **H09HI027701R01-1**
Date: **8/13/2015**

Cased Munitions Information

Item No.	Munition Type (e.g., mortar, projectile, etc.)	Munition Size	Munition Size Units	Mark/ Model	Energetic Material Type	Is Munition Fuzed?	Fuzing Type	Fuze Condition	Minimum Depth for Munition (ft)	Location of Munitions
1	Mortars	81	mm	M43A1	High Explosive	Yes	Impact	Armed		Surface and Subsurface
2	Artillery	75	mm	M48	High Explosive	Yes	Impact	Armed		Surface and Subsurface
3	Artillery	75	mm	MK1	Low Explosive Filler in a fragmenting round	Yes	Impact	Armed		Surface and Subsurface
4	Mortars	60	mm	M49A2, M50A2	High Explosive	Yes	Impact	Armed		Surface and Subsurface
5	Artillery	57	mm	M70	High Explosive	Yes	Impact	Armed		Surface and Subsurface
6	Artillery	37	mm	M63, M51, M74, M59	High Explosive	Yes	Impact	Armed		Surface and Subsurface
7	Rockets	2.36	inches	M6A1,M7A1	High Explosive	Yes	Impact	Armed		Surface and Subsurface
8	Rockets	3.5	inches	M28	High Explosive	Yes	Impact	Armed		Surface and Subsurface
9										
10	Fuzes			PTT, M1907	High Explosive		Time	Armed		Surface and Subsurface
11	Fuzes			TSQ, M54	High Explosive		Impact	Armed		Surface and Subsurface
12	Fuzes			PDSQ, M48	High Explosive		Impact	Armed		Surface and Subsurface
13	Artillery	105	mm	M1	High Explosive	Yes	Impact	Armed		Surface and Subsurface

Reference(s) for table above:
CEPOH, 1994. Inventory Project Report
Zapata, 2008. Engineering Evaluation/Cost Analysis
Wil Chee, 2009. Site Investigation
Environet, 2012. Removal Action at Maunawili Valley Impact Area
Huikala, 2013. RI Work Plan

[redacted]

Bulk Explosive Information

Item No.	Explosive Type	Comments
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Reference(s) for table above:

[redacted]

Site ID: **H09HI027701R01-1**
Date: **8/13/2015**

Activities Currently Occurring at the Site

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours per year a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1	Recreational (hikers)	54,750	2	**109,500**	0	150/day
2	Agricultural	10	2,080	**20,800**	2	M-F: 8 hrs/day
3	Occupational (maintenance, construction)	5	120	**600**	2	10 hrs/month
4						
5						
6						
7						
8						
9						
10						
11						
12						
	Total Potential Contact Time (receptor hrs/yr):			**130,900**		
	Maximum intrusive depth at site (ft):				**2**	

Reference(s) for table above:
CEPOH, 1994. Inventory Project Report
Zapata, 2008. Engineering Evaluation/Cost Analysis
Wil Chee, 2009. Site Investigation
Huikala, 2013. RI Work Plan

Site ID: **H09HI027701R01-1**
Date: **8/13/2015**

Planned Remedial or Removal Actions

Response Action No.	Response Action Description	Expected Resulting Minimum MEC Depth (ft)	Expected Resulting Site Accessibility	Will land use activities change if this response action is implemented?	What is the expected scope of cleanup?	Comments
1	Land Use Controls (LUCs)	0	Moderate Accessibility	No	No MEC cleanup	LUCs will consist of administrative mechanisms, engineering controls, and educational controls.
2	LUCs and Limited Removal Action in Highly Accessible Areas	3	Moderate Accessibility	No	cleanup of MECs located both on the surface and subsurface	LUCs will consist of administrative mechanisms, engineering controls, and educational controls. Surface and subsurface removal will be performed over 3 acres of the most trafficked areas of the site.
3	Complete Removal Action of High Density Areas	3	Moderate Accessibility	No	cleanup of MECs located both on the surface and subsurface	Complete removal of high density areas identified as target and impact areas.

According to the 'Summary Info' worksheet, no future land uses are planned. For those alternatives where you answered 'No' in Column E, the land use activities will be assessed against current land uses.

Reference(s) for table above:
CEPOH, 1994. Inventory Project Report
Zapata, 2008. Engineering Evaluation/Cost Analysis
Wil Chee, 2009. Site Investigation
Huikala, 2014. RI Report

Site ID: **H09HI027701R01-1**
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This worksheet needs to be completed for each remedial/removal action alternative listed in the 'Remedial-Removal Action' worksheet that will cause a change in land use.

No changes in land use are anticipated regardless of remedial/removal action alternative selected.

Site ID: **H09HI027701R01-1**

Date: **8/13/2015**

Energetic Material Type Input Factor Categories

The following table is used to determine scores associated with the energetic materials. Materials are listed in order from most hazardous to least hazardous.

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
High Explosive and Low Explosive Filler in Fragmenting Rounds	100	100	100
White Phosphorus	70	70	70
Pyrotechnic	60	60	60
Propellant	50	50	50
Spotting Charge	40	40	40
Incendiary	30	30	30

The most hazardous type of energetic material listed in the 'Munitions, Bulk Explosive Info' Worksheet falls under the category 'High Explosive and Low Explosive Filler in Fragmenting Rounds'. ***Score***

Baseline Conditions:	**100**
Surface Cleanup:	**100**
Subsurface Cleanup:	**100**

Location of Additional Human Receptors Input Factor Categories

1. What is the Explosive Safety Quantity Distance (ESQD) from the Explosive Siting Plan or the Explosive Safety Submission for the MRS? 2111 feet

2. Are there currently any features or facilities where people may congregate within the MRS, or within the ESQD arc? Yes

3. Please describe the facility or feature.

The MRS includes public hiking trails, agricultural plots, municipal water and power sources, irrigation line. There is a residential area outside of the MRS but within the ESQD.

MEC Item(s) used to calculate the ESQD for current use activities

[redacted]

Item #13. Artillery (105mm)

The following table is used to determine scores associated with the location of additional human receptors (current use activities):

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Inside the MRS or inside the ESQD arc	30	30	30
Outside of the ESQD arc	0	0	0

4. Current use activities are 'Inside the MRS or inside the ESQD arc', based on Question 2.' ***Score***

Baseline Conditions:	**30**
Surface Cleanup:	**30**
Subsurface Cleanup:	**30**

Site Accessibility Input Factor Categories

The following table is used to determine scores associated with site accessibility:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Full Accessibility	No barriers to entry, including signage but no fencing	80	80	80
Moderate Accessibility	Some barriers to entry, such as barbed wire fencing or rough terrain	55	55	55
Limited Accessibility	Significant barriers to entry, such as unguarded chain link fence or requirements for special transportation to reach the site	15	15	15
Very Limited Accessibility	A site with guarded chain link fence or terrain that requires special equipment and skills (e.g., rock climbing) to access	5	5	5

Current Use Activities ***Score***

Select the category that best describes the site accessibility under the current use scenario:

Moderate Accessibility

Baseline Conditions: **55**
Surface Cleanup: **55**
Subsurface Cleanup: **55**

Potential Contact Hours Input Factor Categories

The following table is used to determine scores associated with the total potential contact time:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Many Hours	≥1,000,000 receptor-hrs/yr	120	90	30
Some Hours	100,000 to 999,999 receptor hrs/yr	70	50	20
Few Hours	10,000 to 99,999 receptor-hrs/yr	40	20	10
Very Few Hours	<10,000 receptor-hrs/yr	15	10	5

Current Use Activities :

Input factors are only determined for baseline conditions for current use activities. Based on the 'Current and Future Activities' Worksheet, the Total Potential Contact Time is: **130,900** receptor hrs/yr

Based on the table above, this corresponds to a input factor score for baseline conditions of: **70** Score

Amount of MEC Input Factor Categories

The following table is used to determine scores associated with the Amount of MEC:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Target Area	Areas at which munitions fire was directed	180	120	30
OB/OD Area	Sites where munitions were disposed of by open burn or open detonation methods. This category refers to the core activity area of an OB/OD area. See the "Safety Buffer Areas" category for safety fans and kick-outs.	180	110	30
Function Test Range	Areas where the serviceability of stored munitions or weapons systems are tested. Testing may include components, partial functioning or complete functioning of stockpile or developmental items.	165	90	25
Burial Pit	The location of a burial of large quantities of MEC items.	140	140	10
Maneuver Areas	Areas used for conducting military exercises in a simulated conflict area or war zone	115	15	5
Firing Points	The location from which a projectile, grenade, ground signal, rocket, guided missile, or other device is to be ignited, propelled, or released.	75	10	5
Safety Buffer Areas	Areas outside of target areas, test ranges, or OB/OD areas that were designed to act as a safety zone to contain munitions that do not hit targets or to contain kick-outs from OB/OD areas.	30	10	5
Storage	Any facility used for the storage of military munitions, such as earth-covered magazines, above-ground magazines, and open-air storage areas.	25	10	5
Explosive-Related Industrial Facility	Former munitions manufacturing or demilitarization sites and TNT production plants	20	10	5

Select the category that best describes the ***most hazardous*** amount of MEC:	***Score***
Target Area	
Baseline Conditions:	**180**
Surface Cleanup:	**120**
Subsurface Cleanup:	**30**

Minimum MEC Depth Relative to the Maximum Intrusive Depth Input Factor Categories

Current Use Activities

The shallowest minimum MEC depth, based on the 'Cased Munitions Information' Worksheet: **0** ft
The deepest intrusive depth: **2** ft

The table below is used to determine scores associated with the minimum MEC depth relative to the maximum intrusive depth:

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC.	240	150	95
Baseline Condition: MEC located surface and subsurface, After Cleanup: Intrusive depth does not overlap with subsurface MEC.	240	50	25
Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.	150	N/A	95
Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth does not overlap with minimum MEC depth.	50	N/A	25

Because the shallowest minimum MEC depth is less than or equal to the deepest intrusive depth, the intrusive depth will overlap after cleanup. MECs are located at both the surface and subsurface, based on the 'Munitions, Bulk Explosive Info' Worksheet. Therefore, the category for this input factor is 'Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC.' For 'Current Use Activities', only Baseline Conditions are considered.

240 ***Score***

Migration Potential Input Factor Categories

Is there any physical or historical evidence that indicates it is possible for natural physical forces in the area (e.g., frost heave, erosion) to expose subsurface MEC items, or move surface or subsurface MEC items? Yes

If "yes", describe the nature of natural forces. Indicate key areas of potential migration (e.g., overland water flow) on a map as appropriate (attach a map to the bottom of this sheet, or as a separate worksheet).

steep slopes, erosion caused by overland water flow

The following table is used to determine scores associated with the migration potential:

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Possible	30	30	10
Unlikely	10	10	10

Based on the question above, migration potential is 'Possible.' ***Score***

Baseline Conditions: **30**
Surface Cleanup: **30**
Subsurface Cleanup: **10**

Reference(s) for above information:

[redacted]

MEC Classification Input Factor Categories

Cased munitions information has been inputed into the 'Munitions, Bulk Explosive Info' Worksheet; therefore, bulk explosives do not comprise all MECs for this MRS.

The 'Amount of MEC' category is 'Target Area'. It cannot be automatically assumed that the MEC items from this category are DMM. Therefore, the conservative assumption is that the MEC items in this MRS are UXO.

Has a technical assessment shown that MEC in the OB/OD Area is DMM?

Are any of the munitions listed in the 'Munitions, Bulk Explosive Info' Worksheet: Yes

- Submunitions
- Rifle-propelled 40mm projectiles (often called 40mm grenades)
- Munitions with white phosphorus filler
- High explosive anti-tank (HEAT) rounds
- Hand grenades
- Fuzes
- Mortars

At least one item listed in the 'Munitions, Bulk Explosive Info' Worksheet was identified as 'fuzed'.

The following table is used to determine scores associated with MEC classification categories:

UXO Special Case	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
UXO Special Case	180	180	180
UXO	110	110	110
Fuzed DMM Special Case	105	105	105
Fuzed DMM	55	55	55
Unfuzed DMM	45	45	45
Bulk Explosives	45	45	45

Based on your answers above, the MEC classification is 'UXO Special Case'.

	Score
Baseline Conditions:	**180**
Surface Cleanup:	**180**
Subsurface Cleanup:	**180**

MEC Size Input Factor Categories

The following table is used to determine scores associated with MEC Size:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Small	Any munitions (from the 'Munitions, Bulk Explosive Info' Worksheet) weigh less than 90 lbs; small enough for a receptor to be able to move and initiate a detonation	40	40	40
Large	All munitions weigh more than 90 lbs; too large to move without equipment	0	0	0

Based on the definitions above and the types of munitions at the site (see 'Munitions, Bulk Explosive Info' Worksheet), the MEC Size Input Factor is: Small

	Score
Baseline Conditions:	**40**
Surface Cleanup:	**40**
Subsurface Cleanup:	**40**

Scoring Summary

Site ID:	H09HI027701R01-1	a. Scoring Summary for Current Use Activities	
Date:	8/13/2015	Response Action Cleanup:	No Response Action
Input Factor		Input Factor Category	Score
I. Energetic Material Type		High Explosive and Low Explosive Filler in Fragmenting Rounds	100
II. Location of Additional Human Receptors		Inside the MRS or inside the ESQD arc	30
III. Site Accessibility		Moderate Accessibility	55
IV. Potential Contact Hours		100,000 to 999,999 receptor hrs/yr	70
V. Amount of MEC		Target Area	180
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth		Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC.	240
VII. Migration Potential		Possible	30
VIII. MEC Classification		UXO Special Case	180
IX. MEC Size		Small	40
		Total Score	925
		Hazard Level Category	1

Site ID:	H09HI027701R01-1	c. Scoring Summary for Response Alternative 1: Land Use Controls (LUCs)	
Date:	8/13/2015	Response Action Cleanup:	No MEC cleanup
Input Factor		Input Factor Category	Score
I. Energetic Material Type		High Explosive and Low Explosive Filler in Fragmenting Rounds	100
II. Location of Additional Human Receptors		Inside the MRS or inside the ESQD arc	30
III. Site Accessibility		Moderate Accessibility	55
IV. Potential Contact Hours		100,000 to 999,999 receptor hrs/yr	70
V. Amount of MEC		Target Area	180
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth		Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC.	240
VII. Migration Potential		Possible	30
VIII. MEC Classification		UXO Special Case	180
IX. MEC Size		Small	40
		Total Score	925
		Hazard Level Category	1

Site ID:	H09HI027701R01-1	d. Scoring Summary for Response Alternative 2: LUCs and Limited Removal Action in Highly Accessible Area	
Date:	8/13/2015	Response Action Cleanup:	cleanup of MECs located both on the surface and subsurface
Input Factor		Input Factor Category	Score
I. Energetic Material Type		High Explosive and Low Explosive Filler in Fragmenting Rounds	100
II. Location of Additional Human Receptors		Inside the MRS or inside the ESQD arc	30
III. Site Accessibility		Moderate Accessibility	55
IV. Potential Contact Hours		100,000 to 999,999 receptor hrs/yr	20
V. Amount of MEC		Target Area	30
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth		Baseline Condition: MEC located surface and subsurface, After Cleanup: Intrusive depth does not overlap with subsurface MEC.	25
VII. Migration Potential		Possible	10
VIII. MEC Classification		UXO Special Case	180
IX. MEC Size		Small	40
		Total Score	490
		Hazard Level Category	4

Site ID:	H09HI027701R01-1	e. Scoring Summary for Response Alternative 3: Complete Removal Action of High Density Areas	
Date:	8/13/2015	Response Action Cleanup:	cleanup of MECs located both on the surface and subsurface
Input Factor		Input Factor Category	Score
I. Energetic Material Type		High Explosive and Low Explosive Filler in Fragmenting Rounds	100
II. Location of Additional Human Receptors		Inside the MRS or inside the ESQD arc	30
III. Site Accessibility		Moderate Accessibility	55
IV. Potential Contact Hours		100,000 to 999,999 receptor hrs/yr	20
V. Amount of MEC		Target Area	30
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth		Baseline Condition: MEC located surface and subsurface, After Cleanup: Intrusive depth does not overlap with subsurface MEC.	25
VII. Migration Potential		Possible	10
VIII. MEC Classification		UXO Special Case	180
IX. MEC Size		Small	40
		Total Score	490
		Hazard Level Category	4

MEC HA Hazard Level Determination		
Site ID: H09HI027701R01-1 **Date:** 8/13/2015	**Hazard Level Category**	**Score**
a. Current Use Activities	1	925
b. Future Use Activities	3	530
c. Response Alternative 1: Land Use Controls (LUCs)	1	925
Highly Accessible Areas	4	490
Density Areas	4	490
f. Response Alternative 4:		
g. Response Alternative 5:		
h. Response Alternative 6:		

Characteristics of the MRS	
Is critical infrastructure located within the MRS or within the ESQD arc?	Yes
Are cultural resources located within the MRS or within the ESQD arc?	Yes
Are significant ecological resources located within the MRS or within the ESQD arc?	Yes

Appendix D Remedial Alternatives Cost Estimates

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Table D-1. Cost Estimate Summary

Remedial Alternative	Period of Analysis[(1)]	Total Cost
1	30 years	$0
2	30 years	$1,215,704
3	30 years	$1,714,668
4	30 years	$5,431,686

Notes:

(1) Period of Analysis assumes base year is 2014

Table D-2. Alternative 2, Land Use Controls - Present Value Analysis

Year	Capital Costs	LTM Costs	Periodic Costs	Annual Costs	Hawaii GET (4.712%)	Total Annual Costs (Annual Costs + Hawaii GET)	Remarks
0	$210,676	$0	—	$210,676	$9,927	$220,603	Preparation of land use control work plan, community outreach events, initial installation of educational and warning signs and pamphlet stations, replacement of educational pamphlets
1	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
2	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
3	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
4	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
5	—	$22,815	$13,540	$36,355	$1,713	$38,068	Five year review, replacement of pamphlet stations, educational pamphlets and training CDs. RAB Meeting.
6	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
7	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
8	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
9	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
10	—	$22,815	$74,523	$97,338	$4,587	$101,925	Five year review, replacement of educational and warning signs and pamphlet stations. Replacement of educational pamphlets and training CDs. RAB Meeting.
11	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
12	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
13	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
14	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
15	—	$22,815	$15,231	$38,046	$1,793	$39,839	Five year review, replacement of pamphlet stations, educational pamphlets and training CDs. RAB Meeting. Film an updated version of training CD.
16	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
17	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
18	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
19	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
20	—	$22,815	$74,523	$97,338	$4,587	$101,925	Five year review, replacement of educational and warning signs and pamphlet stations. Replacement of educational pamphlets and training CDs. RAB Meeting.
21	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
22	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
23	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
24	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
25	—	$22,815	$13,540	$36,355	$1,713	$38,068	Five year review, replacement of pamphlet stations, educational pamphlets and training CDs. RAB Meeting.
26	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
27	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
28	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
29	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
30	—	$22,815	$74,523	$97,338	$4,587	$101,925	Five year review, replacement of educational and warning signs and pamphlet stations. Replacement of educational pamphlets and training CDs. RAB Meeting.
Totals	$210,676	$684,440	$265,882	$1,160,998	$54,706	$1,215,704	

Note:

(1) Contingency = 10% scope contingency and 10% bid contingency

(2) Based on a -1.9% discount factor for projects with a 30-year duration, as specified for federal facility sites in Appenix C of Office of Management and Budget Dcircular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c

GET = General Excise Tax

Table D-3. Alternative 2 - Land Use Controls - Capital Cost Detail

Description	Quantity	Unit	Unit Price	Cost	Comments
CAPITAL COSTS	**CAPITAL COSTS SUBTOTAL =**			**$167,666**	**Includes labor and institutional controls**
Labor	**Labor Subtotal =**			**$61,413**	
LUC Outreach	160	hours	$133.87	$21,419	Assumes 32 hours of preparation and two people attending 4 hour meeting. Four outreach meetings in total. Average hourly rate for Senior Project Manager and Technical Staff.
RAB Meetings	80	hours	$133.87	$10,710	Assumes 16 hours of preparation and two people attending a 2-hour meeting. Four RAB meetings in total. Average hourly rate for Senior Project Manager and Technical Staff.
Trainer for Video	32	hours	$133.87	$4,284	Assumes 32 hours of preparation for video. Average hourly rate for Senior Project Manager and Technical Staff.
LUC WP	1	LS	$25,000.00	$25,000	Includes preparation of draft and final copies of land use control work plan detailing the specifics of the adopted institutional controls and their implementation. Costs include draft, draft final, and final versions of report and two rounds of responses to comments.
Material and Other Direct Costs	**Material and Other Direct Costs Subtotal =**			**$105,453**	
Aluminum Danger Signs (with posts)	50	unit	$150.80	$7,540	18" by 24" aluminum and square sign, UV, fade, and weather resistant coating and channel post 10 feet long. Quote from Safety Systems Signs Division. Assume 50 aluminum danger signs and posts installed.
Delivery/Shipment of Aluminum Signs and Posts	50	unit	$124.63	$6,232	Replace all 50 signs every ten years. Assumed 10 signs per year.
Educational Signs with Post	5	unit	$9,000.00	$45,000	KVO porcelain enamel with watering steel; ~$9000 for the first sign includes design, manufacturing, installation; 10 yrs durability; replacement signs ~$7000.; quote from Meacham
Delivery/Shipment of Educational Signs and Posts	1	unit	$1,154.06	$1,154	Assumes shipment of 2 boxes (40"x24"x6") of 100lb each from Parlin, CO to Oahu, HI by UPS Ground. Packages contain 5 educational signs and are insured for $1100 each.
Pamphlet Repro (B&W)	300,000	sheet	$0.06	$18,000	Assumes 300,000 black and white pamphlets (quote is from Arc Pacific in Honolulu, HI)
Courier Delivery (pamphlets)	2	LS	$56.08	$105	Delivery twice a year for 30 years
Pamphlet Station with Post	5	unit	$124.63	$623	Assumes 5 pamphlet boxes with a hinged top, sturdy 1/8" thick plexiglass material and a 6" x 6" x 9' metal post. Www.woodproductsigns.com
Delivery/Shipment of Pamphlet Sation and Posts	1	unit	$1,086.58	$1,087	Assumes shipment of 1 box (30"x30"x32") of 100lb from Parlin, CO to Oahu, HI by UPS Ground. Package contains 5 pamphlet stations and is insured
UXO ID Booklets	10	unit	$37.39	$374	Assumes 10 books every 10 years (i.e. 40 books) with 3% annual inflation markup (quote is from Arc Pacific). Each book assumed to be 20 pages, half sheet (i.e., 8.5" by 5.5") double sided, fully laminated and bound.
Delivery of UXO ID Booklets	4	unit	$30.00	$120	Assumes shipment of 1 large FedEx box to each (DLNR, HARC, Luluku Farmers, HECO).
Training DVDs	1	unit	$44.87	$45	Assumes 5 copies to be made each year. Includes cost of DVDs, cases, and shipping fees.
Community Outreach Materials	400	person	$49.85	$19,940	Includes RRR branded giveaways (e.g., bags, notepads, water bottles, etc) and costs for shipping and preparation of gift bags.
Community Meeting Posters	10	unit	$124.63	$1,246	Assumes 10 posters for events (e.g., community meetings, farmers markets, etc.)
Meeting Costs	8	unit	$498.51	$3,988	Includes meeting room rental, audio/visual equipment rental. Eight meetings total (4 LUC outreach and 4 RAB).
Subcontractors	**Subcontractors Subtotal =**			**$800**	
Videographer (Training Video)	1	ea	$800.00	$800	Filming the training video for DLNR Staff (recording in person training events to cover staff turnover)

CAPITAL COSTS SUBTOTAL =	**$167,665.91**
CAPITAL COSTS (4.71% Tax) =	**$175,562.98**

Note:
LUC = Land Use Controls
LTM = Long Term Management
RAB = Restoration Advisory Board
Labor is based on WD 05-2154 (Rev.-14) located at www.wdol.gov viewed on 09/14/2010.

Table D-4. Alternative 2 - Land Use Controls - LTM and Periodic Cost Detail

Description	Quantity	Unit	Unit Price	Cost	Comments
LTM COSTS (ANNUAL)		**LTM COSTS (annual) Subtotal =**		**$ 18,157**	
Material and Other Direct Costs		**Material and Other Direct Costs Subtotal =**		**$ 18,157**	
Pamphlet Repro (B&W)	300,000	sheet	$0.06	$ 18,000	Assumes 300,000 black and white pamphlets (quote is from Arc Pacific in Honolulu, HI)
Courier Delivery (pamphlets)	2	LS	$56.08	$ 112	Delivery twice a year for 30 years
Training DVDs	1	unit	$44.87	$ 45	Assumes 5 copies to be made each year. Includes cost of DVDs, cases, and shipping fees.
PERIODIC COSTS (EVERY 5 YEARS)		**PERIODIC COSTS (EVERY 5 YEARS) Subtotal =**		**$10,776**	
Labor			**Labor Subtotal =**	**$8,568**	
RAB Meetings	64	hours	$133.87	$8,568	Assumes 60 hours of preparation and two people attending a 2 hour meeting. Average hourly rate for Senior Project Manager and Technical Staff.
Material and Other Direct Costs		**Material and Other Direct Costs Subtotal =**		**$ 2,208**	
Pamphlet Station with Post	5	unit	$124.63	$623	Assumes 5 pamphlet boxes with a hinged top, sturdy 1/8" thick plexiglass material and a 6" x 6" x 9' metal post.
Delivery/Shipment of Pamphlet Sation and Posts	1	unit	$1,086.58	$1,087	Assumes shipment of 1 box (30"x30"x32") of 100lb from Parlin, CO to Honolulu, HI by UPS Ground. Package contains 5 pamphlet stations and is insured for $450. www.ups.com (2-21-14).
Meeting Costs (RAB)	1	unit	$498.51	$499	Includes meeting room rental, audio/visual equipment rental
PERIODIC COSTS (EVERY 10 YEARS)		**PERIODIC COSTS (EVERY 10 YEARS) Subtotal =**		**$50,329**	
Material and Other Direct Costs		**Material and Other Direct Costs Subtotal =**		**$50,329**	
Educational Signs with Post	5	unit	$7,000.00	$35,000	KVO porcelain enamel with watering steel; ~$9000 for the first sign includes design, manufacturing, installation; 10 yrs durability;
Delivery/Shipment of Educational Signs and Posts	1	unit	$1,154.06	$1,154	Replace signs every 10 years.
Aluminum Danger Signs (with posts)	50	unit	$150.80	$7,540	18" by 24" aluminum and square sign, UV, fade, and weather resistant coating and channel post 10 feet long. Quote from Safety
Delivery/Shipment of Signs and Posts	50	unit	$124.63	$6,232	Replace all 50 signs every ten years.
UXO ID Booklets	10	unit	$37.39	$374	10 books every 10 years (i.e. 40 books) (quote is from Arc Pacific). Each book assumed to be 20 pages, half sheet (i.e., 8.5" by 5.5") double sided, fully laminated and bound.
Delivery of UXO ID Booklets	1	unit	$30.00	$30	Assumes shipment of 1 large FedEx box to each (DLNR, HARC, Luluku Farmers, HECO).
PERIODIC COSTS (EVERY 15 YEARS)		**PERIODIC COSTS (EVERY 15 YEARS) Subtotal =**		**$3,142**	
Labor			**Labor Subtotal =**	**$2,142**	
Trainer for Video	16	hours	$133.87	$2,142	Assumes 16 hours of preparation for video. Average hourly rate for Senior Project Manager and Technical Staff.
Subcontractors			**Subcontractors Subtotal =**	**$1,000**	
Videographer (Training Video)	1	ea	$1,000.00	$1,000	Filming the updated version of the training video after 15 years (recording in person training events to cover staff turnover)

LTM COSTS SUBTOTAL =	**$18,157.03**
LTM COSTS (4.71% Tax) =	**$19,012.23**
PERIODIC COSTS (EVERY 5 YEARS) SUBTOTAL =	**$10,775.92**
PERIODIC COSTS (EVERY 5 YEARS) (4.71% Tax) =	**$11,283.47**
PERIODIC COSTS (EVERY 10 YEARS) SUBTOTAL =	**$50,329.46**
PERIODIC COSTS (EVERY 10 YEARS) (4.71% Tax) =	**$52,699.98**
PERIODIC COSTS (EVERY 15 YEARS) SUBTOTAL =	**$3,141.92**
PERIODIC COSTS (EVERY 15 YEARS) (4.71% Tax) =	**$3,289.90**

Note:
IC = Institutional Controls
LTM = Long Term Management
RAB = Restoration Advisory Board

Table D-5. Alternative 3, Removal of MEC in Highly Accessible Areas - Present Value Analysis

Year	Capital Costs	LTM Costs	Periodic Costs	Annual Costs	Hawaii GET (4.712%)	Total Annual Costs (Annual Costs + Hawaii GET)	Remarks
0	$584,109	$0	—	$584,109	$27,523	$611,632	Preparation of land use control work plan, community outreach events, initial installation of educational and warning signs and pamphlet stations, replacement of educational pamphlets. Completion of limited removal action.
1	$103,078	$22,815	—	$125,893	$5,932	$131,825	Final report; replacement of educational pamphlets and training CDs
2	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
3	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
4	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
5	—	$22,815	$13,540	$36,355	$1,713	$38,068	Five year review, replacement of pamphlet stations, educational pamphlets and training CDs. RAB Meeting.
6	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
7	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
8	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
9	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
10	—	$22,815	$74,523	$97,338	$4,587	$101,925	Five year review, replacement of educational and warning signs and pamphlet stations. Replacement of educational pamphlets and training CDs. RAB Meeting.
11	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
12	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
13	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
14	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
15	—	$22,815	$15,231	$38,046	$1,793	$39,839	Five year review, replacement of pamphlet stations, educational pamphlets and training CDs. RAB Meeting. Film an updated version of training CD.
16	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
17	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
18	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
19	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
20	—	$22,815	$74,523	$97,338	$4,587	$101,925	Five year review, replacement of educational and warning signs and pamphlet stations. Replacement of educational pamphlets and training CDs.
21	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
22	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
23	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
24		$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
25	—	$22,815	$13,540	$36,355	$1,713	$38,068	Five year review, replacement of pamphlet stations, educational pamphlets and training CDs. RAB Meeting.
26	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
27	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
28	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
29	—	$22,815	—	$22,815	$1,075	$23,890	Replacement of educational pamphlets and training CDs
30	—	$22,815	$74,523	$97,338	$4,587	$101,925	Five year review, replacement of educational and warning signs and pamphlet stations. Replacement of educational pamphlets and training CDs. RAB Meeting.
Totals	$584,109	$684,440	$265,882	$1,637,509	$77,159	$1,714,668	

Note:

(1) Contingency = 10% scope contingency and 10% bid contingency

(2) Based on a -1.9% discount factor for projects with a 30-year duration, as specified for federal facility sites in Appenix C of Office of Management and Budget Dcircular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circ

Assumed limited removal 85% complete at end of Year 0

Table D-6. Alternative 3 - Removal of MEC in Highly Accessible Areas - Capital Cost Detail

Description	Quantity	Unit	Unit Price	Cost	Comments
CAPITAL COSTS			**CAPITAL COSTS SUBTOTAL =**	**$546,897**	**Includes labor and institutional controls**
Labor			**Labor Subtotal =**	**$314,948**	
Senior Project Geologist (offsite PM)	192	hour	$131.51	$25,250	Offsite PM (financial mgmt, project support, client coordination). Assumed 16 hour per month for 12 months
Project Manager (onsite)	70	hour	$157.60	$11,032	Assumes 14 days, 5 hours/day
SUXOS	52	hour	$96.41	$5,013	Assumes 2 days travel, 1 day training, 1 day mobe/demobe, and 1 hour/day outside of MRS for 12 days.
SUXOS 8%	108	hour	$104.12	$11,245	Assumes 12 9-hour days inside MRS.
UXOQC	52	hour	$91.54	$4,760	Assumes 2 days travel, 1 day training, 1 day mobe/demobe, and 1 hour/day outside of MRS for 12 days.
UXOQC 8%	108	hour	$98.86	$10,677	Assumes 12 9-hour days inside MRS.
UXOSO	52	hour	$91.54	$4,760	Assumes 2 days travel, 1 day training, 1 day mobe/demobe, and 1 hour/day outside of MRS for 12 days.
UXOSO 8%	108	hour	$98.86	$10,677	Assumes 12 9-hour days inside MRS.
UXO Tech III Base	52	hour	$80.25	$4,173	Assumes 2 days travel, 1 day training, 1 day mobe/demobe, and 1 hour/day outside of MRS for 12 days.
UXO Tech III 8%	108	hour	$86.67	$9,360	Assumes 12 9-hour days inside MRS.
UXO Tech II Base	52	hour	$66.96	$3,482	Assumes 2 days travel, 1 day training, 1 day mobe/demobe, and 1 hour/day outside of MRS for 12 days.
UXO Tech II 8%	108	hour	$72.32	$7,810	Assumes 12 9-hour days inside MRS.
UXO Tech I Base	52	hour	$55.35	$2,878	Assumes 2 days travel, 1 day training, 1 day mobe/demobe, and 1 hour/day outside of MRS for 12 days.
UXO Tech I 8%	108	hour	$59.78	$6,456	Assumes 12 9-hour days inside MRS.
CADD Operator	60	hour	$68.44	$4,106	Real-time GIS support; Assume 3 hour per day and 5 days per week (based on past projects of similar size and scope)
Project Administrator	160	hour	$81.54	$13,046	Hiring and project support
Senior Project Accountant	40	hour	$95.19	$3,808	Assume project opening and closeout and 12 invoices
Work Plan/SHSP	1	LS	$65,000.00	$65,000	Prepare work plan and safety plan for the limited removal action. Costs include draft, draft final, and final versions of report and two rounds of responses to comments.
Site-Specific Final Report	1	LS	$50,000.00	$50,000	Prepare site-specific final report documenting the limited removal action. Costs include draft, draft final, and final versions of report and two rounds of responses to comments.
LUC Outreach	160	hours	$133.87	$21,419	Assumes 32 hours of preparation and two people attending 4 hour meeting (includes travel). Four outreach meetings in total. Average hc Senior Project Manager and Technical Staff.
RAB Meetings	80	hours	$133.87	$10,710	Assumes 16 hours of preparation and two people attending a 2-hour meeting. Four RAB meetings in total. Average hourly rate for Senic Manager and Technical Staff.
Trainer for Video	32	hours	$133.87	$4,284	Assumes 32 hours of preparation for video. Average hourly rate for Senior Project Manager and Technical Staff.
LUC WP	1	LS	$25,000.00	$25,000	Includes preparation of draft and final copies of land use control work plan detailing the specifics of the adopted institutional controls and implementation. Costs include draft, draft final, and final versions of report and two rounds of responses to comments.
Subcontractor Labor			**Subcontractor Labor Subtotal =**	**$1,151**	
Security	36.0	hours	$31.96	$1,151	Assumes 3 days security (12hr shift) between MEC ID and transport of demo explosives. Quote is from Aerotek.
Vegetation Removal	4	day	$3,000.00	$12,000	6-man crew
Equipment, Materials, and Other Direct Costs			**Equipment, Materials, and Other Direct Costs Subtotal =**	**$157,422**	
Crew Truck	3.0	Month	$1,370.91	$4,113	Assumes 3 trucks for 4 weeks of work.
Fuel Crew Trucks	336	Gal	$6.61	$2,221	Assumes 3 trucks for 4 weeks, 28 gallons per week. Cost was used from a previous project with similar size and scope.
Office Trailer	1	Month	$1,120.41	$1,120	8 feet by 20 feet office trailer. Hawaii Modular Space.
Trailer Delivery/Return	1	Each	$4,041.61	$4,042	8 feet by 20 feet office trailer. Hawaii Modular Space.
Porta Johns	6	Week	$243.03	$1,458	Assumes 2 porta johns for weekly servicing for 3 weeks.
Generator (20kw)	1	Month	$1,495.54	$1,496	Cost was used from a previous project with similar size and scope.
Fuel Generator	200	Gal	$6.23	$1,246	Cost was used from a previous project with similar size and scope.
55 gallon drum w/lid and ring	5	Each	$120.83	$604	http://www.grainger.com
Connex Delivery & Install (Equip Storage)	1	LS	$872.40	$872	Hawaii Modular Space
Connex Monthly Rental (Equip Storage)	1	Month	$311.57	$312	Hawaii Modular Space
Vegetation removal equipment	4	Each	$1,227.98	$4,912	Cost was used from a previous project with similar size and scope.
Ice Chest	2	Each	$56.08	$112	Cost was used from a previous project with similar size and scope.
ice/water	16	day	$18.69	$299	Cost was used from a previous project with similar size and scope.
Safety Supplies (PPE + sunscreen, bug spray, etc)	1,250	LS	$1.25	$1,563	Cost was used from a previous project with similar size and scope.
Replacement Boots (safety)	9	unit	$155.00	$1,395	Replacement boots (composite toe) for UXO personnel due to rugged terrain. Fukuda Seed store.
Two-Way Radios	4	Week	$7.48	$329	Assumes 9 radios. Cost was used from a previous project with similar size and scope.
Minelab SE	4	Week	$26.17	$628	Assumes 5 minelabs. Cost was used from a previous project with similar size and scope.
Repeater Station	4	Week	$62.31	$249	Cost was used from a previous project with similar size and scope.
Office Supplies	1	Each	$373.88	$374	Cost was used from a previous project with similar size and scope.

Table D-6. Alternative 3 - Removal of MEC in Highly Accessible Areas - Capital Cost Detail *(continued)*

Description	Quantity	Unit	Unit Price	Cost	Comments
Misc supplies	1	Each	$623.14	$623	Cost was used from a previous project with similar size and scope.
Scrapper Setup (Oxy/Propane) (delivery included)	1.5	Month	$2,075.86	$3,114	Cost was used from a previous project with similar size and scope.
Demolition materials and delivery	3	event	$6,231.41	$18,694	Cost was used from a previous project with similar size and scope.
FedEx Freight (MD Shipping)	2	drums	$1,096.73	$2,193	
Aluminum Danger Signs (with posts)	50	unit	$150.80	$7,540	18" by 24" aluminum and square sign, UV, fade, and weather resistant coating and channel post 10 feet long. Quote from Safety Systems Division. Assume 50 aluminum danger signs and posts installed.
Delivery/Shipment of Aluminum Signs and Posts	50	unit	$124.63	$6,232	Replace all 50 signs every ten years. Assumed 10 signs per year.
Educational Signs with Post	5	unit	$9,000.00	$45,000	KVO porcelain enamel with watering steel; ~$9000 for the first sign includes design, manufacturing, installation; 10 yrs durability; replac
Delivery/Shipment of Educational Signs and Posts	1	unit	$1,154.06	$1,154.06	Assumes shipment of 2 boxes (40"x24"x6") of 100lb each from Parlin, CO to Oahu, HI by UPS Ground. Packages contain 5 educationa are insured for $1100 each.
Pamphlet Repro (B&W)	300,000	sheet	$0.06	$18,000	Assumes 300,000 black and white pamphlets (quote is from Arc Pacific in Honolulu, HI)
Pamphlet Station with Post	5	unit	$124.63	$623	Assumes 5 pamphlet boxes with a hinged top, sturdy 1/8" thick plexiglass material and a 6" x 6" x 9' metal post. Www.woodproductsigns
Delivery/Shipment of Pamphlet Sation and Posts	1	unit	$1,086.58	$1,086.58	Assumes shipment of 1 box (30"x30"x32") of 100lb from Parlin, CO to Oahu, HI by UPS Ground. Package contains 5 pamphlet stations insured for $450. www.ups.com.
Courier Delivery (pamphlets)	2	LS	$56.08	$105	Delivery twice a year for 30 years
UXO ID Booklets	10	unit	$37.39	$374	10 books every 10 years (i.e. 40 books) with 3% annual inflation markup (quote is from Arc Pacific). Each book assumed to be 20 pages, half sheet (i.e., 8.5" by 5.5") double sided, fully laminated and bound.
Delivery of UXO ID Booklets	4	unit	$30.00	$120.00	Assumes shipment of 1 large FedEx box to each (DLNR, HARC, Luluku Farmers, HECO).
Training DVDs	1	unit	$44.87	$44.87	Assumes 5 copies to be made each year. Includes cost of DVDs, cases, and shipping fees.
Community Outreach Materials	400	person	$49.85	$19,940	Includes RRR branded giveaways (e.g., bags, notepads, water bottles, etc) and costs for shipping and preparation of gift bags.
Community Meeting Posters	10	unit	$124.63	$1,246	Assume 10 posters for events (e.g., community meetings, farmers markets, etc.)
Meeting Costs	8	unit	$498.51	$3,988	Includes meeting room rental, audio/visual equipment rental. Eight meetings total (4 outreach and 4 RAB).
Subcontractors			**Subcontractors Subtotal =**	**$800**	
Videographer (Training Video)	1	ea	$800.00	$800	Filming the training video (recording in person training events to cover staff turnover)
Travel			**Travel Subtotal =**	**$72,576**	
Airfare Continental U.S. to Oahu	3	ea	$1,000.00	$3,000	Includes 1 round trip per UXO team member (1 SUXOS, 1 UXOQC, 1 UXOSO, 1 UXO Tech III).
Meals/Incidentals	252	ea	$111.00	$27,972	Assume 9 UXO staff working 16 days (2 travel, 2 onsite mobe/demobe, 12 clearance)
Lodging	252	ea	$177.00	$44,604	Assume 9 UXO staff working 16 days (2 travel, 2 onsite mobe/demobe, 12 clearance)
CAPITAL COSTS SUBTOTAL =	**$546,896.81**				
CAPITAL COSTS (4.71% Tax) =	**$572,655.65**				

Note:
IC = Institutional Controls
LTM = Long Term Management
RAB = Restoration Advisory Board
Labor is based on WD 05-2154 (Rev.-14) located at www.wdol.gov viewed on 09/14/2010.

Table D-7. Alternative 3 - Removal of MEC in Highly Accessible Areas - LTM and Periodic Cost Detail

Description	Quantity	Unit	Unit Price	Cost	Comments
LTM COSTS (ANNUAL)			**LTM COSTS (annual) Subtotal =**	**$18,157**	
Material and Other Direct Costs			**Material and Other Direct Costs Subtotal =**	**$18,157**	
Pamphlet Repro (B&W)	300,000	sheet	$0.06	$18,000	Assumes 300,000 black and white pamphlets (quote is from Arc Pacific in Honolulu, HI)
Courier Delivery (pamphlets)	2	LS	$56.08	$112	Delivery twice a year for 30 years
Training DVDs for DLNR	1	unit	$44.87	$45	Assumes 5 copies to be made each year. Includes cost of DVDs, cases, and shipping fees.
PERIODIC COSTS (EVERY 5 YEARS)			**PERIODIC COSTS (EVERY 5 YEARS) Subtotal =**	**$10,776**	
Labor			**Labor Subtotal =**	**$8,568**	
RAB Meetings	64	hours	$133.87	$8,568	Assumes 60 hours of preparation and two people attending a 2 hour meeting. Average hourly rate for Senior Project Manager and Technical Staff.
Material and Other Direct Costs			**Material and Other Direct Costs Subtotal =**	**$2,208**	
Pamphlet Station with Post	5	unit	$124.63	$623	Assumes 5 pamphlet boxes with a hinged top, sturdy 1/8" thick plexiglass material and a 6" x 6" x 9' metal post. Www.woodproductsigns.com
Delivery/Shipment of Pamphlet Sation and Posts	1	unit	$1,086.58	$1,087	Assumes shipment of 1 box (30"x30"x32") of 100lb from Parlin, CO to Honolulu, HI by UPS Ground. Package contains 5 pamphlet stations and is insured for $450. www.ups.com (2·
Meeting Costs (RAB)	1	unit	$498.51	$499	Includes meeting room rental, audio/visual equipment rental.
PERIODIC COSTS (EVERY 10 YEARS)			**PERIODIC COSTS (EVERY 10 YEARS) Subtotal =**	**$50,329**	
Material and Other Direct Costs			**Material and Other Direct Costs Subtotal =**	**$50,329**	
Educational Signs with Post	5	unit	$7,000.00	$35,000	KVO porcelain enamel with watering steel; ~$9000 for the first sign includes design, manufacturing, installation; 10 yrs durability; replacement signs ~$7000.; quote from Meacham
Delivery/Shipment of Educational Signs and Posts	1	unit	$1,154.06	$1,154	Replace signs every 10 years.
Aluminum Danger Signs (with posts)	50	unit	$150.80	$7,540	18" by 24" aluminum and square sign, UV, fade, and weather resistant coating and channel post 10 feet long. Quote from Safety Sysems Signs Division. Assume 50 aluminum danger signs and posts replaced every 10 years
Delivery/Shipment of Signs and Posts	50	unit	$124.63	$6,232	Replace all 50 signs every ten years.
UXO ID Booklets	10	unit	$37.39	$374	10 books every 10 years (i.e. 40 books) (quote is from Arc Pacific). Each book assumed to be 20 pages, half sheet (i.e., 8.5" by 5.5") double sided, fully laminated and bound.
Delivery of UXO ID Booklets	1	unit	$30.00	$30	Assumes shipment of 1 large FedEx box to each (DLNR, HARC, Luluku Farmers, HECO).
PERIODIC COSTS (EVERY 15 YEARS)			**PERIODIC COSTS (EVERY 15 YEARS) Subtotal =**	**$3,142**	
Labor			**Labor Subtotal =**	**$2,142**	
Trainer for Video	16	hours	$133.87	$2,142	Assumes 16 hours of preparation for video. Average hourly rate for Senior Project Manager and Technical Staff.
Subcontractors			**Subcontractors Subtotal =**	**$1,000**	
Videographer (Training Video)	1	ea	$1,000.00	$1,000	Filming the updated version of the training video after 15 years (recording in person training events to cover staff turnover)

LTM COSTS SUBTOTAL =	**$18,157.03**
LTM COSTS (4.71% Tax) =	**$19,012.23**
PERIODIC COSTS (EVERY 5 YEARS) SUBTOTAL =	**$10,775.92**
PERIODIC COSTS (EVERY 5 YEARS) (4.71% Tax) =	**$11,283.47**
PERIODIC COSTS (EVERY 10 YEARS) SUBTOTAL =	**$50,329.46**
PERIODIC COSTS (EVERY 10 YEARS) (4.71% Tax) =	**$52,699.98**
PERIODIC COSTS (EVERY 15 YEARS) SUBTOTAL =	**$3,141.92**
PERIODIC COSTS (EVERY 15 YEARS) (4.71% Tax) =	**$3,289.90**

Note:
IC = Institutional Controls
LTM = Long Term Management
RAB = Restoration Advisory Board

Table D-8. Alternative 4, Complete Removal of MEC in High Density Areas - Present Value Analysis

Year	Capital Costs	LTM Costs	Periodic Costs	Annual Costs	Hawaii GET (4.712%)	Total Annual Costs (Annual Costs + Hawaii GET)	Remarks
0	$3,423,593	$0	$0	$3,423,593	$161,320	$3,584,913	Preparation of work plans and initiation of removal action
1	$1,763,669	$0	$0	$1,763,669	$83,104	$1,846,773	Completion of removal action and final report
Totals	$5,187,263	$0	$0	$5,187,263	$244,424	$5,431,686	

Note:
(1) Contingency = 10% scope contingency and 10% bid contingency
(2) Based on a -1.9% discount factor for projects with a 30-year duration, as specified for federal facility sites in Appenix C of Office of Management and Budget Dcircular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c
Assumed project 66% complete at end of Year 0

Table D-9. Alternative 4 - Complete Removal of MEC in High Density Areas - Capital Cost Detail

Description	Quantity	Unit	Unit Price	Cost	Comments
CAPITAL COSTS			**CAPITAL COSTS SUBTOTAL =**	**$4,128,277**	**Includes labor and institutional controls**
Labor			**Labor Subtotal =**	**$2,263,031**	
Senior Project Geologist (offsite PM)	360	hour	$131.51	$47,344	Offsite PM (financial mgmt, project support, client coordination). Assumed 16hr per month for 18 months
Project Manager (onsite)	480	hour	$157.60	$75,648	Assumes 2 days travel (16 hours), 1 day training (10 hours), and 62 work days (10 hour days)
SUXOS	142	hour	$96.41	$13,690	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days)
SUXOS 8%	864		$104.12		Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days)
UXOQC	142	hour	$91.54	$12,999	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days)
UXOQC 8%	864	hour	$98.86	$85,418	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days)
UXOSO	142	hour	$91.54	$12,999	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days)
UXOSO 8%	864	hour	$98.86	$85,418	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days)
UXO Tech III Base	568	hour	$80.25	$45,582	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days); 4 Tech IIIs.
UXO Tech III 8%	3456	hour	$86.67	$299,532	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days); 4 Tech IIIs.
UXO Tech II Base	710	hour	$66.96	$47,542	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days); 5 Tech IIs.
UXO Tech II 8%	4320	hour	$72.32	$312,409	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days); 5 Tech IIs.
UXO Tech I Base	2272	hour	$55.35	$125,755	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days); 16 Tech Is.
UXO Tech I 8%	13824	hour	$59.78	$826,371	Assume 2 days travel (16 hours), 1 day training (10 hours), and 98 work days (10 hour days); 16 Tech Is.
CADD Operator	360	hour	$68.44	$24,638	Assumes Real-time GIS support; 3hr per day for 5 day per week (based on past projects of similar size and scope)
Project Administrator	1010	hour	$81.54	$82,355	Hiring and project support
Senior Project Accountant	360	hour	$95.19	$34,268	Assumes project opening and closeout and 18 invoices
Work Plan/SHSP	1	LS	$65,000.00	$65,000	Prepare work plan and safety plan for removal action. Costs include draft, draft final, and final versions of report and two rounds of responses to comments.
Site Specific Final Report	1	LS	$50,000.00	$50,000	Prepare site-specific final report documenting the removal action. Costs include draft, draft final, and final versions of report and two rounds of responses to comments.
RAB Meeting	120	hours	$133.87	$16,064	Assumes 16 hours of preparation and two people attending a 2-hour meeting. Six RAB meetings in total. Average hourly rate for Senior Project Manager and Technical Staff.
Subcontractor Labor			**Subcontractor Labor Subtotal =**	**$9,204**	
Vegetation Removal	77	day	$3,000.00	$230,400	6-man crew
Security	288	hours	$ 31.96	$9,204	Assume 24 days security (12hr shift) between MEC ID and demolition. 1 overnight event/week. Quote is from Aerotek.
Equipment, Materials, and Other Direct Costs			**Equipment, Materials, and Other Direct Costs Subtotal =**	**$423,729**	
Crew Truck	46	Month	$1,370.91	$62,376	Assume 7 trucks for 25 weeks of work.
Fuel Crew Trucks	4,900	Gal	$6.61	$32,389	Assume 7 trucks for 25 weeks, 28 gallons per week. Cost was used from a previous project with similar size and scope.
Office Trailer	6	Month	$1,120.41	$6,722	8 feet by 20 feet Office Trailer. Hawaii Modular Space
Trailer Delivery/Return	1	Each	$4,041.61	$4,042	8 feet by 20 feet office trailer. Modular Space
Porta Johns	36	month	$243.03	$8,749	Assume 6 porta johns for weekly servicing for 24 weeks.
Generator (20kw)	6	Month	$1,495.54	$8,973	Cost was used from a previous project with similar size and scope.
Fuel Generator	960	Gal	$6.23	$5,981	Cost was used from a previous project with similar size and scope.
55 gallon drum w/lid and ring	20	Each	$120.83	$2,417	http://www.grainger.com
Connex Delivery & Install (Equip Storage)	1	LS	$872.40	$872	Hawaii Modular Space
Connex Monthly Rental (Equip Storage)	6	Month	$311.57	$1,869	Hawaii Modular Space
Vegetation removal equipment	4	Each	$1,227.98	$4,912	Cost was used from a previous project with similar size and scope.
Ice Chest	5	Each	$56.08	$280	Cost was used from a previous project with similar size and scope.
ice/water	288	day	$18.69	$5,383	Cost was used from a previous project with similar size and scope.
Safety Supplies (PPE + sunscreen, bug spray, etc)	96	day	$70.00	$6,720	Cost was used from a previous project with similar size and scope.
Replacement Boots (safety)	28	unit	$155.00	$4,340	Replacement boots (composite toe) for UXO personnel due to rugged terrain. www.steel-toe-shoes.com (2-20-2014)
Two-Way Radios	24	Week	$7.48	$5,027	Assumes 28 radios. Cost was used from a previous project with similar size and scope.
Minelab SE	240	Week	$26.17	$50,246	Assumes 10 minelabs. Cost was used from a previous project with similar size and scope.
Repeater Station	24	Week	$62.31	$1,495	Cost was used from a previous project with similar size and scope.
Office Supplies	24	Week	$350.00	$8,400	Cost was used from a previous project with similar size and scope.
Misc supplies	24	Week	$650.00	$15,600	Cost was used from a previous project with similar size and scope.
Scrapper Setup (Oxy/Propane) (delivery included)	6	Month	$2,075.86	$12,455	Cost was used from a previous project with similar size and scope.
Demolition materials and delivery	24	event	$6,231.41	$149,554	Cost was used from a previous project with similar size and scope. Includes markup for shipment of explosives to Maui.
FedEx Freight (MD Shipping)	20	drums	$1,096.73	$21,935	
Meeting Costs	6	event	$498.51	$2,991	Includes meeting room rental, audio/visual equipment rental.
Travel			**Travel Subtotal =**	**$1,432,312**	
Airfare Continental U.S. to Maui	7	ea	$1,000.00	$7,000	Includes 1 round trip per UXO team member (1 SUXOS, 1 UXOQC, 1 UXOSO, 4 UXO Tech III).
Meals/Incidentals	4,949	day	$111.00	$549,339	Assume 28 field staff working 96 days plus 2 days of travel and 1 day of training 2 days of mobe/demobe.

Table D-9. Alternative 4 - Complete Removal of MEC in High Density Areas - Capital Cost Detail *(continued)*

Description	Quantity	Unit	Unit Price	Cost	Comments
Lodging	4,949	day	$177.00	$875,973	Assume 28 field staff working 96 days plus 2 days of travel and 1 day of training 2 days of mobe/demobe.
CAPITAL COSTS SUBTOTAL =	**$4,128,276.95**				
CAPITAL COSTS (4.71% Tax) =	**$4,322,718.80**				

Note:

RAB = Restoration Advisory Board

Labor is based on WD 05-2154 (Rev.-14) located at www.wdol.gov viewed on 09/14/2010.

Appendix E Institutional Analysis

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DRAFT-FINAL

INSTITUTIONAL ANALYSIS REPORT

PALI TRAINING CAMP

OAHU, HAWAII

FUDS Project Number H09HI027701
Contract: W912DY-10-D-0053
Task Order: 0003

Prepared for:

U.S. Army Corps of Engineering, Honolulu District

and

U.S. Army Engineering and Support Center, Huntsville

August 2015
Revision 2

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Reviewed by:

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Acronyms and Abbreviations

DEM	City and County of Honolulu, Department of Emergency Management
DLNR	State of Hawaii Department of Land and Natural Resources
DPP	City and County of Honolulu, Department of Planning and Permitting
GIS	geographic information system
HFD	City and County of Honolulu, Honolulu Fire Department
HPD	City and County of Honolulu, Honolulu Police Department
HRS	Hawaii Revised Statues
HAR	Hawaii Administrative Rules
HE	high explosive
IA	institutional analysis
LUC	land use control
MC	munitions constituents
MEC	munitions and explosives of concern
mm	millimeters
MRA	munitions response area
MRS	munitions response site
MTC	Maunawili Training Course
MVIA	Maunawili Valley Impact Area
MVTC	Makalii Valley Training Course
PTC	Pali Training Camp
RI	remedial investigation
USACE	U.S. Army Corps of Engineers
UTC	Ulumawao Training Course
§	Section

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1.0 Introduction and Purpose

1.0.1 This report documents and presents the results of the institutional analysis (IA) performed for the Formerly Used Defense Sites Property Number H09HI0277 Project 01, also known as the former Pali Training Camp (PTC) on Oahu, Hawaii (also referred to herein as "the site"). This report was prepared in accordance with U.S. Army Corps of Engineers (USACE) guidance (Engineer Pamphlet 1110-1-24) for "Establishing and Maintaining Institutional Controls for Ordnance and Explosives (OE) Projects" dated December 15, 2000.

1.0.2 The purpose of this IA is to collect basic data to support the development of a land use control (LUC) program at the PTC to protect property owners and the public from explosive hazards potentially present within the boundaries of the site. The objectives of this IA include (1) illustrating opportunities that exist to implement an LUC program at the site, (2) identifying government stakeholders and landowners with jurisdiction or ownership responsibility over the former PTC, and (3) gathering information and assessing the capability and willingness of identified entities to support implementation of LUCs at the site. In addition, this IA identifies and recommends preliminary LUCs for the site, as discussed in Section 10.

1.0.3 LUCs are mechanisms that protect property owners and the public from hazards on a site by limiting the access or use of a property, or by warning of the potential present hazard. They are implemented to manage residual risk remaining at a site. LUCs may take the form of legal mechanisms, engineering controls, and educational programs. Legal mechanisms are associated with restrictions on the land such as restrictive covenants, zoning, and permitting. Engineering controls either limit the public's access to a site or limit the public's exposure to residual munitions and explosives of concern (MEC) to an acceptable level. Examples of engineering controls include fences, signs, and soil caps. Educational programs focus on educating the public on the hazards associated with a site and appropriate response actions should they encounter a MEC item. Examples of educational programs include formal education seminars and public notices. The overall effectiveness of LUCs at a site depends on the type of controls implemented and the support, involvement, and willingness of local agencies and landowners to enforce and maintain their strict implementation to limit public interaction with MEC.

2.0 Site Background and History

2.0.1 The former PTC is located in portions of the Maunawili and Makalii Valleys at the base of the Koolau mountain range, near Kailua on the southeast side of the island of Oahu. The site consists of 4,378 acres[1] of four non-contiguous parcels: Maunawili Valley Impact Area (MVIA), Maunawili Training Course (MTC), Makalii Valley Training Course (MVTC), and

[1] *Site acreage calculated with GIS is 3,666 acres. The acreages reported in this document and on maps are based on previous reports, unless otherwise noted.*

Ulumawao Training Course (UTC) (Figure 1). Each parcel is considered a munitions response area (MRA) containing one munitions response site (MRS).

2.0.2 MVIA is the largest MRS and encompasses approximately 3,432 acres of Maunawili Valley. MVIA includes portions of the Royal Hawaiian Golf Club (formerly Luana Hills Country Club), and is predominantly controlled by the State of Hawaii Department of Land and Natural Resources (DLNR). MTC encompasses approximately 400 acres and is located on the western edge of the Maunawili Valley and south of the Pali Highway. MVTC (also previously referred to as the Maunawili Stream Area) is the smallest MRA/MRS, encompassing approximately 46 acres, and is located on the northern ridge of Mount Olomana. UTC encompasses approximately 500 acres and is located outside the Maunawili Valley, north of the Pali Highway. Site accessibility to the four MRAs/MRSs is mainly through hiking trails, the golf club, and the Maunawili neighborhood.

2.0.3 The former PTC was established in 1943 as a regimental combat training center and contained barracks used to house troops, latrines, showers, mess halls, administration buildings, motor pools, an ice plant, a bakery, gun pits, and a field hospital. Camp training aids consisted of 200- and 300-yard rifle ranges, a 1,000-inch range, four obstacle courses, an infiltration course, a combat in cities course, a close combat course, a 400-yard long jungle firing course, and an artillery impact area. On 8 October 1945, G-3 Headquarters ordered the release of the PTC, and the PTC's impact area was reportedly cleared of ordnance prior to property disposal in 1945. In June 1948, the Commanding Officer of Army Ordnance Services issued a warning to the public to exercise caution when entering the area because of the potential presence of dud ordnance rounds. Residents and users of the site have reported that artillery rounds were fired into the Maunawili Valley and munitions (e.g., 155-millimeter [mm] round, duds, .30-caliber blanks, mortar rounds, machine gun bullets, 20-mm projectile) were found within the site. However, no anecdotal reports of material potentially presenting an explosive hazard in Maunawili or Makalii Valleys have been substantiated. Some anecdotal reports indicate that sections of Makalii Valley were used as firing points.

2.0.4 Previous investigations conducted at the site included the 1994 Inventory Project Report, 2008 Engineering Evaluation/Cost Analysis, 2009 Site Investigation, and 2012 MVIA Removal Action. These investigations identified the presence of, or the potential presence of, MEC and munitions debris at the PTC. Munitions items recovered at the site include a 60-mm high explosive (HE) mortar, M49A2; 37-mm HE projectile, M63; 75-mm shrapnel projectile, MK1; fuze of a projectile Time Super Quick; fuze of a projectile Point Detonating Super Quick; 57-mm Armor Piercing Tracer projectile, M70; 37-mm Armor Piercing Capped Tracer projectile, M59; 2.36-inch rocket motor; 81-mm HE mortar, M43A1; and fuze of a projectile, M1907M.

2.0.5 A remedial investigation (RI) was conducted at the site in fall 2013 and spring 2014. The purpose of the RI was to evaluate the nature and extent of contamination and the associated explosive hazards and risk to humans from MEC and munitions constituents (MC). Information

gathered during previous investigations and historical records research indicated no evidence of HE munitions use at either the MVTC or UTC. Therefore, no further investigation was required nor conducted at the MVTC and UTC. Additionally, the owner of the area encompassed by the MTC denied access to the property and no further investigation was conducted in that MRS.

2.0.6 RI field activities in the MVIA included (1) surface and subsurface investigations to identify the type and quantity of MEC and (2) collection of soil samples to evaluate the concentrations of MCs at the site. Seven MEC items were found during the RI (i.e., two 81-mm mortars, three 37-mm projectiles M63, one 105-mm projectile, and one 75-mm shrapnel projectile). The potential exposure pathway to human receptors in the MVIA MRS is through direct contact with MEC present at the ground surface and subsurface. MC were not detected at concentrations exceeding the State of Hawaii Department of Health's Tier 1 environmental action levels in any samples, thus MC are not considered to pose a risk to human health or the environment.

3.0 Methodology

3.0.1 The methodology used to perform this IA included a review of publicly available information on the mission, authority, and jurisdiction of primary government agencies. Information was gathered from each agency's website. Information on agencies was also gathered on the website for Hawaii Administrative Rules (HAR) and Hawaii Revised Statues (HRS). Additionally, the IA included a review of major landowners with property greater than 150 acres within the areas investigated in the RI. The majority of the MVIA is owned by DLNR with a portion of the area owned by HRT Realty for the Royal Hawaiian Golf Club. Based on the review and the selection criteria, as discussed in Section 5, the following primary government stakeholders and one private landowner were identified for PTC:

- State of Hawaii Department of Land and Natural Resources (DLNR)
- State of Hawaii Land Use Commission
- City and County of Honolulu, Department of Emergency Management (DEM)
- City and County of Honolulu, Department of Planning and Permitting (DPP)
- City and County of Honolulu, Honolulu Fire Department (HFD)
- City and County of Honolulu, Honolulu Police Department (HPD)
- HRT Realty, Ltd

3.0.2 Telephone interviews were then conducted and questionnaires were sent to the primary government stakeholders and landowner to collect further information on their mission, authority, and jurisdiction and to identify their capabilities to assist with and desire to participate in a LUC program at PTC. Section 11 summarizes the telephone and questionnaire interviews.

4.0 Scope of Effort

This IA supports the development of strategies that require the cooperation of state and local agencies. The effort required to complete the IA Report included internet research of, and communication with, government agencies with jurisdiction over PTC. Representatives of the agencies with jurisdiction over PTC were sent questionnaires to document their concern, capability, and willingness to exercise LUCs over the property. This study documents the results of that research, includes outlines of the agency interviews, and preliminarily identifies recommended LUCs for the site.

5.0 Selection Criteria

5.0.1 State and local agencies were selected for analysis based on their relevance to the LUC process. The following criteria were used in the selection of agencies:

- Have jurisdiction as a public agency
- Have primary concern for ordnance hazards because of ownership or use
- Have a technical capability for access control or behavior modification strategies
- Have authority and capability to assist in implementation and maintenance of LUCs
- Have responsibility for LUC or public safety
- Have capability to conduct public information and education activities
- Expressed an ability and willingness to assist in implementation and maintenance of LUCs

5.0.2 Landowners were selected based on ownership of property greater than 150 acres within the areas investigated in the RI (i.e., MVIA and MTC)

6.0 Acceptance of Joint Responsibility

6.0.1 Overall, the stakeholders have agreed to participate in carrying out land use controls to maintain public safety, depending on the level of effort required. The responses are summarized below:

- DLNR and DPP have expressed a willingness to participate in the LUC planning process and potentially with maintenance of LUCs, depending on their scope and frequency.
- The State of Hawaii Land Use Commission has expressed a willingness to participate in an advisory capacity.
- DEM has expressed a willingness to participate in educating the public on MEC recognition and safety.
- HFD and HPD have agreed to educate and encourage the public to practice the 3Rs safety protocol (Recognize, Retreat, and Report).

6.0.2 At the time of the production of this report, HRT Realty was not available for interviews and did not provide a response to the IA questionnaire.

7.0 Technical Capability

DLNR may be able to assist with the provision of personnel to monitor, repair, and replace LUCs such as signs and informational pamphlets. The Hawaii Land Use Commission can operate in an advisory capacity only. DEM can provide personnel to educate the public on MEC recognition and safety. DPP may be able to assist with the installation of signs, provide informational safety face sheets, enforce zoning laws and land use permits. HFD, and HPD can provide personnel to be trained in MEC recognition and safety and in educating occupants conducting intrusive activities on the site.

8.0 Intergovernmental Relationships

Interagency cooperation may be required between DEM, HFD, and HPD when conducting educational programs as a component of the LUCs at PTC. In addition, interagency cooperation may be required with the State Land Use Commission and DPP for land use restrictions, zoning, or permitting. The identified technical capabilities of the remaining primary government stakeholders do not overlap.

9.0 Stability and Funding

The identified primary government stakeholders have a history of continuing performance in their current capacity and are believed to be sufficiently stable for inclusion in the LUC Plan. The primary funding source for maintaining these governmental agencies is through state and county taxes, as well as potential federal grants. The long-term funding to support these institutions is stable.

10.0 Recommendations

10.0.1 Based on this IA, the preliminary LUCs identified below are recommended for PTC.

<u>Engineering Controls</u>

- Installing signs along the public hiking trails warning of the presence MEC and their explosive hazard.
- Installing information stands at the start of hiking trails containing information on the history of the site, the presence and dangers of MEC, safety considerations when using recreational areas at PTC, and response actions that should be taken if MEC are identified.

<u>Educational Programs</u>

- Conducting educational awareness training (i.e., public meetings, community events, school outreach events, and homeowner association meetings) for community residents and visitors regarding the history of the site, the presence and dangers of MEC, safety considerations when using recreational areas within the PTC, and response actions that should be taken if MEC are identified.
- Conducting MEC recognition and safety training for enforcement agencies (i.e., HFD and HPD).

10.0.2 Once the selection of LUCs and agency participation are finalized, a formal LUC Program and a LUC Plan will be developed to document the details of the selected LUCs and each agency's responsibilities for their administration. The LUC Program and Plan will be made available for public comment on the proposed program and plan.

11.0 Interview Summaries

Agency responses to the IA questionnaires are presented in the following subsections.

11.1 State of Hawaii Department of Land and Natural Resources

The purpose of the DLNR is to "enhance, protect, conserve and manage Hawaii's unique and limited natural, cultural and historic resources held in public trust for current and future generations of visitors and the people of Hawaii nei in partnership with others from the public and private sectors." DLNR manages state-owned lands in ways that will promote the social, environmental, and economic well-being of people in the State of Hawaii and will ensure that these lands are used in accordance with the goals, policies, and plans of the state. DLNR owns and manages most of the land within the MRA/MRS boundary and operates and maintains the 10 miles of the public trails traversing the site.

Institutional Analysis 1: Department of Land and Natural Resources

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Name of Agency	DLNR
Origin of Institution	State Government
Basis of Authority	Statutory, State Law
• What are the limits of the agency's authority?	Manage and administer the public lands of the State and minerals thereon and all water and coastal areas of the State except the commercial harbor areas of the State, including the soil conservation function; the forests and forest reserves; aquatic life; wildlife resources; state parks, including historic sites; and all activities thereon and therein, including but not limited to boating, ocean recreation, and coastal areas programs. (Section [§] 26-15, HRS) DLNR is responsible for managing the owned areas of the PTC and has the authority to close or restrict the public use of all or any portion of DLNR-owned land for up to two years, when deemed necessary for the protection of the natural, geological, or cultural resources of the area or the safety and welfare of persons or property. Signs notifying the public of the duration, extent, and scope of closure are posted during site closure. DLNR may issue special-use permits to conduct activities prohibited by HAR 13-209-4 for research, education, management, or for any other purpose consistent with Chapter 195, HRS.
• How much control is exercised by the agency?	Enforcement of applicable sections of the HRS and HAR.

Institutional Analysis 1: Department of Land and Natural Resources (continued)

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
• Does the agency have enforcement authority?	Yes. DLNR has the power to issue a civil citation to any person who is charged with having committed a civil resource violation. DLNR is authorized to set, charge, or collect administrative fines or bring legal action to recover administrative fees and cost or payment for damages, or for the cost to correct damages resulting from a violation, per HRS §195-8. Penalty for violations of any laws or rules applicable to the reserves system include a fine not less than $1,000 and/or imprisonment of not more than 1 year for each offense (misdemeanor). Administrative fines may also be collected (see below). (HAR §13-209-6 and HRS §195-8)
Sunset Provisions	None
Geographic Jurisdiction	All the islands of the Hawaiian Archipelago, except Midway Atoll, together with their appurtenant reefs and territorial waters (The Admission Act, HRS §2). Territorial waters extend 3 miles from each island.
Mission of the Agency	"Enhance, protect, conserve and manage Hawaii's unique and limited natural, cultural and historic resources held in public trust for current and future generations of the people of Hawaii nei, and its visitors, in partnership with others from the public and private sectors."
• Public Safety Function	DLNR participates in aspects of public safety as directed by HAR and HRS (e.g., design and placement of warning signs on public lands). (HAR, Title 13, Subtitle 1, Chapter 8) DLNR's board may establish a reasonable schedule of visiting hours for all or portions of the premises and close or restrict the public use of all or any portion thereof, when necessary for the protection of the area or for the safety and welfare of persons or property, by posting appropriate signs indicating the extent and scope of closure.

Institutional Analysis 1: Department of Land and Natural Resources (continued)

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
• LUC Function	DLNR has authority to grant Right of Entry to public land, and is responsible for the management of forests, natural areas, public hunting areas, and plant and wildlife sanctuaries on public lands. DLNR's Division of Conservation and Resources Enforcement has full police powers to enforce all State laws and rules involving State land and its State Parks, historical sites, forest reserves, aquatic life and wildlife areas, coastal zones, Conservation districts, and State shores, as well as county ordinances involving county parks.
Financial Capability	Funded by the Hawaii State Legislature and through collection of fees, rents, and other income derived from its inventory of lands. Capability to financially support LUCs at PTC is limited to providing staff to assist with occasional maintenance of LUCs, such as inspection of LUC signs; notifying USACE if signs need to be replaced; and restocking of informational brochures.
Constraints to Institutional Effectiveness	Limited to working within the existing regulatory framework and with available funding.
Known Land Use Restrictions	None
Is your agency able or willing to participate in the implementation and/or maintenance of the following LUCs: • Installation and maintenance of signs warning individuals of potential risks and response actions if they encounter suspected MEC items • Informational and safety fact sheets and notices attached to construction or land use permits and leases • Issuance and enforcement of zoning laws for land use permits • Issuance and enforcement of land use permits • MEC recognition and safety training involving educating lessees and workers conducting intrusive activities on the site	DLNR is willing to participate in the IA to arrive at solutions that support protection of natural resources and public safety. DLNR may also be willing to assist with occasional maintenance of LUCs, depending on their scope and frequency.

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11.2 State of Hawaii Land Use Commission

In 1961, the State of Hawaii Legislature established the Land Use Law, which establishes an overall framework of land use management whereby all lands in the state of Hawaii are classified into one of four Districts: urban, rural, agricultural, and conservation. The State of Hawaii Land Use Commission administers the statewide zoning Land Use Law and is responsible for preserving and protecting Hawaii's lands and encouraging those uses to which lands are best suited.

Institutional Analysis 2: State of Hawaii Land Use Commission

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Name of Agency	State of Hawaii Land Use Commission
Origin of Institution	State Government
Basis of Authority	State Law
• What are the limits of the agency's authority?	The State of Hawaii Land Use Commission has jurisdiction over the four state land use district designations. The State of Hawaii Land Use Commission has the authority to designate and revise land use district boundaries.
• How much control is exercised by the agency?	The State of Hawaii Land Use Commission assigns land use district designations and may revise their boundaries in accordance with HRS §205.
• Does the agency have enforcement authority?	Limited to reclassification of a land use district in response to a violation.
Sunset Provisions	None
Geographic Jurisdiction	State of Hawaii
Mission of the Agency:	Preserving and protecting lands and encouraging those uses to which lands are best suited.
• Public Safety Function	None
• Land Use Control Function	Sets and controls statewide land use district boundaries.

Institutional Analysis 2: State of Hawaii Land Use Commission (continued)

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Financial Capability	None
Constraints to Institutional Effectiveness	Based on agency authority, can only assist as indicated below. Unable to participate in any other LUCs.
Known Land Use Restrictions	None
Is your agency able or willing to participate in the implementation and/or maintenance of the following LUCs: • Installation and maintenance of signs warning individuals of potential risks and response actions if they encounter suspected MEC items • Informational and safety fact sheets and notices attached to construction or land use permits and leases • Issuance and enforcement of zoning laws for land use permits	Willing to assist with providing guidance on when a special use permit, district boundary amendment, or other type of proceeding is required and the general process to implement these actions.
• Issuance and enforcement of land use permits • MEC recognition and safety training involving educating lessees and workers conducting intrusive activities on the site	

11.3 City and County of Honolulu, Department of Emergency Management

11.3.1 The DEM coordinates city and county emergency management plans, programs, and initiatives with that of the state, federal, private, and corporate entities. The mission of the DEM is to develop, prepare for, and assist in the implementation of emergency management plans and programs to protect and promote the public health, safety, and welfare of the city during times of disaster or emergency. Disasters, emergencies, threats, or hazards against which DEM direct their efforts include enemy attack; natural disasters such as hurricanes, earthquakes, tsunamis, flooding, high surf, and high winds; man-caused disasters such as aircraft crashes, radiological incidents, marine and inland oil spills, and hazardous material releases; and acts or threats of terrorism, to include terrorist use of weapons of mass destruction. DEM conforms to the standards for local preparedness set forth by the Federal Emergency Management Agency by performing awareness, prevention, mitigation, preparedness, coordinated response and recovery activities, and planning.

Institutional Analysis 3: City and County of Honolulu, Department of Emergency Management

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Name of Agency	DEM
Origin of Institution	City and County of Honolulu
Basis of Authority	Statutory
• What are the limits of the agency's authority?	The DEM is established by HRS § 128-13 and § 6-103 of the Revised Charter of the City and County of Honolulu.
• How much control is exercised by the agency?	Limited; no regulatory enforcement authority.
• Does the agency have enforcement authority?	None
Sunset Provisions	Not applicable
Geographic Jurisdiction	City and County of Honolulu, comprising the Island of Oahu and the small islands northwest of Kauai and Niihau extending from Nihoe to Kure (except Midway).
Mission of the Agency:	The department's mission is to plan and prepare for, respond to, and recover from disasters to protect the public's health, safety, and welfare. DEM responds to natural disasters (e.g., hurricanes, earthquakes, tsunamis, flooding, high surf, wild fires, and high winds) and technological disasters (e.g., aircraft crashes, radiological and hazardous material releases, and marine and inland oil

Institutional Analysis 3: City and County of Honolulu, Department of Emergency Management (continued)

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Mission of the Agency: (continued)	spills). DEM oversees the City's Emergency Operations Center, where disaster response and recovery are coordinated. The Emergency Operations Center brings together state and federal government agencies and the private sector.
• Public Safety Function	Plan and prepare for, respond to, and recover from disasters (e.g., natural and technological) to protect the public's health, safety, and welfare.
• Land Use Control Function	Limited (recommendation) unless there is a Governor Declaration of Emergency, in which case land can be used and/or controlled for emergency.
Financial Capability	Limited (no budget for LUC program).
Constraints to Institutional Effectiveness	Smallest department within the City and County of Honolulu (14 member full-time staff) with limited budget.
Known Land Use Restrictions	None
Is your agency able or willing to participate in the implementation and/or maintenance of the following LUCs: • Installation and maintenance of signs warning individuals of potential risks and response actions if they encounter suspected MEC items • Informational and safety fact sheets and notices attached to construction or land use permits and leases • Issuance and enforcement of zoning laws for land use permits • Issuance and enforcement of land use permits • MEC recognition and safety training involving educating lessees and workers conducting intrusive activities on the site	• DEM is willing to partner and participate in public safety outreach activities such as public awareness and educating the community of the hazards of MEC. • Continued participation in Restoration Advisory Boards to maintain situational awareness and provide input from a city and county and community health, safety, and welfare perspective. • Encourage USACE – Honolulu District to actively participate in the Honolulu Local Emergency Planning Committee as a forum to communicate and collaborate with other hazardous materials safety and security stakeholders. • Facilitate greater situational awareness among City and County of Honolulu departments of the LUC program. Particular focus among public safety processionals of HFD, HPD, and Emergency Services Department.

11.4 City and County of Honolulu, Department of Planning and Permitting

The DPP provides services and information on building permits, development projects, and planning activities for the City and County of Honolulu. DPP is responsible for the City and County of Honolulu's long-range planning, community planning efforts, administration and enforcement of ordinances and regulations governing the development and use of land, various codes pertaining to the construction of buildings, and city standards and regulations pertaining to infrastructure requirements. PTC is located in an area zoned for general agriculture (AG-2) and restricted preservation (P-1).

Institutional Analysis 4: City and County of Honolulu, Department of Planning and Permitting

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Name of Agency	DPP
Origin of Institution	City and County of Honolulu; reorganization in 1998.
Basis of Authority	Charter Amendment
• What are the limits of the agency's authority?	All land use approvals within the City and County of Honolulu's jurisdiction. Building, plumbing, and electrical codes. Site development (e.g., grading, trenching, sewer connection enforcement) by above regulations.
• How much control is exercised by the agency?	Varies with the application. For some, DPP is the final authority. For others, it is the accepting and recommending authority.
• Does the agency have enforcement authority?	Yes.
Sunset Provisions	Not applicable
Geographic Jurisdiction	City and County of Honolulu
Mission of the Agency:	DPP is responsible for the City and County of Honolulu's long-range planning, community planning efforts, transit oriented development, administration and enforcement of ordinances and regulations governing the development and use of land, various codes pertaining to the construction of buildings, and city standards and regulations pertaining to infrastructure requirements. The department is comprised of seven strategic groups: Administrative Services Office, Honolulu Land Information System, Customer Service Office, Planning, Land Use Permits, Building, and Site Development

Institutional Analysis 4: City and County of Honolulu, Department of Planning and Permitting (continued)

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
	Divisions that conduct the planning, zoning, and permit issuance for the city and manages the GIS used by various governmental agencies and private businesses. The department also provides administrative support for the following commissions, boards, and committees: • The Planning Commission holds public hearings and makes recommendations through the Mayor to the city council on proposals to adopt or amend the general plan, development plans, and zoning ordinances. The commission holds public hearings, makes recommendations on state land use district boundary amendments for parcels of 15 acres or less (other than conservation districts), and approves state land use special use permit applications for changes of land use on agricultural land. • The Zoning Board of Appeals hears and determines appeals from actions of the director of the DPP in the administration and enforcement of zoning, shoreline, subdivision ordinances and regulations. • The Building Board of Appeals hears and determines appeals from actions of the director of the DPP in the administration and enforcement of building, electrical, and plumbing codes, appeals from actions of the fire official in the enforcement of the fire code. The Building Board of Appeals also hears and determines requests for variance from provisions in the building and related codes. The Design Advisory Committee comments on design issues related to major project proposals in special districts.
• Public Safety Function	Issuance of permits and approval must consider public safety concerns. Our divisions assist in disaster response.
• Land Use Control Function	This is the department's primary role.
Financial Capability	Annual budget appropriation
Constraints to Institutional Effectiveness	Limited manpower. Constrained by state and federal limitations.

Institutional Analysis 4: City and County of Honolulu, Department of Planning and Permitting (continued)

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Known Land Use Restrictions	Not applicable
Is your agency able or willing to participate in the implementation and/or maintenance of the following LUCs:	
• Installation and maintenance of signs warning individuals of potential risks and response actions if they encounter suspected MEC items	Yes; within budget constraints.
• Informational and safety fact sheets and notices attached to construction or land use permits and leases	Yes.
• Issuance and enforcement of zoning laws for land use permits	Yes.
• Issuance and enforcement of land use permits	Yes.
• MEC recognition and safety training involving educating lessees and workers conducting intrusive activities on the site	No. This is not our area of expertise or authority.

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11.5 City and County of Honolulu, Honolulu Fire Department

The HFD is a firefighting agency with a jurisdiction encompassing the entire island of Oahu. HFD was established in 1851. The mission of HFD is to save lives, protect property, and provide for a safer community through preparation, prevention, and effective emergency response.

Institutional Analysis 5: City and County of Honolulu, Honolulu Fire Department

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Name of Agency	HFD
Origin of Institution	City and County of Honolulu; department was established in 1851.
Basis of Authority	Revised Charter of the City and County of Honolulu, Chapter 10 HRS §132, Revised Ordinances of Honolulu Chapter 20.
• What are the limits of the agency's authority?	Investigation of fires, prevention, inspection, and education.
• How much control is exercised by the agency?	Authority to respond to fires, medical and hazardous materials incidents, and rescues in the City and County of Honolulu.
• Does the agency have enforcement authority?	No
Sunset Provisions	None known
Geographic Jurisdiction	City and County of Honolulu
Mission of the Agency:	Promoting fire prevention and other public safety education program; respond to fires, medical incidents, and hazardous materials incidents and rescues
• Public Safety Function	Promote safety and fire prevention.
• Land Use Control Function	None
Financial Capability	None known
Constraints to Institutional Effectiveness	None known
Known Land Use Restrictions	None known

Institutional Analysis 5: City and County of Honolulu, Honolulu Fire Department (continued)

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Is your agency able or willing to participate in the implementation and/or maintenance of the following LUCs: • Installation and maintenance of signs warning individuals of potential risks and response actions if they encounter suspected MEC items	No
• Informational and safety fact sheets and notices attached to construction or land use permits and leases	No
• Issuance and enforcement of zoning laws for land use permits	No
• Issuance and enforcement of land use permits	No
• MEC recognition and safety training involving educating lessees and workers conducting intrusive activities on the site	Yes; information provided by the authority having jurisdiction to the HFD

11.6 City and County of Honolulu, Honolulu Police Department

The HPD is a law enforcement agency with a jurisdiction encompassing the entire island of Oahu. HPD was established in 1932. The mission of HPD is to provide excellent service through partnerships that build trust, reduce crime, create a safe environment, and enhance the quality of life in the community.

Institutional Analysis 6: City and County of Honolulu, Honolulu Police Department

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
Name of Agency	HPD
Origin of Institution	The HPD was established in 1932 as a county police department for the City and County of Honolulu.
Basis of Authority	The HRS and the Revised Charter of the City and County of Honolulu.
• What are the limits of the agency's authority?	The area of the PTC appears to be owned by private entities and the State of Hawaii. In most cases, the HPD shares concurrent jurisdiction with federal, state, and military law enforcement agencies.
• How much control is exercised by the agency?	If a conflict arises over jurisdiction, HPD officers shall provide services if they are within their authority to do so. Police services shall not be delayed or hindered by jurisdictional issues.
• Does the agency have enforcement authority?	Yes
Sunset Provisions	Observed in accordance with applicable laws of the HRS.
Geographic Jurisdiction	For assignment purposes, the area of the PTC is the responsibility of the HPD's District 4 Uniformed Patrol Division. Included in District 4's area of responsibility are the Kailua and Waimanalo areas.
Mission of the Agency	Mission statement: "We the men and women of the Honolulu Police Department are dedicated to providing excellent service through partnerships that build trust, reduce crime, create a safe environment, and enhance the quality of life in our community." We are committed to the principles of integrity, respect, and fairness.

Institutional Analysis 6: City and County of Honolulu, Honolulu Police Department (continued)

Institutional Analysis Questionnaire – Former Pali Training Camp	
Required Field	**Agency Response**
• Public Safety Function	• Preservation of public peace • Protection of the rights of persons and property • Prevention of crime • Detection and arrest of offenders • Enforcement of all state laws and city ordinances • Service of processes and notices in civil and criminal proceedings
• Land Use Control Function	Limited in scope and authority.
Financial Capability	Falls within the purview of the City and County of Honolulu.
Constraints to Institutional Effectiveness	The HPD is governed by applicable state laws, Revised Ordinances of the City and County of Honolulu, and Departmental Directives, which assist officers in carrying out their assigned duties.
Known Land Use Restrictions	Not applicable
Is your agency able or willing to participate in the implementation and/or maintenance of the following LUCs: • Installation and maintenance of signs warning individuals of potential risks and response actions if they encounter suspected MEC items • Informational and safety fact sheets and notices attached to construction or land use permits and leases • Issuance and enforcement of zoning laws for land use permits • Issuance and enforcement of land use permits • MEC recognition and safety training involving educating lessees and workers conducting intrusive activities on the site	The HPD would be willing to participate in MEC recognition and safety training involving educating occupants conducting intrusive activities on the site.

11.7 HRT Realty –Major Landowner

11.7.1 HRT Realty is a privately-held real estate company operating in Honolulu, Hawaii. It was founded in 1960. A portion of the land it manages is owned by the Weinberg Foundation.

11.7.2 At the time of the production of this report, HRT Realty was not available for interviews and did not provide a response to the IA questionnaire.

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12.0 References

Huikala, 2014, *Draft-Final Remedial Investigation Report, Pali Training Camp, Oahu, Hawaii*. June.

USACE, 2000. *EP 1110-1-24, Engineering and Design - Establishing and Maintaining Institutional Controls for Ordnance and Explosives (OE) Projects*. December.

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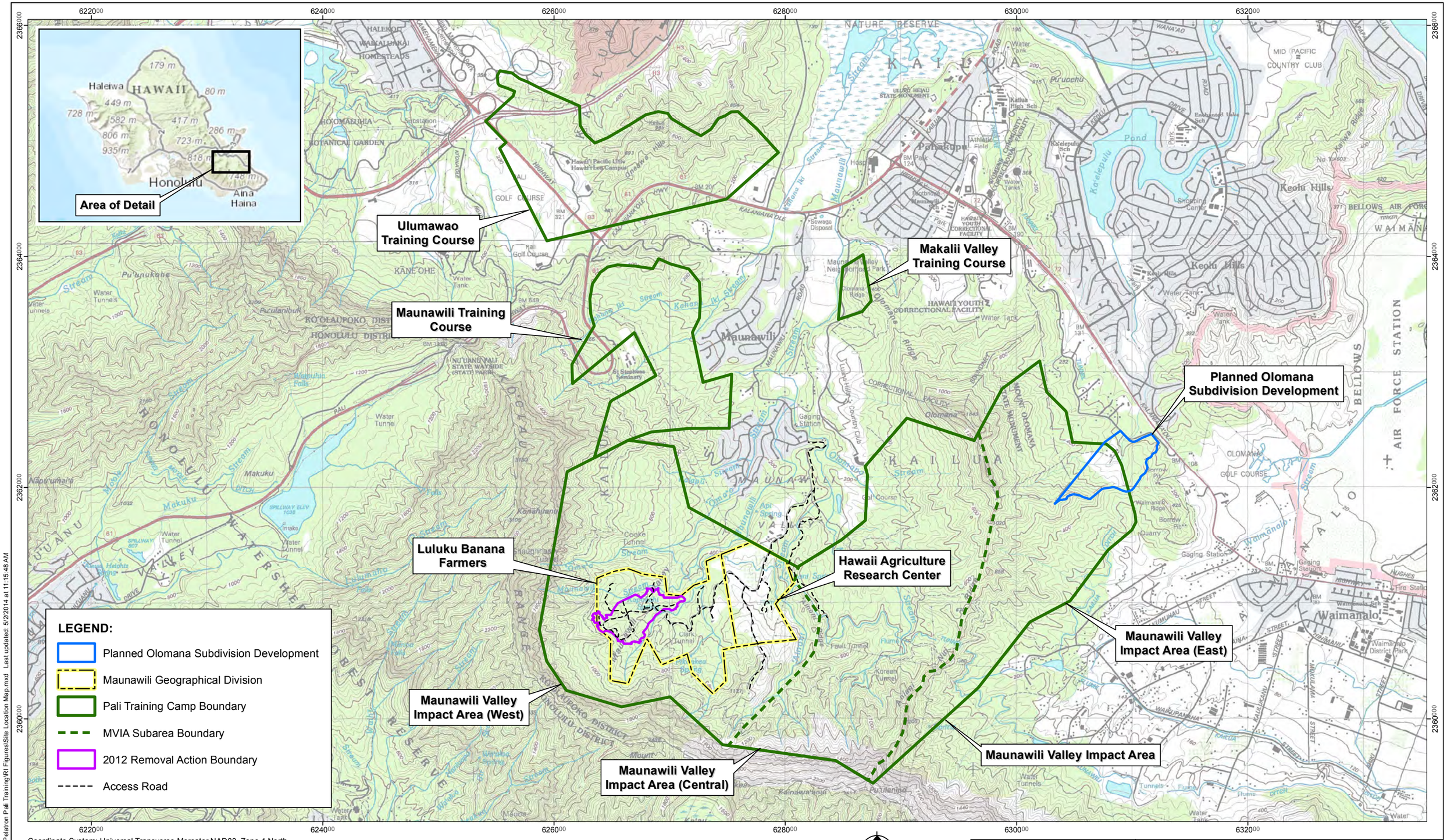

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Coordinate System: Universal Transverse Mercator NAD83, Zone 4 North
Sources: U.S. Geological Survey; U.S. Army Corps of Engineers
References: "Site Investigation Report, Pali Training Camp, Heeia Combat Training Area, and Waikane Training Area, Oahu, Hawaii," September 2009, prepared by Wil Chee-Planning, Inc.

N
0 2,500
SCALE: 1" = 2,500'

PROJECT: Pali Training Camp FUDS Project No. H09HI0277	SITE LOCATION MAP			
LOCATION: City and County of Honolulu, Hawaii	DRAWN BY: MKH 5/2/2014	CHECKED BY: JC 5/2/2014	PROJECT NO. 2012-128	FIG NO. 1