2016 Annual Natural Resource Monitoring, Mitigation, and Management Report

Covering Activities Conducted from 1 January 2016 through 31 December 2016

Environmental Services Cooperative Agreement Remediation Program Munitions Response Areas

Former Fort Ord
Monterey County, California

April 7, 2017

Prepared for:

FORT ORD REUSE AUTHORITY

920 2nd Avenue, Suite A
Marina, California 93933

Prepared Under:

Environmental Services Cooperative Agreement

No. W9128F-07-2-01621
and
FORA Remediation Services Agreement (3/30/07)

Document Control Number: 09595-17-057-001

Prepared by:

ARCADIS Design & Consultancy for natural and built assets

WESTON SOLUTIONS

WESTCLIFFE | ENGINEERS

CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order of Consent
Arcadis	Arcadis US, Inc.
Army	United States Department of the Army
ASP	Ammunition Supply Point
BLM	Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion
BRAC	Base Realignment and Closure
CDFW	California Department of Fish and Wildlife (formerly CDFG, California Department of Fish and Game)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter(s)
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CSUMB	California State University Monterey Bay
CTS	California tiger salamander
dbh	diameter at breast height
DGM	digital geophysical mapping
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESCA	Environmental Services Cooperative Agreement
ESCA RP	Environmental Services Cooperative Agreement Remediation Program
FFA	Federal Facility Agreement
FORA	Fort Ord Reuse Authority
FEG	Future East Garrison
GPS	Global Positioning System
ha	hectare(s)
HMP	Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California
HRP	Habitat Restoration Plan
IAR	Interim Action Ranges
km	kilometer(s)
m	meter(s)

MD	munitions debris
MEC	munitions and explosives of concern
MOU	Memorandum of Understanding
MOUT	Military Operations in Urban Terrain
MPC	Monterey Peninsula College
MRA	Munitions Response Area(s)
MRS	Munitions Response Site
msl	mean sea level
NCA	Non-Completed Area
NRCS	Natural Resources Conservation Service
NRMA	Natural Resources Management Area
QB	Qualified Biologist
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SCA	Special Case Area
SQB	Senior Qualified Biologist
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
UXO	unexploded ordnance

1.0 INTRODUCTION

1.1 Purpose and Scope

This Annual Natural Resource Monitoring, Mitigation, and Management Report summarizes natural resource-related activities performed by the Fort Ord Reuse Authority (FORA) Environmental Services Cooperative Agreement (ESCA) Remediation Program (RP) Team ("ESCA RP Team", consisting of Arcadis U.S., Inc. (Arcadis), Weston Solutions, Inc., and Westcliffe Engineers, Inc.) during the period from 1 January 2016 through 31 December 2016. This report includes data and associated information that meet requirements outlined in the Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California (HMP; USACE 1997) and in Biological Opinions (BOs; USFWS 1999, 2002, 2005, 2007, and 2015) issued to the United States Department of the Army (Army) by the United States Fish and Wildlife Service (USFWS). The HMP and BOs identify mitigation measures to avoid and minimize impacts to rare, threatened, and endangered species and their habitats during pre-disposal activities such as munitions investigation activities. Implementation of the requirements by the ESCA RP Team is conducted in coordination with the Army.

Arcadis US, Inc. (Arcadis) has prepared this document on behalf of FORA (the Recipient) in accordance with industry standards and consistent with the requirements of the Remediation Services Agreement dated 31 March 2007 by and between Arcadis and the Recipient, including any applicable governing documents and applicable laws and regulations.

This report is the ninth in a series of Annual Natural Resource Monitoring, Mitigation, and Management Reports produced for the ESCA RP. The eight previous reports covered the 2008, 2009, 2010, 2011, 2012, 2013, 2014, and 2015 reporting periods (ESCA RP Team 2009, 2010a, 2011a, 2012a, 2013b, 2014, 2015, and 2016).

1.2 Environmental Services Cooperative Agreement

The former Fort Ord (Figure 1) was placed on the National Priorities List in 1990, primarily because of chemical contamination in soil and groundwater that resulted from past Army operations. To oversee the cleanup of the base, the Army, the Department of Toxic Substances Control (DTSC), the Central Coast Regional Water Quality Control Board (RWQCB), and the United States Environmental Protection Agency (EPA) entered into a Federal Facility Agreement (FFA). One of the purposes of the FFA was to ensure that the environmental impacts associated with past and present activities at the former Fort Ord were thoroughly investigated and appropriate remedial action taken as necessary to protect public health and the environment.

In accordance with the FFA, the Army is designated as the lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for conducting environmental investigations, making cleanup decisions, and taking cleanup actions at the former Fort Ord. The EPA is designated as the lead regulatory agency for the cleanup, while the DTSC and RWQCB are supporting agencies.

On March 31, 2007, the Army and FORA entered into an ESCA governing the remaining munitions and explosives of concern (MEC) removal activities required for approximately 3,300 acres (1351.6 hectares [ha]) of former Fort Ord property. In accordance with the ESCA and an Administrative Order on Consent (AOC), FORA is responsible for completion of CERCLA response actions, except for munitions response actions as defined in the ESCA and related documents, except for those retained by the Army. The AOC was entered into voluntarily by FORA, the EPA Region 9, the DTSC, and the United States Department of Justice Environment and Natural Resources Division on December 20, 2006 (EPA Region 9 CERCLA Docket No. R9-2007-03). The underlying property was transferred to FORA in May 2009. The AOC was issued by EPA under the authority vested in the President of the United States by Sections 104, 106, and 122 of CERCLA, as amended, 42 United States Code §§ 9604, 9606, and 9622.

FORA, through the ESCA RP Team, is in the process of completing the Army's MEC response actions in a program hereinafter identified as the ESCA RP. Designated future land use designations for the ESCA Munitions Response Areas (MRAs) include: habitat reserve, habitat corridor, development (residential and non-residential), and borderland development areas along Natural Resources Management Area (NRMA) interface (Figure 2). As described in the 1997 HMP, these categories are defined as:

Habitat Reserve – management goal is conservation and enhancement of threatened and endangered species

Habitat Corridor – lands between major reserve areas; to be managed to promote connections between conservation areas

Development – no management restrictions; some plans for salvage of biological resources from these lands may be specified

Borderland Development Areas along NRMA Interface (also called Borderland Boundary or Borderland Interface) – areas abutting the NRMA that are slated for development; management of these lands includes no restrictions except along the development/reserve interface

Future Road Corridors – lands within habitat reserve set aside for future road development; to be managed as habitat reserve until road development occurs

Development with Reserve or Development with Restriction – lands slated for development that contain inholdings of reserve or require specific restrictions to protect biological resources values; management of reserve inholdings must match that for habitat reserves, while management in development areas must proceed with certain specific restrictions identified in the HMP.

The nine ESCA MRAs are made up of entire or partial parcels. As defined by the HMP, the parcels have multiple intended uses. These MRAs include: California State University at Monterey Bay (CSUMB) Off-Campus MRA, County North MRA, Del Rey Oaks (DRO)/Monterey MRA, Future East Garrison (FEG) MRA, Interim Action Ranges (IAR)

MRA, Laguna Seca Parking MRA, Military Operations in Urban Terrain (MOUT) Site MRA, Parker Flats MRA, and Seaside MRA (Figures 1 and 2). Of these nine ESCA MRAs, five include habitat reserve or habitat corridor parcels: County North, Del Rey Oaks/Monterey, FEG, IAR, and Parker Flats (ESCA RP Team 2009, 2010a, 2011a; Figure 2). These five MRAs that contain habitat reserves or corridors have been subject to natural resource monitoring, mitigation, and management activities since the inception of the ESCA, such as erosion control, target weed management, and active and passive restoration activities. Borderland boundary areas are also subject to erosion control and weed management efforts, as needed. The borderland boundary is shown on Figure 2.

The majority of the ESCA RP Team munitions investigation activities were completed in all MRAs by the end of 2013. Associated biological field activities continue to be performed in three MRAs that contain habitat reserve or habitat corridor parcels: FEG, Parker Flats, and IAR (Table 1-1, Figures 3a, 3b, and 3c). As detailed in Appendix A, habitat restoration monitoring activities were conducted in the IAR MRA Range 47 Special Case Area (SCA) Restoration Area during this period.

Erosion control and weed monitoring were conducted in the Seaside MRA as well as along the adjacent borderland boundary, also called the Blue-line Road.

2.0 NATURAL RESOURCE MONITORING AND MITIGATION REQUIREMENTS

Primary requirements for natural resource monitoring and mitigation are described in the HMP (USACE 1997) and the BO (USFWS 2015) issued to Army to enable compliance with the Federal Endangered Species Act (ESA) and to avoid or minimize, to the extent feasible, the take of listed species as well as protecting other native species of concern.

2.1 Habitat Management Plan

The HMP (USACE 1997) and modifications to the HMP provided in the "Assessment, East Garrison—Parker Flats Land Use Modifications, Fort Ord, California" (Zander 2002) present the boundaries of habitat reserve and development areas and describe land use, conservation, management, and habitat monitoring requirements for target species within the former Fort Ord. Following the HMP, a portion of the Interim Action Ranges MRA was subsequently identified as non-residential development in a proposal for land-use modifications titled Assessment East Garrison – Parker Flats Land Use Modifications ("the 2002 Land Use Modifications"; Zander 2002) and in the Memorandum of Understanding Concerning the Proposed East Garrison/Parker Flats Land-Use Modification Between the FORA, Monterey Peninsula College (MPC), County of Monterey, U.S. Bureau of Land Management (BLM), and U.S. Army as Parties to the Agreement ("the 2004 Memorandum of Understanding [MOU]"; Army 2004). The 2002 Land Use Modifications and 2004 MOU included revision to the position of the borderland interface.

The HMP and BO establish guidelines for the conservation and management of wildlife and plant species and habitats that largely depend on former Fort Ord land for survival (USACE

1992, 1997; USFWS, and 2015). Threatened and endangered plant and animal species as well as designated critical habitat for some species occur at the former Fort Ord. Each reuse area has been screened for potential impacts or disturbances to threatened and endangered species identified in the HMP (USACE 1997). Implementation of the provisions of the HMP and referenced additional measures satisfy the requirements of the ESA.

Pertinent goals of the HMP include:

- Preserve, protect, and enhance populations and habitats of federally listed threatened and endangered wildlife and plant species;
- Avoid reducing populations or habitat of federal proposed and candidate wildlife and plant species to levels that may result in one or more of these species becoming listed as threatened or endangered;
- Preserve and protect populations and habitat of state-listed threatened and endangered wildlife and plant species;
- Avoid reducing populations or habitat of species listed as rare, threatened, and endangered by the California Native Plant Society (CNPS), or with large portions of their range at former Fort Ord, to levels that may result in one or more of these species becoming listed as threatened or endangered.

Natural resource monitoring and mitigation requirements associated with munitions investigation activities addressed in the HMP have several primary objectives: minimize disturbance associated with munitions investigation activities; avoid or minimize impacts to known sensitive HMP species, where feasible; conduct passive and/or active habitat restoration, where required; and conduct employee environmental awareness training.

A total of 18 species are addressed in the HMP and are referred to in this report as HMP species (Table 2-1); these species are described in further detail in Section 4. HMP species are defined as those species that had the following status at the time of HMP preparation (USACE 1997):

- Federally proposed and listed threatened and endangered species;
- Species that are candidates for federal listing as threatened or endangered;
- State-listed threatened and endangered species;
- Species that fell under one of the previous categories during preparation of the 1994 HMP but that no longer have any legal status under the federal or state ESA; and
- California Native Plant Society List 1B species with extensive portions (greater than 10 %) of their known ranges at former Fort Ord: (Hooker's manzanita [*Arctostaphylos hookeri* subsp. *hookeri*], Toro manzanita [*Arctostaphylos montereyensis*], sandmat manzanita [*Arctostaphylos pumila*], Eastwood's ericameria [*Ericameria fasciculata*], and coast wallflower [*Erysimum ammophilum*]).

The types of effects that munitions investigation activities have on sensitive habitats and HMP species were anticipated in the HMP; these include vegetation burning and cutting, whole plant excavation, crushing or trampling from movement of excavation equipment and team foot traffic, and on-site MEC detonation. The anticipated habitat acreage and number of plants of HMP species affected by munitions investigation activities were not quantified in

the HMP because the range and quantity of MEC targets had not been determined and investigations are ongoing.

The HMP addresses potential effects of MEC investigation and remedial activities at the former Fort Ord to sensitive HMP wildlife species, including California black legless lizard (*Anniella pulchra nigra*), California red-legged frog (*Rana draytonii*), California tiger salamander (CTS; *Ambystoma californiense*), California linderiella (*Linderiella occidentalis*), Smith's blue butterfly (*Euphilotes enoptes smithi*), Monterey ornate shrew (*Sorex ornatus salarius*), and western snowy plover (*Charadrius nivosus nivosus*). HMP plant species include Monterey spineflower (*Chorizanthe pungens* var. *pungens*), robust spineflower (*Chorizanthe robusta* var. *robusta*), sand (Monterey) gilia (*Gilia tenuiflora* subsp. *arenaria*), seaside bird's-beak (*Cordylanthus rigidus* subsp. *littoralis*), coast wallflower, Yadon's piperia (*Piperia yadonii*), Eastwood's ericameria, Hooker's manzanita, Toro manzanita, sandmat manzanita, and Monterey ceanothus (*Ceanothus rigidus*). Several HMP species have estimated ranges that include more than 50% of their population at the former Fort Ord; these include: sand (Monterey) gilia, Monterey spineflower, Eastwood's ericameria, Monterey ceanothus, sandmat manzanita, and Toro manzanita (USACE 1997). The HMP considers two federally-listed HMP annual species with populations concentrated at the former Fort Ord as particularly vulnerable to the potential effects of MEC investigation and remedial activities at the former Fort Ord: Monterey spineflower and sand (Monterey) gilia.

Monitoring requirements at munitions investigation sites include baseline surveys prior to munitions investigation activities as well as follow-up monitoring after munitions investigation activities are complete. Follow-up surveys for shrubs and subshrubs are conducted in Years 3, 5, 8, and 13 after munitions investigation activities, and follow-up surveys for HMP annuals are conducted in Years 1, 3, 5, and 8 after munitions investigation activities (Burleson 2009). Data to be gathered during maritime chaparral baseline and follow-up monitoring include site size, methods used for vegetation clearing, extent of soil disturbance, percent cover by different shrub species, percent cover by non-native species, HMP annual species density, field notes and photographic documentation.

Habitat restoration activities in central maritime chaparral vegetation affected by munitions inspection activities focus on restoring naturally regenerating vegetation that exhibits characteristics such as high species diversity, a mosaic of seral stages and age classes, and suitable habitat to support HMP species such as sand (Monterey) gilia, Monterey spineflower, seaside bird's-beak, and California black legless lizard.

Post-disturbance restoration focusing on HMP annual species - sand (Monterey) gilia, Monterey spineflower, and seaside bird's-beak - is considered successful if three criteria are met five years after disturbance: self-sustaining populations of these HMP annual species are observed in a mosaic of various stand ages of maritime chaparral, the amount of habitat supporting these species is comparable to 1992 levels, and population sizes are comparable to 1992 levels (USACE 1997). After each year's monitoring, the resulting data are then utilized for adaptive management of restoration activities to reflect changing conditions and continued progression toward success criteria, including supplemental weeding, planting, or seeding.

Wetlands used by CTS, if disturbed, are also required to be restored (USFWS 2005). Corrective measures for vernal pool and pond (referred to as "aquatic features" by the ESCA RP Team) restoration include minimizing excavation area and depth, topsoil salvaging and replacement, and restoring affected wetlands so that they are of the same acreage and provide the same functions as before MEC clearance. Aquatic feature effects are evaluated on a case-by-case basis.

Follow-up monitoring of restored aquatic features occurs during each rainy season for five years after restoration. Data to be gathered during monitoring of restored aquatic features include dates when the aquatic features begin to fill, when they dry out, water conditions, percent cover by different wetland vegetation types, and occurrence and relative abundance of California linderiella, CTS, and California red-legged frog.

Monitoring methods are detailed in Section 5.

2.2 Biological Opinions

The USFWS has issued BOs to the Army, of which five are applicable to the ESCA (USFWS 1999, 2002, 2005, 2007, and 2015). All biological opinions related to the former Fort Ord are cited in the references of this report; the brief summary below focuses on the four applicable BOs. The ESCA RP Team acts as the Army's agent to implement relevant requirements of the BOs while conducting fieldwork within ESCA MRAs. In this role, the ESCA RP Team members are in frequent communication with Mr. William Collins, Base Realignment and Closure (BRAC) Office Environmental Coordinator and Mr. Bart Kowalski, Chenega Support Services Wildlife Biologist supporting BRAC, to address natural resource compliance requirements and progress.

Of the applicable BOs, the 30 March 1999 "Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California (1-8-99-F/C-39R)" addresses the impacts that the closure and reuse of Fort Ord may have on nine sensitive species, which were at the time federally listed or proposed to be listed (USFWS 1999).

The 22 October 2002 "Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California as it affects Monterey Spineflower Critical Habitat (1-8-01-F-70R)" addresses the impacts that the closure and reuse of Fort Ord may have on the Monterey spineflower and its critical habitat (USFWS 2002). Monterey spineflower critical habitat exists in County North, IAR, Laguna Seca Parking, and FEG MRAs (USACE 1992).

The 30 March 2005 BO titled "Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields ([*Lasthenia conjugens*] 1-8-04-F-25R)" addresses the impacts that the closure and reuse of Fort Ord may have on CTS and critical habitat for Contra Costa goldfields (USFWS 2005); it was amended in 2007 to address new findings of CTS north of Reservation Road as well as a Marina Coast Water District project ("Amendment to Biological Opinion 1-8-04-F-25R, for the Cleanup and Reuse of Former Fort Ord, Monterey County, California"; USFWS 2007). CTS occur within areas adjacent to County North, IAR, FEG, Laguna Seca Parking,

MOUT Site, Parker Flats, and Seaside MRAs (USACE 1992). It should be noted that no critical habitat for Contra Costa goldfields occurs on former Fort Ord.

The 28 May 2015 BO titled "Programmatic Biological Opinion for Cleanup and Property Transfer Actions Conducted at the Former Fort Ord, Monterey County, California (8-8-09-F-74)" contains an updated analysis of the effects of Army cleanup and transfer activities on Contra Costa goldfields, California tiger salamander, Monterey gilia, Smith's blue butterfly, Yadon's piperia (*Piperia yadonii*), and any relevant critical habitat. It should be noted that Contra Costa goldfields and Yadon's piperia have not been reported to occur within the IAR MRA and there is no designated critical habitat for Contra Costa goldfields or Yadon's piperia within the former Fort Ord site. The 2015 BO superseded all previous BOs.

3.0 SITE DESCRIPTION

Former Fort Ord is located about 8 miles (13 kilometers [km]) north of the city of Monterey, California and occupies approximately 28,000 acres (11,331 ha) adjacent to Monterey Bay and the cities of Marina, Seaside, Sand City, Del Rey Oaks, and Monterey. State Highway 1 crosses the western portion of the former Fort Ord, separating the beachfront from most of the former Fort Ord site (Figure 1). The former Fort Ord lies just to the south of the Salinas River delta in a broad low area between the Santa Lucia Mountains to the south and the Santa Cruz Mountains to the north.

The site is dominated by Pleistocene-age Aeolian sand dunes and other geologically younger sediments (Aromas sand and sandstone, Baywood sand, Oceano sand, Paso Robles formation, gravels, sands, silts, and clays), which cover older consolidated rocks, including Mesozoic granite and metamorphic rocks, Miocene sedimentary rocks of the Monterey shale formation, and upper Miocene to lower Pliocene marine sandstones. The sand sheet in the Salinas Basin is the northernmost of six distinctive sand sheets that occur in geologically subsiding basins at the mouths of rivers along the coast of southern California and northern Baja California (Hunt 1993).

The local weather pattern of mild, wet winters and warmer, dry summers is characteristic of Mediterranean-climate regions, with most precipitation concentrated between October and April. In the Monterey area, local climate is influenced by summer fog and predominant cool northwest winds. There is a sharp gradient in climate from the coast to inland areas, where summer temperatures may be much higher, especially during calm periods and/or in areas sheltered from the prevailing winds.

3.1 Vegetation Types in MRAs

The four most frequently encountered vegetation types in MRA habitat parcels are central maritime chaparral, coast live oak woodland, grassland, and aquatic features. Other vegetation types, such as central coastal scrub, cover smaller areas; a brief description of coastal scrub is incorporated into the vegetation description for central maritime chaparral that follows. Observed plant and wildlife species are documented in each of the monitoring

areas in the ESCA MRAs, especially those with habitat parcels where the ESCA RP biologists most frequently work (Tables 3-1 and 3-2). These lists do not represent a comprehensive inventory of all species expected in the MRAs, but only those that have been observed to date.

3.1.1 Central Maritime Chaparral

The predominant vegetation at the former Fort Ord is central maritime chaparral, which is comprised of evergreen shrubs and occasional multi-trunked coast live oaks that grow together at varying densities from open stands to almost impenetrable thickets in coastal areas of the Central Coast underlain with sand or sandstone-derived soils. This woody chaparral shrub vegetation ranges from 4 to 15 or more feet (1 to 5 meters [m]) in height, although low-growing annuals and herbaceous perennials are scattered in exposed openings. Species composition varies with microhabitat characteristics and stand age since the last disturbance.

In general, maritime chaparral is an unusual vegetation type found primarily on sandy substrates in a few coastal locations in Santa Barbara, San Luis Obispo, Monterey, and Santa Cruz Counties. Often these maritime chaparral associations are dominated by local endemic species of ceanothus (*Ceanothus*) and manzanita (*Arctostaphylos*) mixed with other widespread and endemic species (Holland 1986; Holland and Keil 1995). Maritime chaparral is a vegetation type of particular concern in the HMP because it supports a number of rare, threatened, and endangered species populations; see Section 4 below.

Central maritime chaparral is the dominant vegetation type in the ESCA MRAs in which 2016 vegetation transect monitoring was conducted. Mature chaparral vegetation structure consists of a relatively simple canopy layer with a diversity of annual and short-lived herbaceous species occurring in sunny openings between shrubs, including a number of local endemic taxa.

The sandy substrate typical of maritime chaparral habitats tends to be low in organic matter and nutrients, particularly nitrogen and phosphorus (Smith et. al 2002). As a result, microflora and microfauna play a particularly important role in nutrient cycling, and cryptogamic soil crusts are observed in most undisturbed chaparral vegetation. Two generalized subtypes of maritime chaparral have been characterized at the former Fort Ord: sandhill maritime chaparral and inland maritime chaparral (USACE 1992). Sandhill maritime chaparral occurs in the rolling sand hills of coastal areas on loose Aeolian sand (Smith et al. 2002). The deep sandy soils allow deep root penetration and retained moisture below the dry surface layers in summer. Sandhill maritime chaparral is typically dominated by stump-sprouting shrubs such as shaggy-barked manzanita (*Arctostaphylos tomentosa* subsp. *tomentosa*) and chamise (*Adenostoma fasciculatum*), along with a mixture of obligate-seeding regional endemics such as sandmat manzanita, Monterey ceanothus, and dwarf ceanothus (*Ceanothus dentatus*); these obligate-seeding shrubs are often codominant with the stump-sprouting shrubs, and chamise rarely contributes the greatest cover of any shrub species to the canopy. Sandhill chaparral occurs in the Seaside, Parker Flats, and IAR MRAs, as well as elsewhere on the western half of the former Fort Ord.

Further inland the elevation increases as sandstone outcroppings appear. The relatively thin veneer of sand, derived from sand deposits and weathering, forms a layer over the top of the sandstone outcroppings. Soil texture and permeability have a direct impact on root penetration and plant species distribution. Like sandhill chaparral, the inland maritime chaparral vegetation is also dominated by stump-sprouting shrubs such as chamise, which has relatively higher cover on sandstone compared with sand. Shaggy-barked manzanita is replaced by another stump-sprouting shrub, brittleleaf manzanita (*Arctostaphylos crustacea* subsp. *crustacea*), in inland areas, and a stump-sprouting ceanothus species, blue-blossom (*Ceanothus thyrsiflorus*), forms large colonies in the chaparral vegetation. Obligate-seeding shrub dominants include Toro manzanita, Hooker's manzanita, dwarf ceanothus, Monterey ceanothus, and others. Inland chaparral is widespread in the FEG MRA.

Fire plays a major role in chaparral ecosystems, typically occurring every few decades, returning nutrients to the soil that are tied up in dead wood and leaf litter as well as creating openings with ample sunlight and space for seed germination and seedling establishment. A number of chaparral shrubs, such as shaggy-barked manzanita, brittleleaf manzanita, and chamise have underground or surface stems (burls) that resprout after fire. Other shrubs, such as dwarf ceanothus, Monterey ceanothus, sandmat manzanita, Hooker's manzanita, and Toro manzanita, are obligate seeders that can only recolonize a burned site from seed after fire; often the seed requires fire-induced cues in order to germinate. Post-fire sites are often carpeted with a mixture of obligate-seeding shrubs and herbaceous species the spring after a wildfire. As shrubs become re-established after fire, herbaceous and smaller species tend to be excluded by expanding canopies of the dominant shrubs; however, even in mature stands of central maritime chaparral, open areas may occur between shrubs that support herbaceous species.

The primary vegetation alliance for this vegetation type is the Shaggy-Barked or Brittleleaf Manzanita Shrubland Alliance, as characterized by CNPS and California Department of Fish and Wildlife (CDFW; Sawyer et. al 2009). Shaggy-barked or brittleleaf manzanita chaparral has a G2/S2 rating (6-20 viable occurrences and/or 2,000-10,000 acres [518-2590 ha] worldwide and statewide), as listed in the CDFW Natural Communities Hierarchy (CDFW 2010) and in California Natural Diversity Database (CNDDB, CDFW 2016); G2/S2 ratings indicate an alliance that is threatened throughout its range.

Central coastal scrub shares many shrub species with maritime chaparral vegetation, although dominant species differ. Overall stature of mature chaparral vegetation is generally taller than that of coastal scrub vegetation and mature chaparral dominants tend to produce waxy sclerophyllous leaves that contrast with the softer, pubescent or smaller leaves of many coastal scrub dominants such as black sage. In addition, the wood of chaparral shrubs tends to be harder and the burls larger and more resistant to surface disturbance than the stems and burls of shrubs that predominate in coastal scrub vegetation. Coastal scrub vegetation generally occurs in drier sites than chaparral, often on south-facing exposures at slightly lower elevations. Coastal scrub dominants frequently appear in chaparral vegetation immediately after disturbances such as burns or vegetation cutting but gradually get overtopped by the larger chaparral dominant shrubs. Central coastal scrub occurs in a small portion in eastern Parker Flats MRA.

This vegetation type would be classified as the Black Sage Shrubland Alliance by CNPS and CDFW (Sawyer et. al 2009); the Black Sage Shrubland Alliance has global and state ranks of G5/S5 (no threats known), as listed in the CDFW Natural Communities Hierarchy (CDFW 2010) and in CNDDB (CDFW 2016).

3.1.2 Coast Live Oak Woodland

Coast live oak woodland is dominated by mixed-aged stands of coast live oak (*Quercus agrifolia*) that vary in density from concentrated bands of oaks along drainage bottoms to scattered trees on nearby slopes. Coast live oak is an evergreen tree ranging from 20 to 75 feet (6 to 25 m) in height, with a spreading crown, many massive branches, and a dense canopy of thick waxy leaves. Trees can live for 100 years or more. Although common in the hills surrounding Monterey, coast live oaks are restricted to a 50-mile (8-km) wide swath along the coast from Mendocino County south to northern Baja California. They are completely absent in the Sierra Nevada and other interior ranges; rather, they tend to occur in the maritime belt that receives fog during the summer months.

Most healthy stands of coast live oak woodland contain mixed age classes of oak trees, saplings, and seedlings that can vary widely in overall appearance, depending on moisture availability. Associated species such as toyon (*Heteromeles arbutifolia*), poison-oak (*Toxicodendron diversilobum*), California blackberry (*Rubus ursinus*), coastal wood fern (*Dryopteris arguta*), bracken fern (*Pteridium aquilinum*), yerba buena (*Satureja douglasii*), wood mint (*Stachys bullata*), and others also form a dense understory in undisturbed oak woodland.

Coast live oak woodland is found in the FEG MRA in drainage bottoms as well as in the Parker Flats and County North MRAs. Like chaparral vegetation, oak woodland and annual grassland may integrate in areas with extensive habitat disturbance.

Coast live oak woodland is characterized as the Coast Live Oak Woodland Community in the CNDDB legacy community classification system (Holland 1986), and as the *Quercus agrifolia* Woodland Alliance in the CNPS Manual of California Vegetation (Sawyer, Keeler-Wolf, and Evens 2009). *Quercus agrifolia* Woodland Alliance has a G5 global rarity ranking (demonstrably secure because of its worldwide occurrence) and an S4 state rarity ranking (greater than 100 viable occurrences statewide, and/or more than 31,110 acres [12,950 ha]); some associations within the *Quercus agrifolia* Woodland Alliance have G3 and S3 rankings (21-100 viable occurrences worldwide/statewide, and/or more 6,400-31,110 acres [2,590-12,950 ha]), according to the CDFW (2010 and 2016).

3.1.3 Grassland

Annual grassland vegetation is located in disturbed areas where there has been prior soil disturbance, as well as along roadways, access routes, and fuel breaks; annual grasslands tend to be dominated by non-native annual grasses and other native and weedy herbaceous species. Among the non-native grasses observed are invasive annual Mediterranean grasses such as slender wild oats (*Avena barbata*), rip-gut brome (*Bromus diandrus*), soft chess

(*Bromus hordeaceus*), red brome (*Bromus madritensis* subsp. *rubens*), foxtail barley (*Hordeum murinum*), and annual fescues (*Festuca* species) and forbs such as filaree (*Erodium cicutarium, E. botrys*), iceplant (*Carpobrotu*s spp., especially *C. edulis*), and others. Degraded central maritime chaparral subjected to habitat disturbances often supports a mosaic of shrubs and weedy non-native grasses.

Limited annual grassland vegetation occurs in disturbed areas in the three MRAs containing habitat parcels where monitoring was conducted during 2016.

In general, the annual grassland areas would be classified as Non-Native Grasslands in the CNDDB legacy community classification system (Holland 1986) and as California Annual Grassland Series within the CNPS Manual of California Vegetation (Sawyer, Keeler-Wolf, and Evens 2009). Non-native Grassland has a global rank of G4 (apparently secure, but factors exist to cause some concern; i.e., there is some threat or somewhat narrow habitat) and a state rank of S4 (apparently secure, but factors exist to cause some concern; i.e., there is some threat or somewhat narrow habitat), as listed in the CNDDB (CDFW 2016).

Perennial grassland vegetation at the former Fort Ord is more common adjacent to broad drainages and swales, where spreading grasses such as alkali rye (*Elymus triticoides*) form large colonies. Perennial grasslands occur near some aquatic features in the northeast corner of the FEG MRA. Small stands of native perennial bunchgrass species such as purple needlegrass (*Stipa pulchra*) also are observed within central maritime chaparral in all MRAs. In all cases, perennial grassland colonies within MRAs are too small (< 0.2 acres) to be classified separately as perennial grassland.

3.1.4 Aquatic Features

Aquatic features are dominated by native herbaceous annual and perennial plants that are typical of seasonal wetlands in coastal California (Table 3-3). Species tend to occur in zones depending on the depth of the depression, from submergent aquatic species to emergent species and then surrounding upland vegetation such as coast live oak woodland, central maritime chaparral, and grassland. Arroyo willow (*Salix lasiolepis*) occurs adjacent to some of the aquatic features in the northeast corner of the FEG MRA as well. A total of 12 aquatic features are found only in the FEG MRA in two main clusters, one in the northeastern corner and the other in the southern portion of the MRA in a former grenade range (Section 3.2.1). These aquatic features were described in detail in Appendix C of the 2011 Annual Resource Monitoring Report (ESCA RP Team 2012a). The grenade range aquatic features are surrounded by mostly bare sandstone due to apparent historical disturbance.

3.2 Environmental Characteristics of MRAs with Habitat Parcels

A summary of environmental characteristics and existing vegetation for each of the MRAs containing habitat parcels where natural resource monitoring was conducted during 2016 is provided in the following sections. These MRAs are shown in Figures 3a, 3b, and 3c.

3.2.1 Future East Garrison MRA Site Description

The FEG MRA (formerly known as the East Garrison MRA) is located in the northeastern portion of the former Fort Ord (Figures 2 and 3a), and is wholly contained within the jurisdictional boundaries of Monterey County. This MRA encompasses approximately 251.5 acres (102 ha) and contains the following four United States Army Corps of Engineers (USACE) parcels: E11b.6.1, E11b.7.1.1, E11b.8 (includes 100-foot [30-m] borderland interface buffer), and L20.19 1.1. Of the 251.5 acres (102 ha) within this MRA, 177.5 acres (71.8 ha) are designated as habitat reserve.

The topography of the FEG MRA is variable, with gentle ridges and steeper canyon walls. Overall, slopes descend from south to north, with higher ridges in the south over 450 feet (137 m) above mean sea level (msl) and lower slopes to the north at 170 feet (52 m) above msl. The southern portion of the FEG MRA is bisected by a small drainage that descends gradually from west to east before joining an unnamed tributary to the Salinas River. Sandstone Ridge borders this drainage to the south, reaching over 400 feet (122 m) above msl; upper slopes of this drainage exceed 500 feet (152 m) elevation to the immediate west of the FEG MRA. Another small forked drainage is located in the northern portion of the FEG MRA and descends directly to the Salinas River floodplain to the north.

The slope of the terrain in the FEG MRA ranges from relatively flat (3 to 5 percent) within an area formerly used as an Ammunition Supply Point, to steep (up to 50 percent) along the drainages. The FEG MRA is underlain by several hundred feet of Aeolian deposits (Aromas formation) consisting mostly of weathered dune sand (NRCS 2013). Surface soil conditions in the FEG MRA are predominantly weathered dune sand and/or sandstone.

Vegetation on the ridges of the FEG MRA primarily consists of central maritime chaparral, with coast live oak woodland predominating in drainages. A limited amount of grassland vegetation is present as well. The western portion of the MRA is designated as critical habitat for Monterey spineflower (Figure 4).

There are twelve aquatic features concentrated in two main areas within the FEG MRA (Figure 3a). Three aquatic features are located in the eastern portion of the former grenade range. The former grenade range has been repeatedly scraped; as a result, much of the terrain surrounding the aquatic features in the former grenade range is un-vegetated sandstone. The remaining aquatic features occur in the northeast corner of the FEG MRA and are surrounded by coast live oak woodland, arroyo willow clusters, and grassland vegetation.

Aquatic larval surveys were completed in the FEG MRA during the 2009-2010 and 2010-2011 rainy seasons to determine whether CTS were present in advance of munitions investigations remediation activities, consistent with the HMP, 2005 BO, Wetland Monitoring and Restoration Plan for Munitions and Contaminated Soil Remedial Activities at the Former Fort Ord (Burleson 2006) and the Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander (CDFW [CDFG] 2003); two CTS larvae were observed in 2011 by the ESCA RP Team in

aquatic features located in northeast FEG MRA in the habitat parcel (ESCA RP Team 2011a and 2012a).

3.2.2 Parker Flats MRA Site Description

The Parker Flats MRA is located in the central portion of the former Fort Ord, bordered by the CSUMB Off-Campus MRA and the County North MRA to the north, the IAR MRA to the south, CSUMB campus property to the west, and additional former Fort Ord property to the east and southeast (Figures 2 and 3b). The Parker Flats MRA is contained within the jurisdictional boundaries of the City of Seaside and Monterey County.

The Parker Flats MRA was targeted for development prior to the closure of Fort Ord in 1994, and in 1999 all vegetation was mowed as a part of munitions investigations activities. A subsequent land exchange resulted in this parcel being rezoned as habitat reserve (Zander 2002). In 2005, FORA, under the supervision of the Army, performed a prescribed burn on 147 acres (59.5 ha) in the Parker Flats MRA.

The Parker Flats MRA has been divided into two phases of work by FORA, identified as Parker Flats MRA Phase I and Parker Flats MRA Phase II. The Army completed a Track 2 Munitions Response Remedial Investigation/Feasibility Study and the signed Track 2 Munitions Response Site Record of Decision (ROD; MACTEC 2006 and Army 2008, respectively) for the Parker Flats MRA Phase I area. The remediation plan documented in the Army ROD for the Phase I area is implemented in this area by FORA. The Parker Flats MRA (Phase I and Phase II areas) encompasses approximately 1,180 acres (477.5 ha) and fully contains USACE parcels E18.1.1, E18.1.2, E18.1.3, E18.4, E19a.1, E19a.2, E19a.5, E20c.2, E21b.3, L20.18, L23.2, and L32.1, and portions of USACE parcels E19a.3 and E19a.4. The remaining portions of USACE parcels E19a.3 and E19a.4 are contained in the County North MRA. Of the 1,180 acres (477.5 ha) identified as the Parker Flats MRA, approximately 211 acres (85.36 ha) are designated as habitat reserve. The borderland interface in this MRA where the reuse area abuts the NRMA is in the middle of the Parker Flats MRA (Figures 2 and 3b).

The terrain of the Parker Flats MRA consists primarily of rolling sandy hills. The elevation ranges from approximately 280 to approximately 490 feet (85 to 149 m) msl, with 2 to 15 percent slopes. The surface soils are characterized as Aeolian (sand dune) and terrace (river deposits), formed from unconsolidated materials of the Aromas and Old Dune Sand formations. The primary soil type present in the Parker Flats MRA is Oceano Loamy Sand with smaller areas of Arnold-Santa Ynez complex and Baywood Sand, which are all weathered dune sands (NRCS 2013).

Vegetation in the Parker Flats MRA consists primarily of coast live oak woodland, maritime chaparral (and associated central coastal scrub vegetation), and grassland. Vegetation varies from sparsely vegetated areas to heavy brush.

3.2.3 Interim Action Ranges MRA Site Description

The IAR MRA is located in the north-central portion of the former Fort Ord, within the boundary of the historical impact area. The IAR MRA is bordered by the Parker Flats MRA to the north, the Seaside MRA to the northwest, and the historical impact area to the southeast, south, and southwest (Figures 2 and 3c). The IAR MRA is contained within the jurisdictional boundaries of Monterey County and a small portion of the City of Seaside.

The IAR MRA encompasses approximately 227 acres (92 ha) and is located in the area designated by the Army as Munitions Response Site (MRS) Ranges 43-48. An Interim Action ROD was produced by the Army in August 2002 for Interim Action Sites at the former Fort Ord, including MRS Ranges 43-48 (Army 2002). The remedial action selected for the Interim Action Sites was presented in the Interim Action ROD and included surface and subsurface MEC removal.

Previous interim remedial actions conducted by the Army resulted in designation of areas, totaling approximately 235 acres (95 ha), within MRS Ranges 43-48 where subsurface MEC removal was not completed as SCAs or Non-completed Areas (NCAs). Approximately 35.9 acres (14 ha) of the SCAs and approximately 9.2 acres (4 ha) of NCAs within MRS Ranges 43-48 are located within the boundaries of the IAR MRA. An additional surface MEC removal was conducted in a portion of the Range 44 SCA in 2007. Range 44 SCA, Range 47 SCA, and Central Area NCAs are the focus of the ESCA RP Team's efforts. Two additional SCAs (Range 45 Trench SCA [approximately 1.2 acres] and a small portion of the Fenceline SCA [one partial 100-ft by 100-ft grid]) are also located within the IAR MRA; however, these areas were not included in the interim remedial action completed by the ESCA RP Team. The IAR MRA fully contains the following five USACE Parcels: E38, E39, E40, E41, and E42. Of the 227 acres (92 ha) within this MRA, 202 acres (82 ha) are designated as habitat reserve, and the northern boundary comprises part of the borderland interface (Figure 3c).

The terrain of the IAR MRA consists of gently undulating slopes ranging from 370 to approximately 530 feet (161.5 m) above msl, generally with 2 to 15 percent slopes. No ravines pass through the IAR MRA, although a few low areas support grassland and scattered shrubs and/or trees. In the Range 47 SCA, prior military earthwork has modified the original topography, resulting in an artificial escarpment located in the southwest portion of this area.

The primary soil type present in the IAR MRA is Arnold-Santa Ynez Complex, with Baywood Sand in the northwestern portion of the MRA. Soil conditions at the MRA consist predominantly of weathered Aeolian dune sand and are described as unconsolidated materials of the Aromas and Old Dune Sand formations (NRCS 2013).

Vegetation in the IAR MRA consists primarily of central maritime chaparral, with a small patch of grassland vegetation in the southern portion of the MRA. Prior to 2003, much of the IAR MRA was inhabited by mixed-aged stands of dense maritime chaparral. The MRA was subjected to a prescribed burn in 2003. Except for a small parcel on the northern edge of the area, most of the MRA is designated as critical habitat for Monterey spineflower (Figure 4).

The areas within the IAR MRA that have been the focus of monitoring efforts are designated with the following names for the purposes of this report (Figure 3c):

- North Range 44: North Range 44 SCA;
- South Range 44: South Range 44 SCA/Central Area NCAs;
- Range 47 Subarea A: Includes a portion of Range 47 SCA subject to large-scale excavation in which the vegetative cover has historically been low, 10% or less (ESCA RP Team 2012a). Non-native pampas grass *(Cortaderia jubata, C. selloana)* was abundant in places. Historical aerial imagery indicates that the vegetation of the area has changed little since the 1970s, despite an apparent lack of recent disturbance, except for fire that has affected the whole range;
- Range 47 Subarea B: Includes the majority of Range 47 SCA, which was subject to large-scale excavation prior to restoration activities;
- Range 47 Subarea C: Includes a small portion of Range 47 SCA surrounding the large-scale excavation area in which vegetation cutting took place in 2012.

4.0 HMP SPECIES

The requirements outlined in the HMP (USACE 1997) and in the BO (USFWS 2015) are described in more detail in Section 2 and focus on compliance with the federal ESA and avoidance or minimization, to the extent feasible, of take of listed species, as well as protection of other species of concern. A total of 18 species were addressed in the HMP (Table 2-1, see Section 2). Of these, 11 are plant species and 7 are wildlife species. Five species are restricted to the Monterey Bay region: the Monterey ornate shrew, Toro manzanita, sandmat manzanita, Eastwood's ericameria, and Yadon's piperia. An additional eight species are endemic to the Central Coast of California between the Bay area and Santa Barbara County, including the California black legless lizard, Smith's blue butterfly, Hooker's manzanita, Monterey ceanothus, Monterey spineflower, robust spineflower, sand (Monterey) gilia, and seaside bird's-beak. Most of these species have 10 or more percent of their populations concentrated at the former Fort Ord. Two HMP plants (robust spineflower and Yadon's piperia) and three HMP wildlife species (California red-legged frog, CTS, and California linderiella) have 99% of their range outside the Fort Ord region.

Those HMP species that occur in vegetation types that are widespread at the former Fort Ord, such as central maritime chaparral, tend to be much more common in the MRAs addressed in this report than species confined to specific habitats such as aquatic features and shoreline areas. A summary of each HMP species is provided below, along with brief comments on occurrence in the MRAs.

4.1 HMP Amphibians

There are two amphibian species that are designated as HMP species (USACE 1997).

California tiger salamander (*Ambystoma californiense*) – Federally Endangered and California Threatened. Adults are 7 to 8 inches (18 to 20 centimeters [cm]) long, black with yellow to cream-colored spots, larvae are greenish-gray in color. CTS occur in open woodlands and grasslands, ponds, and vernal pools from Sonoma to Santa Barbara Counties, inland to portions of the Sierra Nevada. Surveys were conducted for CTS larvae in 2010 and 2011 in aquatic features in the FEG MRA in advance of munitions investigation activities. Two CTS larvae were observed by the ESCA RP Team in the FEG MRA during the 2011 aquatic surveys (ESCA RP 2012a; Appendix C). Both aquatic features are located in northeast FEG MRA in the habitat parcel. USFWS designated habitat zones for CTS on site are shown on Figure 5. ESCA RP biologists did not observe CTS in ESCA MRAs during 2016.

California red-legged frog (*Rana draytonii*) – Federally Threatened and California Species of Concern. Adults are 2 to 5 inches (5 to 13 cm) long, reddish-brown, olive, or green with black flecks; hind legs can be red underneath. California red-legged frogs require cold water ponds or slow moving river pools with emergent and submergent vegetation and riparian vegetation at the edges. California red-legged frogs range from Humboldt to San Diego Counties and in portions of the Sierra Nevada. Larvae of California red-legged frogs have been reported in the BLM portion of the Fort Ord National Monument adjacent to Toro Park (William Collins, personal communication) and suitable habitat is present in parcels outside of ESCA MRAs (USACE 1997). No red-legged frogs have been reported from vernal pools during Army monitoring since 1994. ESCA RP biologist did not observe California red-legged frogs in ESCA MRAs during 2016.

4.2 HMP Reptiles

There is one reptile species that is designated as an HMP species (USACE 1997).

California black legless lizard (*Anniella pulchra nigra*) – California Species of Concern. The limbless adults reach 7 inches (18 cm) in length and are dark on the upper surface and yellow below. Black legless lizards occur in various coastal plant communities where loose sandy soil and abundant invertebrate populations are available. Presently they are found in Monterey County and possibly extirpated from Santa Cruz and San Luis Obispo Counties.

California black legless lizards have been observed by the ESCA RP Team in Parker Flats MRA and IAR MRA. In 2009, a California black legless lizard was observed in an area of oak woodland habitat at the interface with maritime chaparral habitat in sandy soil in the habitat parcel in the Parker Flats MRA. In 2010, a California black legless lizard was observed in maritime chaparral habitat in a development parcel of Parker Flats MRA. In 2012, a California black legless lizard was observed in maritime chaparral with sandy soil in a habitat reserve parcel in IAR MRA. ESCA RP biologists did not observe black legless lizards in ESCA MRAs during 2016.

4.3 HMP Birds

There is one bird species that is designated as an HMP species (USACE 1997) and it occurs outside of the ESCA MRAs, found in the Beach Ranges.

Western snowy plover (*Charadrius nivosus nivosus*) – Federally Threatened and California Species of Concern. The western snowy plover is a small shore bird about 6 to 7 inches (18 cm) in length with pale grayish brown upper body and white underbody bearing a dark breast band, and black legs and bill. Western snowy plovers occur on flat sandy beaches above the high tide level from Washington to Baja California. Western snowy plovers have not been observed by ESCA RP biologists in any of the MRAs on site, and no MRA includes shoreline habitat.

4.4 HMP Mammals

There is one mammal species that is designated as an HMP species (USACE 1997).

Monterey ornate shrew (*Sorex ornatus salaries*) - California Species of Concern. The Monterey ornate shrew is a small mammal approximately 3.5 to 4.25 inches (10 cm) long with grayish brown black fur. It occurs in riparian, woodland, and upland communities where there is thick duff or downed logs. It is endemic to Monterey region. Potential habitat exists for the Monterey ornate shrew in County North, CSUMB Off-Campus, FEG, IAR, MOUT Site, and Parker Flats MRAs. No Monterey ornate shrews have been observed during ESCA RP biological surveys.

4.5 HMP Invertebrates

There are two invertebrate species that are designated as HMP species (USACE 1997).

California linderiella (*Linderiella occidentalis*) – No California or federal listing. California linderiella is a small (<0.5 inch, or 1.2 cm) aquatic fairy shrimp found in seasonal ponds. California linderiella have been observed by ESCA RP biologists in two aquatic features in habitat parcels in the FEG MRA during the 2010 aquatic surveys (ESCA RP 2011a).

Smith's blue butterfly (*Euphilotes enoptes smithi*) – Federally Endangered. Adults with a wingspan of one inch (2.5 cm); males with bright blue upper (dorsal) wing surfaces and females with brown upper wing surfaces; both with orange spotted band on hind upper wing surface edge and whitish gray underwings with dark speckling. It occurs in coastal sand dunes and ravines associated with coast and seacliff buckwheats in Monterey, Santa Cruz, and San Mateo Counties. The Smith's blue butterfly has not been observed by ESCA RP biologists in the ESCA MRAs; it occurs outside of the ESCA MRAs in the Beach Ranges.

4.6 HMP Shrubs

There are five shrub species that are designated as HMP species (USACE 1997).

Hooker's manzanita (*Arctostaphylos hookeri subsp. hookeri*) – CNPS 1B.2. Hooker's manzanita is a low-growing to medium-sized shrub in the heather family that rarely reaches 5 feet (1.5 m) in height, and is usually much shorter in stature; it lacks a basal burl and therefore does not resprout after fire or vegetation cutting. Hooker's manzanita is endemic to the general Monterey Bay region, where it occurs in central maritime chaparral vegetation, especially in sandy soils (Baywood sands) or on ancient marine terraces of the Aromas sandstone formation. Hooker's manzanita is a smaller manzanita than the two widespread stump-sprouting manzanitas in the MRAs: shaggy-bark manzanita, which predominates in lowland ocean-facing central maritime chaparral, and brittleleaf manzanita, which occurs further inland. Hooker's manzanita has been previously mapped as relatively common in portions of the Parker Flats, FEG, and the MOUT Site MRAs, with smaller numbers in the Laguna Seca Parking MRA (USACE 1992). Mapping work completed in 2012 by ESCA RP biologists suggests that densities of Hooker's manzanita have been over-estimated due to previous plant misidentification. Hooker's manzanita is found in the FEG, Parker Flats, and the MOUT Site MRAs.

Toro manzanita (*Arctostaphylos montereyensis*) – CNPS 1B.2. Toro manzanita is a large single-trunked shrub to 12 feet (3.6 m) in height in the heather family; it lacks a basal burl and therefore does not resprout after fire or vegetation cutting. Toro manzanita is endemic to the Monterey region, where it occurs in central maritime chaparral vegetation, especially in sandy soils (Arnold sands) overtopping leached Aromas sandstone bedrock. Toro manzanita is scattered to dominant in maritime chaparral in portions of the Parker Flats, FEG, and MOUT Site MRAs; it occurs in lower densities in the Seaside and Laguna Seca Parking MRAs.

Sandmat manzanita (*Arctostaphylos pumila*) – CNPS 1B.2. Sandmat manzanita is a low mound-forming shrub in the heather family that can reach up to 3 feet (1 m) in height, with broad spreading branches bearing bicolored dull green to grayish leaves. Like Toro manzanita, sandmat manzanita lacks a basal burl and does not resprout after a fire or vegetation cutting. Sandmat manzanita is endemic to Monterey County, and tends to be found in central maritime chaparral and at the margins of oak woodland and Monterey pine forest in Baywood sands and on marine terraces of the Aromas and Paso Robles formations and sandstones allied to Monterey shale. Sandmat manzanita occurs commonly in maritime chaparral in the Seaside, IAR, Parker Flats, and Del Rey Oaks/Monterey MRAs, and in lower densities in the County North and Laguna Seca Parking MRAs.

Monterey ceanothus (*Ceanothus rigidus*) – CNPS 4.2. Monterey ceanothus is a densely-branching shrub in the buckthorn family that reaches approximately 4.5 feet (1.4 m) in height and rarely exceeds 6 feet (2 m). It lacks a basal burl and does not resprout after a fire or vegetation cutting. Monterey ceanothus is endemic to maritime chaparral, central coastal scrub, and Monterey pine forest habitats from southern Santa Cruz to San Luis Obispo County, with its center of distribution in Monterey County. Monterey ceanothus occurs commonly in maritime chaparral in the Seaside, IAR, Parker Flats, FEG, Laguna Seca Parking, MOUT Site, and Del Rey Oaks/Monterey MRAs.

Eastwood's ericameria (*Ericameria fasciculata*) – CNPS 1B.1. Eastwood's ericameria is a multi-stemmed, rounded subshrub to small shrub in the sunflower family that rarely reaches 5

feet (1.5 m) in height. It is able to resprout after fire or vegetation cutting. Eastwood's ericameria is endemic to Monterey County and is found primarily in central coastal scrub and central maritime chaparral in sandy inland soils (Arnold sands overtopping Aromas sandstone). Eastwood's ericameria occurs in maritime chaparral in the Seaside, IAR, Parker Flats, FEG, MOUT Site, and Del Rey Oaks/Monterey MRAs.

4.7 HMP Herbaceous Perennials

There are two herbaceous perennial species that are designated as HMP species (USACE 1997).

Coast wallflower, sand-loving wallflower (*Erysimum ammophilum*) – CNPS 1B.2. Coast wallflower is a biennial to short-lived perennial in the mustard family that reaches from several inches to 1 to 2 feet (0.3 to 0.6 m) in height when flowering. It is endemic to coastal dunes flanking the Monterey Bay region and is also found on Santa Rosa Island in Santa Barbara County. It is found at Marina Dunes State Beach and has been observed east of the City of Marina. During 2013, 2014, 2015, and 2016, coast wallflower was observed by ESCA RP biologists in both the Seaside MRA and in the IAR MRA North Range 44.

Yadon's piperia (*Piperia yadonii*) – Federally Endangered, CNPS 1B.2. Yadon's piperia is a perennial herb in the orchid family with basal leaves and an elongate flowering spike when it blooms in late spring and summer. A 1992 survey located a population of Yadon's piperia in northwestern former Fort Ord, just to the east of Highway 1 and the Del Monte Boulevard exit (USACE 1997). Yadon's piperia also exists in several locations to the east and south of the IAR MRA (David Styer, personal communication). Yadon's piperia has not been observed by ESCA RP biologists in any of the MRAs on site.

4.8 HMP Annuals

There are four annual species that are designated as HMP species (USACE 1997); these annual HMP species have sometimes been referred to as HMP focus species in past Annual Natural Resource Reports. These HMP species occur on some development parcels as well as some habitat parcels; a general summary is provided below, but the remainder of this report focuses on habitat parcel occurrences.

Monterey spineflower (*Chorizanthe pungens* var. *pungens*) – Federally Threatened, CNPS 1B.2. Monterey spineflower is a low spreading annual in the buckwheat family that is covered with gray hairs and blooms in late spring and early summer. It occurs in sandy soils in coastal strand, coastal scrub, maritime chaparral, margins of oak woodland and riparian habitats, and disturbed sites in grassland below 450 m elevation. It is endemic to northern Monterey and southern Santa Cruz Counties. Monterey spineflower occurs commonly in maritime chaparral in the County North, CSUMB Off-Campus, Del Rey Oaks/Monterey, FEG, IAR, MOUT Site, Parker Flats, and Seaside MRAs; USFWS-designated critical habitat for Monterey spineflower on site is shown on Figure 4. During 2016, Monterey spineflower was observed by ESCA RP biologists in FEG, IAR, and Parker Flats MRAs.

Robust spineflower (*Chorizanthe robusta* var. *robusta*) – Federally Endangered, CNPS 1B.1. Robust spineflower is low spreading to erect annual in the buckwheat family. It occurs in sandy soils in coastal dune and coastal scrub habitats. Robust spineflower ranges from Santa Cruz County to northern Monterey County. Historically one population was found on former Fort Ord west of Highway 1 to the north of the Lightfighter Road exit. According to the HMP, former Fort Ord does not provide important habitat for this species (USACE 1997). Robust spineflower has not been observed by ESCA RP biologists in any of the MRAs on site.

Seaside bird's-beak (*Cordylanthus rigidus* subsp. *littoralis*) – California Endangered, CNPS 1B.1. Seaside bird's-beak is a multi-stemmed annual root parasite that reaches 1 to 2 feet (0.3 to 0.6 m) in height at maturity. Seaside bird's-beak generally occurs in openings in coastal dune scrub, central coastal scrub, and maritime chaparral and is restricted to the ancient sand sheets of Santa Barbara and Monterey Counties. Seaside bird's-beak has been observed by ESCA RP biologists in maritime chaparral in IAR, Seaside, and FEG MRAs. According to the HMP, seaside bird's-beak has the potential to occur in Del Rey Oaks/Monterey and Parker Flats MRAs. During 2016, seaside bird's-beak was observed by ESCA RP biologists in the FEG and IAR MRAs.

Sand (Monterey) gilia, sand gilia (*Gilia tenuiflora* var. *arenaria*) – Federally Endangered, California Threatened, CNPS 1B.2. Sand (Monterey) gilia is a small annual in the phlox family that produces a basal rosette of leaves and lavender flowers that emerge from a short branching inflorescence that reaches about 6.5 inches (16.5 cm) in height in late spring. It occurs in open loose sandy soils with low silt content in coastal dune scrub and maritime chaparral habitats in limited locations near Monterey Bay and the adjacent coastal plain of the Salinas Valley. Sand (Monterey) gilia generally occurs in maritime chaparral and has been observed in IAR, FEG, Parker Flats, and Seaside MRAs. During 2016, sand (Monterey) gilia was observed by ESCA RP biologists in the FEG, Parker Flats, and IAR MRAs.

5.0 METHODS FOR MUNITIONS INVESTIGATION ACTIVITIES AND HABITAT MONITORING

Methods used for ESCA RP munitions investigation activities and associated biological monitoring activities are summarized in this section. The ESCA RP munitions investigation activities addressed here are those that have resulted in disturbance to native vegetation in habitat parcels in the FEG, Parker Flats, and IAR MRAs. By the end of 2013, the majority of the munitions investigation activities were completed in all ESCA MRAs, and all munitions investigation activities in these MRAs were completed by the end of 2015.

Munitions investigation activities included analog or geomagnetic investigation, vegetation cutting, small or large scale soil disturbance, and other minor activities. These are defined more specifically in Section 5.1. A grid system developed by the Army was used to document all activities; each grid was assigned a unique number and covered 100 feet by 100 feet (30.5 m x 30.5 m).

Associated biological monitoring involved using established or modified protocols to document baseline conditions prior to munitions investigation activities as well as documenting post-activity vegetation recovery. Minimization and avoidance measures were also implemented to avoid or reduce impacts to sensitive biological resources.

5.1 Methods for Munitions Investigation Activities

Munitions investigation activities often required vegetation removal in order to facilitate target investigation using visual and electromagnetic means. When surface targets were identified, they were generally removed by hand or with the use of handheld tools. When subsurface targets were identified, they were investigated individually or in larger contiguous areas (soil excavation and sifting). Subsurface investigation areas ranged in size from a single cubic foot to several cubic feet, depending on the type, location, and position of the target. A shovel or other hand tool was typically used, although a backhoe was used for deeper targets. If MEC was identified but was unsafe to move, in situ detonation was sometimes conducted. During soil replacement field crews were directed to follow the same sequence in reverse, with replacement of subsoil and then topsoil replacement after munitions investigation activities were complete.

This method facilitated vegetation regeneration by retaining the seed bank, nutrients, and beneficial organisms on the surface. Other minor activities in support of munitions investigation activities included installation of signage, trash and debris removal, erosion control monitoring and installation of erosion prevention materials.

A brief summary of general methods for munitions investigation activities is provided below.

5.1.1 Tools and Techniques in Munitions Investigations - Digital Geophysical Mapping and Analog Investigations

Digital Geophysical Mapping (DGM) munitions investigation was conducted in areas subject to vegetation cutting (see Section 5.1.2) with either an EM61-MK2 towed array platform ("the FORA ESCA Sled") or manually towed single-array EM61-MK2 combined with a navigation system. Personnel guided the sled along parallel transects through the work area. Data were evaluated and target anomalies were selected for further investigation. Unexploded ordnance (UXO) technicians reacquired target anomalies based on Global Positioning System (GPS) coordinates and intrusively investigated targets to depth.

Analog munitions investigations were generally conducted on foot by technicians to locate and remove surface or subsurface MEC or munitions debris (MD). Technicians generally walked 3-foot (1-m)-wide search lanes through grid cells (grids) with a handheld magnetometer, which recorded the presence of ferrous metal targets. If potential MEC was detected in an investigation area, subsurface investigation (excavation) was sometimes required.

5.1.2 Methods for Vegetation Cutting

Vegetation cutting in this report generally refers to removal of most vegetation to ground level by manual and/or mechanical means, leaving the root mass, soil seedbank, and associated microorganisms and nutrients intact. Prior to initiation of munitions investigation activities, manual and mechanical vegetation cutting was conducted under the direction of the Senior Unexploded Ordnance Supervisor in coordination with an ESCA RP biologist. Manual vegetation cutting entailed the use of power chippers, powered weed cutters, DR™ trimmers, chainsaws, and a variety of similar hand tools and equipment. Vegetation-cutting support equipment included skip loaders, self-loading log trucks, and/or excavators with grappling arms, which were used to haul out salvageable timber or remove cut brush from the work area for chipping. If consolidated chipping operations were conducted, excavators or loaders were used to feed the chipping or grinding equipment and spread or load chips (masticated plant material).

Vegetation cutting and associated target-specific investigations (see Section 5.1.3) were conducted in habitat parcels in the FEG, Parker Flats, and IAR MRAs.

Where feasible, mature coast live oak trees with a diameter at breast height (dbh) equal or greater than 6 inches (15 cm) and HMP shrubs with a smaller dbh were left in place (retained) and limbed up to a height that allowed human access below the tree canopies. Manzanita retention was conducted in the FEG MRA.

5.1.3 Types of Excavations

In general, subsurface investigation areas (excavations) ranged in size from a single cubic foot to several cubic feet, depending on the type, location, and position of the target. Excavation work sometimes involved removal of root mass of individual native plant species and displacement of soil seedbank.

A '**target-specific investigation**' is a subsurface investigation that is smaller than 100 square feet [9.3 m^2]. A shovel or other hand tool was typically used to dig for a target, however a backhoe was sometimes required for deeper targets. Target-specific investigations were conducted in portions of the FEG, Parker Flats, and IAR MRAs on an as-needed basis after vegetation cutting activity.

A '**small-scale excavation'** is a subsurface investigation that affected an area between 100 square feet and 1 acre [9.3 m^2], or alternatively, an area that was greater than 100 square feet but less than 100 feet (30.5 m) wide on the narrowest side. Small-scale excavations were conducted in portions of the IAR MRA and were also required in a portion of the former grenade range in the FEG MRA.

A **'large-scale excavation'** is a subsurface investigation that disturbed an area over 1 acre (0.4 ha) in size. For the habitat parcels, only one large-scale excavation was conducted in the IAR MRA in Range 47 SCA.

5.1.4 Methods for Target Specific Investigation

Target specific investigation was used on the majority of the ESCA RP habitat parcels. This investigation method focused soil disturbance to individual targets, thereby minimizing impacts to the natural resources.

Additionally, a "step-out" approach was employed in the FEG MRA to minimize the areas that were initially cut and investigated. When it became necessary to do munitions investigation in a larger area, successive grid step-outs were performed on an as-needed basis in order to reduce vegetation cutting to only that required for munitions investigation activities.

5.1.5 Methods for Small-Scale Excavation

Small-scale excavations were used in areas where target-specific investigation was not viable due to anomaly density, depth and expanse of investigation area. An investigative approach was developed and implemented by the ESCA RP Team in 2011 to minimize impacts to intact central maritime chaparral vegetation and relatively high densities of associated HMP herbaceous species in the IAR MRA. This approach was implemented under a Design Study and addressed locations where the Army had not previously conducted subsurface MEC removal, called NCAs and SCAs. The IAR MRA Design Study confined vegetation cutting and subsurface investigations to 10-foot-wide (3-m-wide) linear transects placed in the NCAs and SCAs in the IAR MRA; usually two parallel investigation transects traversed a single grid but often extended in a north-south linear alignment of contiguous grids in the study areas (see Appendix A). The Design Study approach greatly reduced disturbance to native habitat while gathering critical information about the location, type, and level of munitions investigation activities needed to support the Army's interim ROD; this process is described in the Phase II Interim Action Work Plan (ESCA RP Team 2011b).

5.1.6 Methods for Interim Action Ranges MRA Design Study

An investigative approach (called the Design Study) was developed by the ESCA RP Team in 2011 to minimize impacts to intact central maritime chaparral vegetation and relatively high densities of associated HMP herbaceous species in the IAR MRA. The Design Study addressed locations where the Army had not previously conducted subsurface MEC removal - NCAs and SCAs. The Design Study confined vegetation cutting and subsurface investigations to 10-foot-wide (3-m-wide) linear transects placed in the NCAs and SCAs in the IAR MRA; as described in Section 5.1.5.

5.1.7 Methods for FEG MRA Step-outs

A "step-out" approach was employed in the FEG MRA to minimize the areas that were initially cut and investigated. When it became necessary to do munitions investigation in a larger area, successive step-outs were performed on an as-needed basis in order to reduce vegetation cutting to only that required for munitions investigation activities.

5.1.8 Methods for Large-Scale Soil Excavation

In the Range 47 SCA, large-scale excavation was required due to the high density of sensitively-fuzed munitions, small metallic debris, and ammunition links discovered within the soil in 2011 in an area encompassing 13.4 acres (5.4 ha). Prior to soil excavation, the above- and below-ground vegetation was removed by "root raking;" during root raking, a bulldozer equipped with heavy tines pushed the tines through the soil, pulling out entire plants, including roots and burls, while retaining most of the soil. The plant material was stockpiled, masticated into wood chips, and inspected by a UXO technician to determine that the material was free from potential MEC or MD. Although there were initial plans to use wood chip material in the Range 47 Restoration Area as mulch and for producing charate, the quantity of weeds and residual materials in the wood chip pile made that approach infeasible. Following size reduction, the material was transported and placed within the development portion of the IAR MRA.

Excavated soils were removed with bulldozers or excavators, transported by dump trucks to an onsite mechanical sift plant, where potential MEC was removed from the soil by UXO technicians.

The excavation process consisted of a sequence of topsoil removal (top 6 to 12 inches [15 to 30 cm]), followed by removal of subsoil. Each soil layer was sifted and stockpiled separately. Soil replacement followed the same sequence in reverse, with replacement of subsoil and then of topsoil. This process encourages regeneration of native species through replacement of seed bank, soil nutrients, and beneficial soil organisms.

The habitat restoration requirements in the large-scale excavation area in Range 47 SCA are detailed in the Phase II Interim Action Work Plan Addendum Habitat Restoration Plan (HRP) for the IAR MRA (ESCA RP Team 2103a), in accordance with the HMP (USACE 1997). See Section 7.0 and Appendix A for details on restoration planning, implementation, and monitoring in the IAR MRA.

5.1.9 Methods for Other Activities in Support of Munitions Investigation Activities

Other minor activities in support of munitions investigation activities have included installation of signage, trash and debris removal, weed and erosion control monitoring, and installation of erosion control materials reflecting current best management practices (BMPs). Most of these activities have been conducted on an as-needed basis except for erosion and weed monitoring. Methods for weed monitoring and management are described in more detail in Section 5.2.7 and methods for erosion monitoring and control are described in Section 5.2.8.

Field activities are conducted in accordance with the HMP, BOs, and the appropriate ESCA work plan. All project personnel and subcontractors working in ESCA parcels receive environmental awareness training provided by ESCA RP Qualified Biologists.

5.2 Biological Monitoring Methods

Biological monitoring in 2016 was conducted in habitat parcels in which vegetation was disturbed as a result of ESCA RP munitions investigation activities to meet the requirements of the 1997 HMP and BOs; biological monitoring methodology adhered to the *U.S. Army Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at the former Fort Ord* (Burleson 2009).

Pre-disturbance (i.e., "baseline") vegetation surveys were conducted to document species dominance and cover in shrub- and tree-dominated central maritime chaparral. In addition, baseline data are gathered on HMP herbaceous species distribution and density prior to munitions investigation activities. Post-remediation surveys are conducted in native shrub- and tree-dominated vegetation types in Years 3, 5, 8, and 13. Post-remediation surveys for HMP annuals and herbaceous perennial species are completed in Years 1, 3, 5, and 8.

Methods are also detailed below for post-rainfall CTS monitoring, monitoring of aquatic features, weed monitoring, and erosion monitoring. Monitoring related to restoration activities in the IAR MRA is described in Appendix A.

Plant nomenclature follows the *Jepson Manual: Vascular Plants of California,* Second Edition (Baldwin et al. 2012). In addition, pertinent volumes of the *Flora of North America* (Flora of North America Editorial Committee, eds. 1993+) are also utilized for plant identification. Plant community classifications and sensitive species information follow Holland (1986), Sawyer, Keeler-Wolfe, and Evens (2009), and the CNDDB (CDFW 2016).

5.2.1 Methods for Vegetation Monitoring

Line-intercept vegetation transects are used to measure shrub and herbaceous vegetation cover in areas subject to munitions investigation activities in project work areas. Both baseline and post-activity transects are monitored in central maritime chaparral vegetation, along with a limited number of transects in central coastal scrub and oak woodland vegetation that consistently support central maritime chaparral species as well. Differences in stand age, species diversity, or other characteristics are documented in order to stratify transect placement into areas that are likely to have distinct species composition and distribution.

Vegetation transects are placed randomly on an MRA-by-MRA basis. A random number generator is used to A) select a grid (total number of grids in strata), B) select the quadrant of the grid for transect starting point (1-4), and C) select which compass direction in which to align the transect from the starting point (0-360 degrees). If a transect location is randomly selected and overlaps another transect, it is discarded and a new transect location is chosen. Transects are generally measured by using a 164-foot-long (50-m-long) tape, although a shorter transect length may be used if it is placed in a single isolated grid; diagonal placement in a grid enables monitoring of a transect that is 141 feet (43 m) long, as in the FEG MRA. Some shorter transects have also been placed in small-scale excavation areas in Range 44 in the IAR. GPS waypoints and the transect survey direction (e.g., north to south) are recorded so that the same transect can be revisited in subsequent years. Additionally, each year a

photograph is taken from one end of each transect. Locations of 2016 transects are shown on Figures 6a and 6b.

Aerial cover by shrub and tree species is recorded on data sheets for all plants that intercept the monitoring tape; all layers of shrub and tree species cover are recorded, so there may be two or more species recorded in the same location. Cover by herbaceous species in the absence of shrub or tree overstory is only recorded as a combined "herbaceous cover" category, per the 2009 protocol (Burleson 2009).

Frequency data are represented here as the percentage of total transects containing at least one rooted individual of a given species.

Bare ground and/or thick layers of masticated vegetation are recorded in transect segments devoid of vegetation; prior to 2016, the "bare ground" category often included both bare ground and loose masticated vegetative material.

Table 1-1 presents all monitoring effort to date.

5.2.1.1 Future East Garrison MRA Vegetation Transect Monitoring

As previously described, a "step-out" approach was employed in the FEG MRA to minimize the areas that were initially cut and investigated. When it became necessary to do munitions investigation in a larger area, successive step-outs were performed on an as-needed basis in order to reduce vegetation cutting to only that required for munitions investigation activities.

Baseline Transects:

A total of 43 baseline transects were established by the Army in the FEG MRA prior to ESCA RP munitions investigation activities which are described below (HLA 1996, 1998).

2010-2011 - Thirty-nine baseline transects were installed in central maritime chaparral.

2012 - Two baseline transects were installed in oak woodland at the edge of the former grenade range; this oak woodland vegetation supported many dominants of central maritime chaparral in the understory and likely represented a seral stage in mature chaparral development.

Baseline data from these 41 transects were gathered during the year of installation, and post-activity data were collected from transects, per the 2009 protocol schedule (Burleson 2009). If there were no previously established transects in an area in which monitoring was required, new transects were established. In 2013, there were no baseline transects in grids subject to activities in 2010, and 6 new transects were installed in these grids. These data were then compared to the 39 original baseline transects.

Munitions Investigation Activities Dates:

2010

- West habitat parcel in the FEG MRA: vegetation cutting took place in four isolated grids and along the single roadway/maintained fuel break.
- East habitat parcel in the FEG MRA: vegetation cutting occurred in 23 scattered grids, along the single roadway/maintained fuel break, and along narrow strips scattered throughout the parcel.

2011

- West habitat parcel in the FEG MRA: vegetation cutting was confined to narrow strips scattered throughout the parcel.
- East habitat parcel in the FEG MRA: vegetation cutting occurred in most grids that had not been previously cut, except for the former grenade range/MRS-11, as well as a few grid clusters around the perimeter of the parcel.

2012

- West habitat parcel in the FEG MRA: vegetation cutting occurred in all remaining uncut area.
- East habitat parcel in the FEG MRA: vegetation cutting occurred in the former grenade range/MRA-11 and in clusters of grids around the perimeter of the parcel.

2013

- West habitat parcel in the FEG MRA: no vegetation cutting occurred.
- East habitat parcel in the FEG MRA: less than an acre (0.4 ha) of vegetation cutting occurred in portions of four grids along the southeast side of the Ammunition Supply Point (ASP) or Explosive Storage Location, which is located in the middle of the MRA.

2015

- East habitat parcel in the FEG MRA: Vegetation pruning was conducted in approximately ¼ acre (0.1 ha) of central maritime chaparral habitat south of the ASP in preparation for munitions investigation. Senior Biologist and certified arborist Mary Carroll assessed the vegetation on January 28, 2015 and gave vegetation crews authorization to cut some live plant material as follows: No removal of individual shrubs and restrict pruning to less than 25% of living branches by limbing-up plants in active work areas to improve access for munitions investigation teams.

Post-activity Transects (Shown in Figure 6a):

2013 - Six Year 3 post-activity transects were established in order to monitor vegetation establishment in areas subject to vegetation cutting in 2010; three transects were placed in the west habitat parcel and three in the east habitat parcel (ESCA RP Team 2014).

2014 - Seventeen Year 3 post-activity vegetation transects in central maritime chaparral were monitored in areas that had been subject to munitions investigation activities, including vegetation cutting, in 2011; all of these transects were located in the east habitat parcel. Monitoring events were conducted on 28-30 April and 5-6 May 2016 (ESCA RP Team 2016).

2015 – A total of 32 post-activity vegetation transects were monitored on 4-8 and 11-15 May 2015, including 26 Year 3 (24 in vegetation cutting and 2 in small-scale excavation areas) and six Year 5 post-activity vegetation transects in central maritime chaparral and oak woodland vegetation; these transects were located in areas that had been subject to munitions investigation activities in 2010 and 2012.

2016 – A total of 23 post-activity vegetation transects were monitored on 4-8, 25, and 26 April and 3-5 May 2016. All transects monitored were Year 5 post-activity transects in central maritime chaparral and oak woodland vegetation; these transects were located in areas that had been subject to vegetation cutting and munitions investigation activities in 2011.

All ESCA RP vegetation monitoring transects in the FEG MRA are shown in Figure 6a.

5.2.1.2 Parker Flats MRA Vegetation Transect Monitoring

Baseline Transects:

Prior to 2008, the Army conducted all biological monitoring (Jones & Stokes 1995a, b; CH2MHill 2005).

2008 - Eleven baseline vegetation transects were established by the ESCA RP Team in the Parker Flats MRA Phase II habitat parcels prior to vegetation cutting in 2009. One isolated transect was established in a small patch of central maritime chaparral surrounded by oak woodland habitat in the middle of the Phase II area. The remaining 10 transects were clustered in the larger contiguous patch of central maritime chaparral on the east end of the habitat reserve; the eastern three transects are dominated by shrubs typical of central coastal scrub (ESCA RP Team 2009).

Vegetation transect monitoring is not required in the Phase I habitat reserve.

Munitions Investigation Activities Dates:

1998 - Phase I: vegetation cutting took place in the MRS-37, MRS-54, and MRS-55 portions of the Parker Flats MRA Phase I habitat reserve completed by the Army.

1999 - Phase I: vegetation cutting took place in the MRS-03 portion of the Parker Flats MRA Phase I habitat reserve completed by the Army.

2000 - Phase I: vegetation cutting was completed in the MRS-52 and MRS-53 portions of the Parker Flats MRA Phase I habitat reserve completed by the Army.

2009 - Phase II: vegetation cutting was completed in the Parker Flats MRA Phase II habitat reserve by the ESCA RP Team. It commenced in the end of 2008 at the east end of the reserve and continued until March 2009 at the west end.

Post-activity Transects:

2012 - Eleven Year 3 post-activity vegetation transects were monitored in the same location as baseline transects.

2014 - Eleven Year 5 post-activity vegetation transects were monitored in the same location as baseline transects.

Vegetation monitoring was conducted in the Phase II habitat parcels on 1 and 6-7 May 2014.

2015 – No post-activity vegetation transect monitoring was required in 2015.

2016 – No post-activity vegetation transect monitoring was required in 2016.

5.2.1.3 Interim Action Ranges MRA Vegetation Transect Monitoring

Baseline Transects:

1999-2000 – Baseline transects established by the Army in the Range 44, Range 45, and Range 47 in 2000, prior to the 2003 prescribed burn (HLA 2001, Parsons 2005).

2008 – Thirty transects established by the Army were monitored by the ESCA RP Team (ESCA RP Team 2009).

2010-2011 – Twenty-three baseline transects were designated by the Army in central maritime chaparral and selected as "proxy" baseline transects for upcoming munitions activities, excluding the Range 47 SCA large-scale excavation area. An additional nine new "proxy" baseline transects were designated by the ESCA RP Team near the proposed ESCA RP munitions investigation areas; three of these transects were located immediately west of Range 47 SCA to serve as proxy baseline transects for the large-scale excavation.

As of 2011, no further monitoring of Army transects outside of the IAR MRA NCAs and SCAs was indicated due to vegetation recovery reflecting an appropriate and sustainable trajectory associated with high quality habitat (ESCA RP 2012a).

Munitions Investigation Activities Dates:

2011 - Vegetation cutting and small-scale excavations were completed in linear scrapes in South Range 44. Limited ingress-egress routes were cut for access to work areas.

2011-2012 - Large-scale excavation was conducted in 14.4 acres (5.8 ha) in Range 47 SCA and completed in December 2012. A small amount of vegetation cutting was conducted

around the edges of Range 47 SCA in 2012. Limited ingress-egress routes were cut for access to work areas.

2012-2013 - Vegetation cutting in North Range 44 SCA was conducted in 2012 and completed in early 2013; in addition, small-scale excavations in targeted areas and along scrapes were also conducted in 2012 and completed in early 2013.

Post-activity Transects (Shown in Figure 6b):

2012 - Sixteen Year 1 post-activity transects were established in the South Range 44 SCA/NCAs, a small portion of North Range 44, and areas outside the large-scale excavation in Range 47 SCA (ESCA RP Team 2013).

2013 - Thirteen Year 1 post-activity transects were established in North Range 44 SCA. Ten new transects were established in the Range 47 SCA large scale excavation. One of these 10 grids was placed in Subarea A, one was placed in the deer exclusion control area (deer present), and one was placed in the irrigation control area. The remaining seven were in Subarea B (ESCA RP Team 2014).

All 29 transects were monitored in 2013 (Years 1 and 2).

2014 – Twenty-nine transects were monitored on 8 and 13-14 May, 26 and 30 June, and 1-3 and 14-15 July 2014 (ESCA RP Team 2015).

2015 – Thirty-eight transects were monitored on 16 and 24 April and 18, 19, 20, 21, 26, 27, and 28 May 2015. These included 5 Year 3 transects in vegetation-cut areas in North Range 44; 7 Year 4 transects in vegetation-cut areas in South Range 44; and 3 Year 4 transects in vegetation-cut areas in Range 47 Subarea C. An additional 13 transects were monitored in areas subject to small-scale excavations in the IAR MRA; these data are presented in Appendix A. Ten transects were also monitored in the large-scale excavation area in the IAR MRA, and those data are also summarized in Appendix A.

2016 – Twenty transects were monitored on 27, 28, and 29 April and 2 and 5 May 2016. These included seven Year 5 transects in vegetation-cut areas in South Range 44. An additional 13 Year 4 transects in areas subject to small-scale excavations -- eight in North Range 44 and five in South Range 44; these data are presented in Appendix A.

Locations of all ESCA RP transects in the IAR MRA are shown in Figure 6b.

5.2.2 Methods for Supplemental Herbaceous Vegetation Monitoring

Herbaceous quadrat monitoring is conducted as a component of the vegetation transect monitoring effort when shrub cover is relatively low and herbaceous species cover is proportionately high; methods follow Burleson (2009). These supplementary 2.7 square-foot (0.25 m^2) herbaceous quadrats are placed every 32.8 feet (10 m) on alternating sides of each transect, for a total of six per transect. Percent aerial cover for each plant species in the plot is

recorded. If any HMP annuals occur within the quadrat, number of plants are counted and recorded. Comparative baseline data may not be available for quadrats.

Monitoring events for supplemental herbaceous vegetation occurs on the same dates and in the same transect locations, when sampled, as vegetation monitoring described in the prior section.

Supplementary herbaceous quadrats are also sampled in grassland vegetation in the IAR MRA. Three grassland "proxy" baseline quadrats were sampled in the IAR MRA grassland on 29 September 2011; these were placed near to proposed munitions investigation activity areas prior to work.

2012 - Six new herbaceous quadrats were monitored in the IAR MRA grassland area on 25 June 2012: three in areas subject to vegetation cutting and three in areas subject to small-scale excavation. These quadrats were not along a transect, but randomly placed within the activity areas, and returned to annually for monitoring.

2013 – The six grassland herbaceous quadrats were monitored on 22 May 2013.

2014 – The six grassland herbaceous quadrats were monitored on 30 June and 1 July 2014.

2015 – The six grassland herbaceous quadrats were monitored on 1 May 2015.

2016 – Twelve herbaceous quadrats were monitored on 5 and 27 April 2016. Six were monitored in FEG. Six grassland quadrats were also monitored in the IAR, and IAR grassland quadrat data are reported in Appendix A.

5.2.3 Methods for HMP Herbaceous Species Monitoring

HMP herbaceous species are sensitive annual or herbaceous perennial species that are generally restricted to the Fort Ord region and are vulnerable to habitat degradation. HMP monitoring surveys document baseline and post-remediation locations and densities during the peak flowering period for each species. A minimum of twenty percent or thirty-eight (which ever number is larger) 100-foot x 100-foot grids per munitions investigation activity type are surveyed for all HMP herbaceous species during the peak flowering period (April through July, depending on the species). Colonies of HMP herbaceous species found within each grid are mapped with a hand-held GPS unit (Trimble GeoHX or Apple iPad with Bad Elf GPS/GLONASS receiver) to record their general distribution and range in the work area (Figures 7a, 7b, and 7c).

Numbers of HMP herbaceous species are either censused, or, in areas with high densities, sampled within circular plots (8.2 feet, or 2.5 m radius), following Burleson (2009). Often an HMP species may be concentrated in only a portion of a grid; these individuals or colonies are mapped with a hand-held GPS unit; those polygons are shown on Figures 7a, 7b, and 7c. On occasion, the plot shape is adjusted to fit the shape of the disturbance area so that the

sampled area fits within the grid, the habitat type, the activity type, and the activity year; this was done in portions of Range 44 and along ingress/egress corridors.

In the FEG and Parker Flats MRAs, HMP herbaceous species are sampled in Years 1, 3, 5, 7, and 10 after munitions investigation activities. In accordance with the HRP for the IAR MRA, HMP herbaceous species in the IAR MRA are counted in each monitoring plot every year for seven years after habitat disturbance or until performance targets are met. All HMP herbaceous species monitoring performance targets were met in the IAR MRA in 2015 (ESCA RP Team 2016).

Reference colonies of each HMP herbaceous species were mapped and sampled if a given HMP herbaceous species was observed in undisturbed vegetation in or around each MRA during a given year; in many cases a reference location could not be found. Identified reference colonies are re-mapped and re-sampled each year, if present, according to the standard protocol described above.

Locations of all grids monitored for HMP annuals in 2016 in the FEG MRA are shown in Figure 6a.

Grids that support existing colonies of HMP herbaceous species in 2016 monitoring areas are shown in Figures 7a, 7b, and 7c. Table 1-1 summarizes all monitoring effort to date.

5.2.3.1 Future East Garrison MRA Herbaceous Species Monitoring

Baseline Locations for HMP Herbaceous Species Monitoring:

2010 Baseline Monitoring - Baseline monitoring was conducted in 2010 for all HMP herbaceous species in the FEG MRA. Three baseline sand (Monterey) gilia plots were sampled in the north and south ends of the east habitat parcel and two baseline Monterey spineflower plots were sampled in the middle of the east habitat parcel. Due to the dense vegetation at the time, the baseline surveys were limited to accessible areas (ESCA RP Team 2011a).

Munitions Investigation Activities Dates: see Section 5.2.1.1.

Post-activity HMP Herbaceous Species Monitoring (Shown in Figure 6a):

2012 HMP Herbaceous Species Monitoring – Surveys for all HMP herbaceous species in the east habitat parcel; Monterey spineflower and sand (Monterey) gilia sampling (ESCA RP Team 2013b).

2013 HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring for all HMP herbaceous species in portions of the east and west habitat parcels, including Monterey spineflower, sand (Monterey) gilia, and seaside bird's-beak sampling (ESCA RP Team 2014).

2014 HMP Herbaceous Species Reference Plots – One seaside bird's-beak reference colony, containing three new reference plots, was surveyed immediately to the southeast of the FEG MRA on 24 June 2014. No Monterey spineflower or sand (Monterey) gilia colonies were observed in 2014 (ESCA RP Team 2015).

2014 HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring was conducted on 21-25 and 29 April, 12 and 14 May, and 24 June 2014. Three plots were sampled for Monterey spineflower in the middle of the east habitat parcel. One plot was sampled for sand (Monterey) gilia in the north end of the east habitat parcel. Eight plots were sampled for seaside bird's-beak just southeast of the FEG MRA (ESCA RP Team 2015).

2015 HMP Herbaceous Species Reference Plots – One seaside bird's-beak reference colony, containing three reference plots, was surveyed immediately to the southeast of the FEG MRA on 22 April 2015. In 2015 ESCA RP biologists were not able to locate Monterey spineflower or sand (Monterey) gilia reference colonies in undisturbed parts of the FEG MRA or proximal to the MRA (ESCA RP Team 2016).

2015 HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring was conducted on 13, 17, and 22 April 2015. Two plots were sampled for Monterey spineflower in the middle of the east habitat parcel. Three plots were sampled for sand (Monterey) gilia in the north end of the east habitat parcel. Seven plots were sampled for seaside bird's-beak in the southeast corner of the FEG MRA (ESCA RP Team 2016).

2016 HMP Herbaceous Species Reference Plots – One seaside bird's-beak reference colony, containing three reference plots, was surveyed immediately to the southeast of the FEG MRA on 3 May 2016. In 2016 ESCA RP biologists were not able to locate Monterey spineflower or sand (Monterey) gilia reference colonies in undisturbed parts of the FEG MRA or proximal to the MRA.

2016 HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring was conducted on 28-31 March, 1 and 11-14 April, and 3 May 2016. Two plots were sampled for Monterey spineflower in the middle of the east habitat parcel. Seven plots were sampled for sand (Monterey) gilia in the north and south ends of the east habitat parcel. Nine plots were sampled for seaside bird's-beak in the southeast corner of the FEG MRA. All areas surveyed in 2016 for HMP herbaceous species in the FEG MRA are shown in Figure 6a, with the exception of the former grenade range, which only includes limited area of central maritime chaparral and oak woodland habitat, although the entire grenade range was surveyed for HMP herbaceous species as a matter of due diligence.

All areas surveyed in 2016 for HMP herbaceous species in the FEG MRA are shown in Figure 6a, with the except of the grenade range, which only includes limited area of central maritime chaparral and oak woodland habitat, although the entire grenade range was surveyed for HMP herbaceous species as a matter of due diligence.

5.2.3.2 Parker Flats MRA Herbaceous Species Monitoring

Baseline Locations for HMP Herbaceous Species Monitoring:

2008 - Phase II Monitoring – Baseline surveys were conducted in the Parker Flats MRA Phase II habitat reserve on 15-23 May 2008 and 8 August 2008. One Monterey spineflower colony, containing three new baseline plots, was surveyed in the middle of the Phase II habitat reserve. An additional seven new baseline plots were sampled in Monterey spineflower colonies that were clustered in several locations in the east end of the habitat reserve close to Watkins Gate Road (ESCA RP Team 2009).

Baseline surveys were not conducted by the ESCA RP Team for herbaceous species in the Phase I habitat reserve, because no munitions investigation activities were conducted in these areas.

Munitions Investigation Activities Dates: see Section 5.2.1.2.

Post-activity HMP Herbaceous Species Monitoring:

2011 Phase II HMP Herbaceous Species Monitoring – Ten Monterey spineflower Year 2 post-activity plots were sampled in the same location as baseline plots.

2012 Phase II HMP Herbaceous Species Monitoring – Ten Monterey spineflower Year 3 post-activity plots were sampled in the same location as baseline plots.

2013 Phase II HMP Herbaceous Species Monitoring – Six Monterey spineflower Year 4 plots were sampled in the east end of the habitat parcel.

2014 - Phase I HMP Herbaceous Species Reference Plots – One Monterey spineflower reference colony, containing three new reference plots, was surveyed just west of the Phase I habitat reserve on 3 July 2014.

2014 - Phase I HMP Herbaceous Species Monitoring – Surveys were conducted for all HMP herbaceous species in suitable habitat on 22 April, 13 May, and 4 and 10-12 June 2014; these areas were subject to activities conducted by the Army between 1998 and 2000. Seventy-one Monterey spineflower plots were sampled.

2014 - Phase II HMP Herbaceous Species Monitoring – Year 5 surveys were conducted for all HMP herbaceous species in suitable habitat on 13 May and 4 and 10-12 June 2014. Five Monterey spineflower plots were sampled.

2015 – No HMP herbaceous species monitoring was required in 2015.

2016 – No HMP herbaceous species monitoring was required in 2016.

5.2.3.3 Interim Action Ranges MRA Herbaceous Species Monitoring

Baseline Locations for HMP Herbaceous Species Monitoring:

2010-2011 - Safety issues in the IAR MRA from 2010 until 2012 necessitated modifications to the 2009 HMP herbaceous species monitoring protocol. Sampling was conducted in nearby areas cleared by UXO support personnel outside of the SCAs and NCAs.

Baseline surveys were conducted for all HMP herbaceous species in the IAR MRA in the following locations, with the number of sampled grids (100-foot x 100-foot) reflecting presence of HMP herbaceous species:

- North Range 44 SCA, South Range 44 SCA/Central Area NCAs central maritime chaparral – Forty-one grids sampled for Monterey spineflower, 30 for sand (Monterey) gilia, and 24 for seaside bird's-beak.
- South Range 44 SCA/Central Area NCAs grassland - One grid sampled for Monterey spineflower and one for sand (Monterey) gilia.
- Range 47 SCA Subarea A maritime chaparral – One grid sampled for Monterey spineflower, one for sand (Monterey) gilia, and one for seaside bird's-beak.
- Range 47 SCA Subarea B maritime chaparral – Twenty-four grids sampled for Monterey spineflower, 24 for sand (Monterey) gilia, and five for seaside bird's-beak.
- Range 47 SCA Subarea C maritime chaparral – Three grids sampled for Monterey spineflower, three for sand (Monterey) gilia, and 30 for seaside bird's-beak.
- Ingress/Egress corridors maritime chaparral – All existing ingress and egress corridors sampled for Monterey spineflower, sand (Monterey) gilia, and seaside bird's-beak.

2012 - Modified baseline HMP species 25 m^2 plots were sampled in 59 grids for Monterey spineflower, 20 grids for sand (Monterey) gilia, and four grids for seaside-bird's-beak around the perimeter of the SCAs/NCAs in habitat with similar vegetation structure and diversity to that of off-limit areas. In addition to monitoring plots, HMP herbaceous species were counted within entire grids when feasible. Baseline data from plots were extrapolated to entire grids for comparison purposes. The HRP (ESCA RP Team 2013a) describes these baseline locations in more detail; the 2012 data are the reference set for required performance standards related to HMP herbaceous species in the HRP.

Munitions Investigation Activities Dates: see Section 5.2.1.3.

Post-activity HMP Herbaceous Species Monitoring (Shown in Figure 6b):

2012 Central Maritime Chaparral Reference Monitoring – Seven Monterey spineflower reference plots were sampled in the same locations as prior Army transects that also contained HMP herbaceous species plots. These were scattered around the IAR MRA habitat parcel outside of the ESCA RP NCAs and SCAs.

Five sand (Monterey) gilia reference plots were sampled in the same locations as prior Army transects that also contained HMP herbaceous species plots. These were scattered around the IAR MRA habitat parcel outside of the ESCA RP NCAs and SCAs.

Five seaside bird's-beak reference plots were sampled in the same locations as prior Army transects that also contained HMP herbaceous species plots. These were scattered on the eastern half of the IAR MRA habitat parcel outside of the ESCA RP NCAs and SCAs.

2012 HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring was conducted in South Range 44 and Range 47 Subarea C.

2013 Central Maritime Chaparral Reference Plots – One sand (Monterey) gilia reference location was sampled in northwest IAR MRA habitat reserve on 6 May 2013.

One Monterey spineflower reference location was sampled just east of North Range 44 on 11 June 2013.

One seaside bird's-beak reference plot was sampled just east of South Range 44 on 16 May 2013.

Two coast wallflower reference plots were sampled just outside the North Range 44 SCA.

2013 HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring was conducted in North Range 44 and Range 47 Subareas A and B.

2013 HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring was conducted in South Range 44 and Range 47 Subarea C.

2014 Central Maritime Chaparral HMP Herbaceous Species Reference Plots - Two new sand (Monterey) gilia reference colonies were surveyed in northwest IAR MRA on 23 May 2014. One new sand (Monterey) gilia reference colony was surveyed just southeast and outside the IAR MRA on 23 May 2014.

Two Monterey spineflower reference colonies, containing with five new reference plots, were sampled just east of North Range 44 SCA on 26 June and 3 July 2014.

One seaside bird's-beak reference colony, containing two new reference plots, was surveyed along Tanker Road on the east side of the IAR MRA on 24 June 2014.

2014 Grassland HMP Herbaceous Species Reference Plots - Three Monterey spineflower reference plots were sampled in an undisturbed part of the IAR MRA grassland on 31 July 2014.

2014 HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring was conducted in North Range 44 and Range 47 Subareas A and B on the following dates: 5, 9, 23, 25-26 June 2014. In the Range 47 Restoration Area, 51 plots were sampled for Monterey spineflower, 13 for sand (Monterey) gilia, 22 for seaside bird's-beak, and four for coast wallflower. HMP herbaceous species were monitored in seeded and planted HMP plots, as well as in all grids per the 2009 protocol (Burleson 2009).

2014 HMP Herbaceous Species Monitoring - HMP herbaceous species monitoring was conducted in South Range 44 and Range 47 Subarea C on the following dates: 13 and 29-30 May, 2-5, 9-12, and 25-26 June, and 3 July 2014. Fifty-one plots were sampled for Monterey spineflower, 13 for sand (Monterey) gilia, and three for seaside bird's-beak.

2014 HMP Herbaceous Species Monitoring - HMP herbaceous species monitoring was conducted on the following dates in the IAR MRA: 13 and 29-30 May, 2-5, 9-12, 23, and 25-26 June, and 3 July 2014.

2015 Central Maritime Chaparral Reference Plots - Two sand (Monterey) gilia reference colonies, each containing one plot, were surveyed in northwest IAR MRA on 28 April. One sand (Monterey) gilia reference colony containing one plot was surveyed just southeast and outside the IAR MRA on 15 April 2015.

Two Monterey spineflower reference colonies, each containing one reference plot, were sampled just east of North Range 44 SCA on 28 April 2015.

One seaside bird's-beak reference colony, containing two reference plots, was surveyed along Tanker Road on the east side of the IAR MRA on 21 April 2015.

2015 Central Maritime Chaparral HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring was conducted in North Range 44 and Range 47 Subareas A and B on the following dates: 14-16, 20, 23, 24, 27, and 28 April 2015. Eighty plots were sampled for Monterey spineflower, 59 for sand (Monterey) gilia, 29 for seaside bird's-beak, and three for coast wallflower.

Inside the Range 47 Restoration Area HMP herbaceous species were monitored in all grids per the 2009 protocol (Burleson 2009), which included all seeded and planted HMP polygons.

2015 Year 3 Central Maritime Chaparral HMP Herbaceous Species Monitoring – HMP herbaceous species monitoring was conducted in South Range 44 and Range 47 Subarea C on the following dates: 21, 28, 29, and 30 April 2015. Seventy-six plots were sampled for Monterey spineflower, 34 for sand (Monterey) gilia, and two for seaside bird's-beak.

2015 Ingress/Egress HMP Herbaceous Species Monitoring – There are two ingress/egress corridors that were sampled for HMP herbaceous species on 14 and 29 April 2015. Two plots were sampled for Monterey spineflower and one for sand (Monterey) gilia.

2015 Grassland HMP Herbaceous Species Monitoring – Four Monterey spineflower plots were sampled in the North Range 44 grassland on 30 April 2015.

Inside the Range 47 Restoration Area, HMP herbaceous species were monitored in seeded and planted HMP plots, as well as in all grids per the 2009 protocol (Burleson 2009); see Appendix A.

2016 – No HMP herbaceous species monitoring was conducted in 2016. Performance criteria were met in 2015; see Appendix A.

5.2.4 Methods for Documenting Species Diversity

Documentation of native species presence in each MRA provides an overview of existing species richness and the suite of species that recolonize work areas over time, along with the relative abundance of HMP species in the site as a whole. A comprehensive list of species for each MRA is compiled and updated each year (Tables 3-1, 3-2, and 3-3).

Additionally, all native plant species occurring along a vegetation transect or within a quadrat were recorded to provide total species richness per sample. All native plant species within one meter of a transect tape measure were also recorded in order to capture a more comprehensive summary of native species in specific munitions investigation areas. Plant species diversity tables for each location and activity type are presented in Tables 6-3 and 6-5. These diversity tables also include information on mean species richness per transect or quadrat, evenness, and summary cover data.

Mean species richness per transect or quadrat is calculated for each year and each activity type.

Diversity was determined using the Shannon-Wiener Index (H'), which is a function of the relative abundances of the species present, depending on both the number of species and their evenness (Pielou 1974). The following equation was used to calculate H'.

$$H' = -\sum p_i \ln p_i$$

Where:

H' = Shannon-Wiener Index

p_i = proportion of community that belongs to the *i*th species

Evenness (J') was calculated as the ratio of the observed H' to the maximum possible H' for a community with the same number of species (H'_{max}) (Pielou 1974). The maximum possible value for evenness (i.e., 1) is achieved when H' = H'_{max}, which occurs when all species are present in equal abundance. The following equation was used to calculate J'.

$$J' = \frac{H'}{H'_{max}} = \frac{H'}{\log s}$$

Where:

J' = evenness

H' = Shannon-Wiener Index

H'max = maximum possible H' for a community with s species

s = total number of species present

Discussion of species diversity is incorporated into vegetation monitoring summaries for each MRA (Section 6.1).

5.2.5 Methods for Post-Rainfall CTS Monitoring

CTS tend to emerge from burrows after large rain events. Inspections for CTS are conducted by biologists and field crews after one-half inch (1.2 cm) or more of rain is recorded on site within the previous 24-hour period. Inspections are focused within two kilometers of known, current, or historical CTS breeding pond (Figure 5). All CTS inspectors have received MRA-specific environmental awareness training.

Inspections take place prior to fieldwork commencement and involve careful examination surrounding and under materials, equipment, and vehicles that could be used during the post-rainfall day, often using a high-powered flashlight. If a CTS is observed by a crew member, the ESCA RP Senior Qualified Biologist (SQB) is consulted for approval prior to CTS relocation to a safe place by a USFWS-approved Qualified Biologist (QB), if necessary. A crew member stays with the animal until it is outside of the work area so that it is not injured or killed by a vehicle, predator, or other means.

5.2.6 Methods for Aquatic Feature Monitoring

During 2016, the three aquatic features in the FEG grenade range were monitored on a routine basis during the rainy season, including AF09-1A, which was subject to sifting during remediation activities that took place between October 2012 and January 2013. Water depth, turbidity, pH, presence of submergent and/or emergent vegetation, and presence of aquatic invertebrates and any sensitive species were documented, along with total rainfall for the period and season. Aquatic feature monitoring events are summarized in Appendix C. Appendix C also includes aquatic feature monitoring reports and photo documentation from 2016.

5.2.7 Methods for Weed Monitoring and Management

During 2016, weed monitoring was conducted throughout the year using visual surveys, with focused attention on pampas and/or jubata grass (*Cortaderia selloana, C. jubata*), French broom (*Genista monspessulana*), and iceplant pursuant to the HMP (USACE 1997).

Weed abatement is conducted where necessary, including in ESCA development parcels, to reduce the spread of these target weed species into and within habitat areas. In addition, any weedy species that are listed by the California Invasive Plant Council as highly invasive weeds are also monitored if present in sufficient numbers to threaten sensitive species or habitats (California Invasive Plant Council 2006). Weed monitoring and abatement events are

summarized in Appendix D. Appendix D also includes weed monitoring reports and photo documentation from 2016.

5.2.8 Methods for Erosion Monitoring and BMPs

During 2016, erosion monitoring was conducted in MRAs before and after rain events of 0.5 to 1 inch (1 to 2.5 cm) or more within 24 hours, depending on the intensity of rainfall. When necessary, the ESCA RP Team installed erosion control BMPs, such as burlap sand bags, silt fencing, biodegradable weed-free straw wattles, biodegradable coconut fiber erosion control blankets, and water bars (Figures 8a and 8b). Erosion monitoring events are summarized in Appendix E. Appendix E also includes erosion monitoring reports and photo documentation from 2016.

6.0 BIOLOGICAL MONITORING RESULTS

Baseline biological monitoring data have been gathered in habitat parcels subject to munitions investigation activities in the FEG, Parker Flats, and IAR MRAs in order to meet the requirements of the 1997 HMP and BOs; biological monitoring methodology adhered to the *U.S. Army Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at the former Fort Ord* (Burleson 2009); methods and general locations of munitions investigation types are summarized in Section 5.1.

A summary of habitat monitoring activities completed by the ESCA RP Team during 2016 is shown in Table 1-1 and includes vegetation transects and associated herbaceous quadrats in shrub-dominated vegetation types, herbaceous quadrats in grassland vegetation, and HMP herbaceous species monitoring. Species richness data are also collected and reported below. In addition, aquatic features are monitored during the rainy season, and results are reported in Appendix C.

Tables 6-1 through 6-8 present the results from biological monitoring activities in habitat parcels in the FEG and IAR MRAs.

6.1 Vegetation Monitoring in MRAs

2016 vegetation monitoring of habitat parcels that were subject to previous vegetation cutting during ESCA RP Team munitions investigation activities is summarized by MRA in this section. Vegetation monitoring was conducted in the FEG MRA and IAR MRA (Table 1-1); no transect monitoring was required in the Parker Flats MRA in 2016. Previous monitoring associated with ESCA RP Team munitions investigation activities in the IAR MRA included small-scale excavation, large-scale excavation, and creation of new ingress-egress routes; vegetation monitoring of areas subject to these activities are reported in Appendix A.

6.1.1 Vegetation Monitoring in Future East Garrison MRA

Native vegetation in the FEG MRA is comprised primarily of central maritime chaparral, with oak woodland vegetation in drainage bottoms and on some north-facing slopes. Munitions investigation activities took place in different locations in different years, as summarized in Section 5.2.1.1. As a result, it is possible to have more than one post-activity year represented in vegetation monitoring data in any given year.

During 2016, a total of 23 transects were monitored in those areas subject to munitions investigation activities that ended in 2011 (Figure 6a), all Year 5 post-activity vegetation transects in central maritime chaparral and oak woodland vegetation. Summary data are presented in Tables 6-1 to 6-3, as well as in Figures 9 and 10.

6.1.1.1 Vegetation-Cut Areas in the Future East Garrison MRA in Central Maritime Chaparral

Data from 23 Year 5 transects in areas subject to vegetation cutting are compared with data obtained from 39 baseline transects in Table 6-1, along with comparisons to data from 24 Year 3 transects and 6 Year 5 transects collected in 2015. The 2015 and 2016 transects were located in different grid locations in the FEG MRA. Section 5.2.1 summarizes transect monitoring methods and Figure 6a shows 2016 transect locations.

Mean baseline total shrub and subshrub cover in central maritime chaparral in the FEG MRA exceeded 100% in 2010 due to dense and overlapping shrub canopies. In 2016, total mean native cover in Year 5 transects was 86.2% and mean shrub cover averaged 73.1%, more than 10% higher than the cover in Year 3 and Year 5 transects sampled in 2015. Herbaceous mean cover increased as well, from 2% in 2015 to 12.3% in 2016 (Table 6-3) after greater precipitation between January and March (12.2 inches in 2016 compared with 1.6 inches in 2015 during the same months).

In all transects, the stump-sprouting shrubs brittleleaf manzanita and chamise maintained dominance before and after vegetation cutting, as measured by mean cover, relative cover, and frequency data (Figure 9). Nonetheless, twenty-one associated woody species were present in one or more of the 2016 transects, suggesting considerable shrub diversity in these areas. When the total native species within a meter of transects are considered, 99 native plant species were observed in 2016, reflecting robust ecological health (Table 6-3).

Distribution and abundance of associated shrub species in the FEG MRA vary based on environmental characteristics and site history; the most common associated shrubs prior to vegetation cutting were Toro manzanita and black sage (Tables 6-1 and 6-2). Mean cover by obligate-seeding shrubs such as Toro manzanita declined after vegetation cutting, from 14.4% average cover in baseline transects to 2.8% in 2016 Year 5 post-activity data, respectively. Black sage, on the other hand, had almost completely recovered to pre-disturbance cover, with 6.6% mean cover in 2016 compared with 7.2% in baseline data from 2011.

Several plants, including colonizing native subshrubs such as coyote bush (*Baccharis pilularis* subsp. *consanguinea*) and bush monkeyflower (*Mimulus aurantiacus*) have the same

mean shrub cover in 2016 as Toro manzanita, suggesting a normal pattern of seedling recruitment into post-disturbance areas. Deerweed (*Acmispon glaber*) has slightly higher mean cover (3.6%) in 2016, compared with 0.1% in 2011; this leguminous subshrub commonly appears in open areas in central maritime chaparral vegetation.

Frequency data facilitate comparisons of species distributions in a given area, even for species with low cover; see Tables 6-1 and 6-2. The two dominant stump-sprouting shrubs, brittleleaf manzanita and chamise, are widespread, exhibiting frequencies greater than 85% before and after vegetation cutting (Figure 10). Although the mean cover of two HMP shrubs, Toro manzanita and Monterey ceanothus, declined after vegetation cutting, frequency data indicate reestablishment of germinating HMP shrub seedlings in at least half of the transects in which they were originally present. Toro manzanita was present in 64.1% of baseline transects and in 34.8% of 2016 Year 5 transects; hence, seedlings are currently found in more than half of transects in which Toro manzanita was originally present and ongoing recruitment is likely. Monterey ceanothus was present in 48.7% of baseline transects and 39.1% of 2016 Year 5 transects, or 80% of baseline transects.

Openings between shrubs support a range of native herbaceous species, including California croton (*Croton californicus*), small-flowered cryptantha (*Cryptantha micromeres*), nude buckwheat (*Eriogonum nudum*), and the native bunchgrass Coast Range melic (*Melica imperfecta*). Mean native herbaceous cover in 2016 Year 5 herbaceous quadrats was 3.9%, more than double the 1.7% recorded for 2014 Year 3 quadrats sampled in different locations in the FEG MRA (Table 6-2). Shrub cover averaged 9.8% in the same 2016 quadrat sampling.

Non-native species mean cover totaled 3.9% in 2016 quadrats, with the primary weed species being three non-native weedy grasses: ripgut brome (*Bromus diandrus*), red brome (*B. madritensis* subsp. *rubens*), and wild oats (*Avena* species).

Non-native target weed cover by iceplant was 1.3% in 2016 Year 5 transects.

Approximately 7% of baseline mean cover was categorized as "bare ground." In 2016, bare ground in Year 5 transects was 9.6% and is expected to continue to decline as shrub cover increases.

Plant species richness increased after vegetation cutting in the FEG MRA (Table 6-3 and Figure 13). A total of 25 native plant species was recorded in 39 baseline transects in dense chaparral vegetation in 2010-2011, 22 of which were shrub species, with an average of 5.7 native shrub species per transect.

In 2016, five years after vegetation cutting, a total of 22 shrub species were recorded in 23 Year 5 transects, with a mean of 8 native shrub species per transect and 38 native species on all Year 5 transects combined (Table 6-3). The number of herbaceous species increased from one to 15 between baseline and Year 5 transect data.

When all species within a meter of 2016 Year 5 transects were compiled, 99 native species were observed in 23 Year 5 transects, more than double what was recorded along the transect

line alone. This total included 2 native tree species, 27 native shrub species, and 69 native herbaceous species, and 3 ferns.

6.1.2 Vegetation Monitoring in Interim Action Ranges MRA

During 2016, a total of 20 transects were monitored in the IAR MRA (Figure 6b). These included seven Year 5 transects in vegetation-cut areas in South Range 44.

An additional 13 Year 4 transects in areas subject to small-scale excavations -- eight in North Range 44 and five in South Range 44; these data are presented in Appendix A.

Native vegetation in the IAR MRA is comprised primarily of central maritime chaparral, with a small grassland area located in South Range 44 SCA. Unlike munitions investigation activities in the FEG and Parker Flats MRAs, which consisted primarily of vegetation cutting in central maritime chaparral, a total of four activity types were conducted in the IAR MRA: vegetation cutting and associated target-specific investigations, small-scale excavations, large-scale excavation, and ingress/egress routes; see Section 5.1. Monitoring results from areas subject to vegetation cutting and associated target-specific investigation in the IAR MRA are provided below (Tables 6-4 and 6-5, Figures 11 and 12); results from monitoring in areas subject to all activity types in the IAR MRA are reported in Appendix A.

Four dominant shrubs formed the majority of shrub cover in 2010-2011 baseline transects in the entire IAR MRA: shaggy-barked manzanita (29.3% average cover), dwarf ceanothus (20.2% cover), Monterey ceanothus (13.5% cover), and chamise (9.0 % average cover; Figure 11), all of which had frequencies of 90% or greater (Figure 12); mean total shrub and subshrub cover was 94.5%.

All post-activity vegetation monitoring transects showed a decline in native shrub cover and an increase in bare ground immediately after vegetation cutting, with a fairly rapid rise in cover during the first five years after munitions investigation activities were complete. Mean native shrub cover was 33.8% in Year 4 post-activity transects in South Range 44, which increased to 51.3% in Year 5 transects in 2016 (Table 6-4 and Figure 11).

The greatest initial cover in post-activity transects is provided by stump-sprouting dominants such as shaggy-barked manzanita and chamise. A comparison of baseline and post-activity data for those two species by site points to a pattern of strong recovery, with combined Year 5 mean cover of these two species equaling 70% of baseline cover in South Range 44. These two species are found in every transect (100% frequency) in South Range 44.

Obligate-seeding HMP species also exhibit high frequencies in post-activity data (Figures 12 and 14). In South Range 44, sandmat manzanita are documented in 100% of South Range 44 transects, and Eastwood’s ericameria occurred in 14.3% of South Range 44 baseline transects, the same frequency as in baseline transects. Monterey ceanothus was found in 57.1% of Year 5 transects in South Range 44.

Other more widespread obligate-seeding shrubs ranged in frequency from 86% (black sage, deerweed) to 71% (golden yarrow), 57% (rush-rose), or lower. Resprouting by burl-forming shrubs, combined with establishment of obligate-seeding species and pioneering subshrubs such as deerweed and rush-rose, suggests that IAR MRA sites are on a recovery trajectory that will mirror the species composition and diversity present under pre-activity conditions (Figures 11 and 12).

Native herbaceous cover in transects was 6.2% in Year 5 transects in South Range 44, up from 3.3% in Year 4 transects.

Native plant species richness increased after vegetation cutting and associated target-specific investigation in the IAR MRA (Table 6-5, Figure 13). In South Range 44, total native species recorded in baseline transects was 15, and 43 in Year 5, with steady increases year by year. The number of shrub species remained about the same (13-15) but herbaceous species richness increased from 1 to 30 between baseline and Year 5, suggesting ongoing colonization from native seed dispersal into disturbance areas. A total of 62 species were observed within the one-meter belt along the transects, including one tree species, 16 shrub species, and 45 herbaceous species.

6.2 Vegetation Monitoring Summary for Central Maritime Chaparral Transects

Vegetation Cover and Frequency in Central Maritime Chaparral Transects: In comparing vegetation cover and recovery after munitions activities between the FEG MRA and the IAR MRA, shrub dominance differs between the two sites: the predominance of widespread stump-sprouting shrubs in the FEG MRA, compared with shared dominance of several shrubs in the IAR MRA.

Vegetation cutting leaves the root systems of many stump-sprouting shrubs intact, and dormant shoots emerge quickly after being cut. In the FEG MRA, two dominant stump-sprouting shrubs, brittle-leaf manzanita (*Arctostaphylos crustacea*) and chamise, shared combined baseline cover of approximately 73%, clearly predominating in this central maritime chaparral environment; by Year 5, these shrubs averaged 42% cover, suggesting rapid recovery by these species. In contrast, in South Range 44 in the IAR MRA, combined mean baseline cover of shaggy-barked manzanita and chamise was 38%, with Year 5 transects indicating 25% mean cover by these species. In both locations, regardless of cover values, these shrubs provide between 55% and 66% of baseline cover five years after vegetation cutting.

Obligate-seeding HMP shrubs like Toro manzanita, Monterey ceanothus, dwarf ceanothus, and sandmat manzanita recolonize sites subject to vegetation cutting from seed, so post-activity cover by these shrubs is initially low and gradually increases over time, especially with adequate rainfall. Obligate-seeding HMP shrubs were frequent associates in baseline conditions in maritime chaparral in the FEG MRA and the IAR MRA, but cover by these species is lower in the FEG MRA than in the IAR MRA. Combined mean cover by HMP shrubs in FEG MRA was 15.9% in baseline transects and 3.4% in Year 5 transects. In South Range 44 in the IAR MRA, mean cover by HMP shrubs was 15.3% in baseline transects and

7% of Year 5 transects, suggesting more robust recovery of these species with lack of competition from the established stump-sprouting shrubs.

Overall Year 5 mean native cover was 86.2% in the FEG MRA and 57.5% in South Range 44 in the IAR RMA.

Frequency data provide an effective means of assessing shrub seedling recruitment (Table 6-1 and 6-4, Figures 10, 12, and 14). 2016 mean cover of HMP shrubs in the FEG MRA is currently below 5%, but Year 5 post-activity frequency show recolonization of these obligate-seeding shrubs. Eastwood's ericameria exhibits higher frequency (8.7%) in Year 5 transects than in baseline transects (2.6%). Frequency of Toro manzanita recruits in Year 5 (34.8%) is below baseline frequency (64.1%), but is gradually colonizing areas subject to vegetation cutting. Monterey ceanothus, with 39.1% frequency in Year 5, is approaching baseline frequency (48.7%).

In South Range 44 in the IAR MRA, post-activity establishment by HMP shrubs based on frequency data has been widespread. Sandmat manzanita frequency in Year 5 transects exceeds baseline frequency; Eastwood's ericameria Year 5 frequency values equal 83% of baseline values; and Monterey ceanothus Year 5 frequency approaches 60% of baseline values.

Figure 14 compares mean baseline frequencies of HMP shrubs with post-activity mean frequencies in both the FEG MRA and South Range 44 of the IAR MRA, illustrating successful recruitment and post-activity establishment trends by most HMP shrubs.

In addition, native subshrubs that rapidly colonize sites after burns and other disturbances often exhibited higher frequencies Year 5 transects compared with baseline transects. Similar vegetation recovery patterns occur in central maritime chaparral in all MRAs that were monitored in 2016, although details vary.

Species Richness and Diversity: The mean number of shrubs and herbaceous species per transect generally tends to increase during the first few years after vegetation cutting in all sites; by Year 5, the mean number of shrubs per transect equals or exceeds the baseline. Species richness, based on comparisons of baseline and post-activity transect species composition data, increased in the FEG and IAR MRAs after vegetation cutting, an expected result due to increased light and space available for seedling recruitment after removal of the dense chaparral canopy. From 2014-2016, species richness documentation also encompassed all species within one meter of the transect tape as a separate metric in order to more thoroughly capture species richness in each post-activity area. Figure 13 presents consistently positive post-activity native plant re-establishment and richness trajectories in the FEG and IAR MRAs in 2016.

In the FEG MRA, a total of 99 native species were observed in the one-meter perimeter area surrounding the tape in the Year 5 transects, all considerably above the 25 species recorded in baseline conditions. Numerous native species appeared in post-activity transects in the FEG MRA that had not been previously documented during baseline surveys and included shrubs, herbaceous perennials and annuals, as well as ferns (Table 6-3).

Annual monitoring in South Range 44 in the IAR MRA provides an opportunity to compare year by year variability in species richness data in the same locations. Species richness increased each successive year after vegetation cutting, despite the prolonged drought. A total of 62 species were recorded in the one-meter transect perimeter in 2016 in South Range 44 (Tables 6-3).

The Shannon index reflects species composition and relative abundance of each species based on transect cover values in central maritime chaparral; a higher Shannon index value reflects not just species diversity but the proportion that each species contributes to the entire sample. In the 2016 sampling effort, the Shannon index values do not incorporate the diversity of species observed within one meter of transects (since cover values were not recorded for species off the immediate transect line).

In the FEG MRA, the Shannon index was higher in Year 5 transects (1.4) than baseline values (1.1); the FEG MRA also has the highest species richness of any of the ESCA MRAs (Table 6-3).

In South Range 44 in the IAR MRA, the Shannon index varies after vegetation cutting. In South Range 44, the baseline Shannon index value was 1.8, and it fell to 1.4 in Year 1, where it remained in Year 5 (Table 6-5).

All sites had relatively low evenness values around 0.2 in baseline and post-activity data; a value of 1 represents complete evenness, or codominance by all species.

6.3 HMP Species Monitoring in FEG MRA

2016 HMP herbaceous species monitoring focused on three annuals in the FEG MRA in areas subject to vegetation cutting -- Monterey spineflower, sand (Monterey) gilia, and seaside bird's-beak (Figures 7a, 7b, and 7c). No HMP monitoring was required in the Parker Flats MRA in 2016. No HMP herbaceous species monitoring was conducted in 2016 in the IAR MRA since performance criteria were met in 2015; see Appendix A

Vegetation cutting and munitions investigation activities were conducted from 2010 to 2013 in monitoring areas. All portions of the FEG MRA subject to vegetation cutting were surveyed for HMP herbaceous species in 2016 (Figure 6a). Only one area in the FEG MRA, the former grenade range, was subject to small-scale excavation and no HMP herbaceous species had ever been recorded from that area. Nonetheless, this area was also surveyed in 2016 for HMP herbaceous species, which were absent.

Figures 7a, 7b, and 7c present HMP species density data in the FEG MRA. Tables 6-6 to 6-8 present HMP herbaceous species monitoring data, providing mean densities, population estimates, and associated statistics. Figures 15 and 16 present comparative HMP herbaceous species summary data by post-activity monitoring year and species.

Munitions investigation activities took place in different locations in different years in the FEG MRA, as summarized in Section 5.2.1.1. As a result, it is possible to have more than one

post-activity year represented in HMP herbaceous species monitoring data in any given year. A total of 956 grids within the FEG MRA were surveyed in areas subject to vegetation cutting between 2010 and 2013 (Section 5.2.3.1), see Figures 6a and 7a, 7b, and 7c.

One new seaside bird's-beak reference plot was also sampled. Data are summarized in Tables 6-6 to 6-8. Figure 15 compares total numbers of HMP herbaceous species in the FEG MRA based on post-activity monitoring year and Figure 16 presents comparative density/plot data for the three HMP herbaceous species observed in the FEG MRA by post-activity year.

Monterey spineflower: In general, Monterey spineflower is found in lower densities in the sandstone-derived substrate in the FEG MRA compared with the relatively high densities of Monterey spineflower that occupy Aeolian sandy substrates at lower elevations to the west and southwest, such as in the IAR and Parker Flats MRAs. Monterey spineflower was not found in the FEG MRA in the flora and fauna base-wide 1992 surveys (USACE 1992).

The entire FEG MRA was surveyed for HMP species in 2010 prior to munitions investigation activities, and Monterey spineflower was found only in one general concentrated area (Figure 7a). In 2010, two grids supported Monterey spineflower, one with 12 plants and one with 224 plants; these grids became one of two baseline sites. The estimated average number of Monterey spineflower in 2010 baseline grids was 118. This area was subject to vegetation cutting in 2011. A second Monterey spineflower baseline site consisting of two grids were established in 2012, a drier year than the wet year of 2010, with a total of 110 Monterey spineflowers and a mean density of 55 individuals/plot.

In 2016, total Monterey spineflower numbers increased between Year 4 and Year 5, from 12 individuals in the FEG MRA in Year 4 to 220 in Year 5. Monterey spineflower mean density was 29 individuals/plot in Year 5. Mean 2016 Monterey spineflower density per occupied grid in the FEG MRA was 110, which compares favorably with baseline grid data (Table 6-6; Figure 7a). In 2016 there were Monterey spineflower individuals in two grids in the FEG MRA, one grid with 15 individuals and one with 205 individuals.

Other than the cluster of Monterey spineflower in the FEG MRA east of Barloy Road shown in Figure 7a, no other Monterey spineflower colonies have been observed in the FEG MRA, despite extensive searches each year, including a survey of 956 grids in 2016 for potential sightings. No undisturbed Monterey spineflower reference plots were available for comparison.

Sand (Monterey) gilia: Sand (Monterey) gilia occurs in low densities in loose sandy soils with low silt content in several locations at the former Fort Ord. It was mapped in 1992 in low densities in a central swath across the former military base, with higher densities in the northwest (USACE 1992). A small area was mapped near the northeastern perimeter of the FEG MRA, and it is in this general area that low numbers of sand (Monterey) gilia continue to be observed.

In 2010, three grids supported 330 sand (Monterey) gilia in two locations. One of these locations encompassed two grids and included 329 sand (Monterey) gilia; this location became one of two baseline sites. The other location was in the center of the southern

perimeter of the eastern habitat parcel, where only one sand (Monterey) gilia was observed in baseline surveys and small numbers were observed in some subsequent years. This entire area was subject to vegetation cutting in 2011. A second sand (Monterey) gilia baseline site consisting of one grid was established in 2012, a drier year than the wet year of 2010, with a total of 15 sand (Monterey) gilia individuals, with 3 individuals/plot in one grid and 12 individuals/plot in the second, resulting in a mean density of 7.5 individuals/plot.

The number of sand (Monterey) gilia individuals in the FEG MRA was 16 plants in 2013 in three grids, 30 individuals in one grid in 2014, 13 individuals in 3 grids in 2015, and 128 individuals in 7 grids in 2016 (Year 5; Tables 6-7 and Figure 7b). Mean sand (Monterey) gilia density was 18.3 individuals/plot in 2016, which is higher than the 2012 baseline, lower than the 2010 baseline, and higher than all other post-activity years.

Sand (Monterey) gilia distribution expanded to seven grids in 2016, from a previous high of three grids. In 2016 there were two sand (Monterey) gilia individuals/plot in two grids, 9 individuals/plot in the two grids, 15 individuals/plot in one grid, 36 individuals/plot in one grid, and 65 individuals/plot in the one grid, for a mean of 18 individuals per grid.

No undisturbed sand (Monterey) gilia reference plots were available for comparison in 2016.

Seaside bird's-beak: In 1992, base-wide mapping indicated low density of seaside bird's-beak in a central swath through mostly the northern half of the former Fort Ord, with a small area of low-density bird's-beak in the eastern FEG MRA (USACE 1992).

Prior to 2013, seaside bird's-beak had not been recorded inside the FEG MRA by ESCA RP biologists, although it had been previously mapped to the south in 1992 (Figure 7c). In 2013, 187 seaside bird's-beak plants were located in one grid cell located just south of the previously mapped 1992 seaside bird's-beak distribution in a Year 3 post-activity vegetation-cut area. This number grew to 375 seaside bird's-beak individuals in six grids in 2014, located in the same general location as the seaside bird's-beak colony that was first recorded in 2013, double the 2013 number of 187 (Tables 6-8). In 2015, a total of 422 seaside bird's-beak individuals were recorded in six grids in the FEG MRA, and in 2016, 745 seaside bird's-beak individuals were counted in the FEG MRA in nine grids.

A total of 188 seaside bird's-beak individuals were counted in two Year 4 grids and 557 in seven Year 5 grids, with mean densities of 16.5 individuals/plot for Year 4 and 13.7 plants/plot for Year 5 (Table 6-8, Figure 7c).

Seaside bird's-beak distribution has expanded most years for the past four years, from one grid in 2013, to six grids in 2014 and in 2015, and nine grids in 2016. Total individuals per grid range from 1 to 260. In 2016 there were one seaside bird's-beak individual/plot in two grids, 8 individuals/plot in the one grid, 22 individuals/plot in one grid, 37 individuals/plot in one grid, 166 individuals/plot in the one grid, 214 individuals/plot in the one grid, and 260 individuals/plot in the one grid for a mean of 93 individuals per grid.

One seaside bird's-beak reference colony, containing three reference plots, was surveyed in undisturbed habitat and supported a total of 112 seaside bird's-beak individuals, with a mean density of 5.3 individuals per plot and an estimated 37 individuals per grid in suitable habitat.

6.4 HMP Herbaceous Species Monitoring Summary

HMP herbaceous species presence in the FEG MRA show strong recovery after vegetation cutting; plot densities for both sand (Monterey) gilia and seaside bird's-beak mostly equal or exceed the 2012 baseline and post-activity data from previous monitoring years (Figures 15 and 16).

In 2016, 220 Monterey spineflower, 128 sand (Monterey) gilia, and 745 seaside bird's-beak individuals were found in small portions of the FEG MRA that had been cut in 2011. HMP herbaceous species in the FEG MRA occupy limited areas with shallow sandy soils underlain by sandstone, where they often persist in fluctuating numbers year after year. Soil depth is shallower than in the IAR MRA and a comparison of weather data between Monterey airport and Spreckels, CA indicates slightly less rainfall inland. These small colonies of HMP herbaceous species in the FEG MRA have exhibited resilience after vegetation cutting and are expected to increase in numbers or stabilize with sufficient rainfall, as long as suitable openings in the chaparral exist.

6.5 Aquatic Feature Monitoring in the Future East Garrison MRA

During 2016, aquatic feature monitoring was conducted in the FEG MRA former grenade range aquatic features and encompassed the following: general site reconnaissance, botanical surveys, photo documentation, geological investigations, munitions investigation activities work monitoring, and restoration. Monitoring summaries for the FEG MRA aquatic features are provided in Appendix C.

All three of the aquatic features in the grenade range contained water at the beginning of 2016 after seasonal rains in late 2015 and early 2016. Ponded water depth slowly dropped during the relatively dry winter and spring until May 2016, when the last aquatic feature, AF09-2, dried out. From January through May 2016 both submergent and emergent vegetation were noted in AF09-1A and AF09-2 (Appendix C: Table C-1). A small colony of hooded ladies' tresses orchids (*Spiranthes romanzoffiana*) was observed for the second year in a row immediately adjacent to AF09-2.

No CTS were observed in these aquatic features in 2016 and have never been observed in the FEG MRA former grenade range; protocol CTS surveys were conducted in 2010-2011 in the former grenade range and elsewhere in the FEG MRA (ESCA RP Team 2011a and 2012a).

Table C-2 in Appendix C compares 2016 data in the former grenade range with pre-disturbance data collected in 2010 and 2011; only AF09-1A was subject to munitions investigation activities, which were completed in January 2013, but data from the other two pools in near proximity are included in Table C-2 as controls. The footprint of AF09-1A covers the same area prior and subsequent to munitions investigation activities. In general,

site hydrology and wetland vegetation have been successfully restored in AF09-1A during the past two years. It should be noted that there was a pronounced difference in annual rainfall between the water years (22.2 inches [56.4 cm] in 2009/2010, 20 inches [50.8 cm] in 2010/2011, 8.8 inches in 2013/2014 [22.4 cm], and 18.2 inches [46.2 cm] in 2015/2016).

Water depth was slightly deeper in AF09-01A in January 2016 than in 2010 and 2011, roughly similar in March 2016, and shallower in April 2016 after a dry spring. Turbidity data collected during the same month are only available for March 2011 and 2016 and April 2010 and 2016. The restored pool exhibited high turbidity levels in March 2016 compared with low turbidity in 2011; in April 2016, turbidity was low in the restored pool, which had exhibited medium turbidity in April 2010.

A range of aquatic invertebrates were observed when the pool was full in 2016 (see Appendix C: Table C-1), although no California linderiella has been observed since restoration activities were complete in January 2013. California linderiella were observed in AF09-1B in 2010 but were absent in 2016 surveys of this "control" aquatic feature.

7.0 HABITAT RESTORATION IMPLEMENTATION AND MONITORING IN THE INTERIM ACTION RANGES MRA

Habitat restoration implementation and monitoring activities for 2016 are summarized in Appendix A and are based on an HRP prepared by the ESCA RP Team as an addendum to the Phase II Interim Action Work Plan for the IAR MRA (ESCA RP Team 2013a). The HRP details the methods for restoration implementation, maintenance, and monitoring of central maritime chaparral and associated plant populations in habitat parcels that were affected by munitions investigation activities in the IAR MRA. Four main activity types were associated with vegetation disturbance in these areas, each with associated remediation, monitoring, and restoration requirements: ingress/egress corridors, vegetation cutting, small-scale excavation, and large-scale excavation. These activity types are associated with the following restoration strategies: monitoring only, passive restoration, and passive and active restoration.

After soil replacement in Range 47 SCA in December 2012, site preparation activities commenced, including installation of erosion control BMPs, animal deterrent fencing around the perimeter of the site, and an irrigation system and associated infrastructure. Over 30,000 container plants representing 16 species were planted in January and early February 2013. In addition, seeding of targeted areas in the IAR MRA was also conducted to boost native species cover and re-establish HMP herbaceous species in suitable locations.

Quantitative success criteria for plant survival, species richness, and percentage cover targeted for the first seven years following site restoration are included in the HRP and results of monitoring for these criteria for Year 4 are reported in Appendix A. Restoration monitoring will continue in 2017 in North Range 44 and South Range 44 in vegetation subject to small-scale excavation.

8.0 MANAGEMENT AND MITIGATION ACTIVITIES SUMMARY

This section summarizes the habitat management and mitigation activities required by the HMP and the BO and performed by the ESCA RP Team through 2016.

8.1 Vegetation and HMP Species Protection Measures

The ESCA RP biologists worked closely with ESCA RP Team UXO personnel to successfully design the following species-specific and MRA-specific measures to reduce impacts to native vegetation and HMP species during field activities. A brief summary of these efforts over the past two years is provided below.

Future East Garrison MRA: In order to preserve mature seed-producing individuals of HMP manzanitas in the FEG MRA, Toro manzanita were preserved and limbed up and all Hooker's manzanita were preserved during vegetation cutting and associated target-specific investigations, where possible, between 2011 and 2012. High survival of Toro and Hooker's manzanitas was documented in 2012, 2013, and 2014 monitoring. Of the 548 Toro manzanitas recorded in sampled grid cells in 2012 only six plants had died after three years, a survival rate of 98.9%.

In addition, a "step-out" approach was employed to minimize the areas that were initially cut and investigated. When it became necessary to do munitions investigation in a larger area, successive grid step-outs were performed on an as-needed basis in order to reduce vegetation cutting to only that required for munitions investigation activities.

Parker Flats MRA: In order to preserve almost all coast live oak trees in the Parker Flats MRA Level 2 Residential Quality Assurance areas, oak tree retention was coordinated by the ESCA RP arborist and field biologists in approximately 10.3 acres (4.2 ha) of coast live oak woodland in 2013. Special measures were taken to preserve coast live oak trees greater than six inches (15.2 cm) dbh. Prior to munitions investigation activities, the ESCA RP arborist and field biology team measured the dbh, number of trunks per tree, and tree health of all trees in the work area. Approximately 885 coast live oak trees were evaluated; most oak trees were in good health and approximately ten trees were dead, diseased, or seriously damaged (bark removed and cambium damaged). Healthy trees greater than six inches dbh (15.2 cm) were left standing. Low-hanging limbs that presented a safety hazard for the munitions investigation team were removed if there was no overall threat to tree health.

Coast live oak trees were qualitatively monitored in 2016, and oak tree health is excellent overall. Native understory has also regrown vigorously in this area.

Interim Action Ranges MRA: Munitions investigation activities in intact central maritime chaparral vegetation were minimized to the maximum extent feasible. Ingress/egress corridors were restricted to existing road and every effort was made to minimize any additional widening or creation of new access routes. As a result, actual munitions investigation activities affected only 0.4 acres (0.2 ha) instead of the anticipated 5.5 acres (2.0 ha).

With the information gained from initial Design Study investigations, vegetation cutting and subsurface investigations in NCAs and SCAs in South Range 44 were confined primarily to10-foot-wide (3-m-wide) linear transects that traversed grids in a north-south linear alignment in the study areas; see Section 5.1.5. As a result, out of 17.7 acres (7.2 ha) of intact central maritime chaparral, only 4.5 acres (1.8 ha) of native vegetation were disturbed during this effort and 13.2 acres (5.3 ha) of central maritime vegetation (75 %) was left intact, preserving central maritime chaparral in an area that supports numerous HMP species.

8.2 Wildlife Relocation

ESCA RP Team members perform animal rescue and/or relocation as needed to avoid or reduce impacts of the fieldwork on wildlife. No CTS were observed in 2016 in any MRA.

8.3 Environmental Awareness Training

Environmental awareness trainings (EATs) are conducted by a QB for field personnel prior to initiation of fieldwork in all MRAs, placing special emphasis on CTS awareness, requirements, and mitigation measures. During the training personnel are advised of the locations of ponds, vernal pools, and aquatic features within 2 km (1.24 miles) that may be potential breeding habitats for CTS, including aquatic features in and near the FEG, Parker Flats, and IAR MRAs (Figure 5). Trainings also introduce work crews to the HMP, the relevant habitats in the MRAs, measures to comply with the federal ESA, protection of HMP species and their habitats, and minimization of environmental impacts during munitions investigation. Site requirements are reviewed, including restricting site access to established roads and paths whenever possible and limiting vegetation cutting and soil disturbance to the minimum feasible area required to conduct the field task. Where appropriate, the ESCA RP biologists communicate and/or mark out locations of HMP plant species and/or their habitats to assist avoidance by field crews. EAT was conducted to new field crew members and CTS-specific refresher training was given to previously trained field crew on November 28, 2016.

8.4 Weed Management Activities

Monitoring and management activities for target weeds are routinely conducted in ESCA RP parcels, consistent with the requirements of the HMP (USACE 1997) and theBO (USFWS 2015) The goal of weed management is to avoid degradation of ecological communities and especially sensitive species populations as a result of weed invasion in parcels not designated for development.

During 2016, weed monitoring occurred on a regular basis, particularly in areas where weeds could easily spread from a development parcel to a habitat parcel. Most weed abatement was done in the IAR MRA Range 47 SCA. All pampas grass seedlings were removed as soon as they were observed. Ice plant seedlings were removed on an ongoing basis in Range 47 SCA but periodically all ice plant seedlings were removed in a single concentrated effort.

All weed monitoring and removal activities are summarized in Appendix D.

8.5 Erosion Control Monitoring and Mitigation

Ongoing erosion control monitoring and installation of erosion control BMPs are implemented as needed in ESCA RP parcels, consistent with the requirements of the HMP (USACE 1997) and BOs relevant to ESCA RP activities (USFWS 1999, 2002, and 2005); the 2005 BO (USFWS 2005, pp. 14-15) and the ESCA RP Soil Management Field Implementation Plans for each MRA (ESCA RP Team 2011, 2012a) describe erosion control measures in detail.

Future East Garrison MRA - There were no major erosion issues in FEG during 2016. Broadcast and hydro-seeding efforts in 2013 and 2014 have been successful at vegetating much of the former grenade range, particularly on the steep eastern slope where native herbaceous and woody species have become widely established (Figure 10a). Ongoing erosion control BMP maintenance was needed in 2016 in isolated locations where rilling was observed. In preparation for the 2016/2016 rainy season, additional erosion control measures were implemented, including repairs and improvements to water bars and installation of sandbags in target locations.

Interim Action Ranges MRA - There were no major erosion issues in the IAR during 2016. Ongoing erosion control BMP maintenance was needed where rilling or small gully formation was observed, such as in some locations in the IAR MRA development parcel (Figure 10b). New straw wattles and erosion control blankets were installed at the lower (north) end of Range 47 SCA in areas where fencing and silt fence were removed in late 2016 as part of the Range 47 SCA Restoration Area Infrastructure Removal. In preparation for the 2016/2017 rainy season additional erosion control measures were implemented, as needed.

ESCA RP erosion monitoring activities are summarized in Appendix E.

9.0 CONCLUSION

No munitions investigation activities were conducted in any ESCA MRAs during 2016. Biological monitoring in 2016 included completion of 43 vegetation transects, 12 herbaceous species quadrats, and 21 HMP herbaceous species plots, along with surveys on 227 acres (92 ha) for HMP herbaceous species; these monitoring events and associated data provide the ESCA RP Team with valuable information to guide in ongoing site management.

Baseline vegetation and herbaceous transects were installed by the ESCA RP Team in the FEG, Parker Flats, and IAR MRAs between 2008 and 2012 in order to document native shrub cover prior to munitions investigation activities. Recovery of native vegetation cover after vegetation cutting has been rapid in central maritime chaparral, exceeding 86% in Year 5 transects in the FEG MRA. In the IAR MRA, mean native vegetation cover in 7 transects in South Range 44 reached 57.5% in 2016, meeting the performance target of 50% mean cover (see Appendix A for performance target discussions). Only 25 % of central maritime chaparral in South Range 44 was cut or otherwise disturbed during munitions response activities, so overall native chaparral shrub cover per grid surpasses 80% or more. A range of

seedlings of obligate-seeding shrubs in these vegetation-cut areas contribute to shrub diversity in chaparral stands in all areas, as evidenced by frequency and diversity data, including HMP shrubs.

HMP species are restricted to isolated areas in the FEG MRA. Seaside bird's-beak, which was not present in baseline surveys, continues to increase in numbers and area year by year in the FEG MRA. Sand (Monterey) gilia numbers also rose in post-activity areas in 2016.

Vegetation cover and species diversity data indicate recovery of all sensitive vegetation types subject to munitions response actions in ESCA MRAs. A combination of committed stewardship, including reductions in acreages potentially subject to vegetation cutting in South Range 44 (saving 13.2 acres [5.4 ha], or 75% of intact central maritime chaparral, along with a diversity of native and HMP species); retention of an average of 20.9 Toro manzanitas per acre in the FEG MRA; retention of over 880 coast live oak trees in the Parker Flats MRA development parcel; habitat restoration (see Appendix A); steady post-activity increases in vegetation cover, species diversity, and number of individual HMP herbaceous species; and weed and erosion control management activities all combine to promote habitat recovery after munitions investigation activities. The enhanced native species diversity and cover observed at all sites, along with wildlife usage and other indications of elevated ecological functionality, suggest all areas are on trajectories toward self-sustaining native plant communities equitable with the species richness and relative cover of species that were present on the site prior to the FORA ESCA RP Team munitions investigation and remedial efforts.

Appendix A provides details on the monitoring activities in the IAR MRA in 2016.

Planned activities in FEG, IAR, and Parker Flats MRAs in 2017 include weed and erosion control monitoring and abatement. Habitat monitoring activities expected in 2017 for each MRA are listed below.

FEG MRA:

- Vegetation Transects
- Herbaceous Quadrats
- HMP Annual Surveys
- Species Diversity Documentation
- Aquatic Feature Monitoring

IAR MRA (SCAs and NCAs):

- Vegetation Transects in central maritime chaparral areas subject to small-scale excavation
- Herbaceous Quadrats, if needed
- Species Diversity Documentation

Parker Flats MRA:

- Vegetation Transects
- Herbaceous Quadrats
- HMP Annual Surveys
- Species Diversity Documentation

There are no biological monitoring requirements for the remaining ESCA MRAs (Seaside MRA, CSUMB Off-Campus MRA, County North MRA (property transferred to County of Monterey), Laguna Seca Parking MRA, MOUT Site MRA, and Del Rey Oaks/Monterey MRA.

10.0 REFERENCES

Baldwin, B. G., Goldman, D. H., Keil, D. J., Patterson, R., Rosatti, T. J., and Wilken, D. H. (eds.). 2012. The Jepson Manual. Vascular plants of California. (2nd ed.). Univ. Calif. Press, Berkeley, CA. xxii+1568 pp. January.

Burleson Consulting Inc. (Burleson). 2006. Wetlands Monitoring and Restoration Plan for Munitions and Contaminated Soil Remedial Activities at Former Fort Ord. (Fort Ord Administrative Record No. BW-2453)

———. 2009. Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at Former Fort Ord. March. (BW-2454a)

California Department of Fish and Wildlife (CDFW, then CDFG). 2003. Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander. Sacramento, California.

California Department of Fish and Wildlife (CDFW). 2010. List of Vegetation Alliances and Associations. Vegetation Classification and Mapping Program. Sacramento, CA. September.

———. 2016. Natural Diversity Data Base (CNDDB) RareFind Version 4. Sacramento, California.

California Invasive Plant Council. 2006. California Invasive Plant Inventory. 39 pp.

California Native Plant Society (CNPS). 2016. Inventory of Rare and Endangered Plants (online edition). Rare Plant Scientific Advisory Committee. California Native Plant Society. Sacramento, CA. www.cnps.org/inventory

CH2M Hill and HydroGeoLogic, Inc. 2005. Operable Unit 1 (OU1) – Result of 2005 Monterey Spineflower and Sand Gilia Surveys, OU1, Former Fort Ord (Fort Ord Administrative Record No. OU1-0533)

Detka, Jon R. and Susan C. Lambrecht. 2010. Effects of Fire on Germination of *Ericameria fasciculata* (Asteraceae), a Rare Maritime Chaparral Shrub. Madroño 57(2):77-84.

Environmental Services Cooperative Agreement Remediation Program Team (ESCA RP Team). 2009. 2008 Annual Natural Resource Monitoring, Mitigation, and Management Report, Former Fort Ord, Monterey County, California. 12 June. (Fort Ord Administrative Record No. ESCA-0160)

———. 2010a. 2009 Annual Natural Resource Monitoring, Mitigation, and Management Report, Former Fort Ord, Monterey County, California. 5 February. (Fort Ord Administrative Record No. ESCA-0248)

———. 2010b. ESCA Weed Management Plan, Former Fort Ord, Monterey County, California.

———. 2010c. Group 4, Remedial Investigation / Feasibility Study Work Plan, Volume 1 - Work Plan, Future East Garrison Munitions Investigation Area. 8 October. (Fort Ord Administrative Record No. ESCA-0233C).

———. 2011a. 2010 Annual Natural Resource Monitoring, Mitigation, and Management Report, Former Fort Ord, Monterey County, California, 29 March. (Fort Ord Administrative Record No. ESCA-0253.1)

———. 2011b. Final Phase II Interim Action Work Plan, Interim Action Ranges Munitions Investigation Area, Former Fort Ord, Monterey County, California. May 24. (Fort Ord Administrative Record No. ESCA-0252B)

———. 2012a. 2011 Annual Natural Resource Monitoring, Mitigation, and Management Report, Former Fort Ord, Monterey County, California, 25 May. (Fort Ord Administrative Record No. ESCA-0258)

———. 2012b. FVF G4WP-005 modifies the Final Group 4 RI/FS Work Plan, Future East Garrison Munitions Investigation Area, Former Fort Ord, Volume 2, Appendix C. Addition of Standard Operating Procedures for Soil and Vegetation Handling in Aquatic Features. September 27, 2012 (Fort Ord Fort Ord Administrative Record No. ESCA-0233C.6)

———. 2013a. Phase II Interim Action Work Plan Addendum Habitat Restoration Plan, Interim Action Ranges Munitions Investigation Area, Former Fort Ord, Monterey County, California. February 2013. (Fort Ord Administrative Record No. ESCA-0261)

———. 2013b. 2012 Annual Natural Resource Monitoring, Mitigation, and Management Report, Former Fort Ord, Monterey County, California, 29 March. (Fort Ord Administrative Record No. ESCA-0266)

———. 2014. 2013 Annual Natural Resource Monitoring, Mitigation, and Management Report, Former Fort Ord, Monterey County, California, 28 March. (Fort Ord Administrative Record No. ESCA-0283)

———. 2015. 2014 Annual Natural Resource Monitoring, Mitigation, and Management Report, Former Fort Ord, Monterey County, California, 15 April. (Fort Ord Administrative Record No. ESCA-0300)

———. 2016. 2015 Annual Natural Resource Monitoring, Mitigation, and Management Report, Former Fort Ord, Monterey County, California, 18 March. (Fort Ord Administrative Record No. ESCA-0325)

Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 12+ vols. New York and Oxford. Vol. 1, 1993; vol. 2, 1993; vol. 3, 1997; vol. 4, 2003; vol. 5, 2005; vol. 19, 2006; vol. 20, 2006; vol. 21, 2006; vol. 22, 2000; vol. 23, 2002; vol. 25, 2003; vol. 26, 20.

Harding Lawson Associates (HLA). 1996. 1996 Annual Monitoring Report, Biological Baseline Studies and Follow-up Monitoring at Unexploded Ordnance Sites 10 East, 10 West, 11, 12, and 16 Presidio of Monterey Annex. 1 December. (Fort Ord Administrative Record No. OE-0212)

———. 1998. 1998 Annual Monitoring Report, Biological Baseline Studies and Follow-up Monitoring at Unexploded Ordnance Sites on Former Fort Ord, Presidio of Monterey Annex, Monterey, California. 10 December. (Fort Ord Administrative Record No. OE-0431)

———. 2001. 2000 Annual Monitoring Report, Biological Baseline Studies and Follow-up Monitoring, Former Fort Ord, Monterey County, California. 19 January. (Fort Ord Administrative Record No. BW-2235)

———. 2003. 2002 Annual Monitoring Report, Biological Baseline Studies and Follow-up Monitoring, Former Fort Ord, Monterey, California. 28 January. (Fort Ord Administrative Record No. BW-2237)

Holland, R.F. 1986. Preliminary descriptions of the terrestrial natural communities of California. Nongame-Heritage Program, The Resources Agency, California Department of Fish and Game. Sacramento, California. iii + 156 pp.

Holland, V.L. and David J. Keil. 1995. California Vegetation. Kendall-Hunt Publishing Company. Dubuque, Iowa. 516 pp.

Hunt, Lawrence E. 1993. Origin, Maintenance and Land Use of Aeolian Sand Dunes of the Santa Maria Basin, California. Prepared for The Nature Conservancy, San Luis Obispo, California.

Jones & Stokes Associates, Inc. (Jones & Stokes). 1995a. Fort Ord 1994 Annual Monitoring Report for Biological Baseline Studies at Unexploded Ordnance Sites. 1 January. (Fort Ord Administrative Record No. OE-0208)

———. 1995b. 1995 Annual Biological Monitoring Report for Unexploded Ordnance Removal Sites at Former Fort Ord. 1 September. (Fort Ord Administrative Record No. OE-0209)

MACTEC Engineering and Consulting, Inc. (MACTEC). 2006. Final Track 2 Munitions investigation Remedial Investigation / Feasibility Study, Parker Flats Munitions Investigation Area, Former Fort Ord, California. August 31. (Fort Ord Administrative Record No. OE-0523N)

Natural Resources Conservation Service (NRCS). 2013. United States Department of Agriculture. Web Soil Survey. http://websoilsurvey.nrcs.usda.gov/.

Parsons. 2005. 2005 Annual Biological Monitoring Report, Ranges 43-48, Former Fort Ord, Monterey County, California. 28 November. (Fort Ord Administrative Record No. OE-0577)

Pielou, E.C. 1974. Population and Community Ecology: Principles and Methods. Gordon and Breach, New York.

Sawyer, John O., Todd Keeler-Wolf, and Julie M. Evens. 2009. Manual of California Vegetation. California Native Plant Society. Sacramento, California. 1300 pp.

Smith, D., Curry; B., Kozlowski, D., Williams, R., Watson, F., Turrini-Smith, L., and Newman, W. 2002. Watershed and Riparian Assessment Report (WRAR) Bureau of Land Management Lands, Former Fort Ord, Monterey County, CA. Report No. WI-2002-01 (February 2002). The Watershed Institute. California State University Monterey Bay, Seaside, CA.

U.S. Army Corps of Engineers (USACE) (with Technical Assistance from Jones & Stokes Associates). 1992. Flora and Fauna Baseline Study of Fort Ord, California. Sacramento District. Sacramento, California. (Fort Ord Administrative Record No. BW-1938)

———. 1997. Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, CA, U.S. Army Corps of Engineers, Sacramento District. April. (Fort Ord Administrative Record No. BW-1787)

U.S. Department of the Army (Army). 2002. Record of Decision, Interim Action for Ordnance and Explosives at Ranges 43-48, Range 30A, and Site OE-16, Former Fort Ord, California. September 20. (Fort Ord Administrative Record No. OE-0414)

———. 2008. Record of Decision, Parker Flats Munitions Investigation Area, Track 2 Munitions investigation Site, Former Fort Ord, California. June 24. (Fort Ord Administrative Record No. OE-0661)

United States Fish and Wildlife Service (USFWS). 1993. Biological Opinion for the Disposal and Reuse of Fort Ord, Monterey County, California (1-8-93-F-14). October 19. (Fort Ord Administrative Record No. OE-0045)

———. 1997a. Biological and Conference Opinion on the Closure and Reuse of Fort Ord (1-8-97-F/C-13). January 31. (Fort Ord Administrative Record No. BW-2009)

———. 1997b. Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California (1-8-97-F/C-23R). March 11. (Fort Ord Administrative Record No. OE-0044)

———. 1999. Biological Opinion on the Closure and Reuse of Fort Ord, Monterey County, California (1-8-99-F/C-39R). March 30. (Fort Ord Administrative Record No. BW-2232A)

———. 2002. Biological Opinion on the Closure and Reuse of Fort Ord, Monterey County, California, as it affects Monterey Spineflower Critical Habitat (1-8-01-F-70R). October 22. (Fort Ord Administrative Record No. BW-2233)

———. 2005. Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields (1-8-04-F-25R). March 14. (Fort Ord Administrative Record No. BW-2334)

———. 2007. Amendment to Biological Opinion 1-8-04-F-25R, for the Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields. June 1. (Fort Ord Administrative Record No. BW-2334C)

———. 2008a. Endangered and Threatened Wildlife and Plants; Designation of Critical habitat for the Monterey Spineflower (*Chorizanthe pungens* var. *pungens*). Federal Register Vol. 73, No. 6. 1525. January 9 (73 FR 1525).

———. 2008b. Sand (Monterey) gilia (*Gilia tenuiflora* subsp. *arenaria*) 5-Year Review: Summary and Evaluation. Ventura Fish and Wildlife Office, Ventura, California. March.

———. 2011. Biological Opinion for the Former Fort Ord Vegetation Clearance Activities and Transfer of Parcel E29b.3.1 (8-8-11-F-39). August 3. (Fort Ord Administrative Record No. BW-2579)

———. 2014. Biological Opinion, Formal Consultation for Vegetative Clearance Activities on 309 Acres in Burn Units 1, 2, and 3, on Former Fort Ord, Monterey County, California (8-8-14-F-28). April 28. (Fort Ord Administrative Record No. BW-2713)

———. 2015. Programmatic Biological Opinion for Cleanup and Property Transfer Actions Conducted at the Former Fort Ord, Monterey County, California (8-8-09-F-74). May 28. (Fort Ord Administrative Record No. BW-2747)

Zander Associates (Zander). 2002. Assessment East Garrison – Parker Flats Land Use Modifications, Fort Ord, California. May 1. (Fort Ord Administrative Record No. BW-2180).

Table 1-1
Vegetation Monitoring Activities in Habitat Parcels of MRAs
2008 - 2016

ESCA RP 2016 Annual Natural Resources Report

Munitions Response Area	Monitoring Activity	Number of Monitoring Events per Year														Total Baseline Transects and HMP Annuals Plots	Post-activity Transects, HMP Annuals Plots and Surveys	Total Transects, HMP Annuals Plots, and Surveys
		2008		2009		2010		2011		2012		2013[1]	2014[1]	2015[1]	2016[1]			
		Baseline	Post-activity	Baseline	Post-activity	Baseline	Post-activity	Baseline	Post-activity	Baseline	Post-activity	Post-activity	Post-activity	Post-activity	Post-activity			
Future East Garrison	Vegetation transects	-	-	-	-	-	-	39	-	2	-	6	17	32	23	**41**	**78**	**119**
	Herbaceous quadrats	-	-	-	-	-	-	-	-	-	-	-	18	18	6	**0**	**42**	**42**
	HMP herbaceous species plots	-	-	-	-	5	-	-	-	-	5	6	15	14	21	**5**	**61**	**66**
	HMP annual surveys (acres)*	-	-	-	-	-	-	-	-	-	-	64.7	71.6	138.2	227.1	**0**	**502**	**501.6**
	Toro manzanita surveys (acres)*	-	-	-	-	-	-	-	-	-	29	26.4	26.4	0	0	**0**	**82**	**81.8**
Interim Action Ranges-Army Remediation Areas	Vegetation transects	-	30	-	-	-	20	-	-	-	-	-	-	0	0	**0**	**50**	**50**
	Herbaceous quadrats	-	12	-	-	-	-	-	-	-	-	-	-	0	0	**0**	**12**	**12**
	HMP herbaceous species plots	-	63	-	-	-	63	-	-	-	-	-	-	0	0	**0**	**126**	**126**
Interim Action Ranges-ESCA Remediation Areas (SCAs/NCAs)	Vegetation transects	-	-	-	-	17	-	2	-	-	16	28	28	38	20	**19**	**130**	**149**
	Herbaceous quadrats	-	-	-	-	-	-	-	6	-	53	96	96	6	6	**0**	**263**	**263**
	HMP herbaceous species plots	-	-	-	-	187	-	-	-	-	44	173	161	263	0	**187**	**641**	**828**
	HMP annual surveys (acres)*	-	-	-	-	-	-	-	-	-	-	27.5	30.8	57.6	0	**0**	**116**	**115.9**

Table 1-1
Vegetation Monitoring Activities in Habitat Parcels of MRAs
2008 - 2016

ESCA RP 2016 Annual Natural Resources Report

Munitions Response Area	Monitoring Activity	Number of Monitoring Events per Year														Total Baseline Transects and HMP Annuals Plots	Post-activity Transects, HMP Annuals Plots and Surveys	Total Transects, HMP Annuals Plots, and Surveys
		2008		2009		2010		2011		2012		2013[1]	2014[1]	2015[1]	2016[1]			
		Baseline	Post-activity	Baseline	Post-activity	Baseline	Post-activity	Baseline	Post-activity	Baseline	Post-activity	Post-activity	Post-activity	Post-activity	Post-activity			
Parker Flats Phase II	Vegetation transects	11	-	-	-	-	-	-	-	-	11	-	11	0	0	**11**	**22**	**33**
	Herbaceous quadrats	-	-	-	-	-	-	-	-	-	6	-	6	0	0	**0**	**12**	**12**
	HMP herbaceous species plots	10	-	-	-	-	-	-	10	-	10	6	5	0	0	**10**	**31**	**41**
	HMP annual surveys (acres)*	-	-	-	-	-	-	-	-	-	-	16.8	87.5	0	0	**0**	**104**	**104.3**
Parker Flats Phase I	Vegetation transects	-	-	-	-	-	-	-	-	-	-	-	-	0	0	**0**	**0**	**0**
	Herbaceous quadrats	-	-	-	-	-	-	-	-	-	-	-	-	0	0	**0**	**0**	**0**
	HMP annual plots	-	-	-	-	-	-	-	-	-	-	-	32	0	0	**0**	**32**	**32**
	HMP annual surveys (acres)*	-	-	-	-	-	-	-	-	-	-	-	93.2	0	0	**0**	**93**	**93.2**
County North	HMP herbaceous species plots	-	-	15	-	-	-	-	-	-	-	-	-	0	0	**15**	**0**	**15**
Total Vegetation Transects		**11**	**30**	**0**	**0**	**17**	**20**	**41**	**0**	**2**	**27**	**34**	**56**	**70**	**43**	**71**	**280**	**351**
Total Herbaceous Quadrats		**0**	**12**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**59**	**96**	**120**	**24**	**12**	**0**	**329**	**329**
Total HMP Herbaceous Species Plots		**10**	**63**	**15**	**0**	**192**	**63**	**0**	**10**	**0**	**59**	**185**	**181**	**277**	**21**	**217**	**859**	**1076**
Total Acres for HMP Herbaceous Species Surveys*		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**109**	**283**	**196**	**227**	**-**	**815**	**815**
Total Acres for Toro Manzanita Surveys*		-	-	-	-	-	-	-	-	**-**	**29**	**26**	**26**	**0**	**0**	-	**82**	**82**

*Survey acreages are approximate, based on number of grid cells surveyed

[1] no baseline surveys conducted during this reporting period

HMP = Habitat Monitoring Plan; SCA = Special Case Area; NCA = Non-completed Area

Table 2-1
HMP Species Occurrence within MRA Habitat Parcels of Munition Response Areas

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	Current Regulatory Status	Habitat	Recorded as Present or Habitat Present in MRAs[1]	Observed by ESCA RP
Animals					
Amphibians					
Ambystoma californiense	California tiger salamander	Federally Endangered/ California Threatened	Open woodlands and grasslands, ponds and vernal pools from Sonoma to Santa Barbara Counties, inland to portions of the Sierra Nevada.	CN, FEG, IAR, LS	2010-2011 FEG
Rana draytonii	California red-legged frog	Federally Threatened/California Species of Concern	Coldwater ponds or river pools with emergent and submergent vegetation, often with riparian vegetation at margins from Humboldt to San Diego Counties and in portions of the Sierra Nevada.	CN, IAR, LS	None
Birds					
Charadrius nivosus nivosus	western snowy plover	Federally Threatened/California Species of Concern	Flat sandy beach above the high tide level from Washington to Baja California.	None	None
Invertebrates					
Euphilotes enoptes smithi	Smith's blue butterfly	Federally Endangered	Coastal sand dunes and ravines associated with coast and seacliff buckwheat in Monterey, Santa Cruz, and San Mateo Counties.	None	None
Linderiella occidentalis	California linderiella	Not listed	Vernal pools and ponds from Lake to Riverside Counties and in the Great Central Valley.	CN, IAR, LS	2010 FEG

Table 2-1
HMP Species Occurrence within MRA Habitat Parcels of Munition Response Areas

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	Current Regulatory Status	Habitat	Recorded as Present or Habitat Present in MRAs[1]	Observed by ESCA RP
Mammals					
Sorex ornatus salarius	Monterey ornate shrew	California Species of Concern	Riparian, woodland, and upland communities where there is thick duff or downed logs. Endemic to Monterey region.	CN, CSUMB, FEG, IAR, MOUT, PF	None
Reptiles					
Anniella pulchra nigra	California black legless lizard	California Species of Concern	Various coastal plant communities where loose sandy soil and abundant invertebrate populations are available. Presently found in Monterey County and possibly extirpated from Santa Cruz and San Luis Obispo Counties	CN, CSUMB, DRO/M, IAR, PF, SEA	2009-2010 PF, 2012 IAR
Plants					
Annuals					
Chorizanthe pungens var. *pungens*	Monterey spineflower	Federally Threatened/CNPS 1B.2	Sandy soils in coastal strand, coastal scrub, maritime chaparral, and disturbed sites in grassland, below 450 meters elevation. Endemic to Monterey and Santa Cruz Counties.	CN, CSUMB, DRO/M, FEG, IAR, MOUT, PF, SEA	2009 CN, 2010-2016 FEG, 2008-2016 IAR, 2008-2015 PF, 2012-2016 SEA
Chorizanthe robusta var. *robusta*	robust spineflower	Federally Endangered/CNPS 1B.1	Coastal strand, coastal scrub areas below 300 meters elevation from Marin to Monterey Counties.	None	None
Cordylanthus rigidus ssp. *littoralis*	seaside bird's beak	California Endangered/CNPS 1B.1	Coastal dunes, coastal scrub, and maritime chaparral, below 425 meters; root parasite, dependent on nearby host plant. Endemic to Monterey and Santa Barbara Counties.	DRO/M, FEG, IAR, PF, SEA	2013-2015 FEG, 2008-2015 IAR

Table 2-1
HMP Species Occurrence within MRA Habitat Parcels of Munition Response Areas

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	Current Regulatory Status	Habitat	Recorded as Present or Habitat Present in MRAs[1]	Observed by ESCA RP
Annuals					
Gilia tenuiflora subsp. *arenaria*	Monterey (sand) gilia	Federally Endangered/ California Threatened/CNPS 1B.2	Open sandy soils in coastal dunes and maritime chaparral. Endemic to Monterey and Santa Cruz Counties.	CN, FEG, IAR, MOUT, PF, SEA	2008-2016 IAR, 2010-2016 FEG, 2010 SEA
Herbaceous Perennials					
Erysimum ammophilum	coast wallflower	CNPS 1B.2	Coastal dunes below 60 meters in San Mateo, Santa Cruz, Monterey, Santa Barbara, and San Diego Counties and on Santa Rosa Island.	IAR, SEA	2013-2015 IAR, 2013-2014 SEA
Piperia yadoni	Yadon's piperia	Federally Endangered/CNPS 1B.1	Sandy soil or sandstone coastal shrubland, Monterey pine forest and maritime chaparral below 510 meters. Restricted to Monterey region.	None	None
Shrubs					
Arctostaphylos hookeri subsp. *hookeri*	Hooker's manzanita	CNPS 1B.2	Sandy soils, sandy shales, sandstone outcrops, chaparral, below 536 meters elevation. Endemic to Monterey and Santa Cruz Counties.	FEG, IAR, LS, MOUT, PF	2012-2016 FEG, 2012, 2014, 2016 PF
Arctostaphylos montereyensis	Toro manzanita	CNPS 1B.2	Chaparral in sandy soils below 730 meters elevation, especially on Aromas formation sandstone. Endemic to Monterey County.	FEG, IAR, LS, MOUT, PF, SEA	2010-2016 FEG, 2008-2014 PF
Arctostaphylos pumila	sandmat manzanita	CNPS 1B.2	Sandy soils, hills, chaparral, woodland, coniferous forest below 205 meters elevation. Endemic to Monterey County.	CN, DRO/M, FEG, IAR, LS, PF, SEA	2008-2016 IAR, 2008-2014 SEA

Table 2-1
HMP Species Occurrence within MRA Habitat Parcels of Munition Response Areas

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	Current Regulatory Status	Habitat	Recorded as Present or Habitat Present in MRAs[1]	Observed by ESCA RP
Shrubs					
Ceanothus rigidus	Monterey ceanothus	CNPS 4.2	Sandy hills, flats, chaparral, close-coned-pine forest below 550 meters elevation. Restricted to Monterey County; historic collections in Santa Cruz County.	DRO/M, FEG, IAR, LS, MOUT, PF, SEA	2010-2016 FEG, 2008-2016 IAR, 2013-2014 PF
Ericameria fasciculata	Eastwood's ericameria	CNPS 1B.1	Sandy soils, chaparral, closed-cone pine forest, northern coastal scrub, elevation 29-275 meters. Endemic to Monterey County.	DRO/M, FEG, IAR, MOUT, PF, SEA	2010-2016 FEG, 2008-2016 IAR

1 Occurrence records from 1992 Fort Ord Baseline Flora and Fauna

CNPS = California Native Plant Society

MRA Abbreviations (* habitat parcel present)

CN = County North*
CSUMB = California State University Monterey Bay
DRO/M = Del Rey Oaks/ Monterey*
FEG = Future East Garrison*
IAR = Interim Action Ranges*
LS = Laguna Seca Parking
MOUT = Military Operations Urban Training Site
PF = Parker Flats*
SEA = Seaside

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Trees										
Acacia baileyana	Cootamundra wattle, Bailey's acacia						x			
Acacia melanoxylon	blackwood acacia			lim			x		x	
Arbutus menziesii	**Pacific madrone**					**x**	**x**	**x**		
Eucalyptus camaldulensis	red river gum			lim			x			
Hesperocyparis macrocarpa	**Monterey cypress**		**1B.2**			**x**	**x**	**x**	**x**	
Juniperus sp.	Juniper						**x**			
Myoporum laetum	myoporum			mod			x		x	
Pinus radiata	**Monterey pine**		**1B.1**			**x**	**x**	**x**	**x**	**x**
Populus trichocarpa	**black cottonwood**					**x**	**x**			
Quercus agrifolia	**coast live oak**				**x**	**x**	**x**	**x**	**x**	**x**
Quercus wislizenii **var. *wislizenii***	**interior live oak**						**x**			
Salix lasiolepis	**arroyo willow**				**x**	**x**	**x**	**x**	**x**	
Shrubs and Subshrubs										
Acmispon glaber	**deerweed**				**x**	**x**	**x**	**x**	**x**	**x**
Adenostoma fasciculatum	**chamise**				**x**	**x**	**x**	**x**	**x**	**x**
Arctostaphylos crustacea **subsp. *crustacea***	**brittleleaf manzanita**						**x**	**x**		
Arctostaphylos hookeri	**Hooker's manzanita**	**HMP**	**1B.2**				**x**	**x**		**x**
Arctostaphylos montereyensis	**Toro manzanita**	**HMP**	**1B.2**				**x**	**x**		**x**
Arctostaphylos pajaroensis	**Pajaro manzanita**						**x**			
Arctostaphylos pumila	**sandmat manzanita**	**HMP**	**1B.2**		**x**	**x**		**x**	**x**	**x**
Arctostaphylos tomentosa **subsp. *tomentosa***	**shaggy-barked manzanita**				**x**	**x**		**x**	**x**	**x**
Artemisia californica	**California sagebrush**				**x**	**x**	**x**	**x**	**x**	**x**
Baccharis pilularis **subsp. *consanguinea***	**coyote bush, coyote brush**				**x**	**x**	**x**	**x**	**x**	**x**
Baccharis pilularis **subsp. *pilularis***	**coyote brush**					**x**				
Ceanothus dentatus	**dwarf ceanothus**				**x**	**x**	**x**	**x**	**x**	**x**
Ceanothus incanus	**coast whitethorn**						**x**			
Ceanothus rigidus	**Monterey ceanothus**	**HMP**	**4.2**		**x**	**x**	**x**	**x**	**x**	**x**
Ceanothus thyrsiflorus	**blue blossom**						**x**	**x**		
Cistus incanus	hairy rock-rose						x	x		x
Cistus salvifolius	rock-rose								x	
Crocanthemum scoparium	**rush-rose**				**x**	**x**	**x**	**x**	**x**	**x**

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Shrubs and Subshrubs										
Ericameria ericoides	**dune-heather, mock-heather**				x	x	x	x	x	x
Ericameria fasciculata	**Eastwood's ericameria, Eastwood's goldenbush**	**HMP**	**1B.1**		x	x	x	x	x	x
Eriodictyon californicum	**California yerba santa**							x		
Eriogonum fasciculatum* var. *foliolosum	**California buckwheat**							x		
Eriophyllum confertiflorum	**golden yarrow**				x	x	x	x	x	x
Frangula californica* subsp. *californica	**California coffeeberry**				x	x	x	x	x	x
Frangula californica* subsp. *tomentella	**California coffeeberry**				x	x	x	x	x	x
Garrya elliptica	**coast silk-tassel**				x	x	x	x	x	
Genista monspessulana	French broom			high			x	x	x	
Heteromeles arbutifolia	**toyon**				x	x	x	x	x	x
Lepechinia calycina	**pitcher sage**				x	x	x	x		
Lupinus arboreus	**coastal bush lupine**				x	x	x	x	x	x
Lupinus chamissonis	**silver bush lupine**				x	x	x	x	x	x
Mimulus aurantiacus	**bush monkeyflower**				x	x	x	x	x	x
Pyracantha sp.	firethorn			lim				x		
Ribes malvaceum	**chaparral currant**				x	x	x	x	x	x
Ribes speciosum	**fuchsia-flowered gooseberry**				x	x	x	x	x	x
Rosa californica	**California wild rose**						x			
Rosa gymnocarpa* var. *gymnocarpa	**dwarf wood rose**						x			
Rubus ursinus	**California blackberry**						x	x	x	
Salvia mellifera	**black sage**				x	x	x	x	x	x
Solanum umbelliferum	**blue witch nightshade**				x	x		x	x	
Symphoricarpos mollis	**creeping snowberry**				x	x	x	x	x	
Toxicodendron diversilobum	**poison-oak**				x	x	x	x	x	x
Vaccinium ovatum	**California huckleberry, evergreen huckleberry**						x			
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Acaena pinnatifida* var. *californica	**biddy biddy**							x		
Achillea millefolium	**common yarrow**				x	x	x	x	x	x
Acmispon americanus* var. *americanus	**Spanish lotus**							x		
Acmispon heermannii var. orbicularis	**wooly lotus**				x	x	x	x	x	
Acmispon strigosus	**Bishop's lotus**				x	x	x	x	x	
Agoseris apargioides	**seaside dandelion**						x	x		

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Agrostis exarata* var. *pacifica	**spike bentgrass**						**x**	**x**		
Agoseris grandiflora* var. *leptophylla	**giant mountain dandelion**						**x**			
Agrostis pallens	**thin grass**						**x**	**x**	**x**	
Aira caryophyllea	common silver-hair grass				x	x	x	x	x	
***Allium* sp.**	**onion**						x			
Alopecurus saccatus	Pacific foxtail						**x**			
Amblyopappus pusillus	**amblyopappus**				**x**	**x**				
Amsinckia intermedia	**common fiddleneck**				**x**	**x**				
Amsinckia spectabilis* var. *microcarpa	**small fruited seaside fiddleneck**						**x**			
Anagallis arvensis	scarlet pimpernel				x	x	x	x	x	x
Antirrhinum kelloggii	**Kellogg's snapdragon**						**x**			
Antirrhinum majus	snapdragon					x				
Apiastrum angustifolium	**wild celery**				**x**	**x**	**x**	**x**		**x**
Armeria maritima* subsp. *californica	**California sea pink, sea thrift**				**x**					
Artemisia douglasiana	**mugwort**					**x**	**x**			
Artemisia dracunculus	**tarragon**								**x**	
Artemisia pycnocephala	**sandhill sagebrush, beach sagewort**								**x**	
Avena barbata	slender wild oat			mod	x	x	x	x	x	x
Avena fatua	wild oat			mod			x	x		
Briza maxima	rattlensnake grass			lim		x	x	x	x	x
Briza minor	little rattlesnake grass						x	x		
Brodiaea terrestris* subsp. *terrestris	**dwarf brodiaea**						**x**			
Bromus carinatus	**California brome**						**x**	**x**	**x**	
Bromus diandrus	ripgut brome			mod	x	x	x	x	x	x
Bromus hordeaceus	soft chess			lim	x	x	x	x	x	x
Bromus madritensis subsp. *rubens*	red brome			high	x	x	x	x	x	x
Calandrinia ciliata	**red maids**				**x**	**x**	**x**	**x**	**x**	
Callitriche	**water starwort**						**x**			
Calochortus albus* var. *albus	**fairy lanterns, globe lily**				**x**	**x**	**x**	**x**	**x**	
Calyptridium monandrum	**pussy paws**				**x**	**x**				
Calystegia subacaulis	**hill morning -glory**				**x**		**x**	**x**		
Camissonia contorta	**contorted suncups**				**x**	**x**	**x**	**x**	**x**	

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Camissonia strigulosa	**strigose suncups**				**x**		**x**			
Camissoniopsis cheiranthifolia **subsp. *cheiranthifolia***	**beach evening- primrose**					**x**				
Camissoniopsis micrantha	**small suncups**				**x**	**x**	**x**	**x**	**x**	
Cardionema ramosissimum	**sand mat**				**x**	**x**	**x**	**x**	**x**	
Carduus pycnocephalus	Italian thistle			mod					x	
Carex brevicaulis	**short-stemmed sedge**						**x**			
Carex globosa	**round-fruited sedge**				**x**	**x**	**x**	**x**	**x**	
Carex subbracteata	**small bract sedge**						x			
Carpobrotus edulis	hottentot fig/ice plant			high	x	x	x	x	x	x
Castilleja affinis **subsp. *affinis***	**coast Indian paint-brush**							**x**		
Castilleja exserta **subsp. *latifolia***	**wideleaf purple owl's clover**				**x**	**x**			**x**	
Castilleja foliolosa	**wooly paintbrush**								**x**	
Caulanthus lasiophyllus	**California mustard**				**x**	**x**				
Centaurea melitensis	tocalote			mod	x	x	x	x	x	x
Cerastium glomeratum	mouse-eared chickweed						x	x		
Chenopodium californicum	**California goosefoot**					**x**	**x**	**x**	**x**	
Chlorogalum pomeridianum **var. *divaricatum***	**soap plant/amole**						**x**	**x**		
Chorizanthe diffusa	**diffuse chorizanthe**				**x**	**x**	**x**	**x**	**x**	
Chorizanthe douglasii	**Douglas' spineflower**						**x**			
Chorizanthe c.f. minutiflora	**small-flowered spineflower**							**x**		
Chorizanthe pungens **var. *pungens***	**Monterey spine-flower**	**HMP**	**1B.1**		**x**	**x**	**x**	**x**	**x**	
Cicendia quadrangularis	**Oregon timwort**						**x**			
Cirsium brevifolium	**clustered thistle, Indian thistle**						**x**			
Cirsium occidentale **var. *occidentale***	**cobweb thistle**				**x**	**x**	**x**		**?**	
Cirsium occidentale **var. *venustum***	**Venus thistle**								**x**	
Cirsium vulgare	bull thistle			mod		x	x		x	
Clarkia lewisii	**Lewis' clarkia**		**4.3**					**x**		
Clarkia amoenea	**farewell-to-spring**					**x**				
Clarkia purpurea	**wine cup clarkia**							**x**		
Claytonia perfoliata	**miner's lettuce**				**x**	**x**				
Clinopodium douglasii	**yerba buena**						**x**	**x**		
Collinsia heterophylla	**Chinese houses**					**x**				

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Conium maculatum	poison-hemlock			mod			x			x
Cordylanthus rigidus* subsp. *littoralis	**seaside bird's-beak**	**HMP**	**1B.1**		**x**	**x**	**x**		**x**	
Corethrogyne filaginifolia	**California aster**				**x**	**x**	**x**	**x**	**x**	**x**
Cortaderia jubata	pampas grass, jubata grass			high	x	x	x	x	x	x
Cotula coronopifolia	brass buttons			lim			x			
Crassula aquatica	**water pygmyweed**						**x**			
Crassula connata	**pygmy weed**				**x**	**x**	**x**	**x**	**x**	
Croton californicus	**California croton**				**x**	**x**	**x**	**x**	**x**	**x**
Cryptantha clevelandii* var. *florosa	**coastal cryptantha**				**x**	**x**	**x**		**x**	
Cryptantha micromeres	**small-flowered cryptantha**				**x**	**x**	**x**			
Cryptantha microstachys	**Tejon cryptantha**					**x**				
Danthonia californica	**California oat grass**						**x**			
Cyperus eragrostis	**tall flatsedge**						**x**			
Danthonia californica	**California oat grass**						**x**	**x**		
Daucus pusillus	**rattlesnake weed**				**x**	**x**	**x**			
Deinandra [Hemizonia] corymbosa subsp. corymbosa	**tarplant**						**x**			
Deinandra increscens* subsp. *increscens	**coast tarplant**				**x**	**x**	**x**	**x**	**x**	**x**
Delphinium parryi* subsp. *maritimum	**seaside larkspur**							**x**		
Deschampsia danthonioides	**annual hairgrass**						**x**		**x**	
Dichelostemma capitatum	**blue dicks, wild hyacinth**				**x**	**x**	**x**	**x**		
Distichlis spicata	**saltgrass**						**x**			
Dodecatheon clevelandii* var. *sanctarum	**padre's shooting stars**						**x**			
Drymocallis glandulosa* var. *glandulosa	**sticky cinquefoil**				**x**	**x**	**x**	**x**	**x**	
Dudleya lanceolata	**lance-leaved live-forever**						**x**	**x**	**x**	
Eleocharis acicularis var. acicularis	**slender spikerush**						**x**			
Eleocharis macrostachya	**common spikerush**						**x**	**x**		
Elymus glaucus	**western ryegrass**				**x**	**x**	**x**	**x**	**x**	**x**
Elymus triticoides	**alkali rye**							**x**		
Epilobium brachycarpus	**tall annual willowherb**					**x**			**x**	
Epilobium canum	**California-fuchsia**					**x**	**x**			
Epilobium ciliatum* var. *ciliatum	**northern willowherb**					**x**				
Eriastrum virgatum	**wand woollystar**		**4.3**		**x**	**x**	**x**			

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Erigeron canadensis	**horseweed**				**x**	**x**	**x**	**x**	**x**	**x**
Erigeron foliosus **var. *foliosus***	**leafy daisy**				**x**					
Erigeron sumatrensis	tropical horseweed					x				
Eriogonum latifolium	**coast buckwheat**							**x**		
Eriogonum nudum **var. *auriculatum***	**nude buckwheat**						**x**			
Erodium botrys	long-beaked filaree				x	x	x	x	x	x
Erodium cicutarium	red-stemmed filaree			lim	x	x		x		
Eryngium armatum	**coyote thistle**						**x**			
Erysimum ammophilum	**coast wallflower**	**HMP**	**1B.2**		**x**				**x**	
Eschscholzia californica	**California poppy**				**x**	**x**	**x**	**x**	**x**	
Euphorbia peplus	petty spurge					x				
Euthamia occidentalis	**western goldenrod**						**x**	**x**		
Festuca bromoides	brome fescue						x			
Festuca microstachya	**small fescue**				**x**	**x**				
Festuca myuros	rattail fescue			mod	x	x	x	x	x	
Festuca octoflora	**six-weeks fescue**				**x**	**x**	**x**	**x**	**x**	
Festuca perennis	Italian rye grass			mod			x			
Fritillaria affinis	**checker lily, Mission bells**				**x**		**x**		**x**	
Galium aparine	**bedstraw**							**x**		
Galium californicum **subsp. *californicum***	**California bedstraw**				**x**	**x**	**x**	**x**	**x**	
Galium porrigens **var. *porrigens***	**climbing bedstraw**				**x**	**x**	**x**	**x**	**x**	**x**
Gamochaeta ustulata	**purple cudweed**				**x**	**x**	**x**	**x**		
Gastridium phleoides	nit grass						x			
Geranium dissectum	cut-leaved geranium			lim			x			
Gilia achilleafolia var. *achilleafolia*	California gilia						x			
Gilia capitata **subsp. *abrotanifolia***	**ball gilia**					**x**	**x**			
Gilia capitata **subsp. *capitata***	**ball gilia**					**x**				
Gilia tenuiflora **subsp. *arenaria***	**sand [Monterey] gilia**	**HMP**	**1B.2**		**x**	**x**	**x**		**x**	
Gilia tricolor	**bird's eyes gilia**					**x**				
Helminthotheca echioides	bristly ox-tongue			lim		x				
Heliotropium curassivicum	**wild heliotrope**							**x**	**x**	
Herniaria hirsuta subsp. *cinerea*	hairy rupturewort					x		x		

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Hesperevax acaulis var. ambusticola	**fire evax, stemless dwarf cudweed**							**x**		
Heterotheca grandifolia	**telegraph weed**				**x**	**x**	**x**	**x**	**x**	**x**
Holcus lanatus	velvet grass			mod				x		
Hordeum brachyantherum* subsp. *brachyantherum	**meadow barley**					**x**				
Hordeum marinum subsp. *gussoneanum*	Mediterranean barley			mod			x			
Hordeum murinum	foxtail barley			mod						
Horkelia californica* var. *frondosa	**Californica horkelia**					**x**				
Horkelia cuneata* var. *cuneata	**coast horkelia, wedge-leaved horkelia**				**x**	**x**	**x**	**x**	**x**	**x**
Hypochaeris glabra	smooth cat's ears			lim	x	x	x	x		
Hypochaeris radicata	cat's ears			mod	x	x	x			
Juncus bufonius* var. *occidentalis	**toad rush**						**x**			
Juncus capitatus	**leafy-bract dwarf rush**						**x**			
Juncus effusus* var. *pacificus	**bog rush**					**x**				
Juncus mexicanus	**Mexican rush**						**x**	**x**		
Juncus occidentalis	**western rush**						**x**			
Juncus patens	**common rush**							**x**		
Juncus phaeocephalus* var. *phaeocephalus	**brown-headed rush**						**x**	**x**		
Koeleria macrantha	**June grass**				**x**		**x**	**x**	**x**	
Lagurus ovatus	hare's tail grass						x	x		
Lasthenia glaberrima	**smooth goldfields**						**x**			
Lasthenia gracilis	**slender goldfields**						**x**			
Lathyrus vestitus* var. *vestitus	**wild sweet pea, Pacific pea**							**x**		**x**
Layia hieracioides	**tall layia**						**x**			
Layia platyglossa	**tidy tips**				**x**	**x**				
Lamarckia aurea	goldentop grass						x			
Lastarriaea coriacea	**leather spineflower**							**x**		
Lemna minor	**least duckweed**						**x**			
Leontodon saxatilis	hawkbit								x	
Lepidium nitidum	**common peppergrass**					**x**				
Leptochloa fusca* subsp. *fascicularis	**bearded sprangletop**					**x**				
Leptosiphon parviflorus	**common linanthus**					**x**				
Leptosiphon pygmaeus* subsp. *continentalis	**pygmy linanthus**						**x**			

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Lessingia pectinata* var. *pectinata	**common lessingia**				**x**	**x**	**x**	**x**		
Limonium sinuatum	wavyleaf sea-lavender, statice						x			
Lithophragma species	**woodland star**						**x**			
Logfia gallica	narrow-leaved filago				x	x	x	x	x	x
Logfia filaginoides	**California filago**				**x**	**x**	**x**	**x**	**x**	
Lomatium parvifolium	**coastal biscuitroot**		**4.2**		**x**		**x**		**x**	
Lupinus bicolor	**miniature lupine**				**x**		**x**			
Lupinus concinnus	**elegant lupine**					**x**	**x**			
Lupinus nanus	**sky lupine**				**x**	**x**	**x**	**x**		
Lupinus truncatus	**blunt-leaved lupine**					**x**	**x**		**x**	
Luzula comosa	**Pacific wood rush**						**x**	**x**		
Lysimachia (Centunculus) minima	**chaff weed**						**x**			
Lythrum hyssopifolium	hyssop-leaved loosestrife			lim			x			
Madia exigua	**small tarplant**				**x**	**x**	**x**			
Madia gracilis	**grassy tarweed**							**x**		
Madia sativa	**coast tarplant**							**x**		
Malva pseudolavatera	Cretan mallow						**x**			
Malvella leprosa	**alkali mallow**						**x**			
Marah fabaceus	**wild cucumber**				**x**	**x**	**x**			
Medicago polymorpha	bur-clover			lim			x			
Melica imperfecta	**Coast Range melic**				**x**	**x**	**x**			
Melilotus indicus	yellow sweet-clover					x	x		x	
Micropus californicus* var. *californicus	**cottontop**				**x**					
Mimulus cardinalis	**scarlet monkeyflower**					**x**				
Monardella sinuata* subsp. *nigrescens	**northern curly-leaved monardella**		**4.2**		**x**	**x**				
Monardella villosa* subsp. *obispoensis	**San Luis Obispo coyote mint**						**x**	**x**		
Muilla maritima	**sea muilla**							**x**		
Navarretia hamata subsp. parviloba	**hooked navarretia**				**x**	**x**	**x**		**x**	
Navarretia intertexta	**needle-leaved navarretia**				**x**		**x**			
Navarretia squarrosa	**skunkweed**				**x**		**x**	**x**		
Nemophila menziesii	**baby blue-eyes**					**x**				
Nuttallanthus texanus	**toad-flax**				**x**	**x**	**x**	**x**	**x**	

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Orobanche bulbosa	**chaparral broomrape**				**x**					
Orobanche californica* var. *grandis	**California broomrape**				**x**					
Orobanche fasciculata	**clustered broomrape**						**x**			
Oxalis micrantha	dwarf woodsorrel							x		
Oxalis pilosa	**hairy woodsorrel**					**x**				
Papaver californicum	**fire poppy**						**x**			
Parapholis incurva	sicklegrass					x				
Pectocarya penicillata	**winged combseed**				**x**	**x**	**x**	**x**	**x**	
Pedicularis densiflora	**Indian warrior**						**x**		**x**	
Petrorhagia dubia	hairypink				x	x	x	x		
Phacelia campanularia	**desert bluebells**					**x**				
Phacelia distans	**wild heliotrope**				**x**					
Phacelia douglasii	**Douglas' phacelia**				**x**	**x**				
Phacelia malvifolia	**stinging phacelia**							**x**		
Phacelia ramosissima	**branching phacelia**								**x**	
Piperia michaelii	**Michael's rein-orchid**		**4.2**		**x**		**x**		**x**	
Plagiobothrys canescens	**valley popcorn flower**							**x**		
Plagiobothrys collinus* var. *fulvescens	**rusty-haired popcorn flower**				**x**	**x**				
Plantago coronopus	cut-leaved plantain				x		x	x	x	
Plantago erecta	**California plantain**				**x**	**x**	**x**	**x**	**x**	
Plantago lanceolata	English plantain			lim			x			
Poa annua	annual bluegrass					x				
Poa howellii	**Howell's bluegrass**						**x**			
Poa secunda	**one-sided bluegrass, pine bluegrass**				**x**			**x**		**x**
Pogogyne serpylloides	**thymeleaf mesamint**						**x**	**x**		
Polycarpon depressum	**California polycarp**						**x**			
Polygala californica	**California milkwort**						**x**			
Polypogon interruptus	ditch beard grass					x				
Polypogon monspeliensis	rabbitsfoot grass			lim		x	x			
Polypogon viridis	water beard grass					x				
Pseudognaphalium beneolens	**fragrant everlasting**				**x**	**x**	**x**			
Pseudognaphalium californicum	**California everlasting**				**x**	**x**	**x**		**x**	

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Pseudognaphalium canescens	**white everlasting**							**x**	**x**	
Pseudognaphalium ramosissimum	**pink everlasting**				**x**	**x**	**x**	**x**	**x**	**x**
Pseudognaphalium stramineum	**cottonbatting plant**				**x**	**x**	**x**			
Psilocarphus tenellus	**slender woolly marbles**					**x**	**x**	**x**	**x**	
Pterostegia drymarioides	**fairy mist**				**x**	**x**	**x**	**x**	**x**	
Ranunculus californicus	**California buttercup**							**x**		
Rumex acetosella	sheep sorrel			mod	x	x	x	x	x	x
Rumex crispus	curly dock			lim			**x**			
Rumex salicifolius* subsp. *salicifolius	**willow dock**						**x**	**x**		
Sagina apetela	**sticky pearlwort**					**x**				
Sanicula crassicaulis	**Pacific sanicle**						**x**			
Sanicula laciniata	**coast sanicle**						**x**			
Schismus arabicus	Mediterranean grass			lim			x			
Scutellaria tuberosa	**scull cap**						**x**	**x**		
Senecio c.f. aphanactis	**chaparral ragwort**		**2B.2**		**x**					
Senecio glomeratus	cut-leaved fireweed			mod		x	x	x	x	x
Senecio vulgaris	common ragwort					x	x			
Sidalcea malviflora* subsp. *malviflora	**checkerbloom**							**x**		
Silene gallica	windmill pink				x	x	x			
Silybum marianum	milk thistle			lim					x	
Sisymbrium orientale	Indian hedgemustard					x				
Sisyrinchium bellum	**blue-eyed grass**					**x**	**x**			
***Solanum americanum* (herbaceous)**	**American nightshade**					**x**				
Solidago californica	**California goldenrod**							**x**		
Soliva sessilis	South American soliva						x			
Sonchus asper subsp. asper	prickly sow-thistle				x	x	x	x	x	
Sonchus oleraceus	common sow-thistle				x	x	x	x	x	x
Spiranthes romanzoffiana	**hooded ladies tresses**						**x**			
Spergula arvensis	corn spurrey					x		x	x	
Spergularia rubra	red sand-spurrey					x	x			
Stachys bullata	**wood mint**				**x**		**x**			**x**
Stephanomeria virgata* subsp. *virgata	**tall milk aster**							**x**		

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Herbaceous species (annuals, perennial herbs, grasses, and grass-like species)										
Stipa cernua	**nodding needlegrass**				**x**			**x**		
Stipa lepida	**foothill needlegrass**						**x**	**x**		
Stipa pulchra	**purple needlegrass**				**x**	**x**	**x**	**x**		
Stylocline gnaphaliodes	**everlasting neststraw**				**x**	**x**	**x**			
Taraxia [Camissonia] ovata	**suncups**				**x**	**x**	**x**	**x**		
Thysanocarpus curvipes	**lace pod**						**x**			
Toxicoscordion fremontii	**Fremont's star lily**				**x**		**x**		**x**	
*Tribolium obliterum**	cape grass						x			
Trichostema lanceolatum	**vinegar weed**						**x**			
Trifolium angustifolium	narrow-leaved crimson clover						x	x		x
Trifolium ciliolatum	**foothill clover**				**x**					
Trifolium dubium	shamrock clover						x	x		
Trifolium gracilentum	**pinpoint clover**				**x**		**x**			
Trifolium hirtum	rose clover			mod		x	x	x	x	
Trifolium microcephalum	**hairy clover, small-headed clover**					**x**				
Trifolium wormskoldii	**tomcat clover**						**x**			
Triteleia hyacinthina	**white brodiaea**							**x**		
Triteleia ixioides **subsp. *ixioides***	**golden brodiaea, prettyface**						**x**			
Triglochin scillioides	**flowering quillwort**						**x**			
Triodanis perfoliata	**Venus' looking-glass**						**x**	**x**		
Typha domingensis	**southern cattail**						**x**			
Uropappus lindleyi	**silver puffs**				**x**	**x**	**x**			
Vicia americana **subsp. *americana***	**American vetch**						**x**			
Vicia sativa var. nigra	narrow-leaved vetch						**x**			
Viola cultivar	pansy					x				
Viola pedunculata	**Johnny jump-ups**						**x**	**x**		
Zeltnera davyi	**Davy's centaury**						**x**			

Table 3-1
Observed Plant Species in Munitions Response Areas 2008-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	HMP species	CNPS Listing status (Rare Plant Ranking)	Cal-IPC Invasiveness Status	IAR MRA Range 44	IAR MRA Range 47	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
Ferns and Fern-relatives										
Dryopteris arguta	**coastal wood fern**						**x**	**x**		
Pellea mucronata **var. *mucronata***	**bird's nest fern**						**x**			
Pentagramma triangularis **subsp. *triangularis***	**goldenback fern**						**x**	**x**		
Pteridium aquilinum **var. *pubescens***	**western bracken fern**				**x**		**x**	**x**	x	

Notes:
Native species in bold
Species and locations noted in this table are for work areas, including monitoring areas and ingress/egress routes; this is not a comprehensive list

Status Codes:

California Native Plant Society (CNPS)

Rare Plant Rank (RPR)
RPR 1B: Plants Rare, Threatened, or Endangered in California and Elsewhere

RPR 2A: Plants Presumed Extirpated in California, but More Common Elsewhere

RPR 2B: Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere

RPR 3: Plants About Which More Information is Needed - A Review List

RPR 4: Plants of Limited Distribution - A Watch List

Extensions to List Categories
0.1 - Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)

0.2 – Moderately threatened in California (20-80% occurrences threatened/moderate degree and immediacy of threat)

0.3 – Not very threatened in California (<20% of occurrences threatened/low degree and immediacy of threat or no current threats known)

California Invasive Plant Council (Cal-IPC) ratings:
• high – severe ecological impacts, high rates of dispersal and establishment.
• moderate (mod) – substantial and apparent ecological impacts , moderate to high rates of dispersal, establishment dependent upon
• limited (lim) – invasive but impacts not widespread statewide, low to moderate rates of dispersal, may be locally persistent and

Table 3-2
Observed Wildlife Species in Munitions Response Areas 2008 - 2016

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	HMP species	IAR MRA Range 44	IAR MRA Range 47	IAR MRA	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
MAMMALS									
Canis latrans	Coyote		x	x	x	x	x	x	x
Dipodomys heermanni	Heermann's kangaroo rat							x	
Lepus californicus	Black-tailed jackrabbit		x	x	x	x	x	x	x
Lynx rufus	Bobcat		x	x	x	x	x	x	x
Mus musculus	House mouse				x				
Neotoma fuscipes	Dusky-footed wood rat		x		x	x	x	x	
Odocoileus hemionus	Mule deer		x	x	x	x	x	x	x
Procyon lotor	Raccoon					x		x	
Sorex ornatus salarius	Monterey ornate shrew	x							
Spermophilus beecheyi	California ground squirrel							x	
Sylvilagus audubonii	Desert cottontail		x	x				x	
Sylvilagus bachmani	Brush rabbit							x	
Thomomys bottae	Botta's pocket gopher			x				x	
Urocyon cinereoargenteus	Gray fox					x		x	
REPTILES AND AMPHIBIANS									
Ambystoma californiense	California tiger salamander	x				x			
Aneides lugubris	Arboreal salamander				x				
Anniella pulchra nigra	California black legless lizard	x	x				x		
Bufo boreas	Western toad					x			
Crotalus oreganus oreganus	Northern Pacific rattlesnake		x	x	x	x	x		
Ensatina eschscholtzii eschscholtzii	Monterey ensatina		x		x				
Lampropeltis getulus	Common kingsnake					x			
Phrynosoma blainvillii	coast horned lizard		x	x	x	x			
Pituophis melanoleucus	Gopher snake		x	x	x	x	x		
Pseudacris regilla	Pacific treefrog					x			
Rana catesbeiana	Bullfrog					x			
Sceloporus occidentalis	Western fence lizard		x	x	x	x	x	x	x
Thamnophis sirtalis	Common garter snake					x			
Uta stansburiana	Side-blotched lizard							x	

Table 3-2
Observed Wildlife Species in Munitions Response Areas 2008 - 2016

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	HMP species	IAR MRA Range 44	IAR MRA Range 47	IAR MRA	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
BIRDS									
Accipiter cooperii	Cooper's hawk					x		x	
Amphispiza belli	Bell's sage sparrow			x				x	
Anas platyrhynchos	Mallard duck					*x*			
Aphelocoma californica	Western scrub jay		x	x	x	x	x	x	
Asio otus	Long-eared owl			x					
Baeolophus inornatus	Oak titmouse					x		x	
Buteo lineatus	Red-shouldered hawk					x			
Buteo jamaicensis	Red-tailed hawk		x	x	x	x	x	x	
Callipepla californica	California quail		x	x	x	x	x	x	
Calypte anna	Anna's hummingbird		x	x	x	x	x	x	
Carduelis psaltria	Lesser goldfinch		x	x	x	x	x		
Carpodacus mexicanus	House finch					x		x	
Carpodacus purpureus	Purple finch					x			
Cathartes aura	Turkey vulture		x	x	x	x			
Chamaea fasciata	Wrentit		x	x	x	x	x	x	
Charadrius alexandrinus nivosus	Western snowy plover	x							
Charadrius vociferus	Killdeer		x	x	x	x	x		
Circus cyaneus	Northern harrier		x	x	x				
Colaptes auratus	Northern flicker		x		x	x		x	
Corvus brachyrhynchos	American crow		x	x	x	x	x	x	x
Dendroica coronata	Yellow-rumped warbler							x	
Dendroica occidentalis	Hermit warbler							x	
Dendroica townsendi	Townsend's warbler							x	
Empidonax difficilis	Pacific-slope flycatcher					x			
Falco sparverius	American kestrel		x	x	x	x	x		
Gallinago gallinago	Common snipe					x			
Geococcyx californianus	Greater roadrunner		x	x	x				
Hirundo rustica	Barn swallow		x	x	x	x			
Junco hyemalis	Dark-eyed junco					x		x	
Lanius ludovicianus	Loggerhead shrike							x	
Meleagris gallapavo	Wild turkey					x	x		

Table 3-2
Observed Wildlife Species in Munitions Response Areas 2008 - 2016

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	HMP species	IAR MRA Range 44	IAR MRA Range 47	IAR MRA	FEG MRA	Parker Flats MRA	Seaside MRA	County North MRA
BIRDS									
Mimus polyglottos	**Northern mockingbird**							x	
Myiarchus cinerascens	**Ash-throated flycatcher**					x			
Petrochelidon pyrrhonota	**Cliff swallow**					x			
Phalacrocorax auritus	**Double-crested cormorant**								
Phalaenoptilus nuttallii	**Common poorwill**					x			
Phalaropus lobatus	**Red-necked phalarope**					x			
Picoides nuttallii	**Nuttall's woodpecker**							x	
Pipilo crissalis	**California towhee**		x	x	x	x		x	
Pipilo maculatus	**Spotted towhee**		x		x	x		x	
Poecile rufescens	**Chestnut-backed chickadee**							x	
Psaltriparus minimus	**Bushtit**					x		x	
Sayornis saya	***Say's phoebe***							x	
Sturnella neglecta	**Western meadowlark**							x	
Tachycineta bicolor	**Tree swallow**							x	
Thryomanes bewickii	**Bewick's wren**					x		x	
Toxostoma redivivum	**California thrasher**		x	x	x			x	
Vireo huttoni	**Hutton's vireo**					x		x	
Vermivora ruficapilla	**Nashville warbler**								
Zenaida macroura	**Mourning dove**		x	x	x	x	x	x	
Zonotrichia atricapilla	**Golden-crowned sparrow**							x	
INVERTEBRATES									
Linderiella occidentalis	**California linderiella**	x				x			

Table 3-3
Future East Garrison MRA Grenade Range
Observed Plant Species in or Arround Aquatic Features
2011-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	Wetland Indicator Status[1]	Aquatic Features		
			AF09-1	AF09-1B	AF09-2
Acmispon glaber	**deerweed**	**NL**	**x**	**x**	**x**
Agrostis exarata* var. *pacifica	**spike bentgrass**	**FACW**	**x**		**x**
Aira caryophyllea	common silver-hair grass	FACU			x
Alopecurus saccatus	Pacific foxtail	OBL	x		
Anagallis arvensis	scarlet pimpernel	NL	x	x	x
Arctostaphylos montereyensis	**Toro manzanita**	**NL**			**x**
Baccharis pilularis* subsp. *consanguinea	**coyote brush**	**NL**	**x**	**x**	**x**
Briza minor	little rattlesnake grass	NL			x
Bromus diandrus	ripgut brome	NL	x		
Bromus hordeaceus	soft chess	NL	x		
Bromus madritensis subsp. *rubens*	red brome	NL	x		
***Callitriche* species**	**water starwort**	**OBL**	**x**		
Carex c.f. brevicaulis	**short-stemmed sedge**	**NL**		**x**	
Cicendia quadrangularis	**Oregon timwort**	**FAC**			**x**
Crassula connata	**pygmy weed**	**FAC**		**x**	
Crassula aquatica	**water pygmyweed**	**OBL**			**x**
Deschampsia danthonioides	**annual hairgrass**	**FACW**	**x**		**x**
Eleocharis acicularis* var. *acicularis	**slender spikerush**	**OBL**	**x**	**x**	
Eleocharis bella	**beautiful spikerush**	**FACW**	**x**		**x**
Eleocharis macrostachya	**common spikerush**	**OBL**	**x**		**x**
Euthamia occidentalis	**western goldenrod**	**FACW**	**x**		
Festuca myuros	rattail fescue	NL		x	x
Festuca perenne	annual wild rye	NL			x

Table 3-3
Future East Garrison MRA Grenade Range
Observed Plant Species in or Arround Aquatic Features
2011-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	Wetland Indicator Status[1]	AF09-1	AF09-1B	AF09-2
Gamochaeta ustulata	**purple cudweed**	**NL**	**x**	**x**	**x**
Gastridium phleoides	nit grass	FACU			x
Geranium dissectum	cut-leaved geranium	NL	x		
Helianthemum scoparium	**rush-rose**	**NL**			**x**
Hypochaeris glabra	smooth cat's ear	NL	x		x
Juncus bufonius* var. *occidentalis	**toad rush**	**FACW**	**x**	**x**	**x**
Juncus occidentalis	**western rush**	**FACW**	**x**	**x**	**x**
Juncus phaeocephalus* var. *phaeocephalus	**brown-headed rush**	**FACW**	**x**	**x**	**x**
Lasthenia glaberrima	**smooth goldfields**	**OBL**			**x**
Lasthenia gracilis	**slender goldfields**	**NL**			**x**
Lemna minuta	**least duckweed**	**OBL**	**x**		**x**
Logfia [Filago] gallica	narrow-leaved filago	NL	x	x	x
Luzula comosa	**Pacific wood rush**	**FAC**			**x**
Lysimachia (Centunculus) minima	**chaff weed**	**FACW**			**x**
Lythrum hyssopifolium	hyssop-leaved loosestrife	OBL	x	x	x
Madia exigua	**small tarweed**	**NL**	**x**	**x**	**x**
Medicago polymorpha	bur-clover	NL	x		
Navarretia hamata* subsp. *parviloba	**hooked navarretia**	**NL**		**x**	
Plantago coronopus	cut-leaved plantain	FACW	x		x
Plantago erecta	**California plantain**	**NL**	**x**		**x**
Polypogon monspeliensis	rabbitsfoot grass	FACW	x	x	x
Psilocarphus brevissimus* var. *brevissimus	**woolly marbles**	**FACW**	**x**	**x**	
Psilocarphus tenellus	**slender woolly marbles**	**OBL**		**x**	**x**
Quercus agrifolia	**coast live oak**	**NL**			**x**

Table 3-3
Future East Garrison MRA Grenade Range
Observed Plant Species in or Arround Aquatic Features
2011-2016

ESCA RP 2016 Annual Natural Resources Report

Scientific Name	Common Name	Wetland Indicator Status[1]	AF09-1	AF09-1B	AF09-2
Rubus ursinus	**California blackberry**	**FACU**	**x**		
Salix lasiolepis	**arroyo willow**	**FACW**	**x**		
Soliva sessilis	South American soliva	FACU	x		
Sonchus asper subsp. *asper*	prickly sow-thistle	FACU	x		
Spiranthes romanzoffiana	**hooded ladies tresses**	**FACW**			**x**
Triglochin scillioides	**flowering quillwort**	**OBL**	**x**	**x**	
Tribolium obliterum	cape grass	NL	x	x	
Typha latifolia	**broadleaf cattail**	**OBL**			**x**

Native species in bold

1. Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2016. The National Wetland Plant List: 2016 wetland ratings. Phytoneuron 2016-30: 1-17. Published 28 April 2016. ISSN 2153 733X

Wetland indicator status -- OBL: obligate wetland species, occurs almost always in wetlands (99% of time or more); FACW: facultative wetland species, usually occurs in wetlands (66 to 99% of time); FAC: facultative species, equally likely to occur in wetlands or nonwetlands (33 to 66% of time); FACU: facultative upland species, found in wetlands 1 to 33% of the time, but usually found in upland habitats. NL: no listing.

Table 6-1
Future East Garrison MRA
Vegetation Cover in Areas Subject to Vegetation Cutting in 2011

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Baseline Data 2010 - 2011				
		Thirty-nine Transects				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Mean Relative Cover	Frequency
Tree Species						
Quercus agrifolia	coast live oak	0.7%	3.5%	0.9%	0.7%	12.8%
Total Mean Percent Native Tree Cover		***0.7%***			***0.7%***	
Shrub and Sub-shrub Species						
Acmispon glaber	deerweed	0.1%	0.4%	0.1%	0.1%	2.6%
Adenostoma fasciculatum	chamise	27.4%	22.4%	6.0%	25.0%	100%
Arctostaphylos crustacea subsp. *crustacea*	brittleleaf manzanita	45.8%	32.3%	8.7%	41.8%	89.7%
Arctostaphylos hookeri	**Hooker's manzanita**	**0.0%**	**--**	--	0.0%	**0.0%**
Arctostaphylos montereyensis	**Toro manzanita**	**14.4%**	**19.8%**	5.3%	13.1%	**64.1%**
Artemisia californica	California sagebrush	0.3%	1.4%	0.4%	0.2%	5.1%
Baccharis pilularis subsp. *consanguinea*	coyote brush	2.2%	4.1%	1.1%	2.0%	48.7%
Ceanothus dentatus	dwarf ceanothus	0.0%	0.1%	0.0%	0.0%	2.6%
Ceanothus rigidus	**Monterey ceanothus**	**1.5%**	**2.2%**	0.6%	1.4%	**48.7%**
Ceanothus thyrsiflorus	blue blossom	0.3%	1.8%	0.5%	0.3%	5.1%
Crocanthemum scoparium	rush-rose	0.0%	0.0%	0.0%	0.0%	5.1%
Ericameria ericoides	dune-heather, mock-heather	0.7%	3.9%	1.1%	0.6%	5.1%
Ericameria fasciculata	**Eastwood's ericameria**	**0.0%**	**0.2%**	0.0%	0.0%	**2.6%**
Eriophyllum confertiflorum	golden yarrow	0.0%	0.1%	0.0%	0.0%	5.1%
Frangula californica subsp. *californica*	California coffeeberry	1.3%	3.5%	0.9%	1.2%	20.5%
Garrya elliptica	coast silk tassel	1.5%	3.9%	1.0%	1.4%	28.2%
Heteromeles arbutifolia	toyon	1.0%	2.7%	0.7%	1.0%	17.9%
Lepechinia calycina	pitcher sage	0.0%	0.3%	0.1%	0.0%	2.6%
Mimulus aurantiacus	sticky monkeyflower	2.1%	4.1%	1.1%	1.9%	59.0%
Quercus wislizenii var. *wislizenii*	interior live oak	0.0%	0.0%	0.0%	0.0%	0.0%
Ribes malvaceum	chaparral currant	0.1%	0.6%	0.2%	0.1%	5.1%
Ribes speciosum	fuchsia-flowered gooseberry	0.0%	--	--	0.0%	0.0%
Rosa gymnocarpa var. *gymnocarpa*	wood rose	0.0%	--	--	0.0%	0.0%
Rubus ursinus	California blackberry	0.0%	--	--	0.0%	0.0%
Salvia mellifera	black sage	7.2%	15.5%	4.2%	6.6%	56.4%
Croton californicus	California croton	0.1%	0.3%	0.1%	0.1%	5.1%
Solanum umbelliferum	blue witch nightshade	0.0%	--	--	0.0%	0.0%
Symphoricarpos mollis	creeping snowberry	0.0%	--	--	0.0%	0.0%
Toxicodendron diversilobum	poison-oak	0.4%	1.4%	0.4%	0.4%	10.3%
Total Mean Percent Native Shrub and Subshrub Cover		***106.3%***			***97.5%***	
Total Combined Mean Native Herbaceous Cover Between Shrubs and Subshrubs		***2.0%***	***4.4%***	***1.2%***	***--***	***51.3%***
Total Mean Cover of Target Weed Species (*Carpobrotus edulis*)		***0.4%***	***2.7%***	***0.7%***	***0.4%***	***2.6%***
Total Mean Non-native Herbaceous Species Cover		***na***	***na***	***na***	***na***	***na***
Total Mean Percent Native Vegetative Cover		***109.0%***				
Total Bare Ground (Including Masticated Vegetation)		***7.1%***				
Total Mean Percent Masticated Vegetation		***na***				
Total Mean Percent Bare Ground		***7.1%***	***10.7%***	***--***	***--***	***84.6%***

HMP Species in Bold

*A calculation error was discovered after report submission in 2015; updated values reported here.

Table 6-1
Future East Garrison MRA
Vegetation Cover in Areas Subject to Vegetation Cutting in 2011

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Post-activity Data 2015* (Year 5)				
		Six Transects (in Grid Cells Veg Cut in 2010)				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Mean Relative Cover	Frequency
Tree Species						
Quercus agrifolia	coast live oak	0.8%	1.6%	1.3%	1.0%	33.3%
Total Mean Percent Native Tree Cover		***0.8%***			***1.2%***	
Shrub and Sub-shrub Species						
Acmispon glaber	deerweed	5.2%	11.4%	9.4%	6.8%	66.7%
Adenostoma fasciculatum	chamise	13.5%	7.6%	6.3%	17.8%	100.0%
Arctostaphylos crustacea subsp. *crustacea*	brittleleaf manzanita	19.6%	14.4%	11.9%	25.9%	100.0%
Arctostaphylos hookeri	**Hooker's manzanita**	**0.2%**	**0.5%**	0.4%	0.3%	**16.7%**
Arctostaphylos montereyensis	**Toro manzanita**	**0.5%**	**1.3%**	1.1%	0.7%	**16.7%**
Artemisia californica	California sagebrush	0.0%	--	--	0.0%	0.0%
Baccharis pilularis subsp. *consanguinea*	coyote brush	8.6%	8.4%	6.9%	11.4%	100.0%
Ceanothus dentatus	dwarf ceanothus	0.0%	0.0%	0.0%	0.0%	0.0%
Ceanothus rigidus	**Monterey ceanothus**	**0.9%**	**1.9%**	1.5%	1.1%	**33.3%**
Ceanothus thyrsiflorus	blue blossom	0.8%	0.9%	0.7%	1.0%	50.0%
Crocanthemum scoparium	rush-rose	1.5%	2.4%	2.0%	2.1%	66.7%
Ericameria ericoides	dune-heather, mock-heather	0.3%	0.8%	0.7%	0.4%	16.7%
Ericameria fasciculata	**Eastwood's ericameria**	**0.0%**	**0.0%**	0.0%	0.0%	**0.0%**
Eriophyllum confertiflorum	golden yarrow	0.4%	0.4%	0.3%	0.5%	66.7%
Frangula californica subsp. *californica*	California coffeeberry	0.7%	1.8%	1.5%	1.0%	16.7%
Garrya elliptica	coast silk tassel	0.3%	0.7%	0.5%	0.4%	16.7%
Heteromeles arbutifolia	toyon	0.5%	1.0%	0.8%	0.6%	33.3%
Lepechinia calycina	pitcher sage	0.0%	--	--	0.0%	0.0%
Mimulus aurantiacus	sticky monkeyflower	4.6%	5.8%	4.8%	6.1%	83.3%
Quercus wislizenii var. *wislizenii*	interior live oak	0.0%	0.0%	0.0%	0.0%	0.0%
Ribes malvaceum	chaparral currant	0.1%	0.3%	0.2%	0.2%	16.7%
Ribes speciosum	fuchsia-flowered gooseberry	0.0%	--	--	0.0%	0.0%
Rosa gymnocarpa var. *gymnocarpa*	wood rose	0.0%	--	--	0.0%	0.0%
Rubus ursinus	California blackberry	0.0%	0.1%	0.1%	0.1%	16.7%
Salvia mellifera	black sage	3.6%	6.9%	5.6%	4.8%	50.0%
Croton californicus	California croton	0.0%	--	--	0.0%	0.0%
Solanum umbelliferum	blue witch nightshade	0.0%	--	--	0.0%	0.0%
Symphoricarpos mollis	creeping snowberry	0.0%	--	--	0.0%	0.0%
Toxicodendron diversilobum	poison-oak	0.1%	0.2%	0.2%	0.2%	33.3%
Total Mean Percent Native Shrub and Subshrub Cover		***61.5%***			***95.1%***	
Total Combined Mean Native Herbaceous Cover Between Shrubs and Subshrubs		***2.4%***	***3.3%***	***1.0%***	***3.7%***	***100.0%***
Total Mean Cover of Target Weed Species (*Carpobrotus edulis*)		***0.0%***				
Total Mean Non-native Herbaceous Species Cover		***9.9%***	***3.3%***	***1.0%***		
Total Mean Percent Native Vegetative Cover		***64.7%***				
Total Bare Ground (Including Masticated Vegetation)		***28.7%***				
Total Mean Percent Masticated Vegetation		***14.1%***	***9.0%***	***2.8%***	***--***	***20.0%***
Total Mean Percent Bare Ground		***14.6%***	***10.2%***	***3.2%***	***--***	***17%***

HMP Species in Bold

*A calculation error was discovered after report submission in 2

Table 6-1
Future East Garrison MRA
Vegetation Cover in Areas Subject to Vegetation Cutting in 2011

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Post-activity Data 2015* (Year 3)				
		24 Transects (in Grid Cells Veg Cut in 2012)				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Mean Relative Cover	Frequency
Tree Species						
Quercus agrifolia	coast live oak	0.9%	2.7%	0.9%	1.3%	29.2%
Total Mean Percent Native Tree Cover		***0.9%***			***1.4%***	
Shrub and Sub-shrub Species						
Acmispon glaber	deerweed	0.4%	0.9%	0.3%	0.5%	25.0%
Adenostoma fasciculatum	chamise	16.2%	11.3%	4.0%	24.1%	100.0%
Arctostaphylos crustacea subsp. *crustacea*	brittleleaf manzanita	24.4%	15.1%	5.3%	36.3%	95.8%
Arctostaphylos hookeri	**Hooker's manzanita**	**0.0%**	**--**	--	0.0%	**0.0%**
Arctostaphylos montereyensis	**Toro manzanita**	**2.9%**	**5.3%**	1.9%	4.2%	**54.2%**
Artemisia californica	California sagebrush	0.1%	0.4%	0.1%	0.1%	4.2%
Baccharis pilularis subsp. *consanguinea*	coyote brush	2.3%	4.1%	1.4%	3.4%	54.2%
Ceanothus dentatus	dwarf ceanothus	0.0%	0.1%	0.1%	0.1%	8.3%
Ceanothus rigidus	**Monterey ceanothus**	**0.5%**	**0.9%**	0.3%	0.8%	**54.2%**
Ceanothus thyrsiflorus	blue blossom	0.4%	1.7%	0.6%	0.6%	8.3%
Crocanthemum scoparium	rush-rose	1.5%	2.4%	0.8%	2.1%	62.5%
Ericameria ericoides	dune-heather, mock-heather	0.1%	0.3%	0.1%	0.1%	4.2%
Ericameria fasciculata	**Eastwood's ericameria**	**0.0%**	**0.0%**	0.0%	0.0%	**0.0%**
Eriophyllum confertiflorum	golden yarrow	2.0%	3.7%	1.1%	2.8%	45.8%
Frangula californica subsp. *californica*	California coffeeberry	0.5%	1.1%	0.4%	0.7%	20.8%
Garrya elliptica	coast silk tassel	0.5%	1.6%	0.6%	0.8%	16.7%
Heteromeles arbutifolia	toyon	1.1%	3.0%	1.1%	1.6%	16.7%
Lepechinia calycina	pitcher sage	0.4%	1.2%	0.4%	0.7%	29.2%
Mimulus aurantiacus	sticky monkeyflower	0.0%	--	--	0.0%	87.5%
Quercus wislizenii var. *wislizenii*	interior live oak	3.1%	3.5%	1.2%	4.7%	4.2%
Ribes malvaceum	chaparral currant	0.2%	0.7%	0.2%	0.3%	20.8%
Ribes speciosum	fuchsia-flowered gooseberry	0.0%	--	--	0.0%	8.3%
Rosa gymnocarpa var. *gymnocarpa*	wood rose	0.0%	--	--	0.0%	4.2%
Rubus ursinus	California blackberry	0.7%	3.2%	1.1%	1.0%	4.2%
Salvia mellifera	black sage	1.8%	4.4%	1.6%	2.6%	45.8%
Croton californicus	California croton	0.0%	--	--	0.0%	0.0%
Solanum umbelliferum	blue witch nightshade	0.0%	--	--	0.0%	0.0%
Symphoricarpos mollis	creeping snowberry	0.3%	1.1%	0.4%	0.4%	6.7%
Toxicodendron diversilobum	poison-oak	0.6%	1.7%	0.6%	0.8%	25.0%
Total Mean Percent Native Shrub and Subshrub Cover		***59.7%***			***94.9%***	
Total Combined Mean Native Herbaceous Cover Between Shrubs and Subshrubs		***2.3%***	***2.4%***	***0.8%***	***3.4%***	***100.0%***
Total Mean Cover of Target Weed Species (*Carpobrotus edulis*)		***1.0%***	***4.2%***	***1.5%***	***1.5%***	
Total Mean Non-native Herbaceous Species Cover		***4.9%***	***7.5%***	***2.6%***	***7.2%***	
Total Mean Percent Native Vegetative Cover		***62.9%***				
Total Bare Ground (Including Masticated Vegetation)		***38.3%***				
Total Mean Percent Masticated Vegetation		***19.2%***	***11.6%***	***4.1%***		***95.8%***
Total Mean Percent Bare Ground		***19.1%***	***13.2%***	***4.6%***		***87.5%***

HMP Species in Bold

*A calculation error was discovered after report submission in 2

Table 6-1
Future East Garrison MRA
Vegetation Cover in Areas Subject to Vegetation Cutting in 2011

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Post-activity Data 2016 (Year 5)				
		23 Transects (in Grid Cells Veg Cut in 2011)				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Mean Relative Cover	Frequency
Tree Species						
Quercus agrifolia	coast live oak	0.8%	2.5%	0.9%	0.8%	26.1%
Total Mean Percent Native Tree Cover		***0.8%***			***0.9%***	
Shrub and Sub-shrub Species						
Acmispon glaber	deerweed	3.6%	7.5%	2.7%	3.5%	43.5%
Adenostoma fasciculatum	chamise	12.8%	11.6%	4.2%	12.5%	91.3%
Arctostaphylos crustacea subsp. *crustacea*	brittleleaf manzanita	29.4%	21.9%	7.8%	28.5%	87.0%
Arctostaphylos hookeri	**Hooker's manzanita**	**0.0%**	--	--	0.0%	**0.0%**
Arctostaphylos montereyensis	**Toro manzanita**	**2.8%**	**6.9%**	2.5%	2.7%	**34.8%**
Artemisia californica	California sagebrush	0.0%	--	--	0.0%	0.0%
Baccharis pilularis subsp. *consanguinea*	coyote brush	2.6%	4.1%	1.5%	2.5%	56.5%
Ceanothus dentatus	dwarf ceanothus	0.7%	1.7%	0.6%	0.7%	30.4%
Ceanothus rigidus	**Monterey ceanothus**	**0.6%**	**1.3%**	0.5%	0.6%	**39.1%**
Ceanothus thyrsiflorus	blue blossom	0.0%	--	--	0.0%	0.0%
Crocanthemum scoparium	rush-rose	2.3%	3.0%	1.1%	2.3%	87.0%
Ericameria ericoides	dune-heather, mock-heather	0.9%	2.9%	1.0%	0.9%	13.0%
Ericameria fasciculata	**Eastwood's ericameria**	**0.1%**	**0.2%**	0.1%	0.1%	**8.7%**
Eriophyllum confertiflorum	golden yarrow	1.1%	1.2%	0.4%	1.1%	73.9%
Frangula californica subsp. *californica*	California coffeeberry	2.2%	4.0%	1.4%	2.1%	34.8%
Garrya elliptica	coast silk tassel	0.4%	0.7%	0.3%	0.4%	26.1%
Heteromeles arbutifolia	toyon	0.8%	1.6%	0.6%	0.8%	30.4%
Lepechinia calycina	pitcher sage	0.5%	1.2%	0.4%	0.5%	30.4%
Mimulus aurantiacus	sticky monkeyflower	2.5%	2.9%	1.0%	2.4%	69.6%
Quercus wislizenii var. *wislizenii*	interior live oak	0.0%	--	--	0.0%	0.0%
Ribes malvaceum	chaparral currant	0.0%	0.2%	0.1%	0.0%	4.3%
Ribes speciosum	fuchsia-flowered gooseberry	0.0%	--	--	0.0%	0.0%
Rosa gymnocarpa var. *gymnocarpa*	wood rose	0.1%	0.6%	0.2%	0.1%	4.3%
Rubus ursinus	California blackberry	0.9%	4.0%	1.4%	0.9%	13.0%
Salvia mellifera	black sage	6.6%	9.2%	3.3%	6.4%	56.5%
Croton californicus	California croton	0.0%	--	--	0.0%	0.0%
Solanum umbelliferum	blue witch nightshade	0.0%	--	--	0.0%	4.3%
Symphoricarpos mollis	creeping snowberry	1.0%	3.4%	1.2%	1.0%	17.4%
Toxicodendron diversilobum	poison-oak	1.0%	2.3%	0.8%	0.9%	30.4%
Total Mean Percent Native Shrub and Subshrub Cover		***73.1%***			***84.9%***	
Total Combined Mean Native Herbaceous Cover Between Shrubs and Subshrubs		***12.3%***	***15.3%***	***5.5%***	***11.9%***	
Total Mean Cover of Target Weed Species (*Carpobrotus edulis*)		***1.3%***	***3.3%***	***1.2%***	***1.2%***	
Total Mean Non-native Herbaceous Species Cover						
Total Mean Percent Native Vegetative Cover		***86.2%***				
Total Bare Ground (Including Masticated Vegetation)		***21.3%***				
Total Mean Percent Masticated Vegetation		***11.7%***	***9.9%***	***3.5%***		***78.3%***
Total Mean Percent Bare Ground		***9.6%***	***7.3%***	***2.6%***		***96%***

HMP Species in Bold

*A calculation error was discovered after report submission in 2

Table 6-2
Future East Garrison 2016 Cover and Frequency of Herbaceous Species
After Vegetation Cutting (6 Quadrats)

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Post-activity Data 2014 (Year 3)				
		Eighteen Quadrats in Cut Vegetation				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Relative Percent Cover	Mean Frequency
Shrub and Subshrubs						
Acmispon glaber	deerweed	0.5%	1.0%	0.8%	4.3%	33.3%
Adenostoma fasciculatum	chamise	4.0%	9.1%	7.5%	37.4%	33.3%
Arctostaphylos crustacea subsp. crustacea	brittleleaf manzanita	0.0%	--	--	0.0%	0.0%
Arctostaphylos montereyensis	**Toro manzanita**	**0.0%**	**--**	**--**	**0.0%**	**0.0%**
Arctostaphylos tomentosa subsp. tomentosa	shaggy-barked manzanita	0.0%	--	--	0.0%	0.0%
Artemisia californica	California sagebrush	0.0%	--	--	0.0%	0.0%
Crocanthemum scoparium	rush-rose	0.0%	--	--	0.0%	0.0%
Ericameria ericoides	dune-heather, mock-heather	0.0%	0.1%	0.1%	0.4%	16.7%
Eriophyllum confertiflorum	golden yarrow	0.0%	--	--	0.0%	0.0%
Mimulus aurantiacus	bush monkeyflower	0.0%	--	--	0.0%	0.0%
Salvia mellifera	black sage	0.0%	--	--	0.0%	0.0%
Solanum umbelliferum	witch's nightshade	0.0%	--	--	0.0%	0.0%
Total Cover by Native Shrub and Subshrub Species		***4.5%***			42.5%	
Herbaceous Species						
Acmispon strigosus	Bishop's lotus	0.0%	--	--	0.0%	0.0%
Cirsium brevistylum	Indian thistle	0.0%	--	--	0.0%	0.0%
Corethrogyne filaginifolia	California aster	1.0%	2.6%	2.1%	9.8%	16.7%
Chorizanthe douglasii	Douglas' spineflower	0.0%	--	--	0.0%	0.0%
Croton californicus	California croton	0.0%	--	--	0.0%	0.0%
Cryptantha micromeres	small-flowered cryptantha	0.0%	--	--	0.0%	0.0%
Cryptantha microstachys	Tejon cryptantha	0.2%	0.2%	0.2%	1.6%	50.0%
Daucus pusillus	rattlesnake weed	0.0%	--	--	0.0%	0.0%
Deinandra increscens subsp. increscens	grassland tarweed	0.0%	--	--	0.0%	0.0%
Dichelostemma capitatum subsp. *capitatum*	blue dicks, wild hyacinth	0.0%	0.1%	0.1%	0.4%	16.7%
Eriastrum virgatum	wand woollystar	0.0%	--	--	0.0%	0.0%
Erigeron canadensis	horseweed	0.0%	--	--	0.0%	0.0%
Eriogonum nudum var. *auriculatum*	nude buckwheat	0.4%	0.6%	0.5%	3.9%	33.3%
Festuca octoflora	six-weeks fescue	0.0%	--	--	0.0%	0.0%
Galium porrigens var. porrigens	climbing bedstraw	0.0%	--	--	0.0%	0.0%
Gamochaeta ustulata	purple cudweed	0.0%	--	--	0.0%	0.0%
Horkelia cuneata var *cuneata*	coast horkelia, wedge-leaved horkelia	0.0%	--	--	0.0%	0.0%
Lessingia pectinata var. pectinata	valley lessingia	0.0%	--	--	0.0%	0.0%
Logfia filaginoides	California cottonrose	0.0%	--	--	0.0%	0.0%
Madia sativa	coast tarweed	0.0%	--	--	0.0%	0.0%
Marah fabaceus	wild cucumber	0.0%	--	--	0.0%	0.0%
Melica imperfecta	California melic	0.0%	--	--	0.0%	0.0%
Pentagramma triangularis subsp. triangularis	goldenback fern	0.0%	--	--	0.0%	0.0%
Pseudognaphalium californicum	California everlasting	0.0%	--	--	0.0%	0.0%

Table 6-2
Future East Garrison 2016 Cover and Frequency of Herbaceous Species
After Vegetation Cutting (6 Quadrats)

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Post-activity Data 2014 (Year 3)				
		Eighteen Quadrats in Cut Vegetation				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Relative Percent Cover	Mean Frequency
Herbaceous Species						
Pterostegia drymarioides	fairy mist	0.0%	--	--	0.0%	0.0%
Stephanomeria virgata subsp. *virgata*	tall milk aster	0.0%	--	--	0.0%	0.0%
Stipa lepida	foothill needlegrass	0.0%	--	--	0.0%	0.0%
Trifolium sp.	clover	0.0%	--	--	0.0%	0.0%
Uropappus lindleyi	silver puffs	0.0%	--	--	0.0%	0.0%
Total Cover by Native Herbaceous Species		***1.7%***			16.0%	
*Aira caryophyllea**	hairy grass	0.0%	--	--	0.0%	0.0%
*Anagallis arvensis**	scarlet pimpernel	0.0%	--	--	0.0%	0.0%
*Avena barbata**	slender wild oat	1.3%	3.1%	2.5%	11.8%	16.7%
*Briza minor**	little rattlesnake grass	0.0%	--	--	0.0%	0.0%
*Bromus diandrus**	ripgut brome	0.2%	0.2%	0.2%	1.6%	50.0%
*Bromus hordeaceus**	smooth brome	0.0%	--	--	0.0%	0.0%
Bromus madritensis subsp. *rubens**	red brome	2.7%	2.6%	2.1%	25.2%	100.0%
*Carpobrotus edulis**	iceplant	0.0%	--	--	0.0%	0.0%
*Cerastium glomeratum**	mouse-ear chickweed	0.0%	--	--	0.0%	0.0%
*Erodium cicutarium**	red-stemmed filaree	0.2%	0.5%	0.4%	2.0%	16.7%
*Erodium botrys**	broad leaf filaree	0.0%	--	--	0.0%	0.0%
*Festuca myuros**	rattail fescue	0.0%	--	--	0.0%	0.0%
*Hypochaeris glabra**	smooth cat's ear	0.1%	0.1%	0.1%	0.8%	33.3%
*Logfia gallica**	narrowleaf cottonrose	0.0%	--	--	0.0%	0.0%
Silene gallica	windmill pink	0.0%	--	--	0.0%	0.0%
*Senecio glomeratus**	cutleaf burnweed	0.0%	--	--	0.0%	0.0%
*Senecio vulgaris**	common groundsel	0.0%	--	--	0.0%	0.0%
Sonchus asper subsp. *asper**	sow thistle	0.0%	--	--	0.0%	0.0%
Total Cover by Non-native Herbaceous Species		***4.4%***			41.5%	
Total Cover by Non-native Grass Cover		***4.1%***				
Total Cover by All Herbaceous Species		***6.1%***			***57.5%***	
Total Mean Percent All Vegetative Cover		***10.6%***				
Total Mean Percent Native Vegetative Cover		***6.2%***				
Total Mean Percent Litter		***na***				
Total Mean Percent Bare ground		***89.4%***				

*non-native species

HMP species in bold

Table 6-2
Future East Garrison 2016 Cover and Frequency of Herbaceous Species
After Vegetation Cutting (6 Quadrats)

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Post-activity Data 2016 (Year 5)				
		Six Quadrats in Cut Vegetation				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Relative Percent Cover	Mean Frequency
Shrub and Subshrubs						
Acmispon glaber	deerweed	0.5%	1.0%	0.8%	4.6%	33.3%
Adenostoma fasciculatum	chamise	0.4%	1.0%	0.8%	4.7%	16.7%
Arctostaphylos crustacea subsp. crustacea	brittleleaf manzanita	0.0%	0.0%	--	0.0%	0.0%
Arctostaphylos montereyensis	**Toro manzanita**	0.0%	0.0%	--	0.0%	0.0%
Arctostaphylos tomentosa subsp. tomentosa	shaggy-barked manzanita	0.0%	0.0%	--	0.0%	0.0%
Artemisia californica	California sagebrush	0.0%	0.0%	--	0.0%	0.0%
Crocanthemum scoparium	rush-rose	0.0%	0.0%	--	0.0%	0.0%
Ericameria ericoides	dune-heather, mock-heather	0.2%	0.5%	0.4%	2.4%	16.7%
Eriophyllum confertiflorum	golden yarrow	0.4%	1.0%	0.8%	4.7%	16.7%
Mimulus aurantiacus	bush monkeyflower	0.0%	0.0%	--	0.0%	0.0%
Salvia mellifera	black sage	8.2%	9.7%	8.0%	45.0%	66.7%
Solanum umbelliferum	witch's nightshade	0.2%	0.4%	0.3%	1.9%	16.7%
Total Cover by Native Shrub and Subshrub Species		***9.8%***			55.7%	
Herbaceous Species						
Acmispon strigosus	Bishop's lotus	0.1%	0.2%	0.2%	1.0%	33.3%
Cirsium brevistylum	Indian thistle	0.0%	0.0%	--	0.0%	0.0%
Corethrogyne filaginifolia	California aster	0.0%	0.0%	--	0.0%	0.0%
Chorizanthe douglasii	Douglas' spineflower	0.2%	0.3%	0.2%	1.2%	33.3%
Croton californicus	California croton	1.0%	1.7%	1.4%	7.7%	33.3%
Cryptantha micromeres	small-flowered cryptantha	0.8%	0.9%	0.7%	4.2%	83.3%
Cryptantha microstachys	Tejon cryptantha	0.0%	0.0%	--	0.0%	0.0%
Daucus pusillus	rattlesnake weed	0.0%	0.0%	--	0.0%	0.0%
Deinandra increscens subsp. increscens	grassland tarweed	0.0%	0.0%	--	0.0%	0.0%
Dichelostemma capitatum subsp. *capitatum*	blue dicks, wild hyacinth	0.0%	0.0%	--	0.0%	0.0%
Eriastrum virgatum	wand woollystar	0.1%	0.2%	0.2%	0.9%	16.7%
Erigeron canadensis	horseweed	0.0%	0.0%	--	0.0%	0.0%
Eriogonum nudum var. *auriculatum*	nude buckwheat	0.4%	1.0%	0.8%	4.7%	16.7%
Festuca octoflora	six-weeks fescue	0.0%	0.0%	--	0.0%	0.0%
Galium porrigens var. porrigens	climbing bedstraw	0.0%	0.0%	--	0.0%	0.0%
Gamochaeta ustulata	purple cudweed	0.0%	0.0%	--	0.0%	0.0%
Horkelia cuneata var *cuneata*	coast horkelia, wedge-leaved horkelia	0.0%	0.0%	--	0.0%	0.0%
Lessingia pectinata var. pectinata	valley lessingia	0.0%	0.1%	0.1%	0.5%	16.7%
Logfia filaginoides	California cottonrose	0.1%	0.2%	0.2%	0.9%	16.7%
Madia sativa	coast tarweed	0.0%	0.0%	--	0.0%	0.0%
Marah fabaceus	wild cucumber	0.0%	0.1%	0.1%	0.5%	16.7%
Melica imperfecta	California melic	1.1%	2.4%	2.0%	11.2%	33.3%
Pentagramma triangularis subsp. triangularis	goldenback fern	0.0%	0.0%	--	0.0%	0.0%
Pseudognaphalium californicum	California everlasting	0.0%	0.0%	--	0.0%	0.0%

Table 6-2
Future East Garrison 2016 Cover and Frequency of Herbaceous Species
After Vegetation Cutting (6 Quadrats)

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Post-activity Data 2016 (Year 5)				
		Six Quadrats in Cut Vegetation				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Relative Percent Cover	Mean Frequency
Herbaceous Species						
Pterostegia drymarioides	fairy mist	0.0%	0.0%	--	0.0%	0.0%
Stephanomeria virgata subsp. *virgata*	tall milk aster	0.0%	0.0%	--	0.0%	0.0%
Stipa lepida	foothill needlegrass	0.0%	0.0%	--	0.0%	0.0%
Trifolium sp.	clover	0.0%	0.0%	--	0.0%	0.0%
Uropappus lindleyi	silver puffs	0.1%	0.2%	0.2%	0.9%	16.7%
Total Cover by Native Herbaceous Species		***3.9%***			22.1%	
*Aira caryophyllea**	hairy grass	0.0%	0.0%	--	0.0%	0.0%
*Anagallis arvensis**	scarlet pimpernel	0.0%	0.0%	--	0.0%	0.0%
*Avena barbata**	slender wild oat	0.8%	0.5%	0.4%	2.2%	83.3%
*Briza minor**	little rattlesnake grass	0.0%	0.0%	--	0.0%	0.0%
*Bromus diandrus**	ripgut brome	1.0%	0.4%	0.3%	1.9%	100.0%
*Bromus hordeaceus**	smooth brome	0.0%	0.0%	--	0.0%	0.0%
Bromus madritensis subsp. *rubens**	red brome	1.0%	0.7%	0.5%	3.1%	83.3%
*Carpobrotus edulis**	iceplant	0.0%	0.0%	--	0.0%	0.0%
*Cerastium glomeratum**	mouse-ear chickweed	0.0%	0.0%	--	0.0%	0.0%
*Erodium cicutarium**	red-stemmed filaree	0.0%	0.0%	--	0.0%	0.0%
*Erodium botrys**	broad leaf filaree	0.3%	0.5%	0.4%	2.4%	33.3%
*Festuca myuros**	rattail fescue	0.2%	0.5%	0.4%	2.4%	16.7%
*Hypochaeris glabra**	smooth cat's ear	0.4%	0.5%	0.4%	2.4%	50.0%
*Logfia gallica**	narrowleaf cottonrose	0.1%	0.2%	0.2%	0.9%	16.7%
Silene gallica	windmill pink	0.1%	0.2%	0.2%	1.0%	33.3%
*Senecio glomeratus**	cutleaf burnweed	0.0%	0.0%	--	0.0%	0.0%
*Senecio vulgaris**	common groundsel	0.0%	0.0%	--	0.0%	0.0%
Sonchus asper subsp. *asper**	sow thistle	0.0%	0.0%	--	0.0%	0.0%
Total Cover by Non-native Herbaceous Species		***3.9%***			22.1%	
Total Cover by Non-native Grass Cover		***3.0%***				
Total Cover by All Herbaceous Species		***7.8%***			***44.3%***	
Total Mean Percent All Vegetative Cover		***17.5%***				
Total Mean Percent Native Vegetative Cover		***13.6%***				
Total Mean Percent Litter		***0.0%***				
Total Mean Percent Bare ground		***82.5%***				

*non-native species

HMP species in bold

Table 6-3
Future East Garrison MRA
2016 Plant Species Richness and Diversity

ESCA RP 2016 Annual Natural Resource Report

Future East Garrison MRA									
	Vegetation Cutting in Central Maritime Chaparral								
Activity Year	**Baseline (2011)**	**Year 3 (2014)**	**Year 3 with surrounding species included (2014)**	**Year 3 (2015)**	**Year 3 with surrounding species included (2015)**	**Year 5 (2015)**	**Year 5 with surrounding species included (2015)**	**Year 5 (2016)**	**Year 5 with surrounding species included (2016)**
Number of Transects/Quadrats	39 Transects	17 Transects and 18 Quadrats		24 Transects and 12 Quadrats		6 Transects		23 Transects and 6 Quadrats	
Total Number of Native Species	25	28	94	51	104	30	71	38	99
Total Number of HMP Species Present	3	3	5	2	3	3	3	3	3
Total Number of HMP Herbaceous Species Present	0	0	2	0	0	0	0	0	0
Total Native Tree Species in All Transects	1	1	1	2	2	1	1	1	2
Total Shrub Species in All Transects	22	22	27	24	27	18	21	22	27
Total Native Herbaceous Species in All Transects or Related Herbaceous Plots	1	5	64	23	73	11	48	15	69
Total Native Ferns and Fern Allies in All Transects or Related Herbaceous Plots	1	0	2	2	2	0	1	0	3
Mean Number Tree Species per Transect	0.1	0.3	0.6	0.3	0.5	0.3	0.8	0.2	0.8
Mean Number Shrub Species per Transect	5.7	8.4	11.6	8.3	11.2	8.8	12.5	8.0	12.0
Mean Number of Native Herbaceous Species per Transect[1]	0.05	0.3	10.7	2.4	13.3	3.7	12.7	7.4	14.3
Mean number of Native Ferns and Fern Allies per Transect	0.1	0.0	0.2	0.1	0.2	0.0	0.2	0.0	0.2
Diversity - Shannon Index	1.1	1.5	--	1.3	--	1.5	--	1.4	--
Evenness	0.2	0.2	--	0.2	--	0.2	--	0.2	--
Total Percent Mean Native Cover (Transects)	109.0%	66.5%	--	64.7%	--	61.6%	--	86.1%	--
Total Percent Mean Native Shrub Cover (Transects)	106.3%	57.8%	--	60.9%	--	58.5%	--	73.1%	--
Total Percent Mean Native Herbaceous Species Cover (Transects)	2.0%	8.4%	--	2.4%	--	2.4%	--	12.3%	--
Total Percent Mean Native Cover (Herbaceous Quadrats)	0%[2]	6.3%	--	12.4%	--	0%[2]	--	13.6%	--

[1]Data collected from those transects in which herbaceous plots were monitored
[2]Quadrat data were not collected in baseline, due to lack of herbaceous cover

Table 6-4
IAR MRA South Range 44 SCA and Central Area NCAs
Vegetation Cover in Areas Subject to Vegetation Cutting in 2011

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Twenty-nine Baseline Transects				
		Baseline Data 2010 - 2011 (all IAR MRA baseline transects)				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Mean Relative Cover	Frequency
Tree Species						
Quercus agrifolia	coast live oak	0.0%	0.0%	--	0.0%	0.0%
Total Cover by Native Tree Species		***0.0%***			***0%***	
Shrub and Sub-shrub Species						
Acmispon glaber	deerweed	1.4%	0.0%	--	1.5%	0.0%
Adenostoma fasciculatum	chamise	9.0%	6.9%	2.2%	9.5%	89.7%
Arctostaphylos pumila	**sandmat manzanita**	**1.6%**	**2.0%**	**0.6%**	**1.7%**	**65.5%**
Arctostaphylos tomentosa subsp. *tomentosa*	shaggy-barked manzanita	29.3%	15.6%	4.9%	31.0%	100%
Baccharis pilularis subsp. *consanguinea*	coyote brush	0.7%	1.8%	0.6%	0.7%	24.1%
Ceanothus dentatus	dwarf ceanothus	20.2%	16.0%	5.0%	21.4%	89.7%
Ceanothus rigidus	**Monterey ceanothus**	**13.5%**	**9.3%**	**2.9%**	**14.3%**	**96.6%**
Crocanthemum scoparium	rush-rose	8.1%	9.1%	2.9%	8.6%	86.2%
Ericameria ericoides	dune-heather, mock-heather	1.5%	5.6%	1.8%	1.6%	24.1%
Ericameria fasciculata	**Eastwood's ericameria**	**0.2%**	**0.5%**	**0.2%**	**0.2%**	**17.2%**
Eriophyllum confertiflorum	golden yarrow	1.5%	2.2%	0.7%	1.6%	65.5%
Frangula californica subsp. *californica*	California coffeeberry	0.9%	1.9%	0.6%	1.0%	31.0%
Garrya elliptica	coast silk-tassel	0.0%	0.0%	--	0.0%	0.0%
Lepechinia calycina	pitcher sage	0.4%	1.4%	0.5%	0.4%	20.7%
Lupinus chamissonis	silver bush lupine	0.4%	1.1%	0.4%	0.4%	13.8%
Mimulus aurantiacus	bush monkeyflower	0.5%	0.9%	0.3%	0.5%	27.6%
Salvia mellifera	black sage	5.3%	7.2%	2.3%	5.6%	69.0%
Symphoricarpos mollis	creeping snowberry	0.0%	0.0%	--	0.0%	0.0%
Toxicodendron diversilobum	poison-oak	0.0%	0.0%	--	0.0%	0.0%
Total Cover by Native Shrub and Subshrub Species		***94.5%***			***99%***	
Total Combined Mean Native Cover Between Shrubs and Subshrubs		***1.3%***	***2.3%***	***1.3%***	***1%***	***90%***
Target Weed Total (*Carpobrotus edulis*)		***0.0%***	***0.0%***		***0%***	***0%***
Total Mean Non-native Herbaceous Species Cover		***na***				
Total Mean Percent Native Vegetative Cover		***95.8%***				
Total Mean Percent Bare Ground (Including Masticated Vegetation)		***19.3%***				
Total Mean Percent Masticated Vegetation (Calculated in 2014 - 2016)		***--***	***--***	***--***	***--***	***--***
Total Mean Percent Bare Ground Only		***19.3%***	***9.3%***	***2.9%***	***--***	***100%***

HMP Species in Bold

Not all species observed along transects listed in this table

*A calculation error was discovered after report submission in 2015; updated values reported here.

Table 6-4
IAR MRA South Range 44 SCA and Central Area NCAs
Vegetation Cover in Areas Subject to Vegetation Cutting in 2011

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Seven Baseline Transects				
		Baseline Data 2010 - 2011 (South Range 44 MRA baseline transects only)				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Mean Relative Cover	Frequency
Tree Species						
Quercus agrifolia	coast live oak	0.0%	0.0%	--	0.0%	0.0%
Total Cover by Native Tree Species		***0%***			***0%***	
Shrub and Sub-shrub Species						
Acmispon glaber	deerweed	1.2%	1.1%	0.8%	1.1%	85.7%
Adenostoma fasciculatum	chamise	9.9%	7.1%	5.2%	9.1%	100%
Arctostaphylos pumila	**sandmat manzanita**	**0.7%**	**0.6%**	**0.4%**	0.7%	**71.4%**
Arctostaphylos tomentosa subsp. *tomentosa*	shaggy-barked manzanita	25.8%	9.5%	6.9%	23.7%	100%
Baccharis pilularis subsp. *consanguinea*	coyote brush	0.2%	0.4%	0.3%	0.2%	28.6%
Ceanothus dentatus	dwarf ceanothus	30.4%	14.9%	10.9%	27.9%	100%
Ceanothus rigidus	**Monterey ceanothus**	**16.3%**	**5.0%**	**3.7%**	14.9%	**100%**
Crocanthemum scoparium	rush-rose	10.0%	8.5%	6.2%	9.2%	100%
Ericameria ericoides	dune-heather, mock-heather	0.0%	0.0%	--	0.0%	0.0%
Ericameria fasciculata	**Eastwood's ericameria**	**0.1%**	**0.2%**	**0.2%**	**0.1%**	**14.3%**
Eriophyllum confertiflorum	golden yarrow	3.0%	2.7%	2.0%	2.8%	85.7%
Frangula californica subsp. *californica*	California coffeeberry	0.1%	0.2%	0.2%	0.1%	14.3%
Garrya elliptica	coast silk-tassel	0.0%	0.0%	--	0.0%	0.0%
Lepechinia calycina	pitcher sage	0.0%	0.0%	--	0.0%	0.0%
Lupinus chamissonis	silver bush lupine	1.2%	2.1%	1.5%	1.1%	28.6%
Mimulus aurantiacus	bush monkeyflower	0.0%	0.0%	--	0.0%	0.0%
Salvia mellifera	black sage	8.7%	9.7%	7.1%	8.0%	100%
Symphoricarpos mollis	creeping snowberry	0.0%	0.0%	--	0.0%	0.0%
Toxicodendron diversilobum	poison-oak	0.0%	0.0%	--	0.0%	0.0%
Total Cover by Native Shrub and Subshrub Species		***108%***			***99%***	
Total Combined Mean Native Cover Between Shrubs and Subshrubs		***1.2%***	***1.2%***	***0.9%***	***1.1%***	***71%***
Target Weed Total (*Carpobrotus edulis*)		***0%***	***0%***	***--***	***0%***	***0%***
Total Mean Non-native Herbaceous Species Cover		***na***				
Total Mean Percent Native Vegetative Cover		***108.8%***				
Total Mean Percent Bare Ground (Including Masticated Vegetation)		***16.2%***				
Total Mean Percent Masticated Vegetation (Calculated in 2014 - 2016)		***--***	***--***	***--***	***--***	***--***
Total Mean Percent Bare Ground Only		***16.2%***	***7.9%***	***5.8%***	***14.8%***	***100%***

HMP Species in Bold

Not all species observed along transects listed in this table

*A calculation error was discovered after report submission in 2015; updated values reported here.

Table 6-4
IAR MRA South Range 44 SCA and Central Area NCAs
Vegetation Cover in Areas Subject to Vegetation Cutting in 2011

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Seven Transects in Vegetation Cut in 2011				
		Post-activity Data 2015* (Year 4)				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Mean Relative Cover	Frequency
Tree Species						
Quercus agrifolia	coast live oak	0.4%	1.2%	0.9%	1.2%	14.3%
Total Cover by Native Tree Species		***0.4%***			***1.2%***	
Shrub and Sub-shrub Species						
Acmispon glaber	deerweed	2.7%	4.2%	3.1%	7.1%	86%
Adenostoma fasciculatum	chamise	6.1%	3.2%	2.4%	16.3%	100%
Arctostaphylos pumila	**sandmat manzanita**	**5.1%**	**3.1%**	**2.2%**	**13.5%**	**100.0%**
Arctostaphylos tomentosa subsp. *tomentosa*	shaggy-barked manzanita	13.2%	8.1%	5.9%	35.1%	100%
Baccharis pilularis subsp. *consanguinea*	coyote brush	0.0%	0.0%	--	0.0%	0.0%
Ceanothus dentatus	dwarf ceanothus	0.0%	0.0%	0.0%	0.1%	42.9%
Ceanothus rigidus	**Monterey ceanothus**	**0.4%**	**0.6%**	**0.5%**	**1.2%**	**57.1%**
Crocanthemum scoparium	rush-rose	0.1%	0.1%	0.1%	0.2%	42.9%
Ericameria ericoides	dune-heather, mock-heather	0.9%	2.3%	1.7%	2.3%	14.3%
Ericameria fasciculata	**Eastwood's ericameria**	**0.0%**	**0.0%**	0.0%	**0.0%**	**14.3%**
Eriophyllum confertiflorum	golden yarrow	0.4%	0.6%	0.4%	1.2%	71.4%
Frangula californica subsp. *californica*	California coffeeberry	0.0%	0.0%	--	0.0%	0.0%
Garrya elliptica	coast silk-tassel	0.5%	1.4%	1.0%	1.4%	14.3%
Lepechinia calycina	pitcher sage	0.0%	0.0%	--	0.0%	0.0%
Lupinus chamissonis	silver bush lupine	0.0%	0.0%	--	0.0%	0.0%
Mimulus aurantiacus	bush monkeyflower	0.1%	0.2%	0.1%	0.2%	28.6%
Salvia mellifera	black sage	3.8%	5.1%	3.7%	10.1%	85.7%
Symphoricarpos mollis	creeping snowberry	0.3%	0.7%	0.5%	0.7%	14.3%
Toxicodendron diversilobum	poison-oak	0.2%	0.3%	0.3%	0.5%	28.6%
Total Cover by Native Shrub and Subshrub Species		***33.8%***			***90.1%***	
Total Combined Mean Native Cover Between Shrubs and Subshrubs		***3.3%***	***4.0%***	***2.9%***	***5.1%***	***100.0%***
Target Weed Total (*Carpobrotus edulis*)		***0.0%***	***0.0%***	*--*	*--*	***0.0%***
Total Mean Non-native Herbaceous Species Cover		***0.0%***	*--*	*--*	*--*	
Total Mean Percent Native Vegetative Cover		***37.6%***				
Total Mean Percent Bare Ground (Including Masticated Vegetation)		***62.1%***				
Total Mean Percent Masticated Vegetation (Calculated in 2014 - 2016)		***4.4%***	***5.1%***	***3.7%***	*--*	***57.1%***
Total Mean Percent Bare Ground Only		***57.7%***	***10.3%***	***7.5%***	*--*	***100%***

HMP Species in Bold

Not all species observed along transects listed in this table

*A calculation error was discovered after report submission in 2015; updated values reported here.

Table 6-4
IAR MRA South Range 44 SCA and Central Area NCAs
Vegetation Cover in Areas Subject to Vegetation Cutting in 2011

ESCA RP 2016 Annual Natural Resource Report

Scientific Name	Common Name	Seven Transects in Vegetation Cut in 2011				
		Post-activity Data 2016 (Year 5)				
		Mean Percent Cover	Standard Deviation	90% Confidence Interval	Mean Relative Cover	Frequency
Tree Species						
Quercus agrifolia	coast live oak	0.0%	0.0%	0.0%	0.0%	14.3%
Total Cover by Native Tree Species		***0.0%***			***0.0%***	
Shrub and Sub-shrub Species						
Acmispon glaber	deerweed	2.4%	2.1%	1.5%	4.2%	86%
Adenostoma fasciculatum	chamise	7.9%	3.8%	2.8%	13.6%	100%
Arctostaphylos pumila	**sandmat manzanita**	**6.3%**	**3.8%**	**2.8%**	**10.9%**	**100.0%**
Arctostaphylos tomentosa subsp. *tomentosa*	shaggy-barked manzanita	17.0%	10.1%	7.4%	29.2%	100%
Baccharis pilularis subsp. *consanguinea*	coyote brush	0.0%	0.0%	--	0.0%	0.0%
Ceanothus dentatus	dwarf ceanothus	0.0%	0.1%	0.1%	0.1%	14.3%
Ceanothus rigidus	**Monterey ceanothus**	**0.6%**	**0.9%**	**0.7%**	**1.0%**	**57.1%**
Crocanthemum scoparium	rush-rose	9.1%	22.9%	16.9%	15.6%	57.1%
Ericameria ericoides	dune-heather, mock-heather	0.9%	2.3%	1.7%	1.5%	14.3%
Ericameria fasciculata	**Eastwood's ericameria**	**0.1%**	**0.2%**	0.1%	**0.1%**	**14.3%**
Eriophyllum confertiflorum	golden yarrow	0.7%	0.8%	0.6%	1.3%	71.4%
Frangula californica subsp. *californica*	California coffeeberry	0.0%	0.0%	--	0.0%	0.0%
Garrya elliptica	coast silk-tassel	0.7%	1.7%	1.3%	1.1%	14.3%
Lepechinia calycina	pitcher sage	0.0%	0.0%	--	0.0%	0.0%
Lupinus chamissonis	silver bush lupine	0.0%	0.0%	--	0.0%	0.0%
Mimulus aurantiacus	bush monkeyflower	0.1%	0.3%	0.2%	0.2%	14.3%
Salvia mellifera	black sage	4.7%	6.0%	4.4%	8.1%	85.7%
Symphoricarpos mollis	creeping snowberry	0.7%	1.8%	1.3%	1.2%	14.3%
Toxicodendron diversilobum	poison-oak	0.1%	0.2%	0.2%	0.1%	14.3%
Total Cover by Native Shrub and Subshrub Species		***51.3%***			***89.2%***	
Total Combined Mean Native Cover Between Shrubs and Subshrubs		***6.2%***	***4.9%***	***3.6%***	***10.7%***	***100.0%***
Target Weed Total (*Carpobrotus edulis*)		***0.1%***	***0.2%***	***0.2%***	***0.1%***	***14.3%***
Total Mean Non-native Herbaceous Species Cover		***0.6%***	***0.5%***	***0.4%***	***1.1%***	***100.0%***
Total Mean Percent Native Vegetative Cover		***57.5%***				
Total Mean Percent Bare Ground (Including Masticated Vegetation)		***51.9%***				
Total Mean Percent Masticated Vegetation (Calculated in 2014 - 2016)		***0.0%***	***--***	***--***	***--***	***0.0%***
Total Mean Percent Bare Ground Only		***51.9%***	***8.7%***	***6.4%***	***--***	***100%***

HMP Species in Bold

Not all species observed along transects listed in this table

*A calculation error was discovered after report submission in 2015; updated values reported here.

Table 6-5
Interim Action Ranges MRA Range 44 SCA and Central Area NCAs
2016 Plant Species Richness and Diversity

ESCA RP 2016 Annual Natural Resource Report

Interim Action Ranges MRA in Central Maritime Chaparral														
Location	**IAR MRA Range R44**													
Area	**All**	**South Range NCAs and Central Area SCAs**								**North Range NCA and SCAs**				
Activity Type	**Baseline**	**Vegetation Cutting**												
Activity Year	**2010**	**Year 1 (2012)**	**Year 2 (2013)**	**Year 3 (2014)**	**Year 3 with surrounding species included (2014)**	**Year 4* (2015)**	**Year 4 with surrounding species included (2015)**	**Year 5 (2016)**	**Year 5 with surrounding species included (2016)**	**Year 1 (2013)**	**Year 2 (2014)**	**Year 2 with surrounding species included (2014)**	**Year 3* (2015)**	**Year 3 with surrounding species included (2015)**
Number of Transects/Quadrats	**Seven Transects**									**Five Transects**				
Total Number of Native Species	**15**	24	18	23	41	37	52	43	62	17	28	50	47	56
Total Number of HMP Species Present	**3**	4	3	3	3	6	6	4	6	3	5	5	6	6
Total Number of HMP Herbaceous Species Present	**0**	1	0	1	1	3	3	2	3	0	2	2	3	3
Total Tree Species in All Transects	**0**	0	1	1	1	1	1	0	1	0	0	1	0	1
Total Shrub Species in All Transects	**14**	16	16	12	17	15	16	13	16	14	13	18	16	17
Total Herbaceous Species in All Transects	**1**	8	1	10	23	21	35	30	45	3	14	30	30	37
Total Fern and Fern Allies Species in All Transects	**0**	0	0	0	0	0	0	0	0	0	1	1	1	1
Mean Number of Tree Species per Transect	**0.0**	0.0	0.1	0.1	0.3	0.1	0.3	0.0	0.4	0.0	0.0	0.2	0.0	0.2
Mean Number of Shrub Species per Transect	**9.6**	4.7	8.6	7.1	10.6	8.0	11.1	6.4	10.3	9.4	8.6	11.2	10.0	8.8
Mean Number of Herbaceous Species per Transect[2]	**0.0**	0.7	0.3	2.1	5.9	6.3	13.7	16.1	24.9	2.0	4.2	11.6	12.0	16.8
Mean Number of Fern and Fern Allies Species per Transect	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2
Diversity - Shannon Index	**1.8**	1.4	1.5	1.4	--	1.4	--	1.4	--	1.7	1.7	--	1.8	1.8
Evenness	**0.2**	0.2	0.2	0.2	--	0.2	--	0.2	--	0.2	0.2	--	0.2	0.2
Total Percent Mean Native Cover (Transects)	**108.8%**	24.6%	34.2%	30.6%	--	37.2%	--	57.5%	--	49.1%	51.2%	--	56.0%	--
Percent Mean Shrub Cover	**107.6%**	21.1%	31.3%	28.4%	--	33.8%	--	51.3%	--	35.2%	38.4%	--	41.0%	--
Percent Mean Herbaceous Cover (Transects)	**1.2%**	3.5%	2.8%	2.2%	--	3.3%	--	6.2%	--	14.0%	12.7%	--	15.0%	--
Percent Mean Herbaceous Species Cover (Quadrats)	**--**	--	--	--	--	--	--	18.9%	--	--	--	--	--	--
Total Percent Mean Native Cover (Herbaceous Quadrats)	**--**	--	--	--	--	--	--	19.1%	--	--	--	--	--	--

Table 6-6
Future East Garrison MRA
2013-2016 Total Presence and Density of Monterey Spineflower
after Vegetation Cutting

ESCA RP 2016 Annual Natural Resource Report

	Total Plants in Surveyed Grids (Occupied Grids)	Mean Number of Plants per Occupied Grid	Total Number of All Plants in Plots	Mean Density per Plot	Standard Deviation	90% Confidence Interval	Total Surveyed Grids	Percentage of Occupied Grid Compared to Baseline[1]
Post Activity Data 2013 - 2016								
Vegetation Cut/Target Specific Excavation								
Post-activity Year 1 (2014)	0 (0)	0	0	0.0	--	--	6	0%
Post-activity Year 2 (2013)	138 (1)	138	138	138.0	--	--	2	50%
Post-activity Year 2 (2014)	0 (0)	0	0	0.0	--	--	46	0%
Post-activity Year 3 (2014)	377 (3)	126	92	30.7	38.9	66	307	100%*
Post-activity Year 3 (2015)	0 (0)	0	0	0.0	--	--	346	0%
Post-activity Year 3 (2016)	0 (0)	0	0	0.0	--	--	8	0%
Post-activity Year 4 (2014)	0 (0)	0	0	0.0	--	--	20	0%
Post-activity Year 4 (2015)	12 (2)	6	3	1.5	0.7	3	47	100%
Post-activity Year 4 (2016)	0 (0)	0	0	0.0	--	--	349	0%
Post-activity Year 5 (2015)	0 (0)	0	0	0.0	--	--	26	0%
Post-activity Year 5 (2016)	220 (2)	110	58	29.0	19.8	88	599	100%
2016 Sampling Totals	***220 (2)***	***110***	***58***	***--***	***--***	***--***	***956***	***100%***
Baseline Pre-disturbance								
2010	236 (2)	118	236	118.0	106.0	473.2	2	--
2012	110 (2)	55	110	55.0	52.3	233.6	2	--

*exceeds number of baseline grids sampled

[1]2012 baseline used for comparison because 2010 was an above-average rainfall year.

Table 6-7
Future East Garrison MRA
2013-2016 Total Presence and Density of Sand (Monterey) Gilia
after Vegetation Cutting

ESCA RP 2016 Annual Natural Resource Report

	Total Plants (Occupied Grids)	Mean Number of Plants per Occupied Grid	Total Number of All Plants in Plots	Mean Density per Plot	Standard Deviation	90% Confidence Interval	Total Surveyed Grids	Percentage of Occupied Grid Compared to Baseline[1]
Post Activity Data 2013 - 2016								
Vegetation Cut/Target Specific Excavation								
Post-activity Year 1 (2014)	0 (0)	0	0	0.0	--	--	6	0%
Post-activity Year 2 (2013)	11 (1)	11	11	11.0	--	--	39	100%
Post-activity Year 2 (2014)	0 (0)	0	0	0.0	--	--	46	0%
Post-activity Year 3 (2013)	5 (2)	3	4	2.0	0.0	--	37	100%*
Post-activity Year 3 (2014)	30 (1)	30	9	9.0	--	--	307	100%
Post-activity Year 3 (2015)	0 (0)	0	0	0.0	--	--	346	0%
Post-activity Year 3 (2016)	0 (0)	0	0	0.0	--	--	8	0%
Post-activity Year 4 (2014)	0 (0)	0	0	0.0	--	--	20	0%
Post-activity Year 4 (2015)	13 (3)	4	11	3.7	3.8	6	47	100%*
Post-activity Year 4 (2016)	0 (0)	0	0	0.0	--	--	349	0%
Post-activity Year 5 (2015)	0 (0)	0	0	0.0	--	--	26	0%
Post-activity Year 5 (2016)	128 (7)	18	128	18.3	23.7	17	599	100%*
2016 Sampling Totals	***128 (7)***	***18***	***128***	***--***	***--***	***--***	***956***	**100%***
Baseline Pre-Activity								
2010	330 (3)	110	90	30.0	22.9	38.6	3	--
2012	15 (1)	15	15	7.5	6.4	28.4	2	--

*exceeds number of baseline grids sampled

[1]2012 baseline used for comparison because 2010 was an above-average rainfall year.

Table 6-8
Future East Garrison MRA
2013-2016 Total Presence and Density of Seaside Bird's-beak
after Vegetation Cutting

ESCA RP 2016 Annual Natural Resource Report

	Total Plants in Occupied Grids	Mean Number of Plants per Occupied Grid	Total Number of All Plants in Plots	Mean Density per Plot	Standard Deviation	90% Confidence Interval	Total Surveyed Grids	Percentage of Occupied Grid Compared to Baseline
Post-Activity Data 2013 -2016								
Vegetation Cut/Target Specific Excavation								
Post-activity Year 1 (2014)	0 (0)	--	--	--	--	--	6	--
Post-activity Year 2 (2014)	132 (2)	66	38	19.0	1.4	6	46	100%*
Post-activity Year 3 (2013)	187 (1)	187	61	61.0	0.0	--	37	100%*
Post-activity Year 3 (2014)	243 (4)	61	46	11.5	10.2	12	307	100%*
Post-activity Year 3 (2015)	202 (2)	101	19	9.5	12.0	54	346	100%*
Post-activity Year 3 (2016)	0 (0)	0	0	0.0	--	--	8	--
Post-activity Year 4 (2014)	0 (0)	0	0	--	--	--	20	100%*
Post-activity Year 4 (2015)	220 (4)	44	47	9.4	7.4	7	47	100%*
Post-activity Year 4 (2016)	188 (2)	94	33	16.5	10.6	47	349	--
Post-activity Year 5 (2015)	0 (0)	0	0	0.0	--	--	26	100%*
Post-activity Year 5 (2016)	557 (7)	93	80	13.7	13.5	11	599	100%*
2016 Sampling Totals	***745 (9)***	***93***	***113***	**--**	**--**	**--**	***956***	**100%***
Baseline Pre-disturbance								
2010	--	--	--	--	--	--	--	--
2012	--	--	--	--	--	--	--	--
Reference Plots								
2014 Survey	139 (3)	46	15	5.0	1.7	2.9	4	100%*
2015 Survey	112 (3)	37	16	5.3	2.1	3.5	3	100%*
2016 Survey	24 (3)	8	16	5.3	2.1	3.5	3	100%*

*exceeds number of baseline grids sampled