FORA ESCA REMEDIATION PROGRAM

FINAL

Group 4

Remedial Investigation / Feasibility Study Work Plan

Volume 1 - Work Plan

Future East Garrison Munitions Response Area

Former Fort Ord
Monterey County, California

October 8, 2010

Prepared for:

FORT ORD REUSE AUTHORITY

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Future East Garrison Munitions Response Area
Former Fort Ord
Monterey County, California

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ACRONYMS AND ABBREVIATIONS

ACES	Areas Covered by Environmental Services
AOC	Administrative Order on Consent
ARARs	applicable or relevant and appropriate requirements
Army	United States Department of the Army
ASP	Ammunition Supply Point
bgs	below ground surface
BO	biological opinion
CA	chemical agent
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIOP	Community Involvement and Outreach Program
CMS	CMS Environmental, Inc
CRP	Community Relations Plan
CSM	Conceptual Site Model
CSUMB	California State University Monterey Bay
CTS	California tiger salamander
DMM	discarded military munitions
DOD	United States Department of Defense
DQO	Data Quality Objective
DTSC	Department of Toxic Substances Control
EOD	explosive ordnance disposal
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
ESCA	Environmental Services Cooperative Agreement
ESCA RP	Environmental Services Cooperative Agreement Remediation Program
FS	Feasibility Study
FFA	Federal Facility Agreement
FORA	Fort Ord Reuse Authority
FOSET	Findings of Suitability of Early Transfer
G4 SAP	Group 4 Sampling and Analysis Plan
GIS	Geographical Information System
HFA	Human Factors Applications, Inc.
HMP	Habitat Management Plan
ISD	Insufficient Data
km	kilometer

LFR	LFR Inc.
MEC	munitions and explosives of concern
MD	munitions debris
mm	millimeter
MMRP	Military Munitions Response Program
MRA	Munitions Response Area
MRS	Munitions Response Site
msl	mean sea level
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRMA	natural resources management area
OE	Ordnance and Explosives
PRGs	preliminary remediation goals
QA	quality assurance
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
RAOs	Remedial Action Objectives
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RQA	Residential Quality Assurance
RWQCB	Regional Water Quality Control Board
SEDR	Summary of Existing Data Report
SOP	standard operating procedure
SS/GS	Site Stats/Grid Stats
TBC	to be considered
TRC	Technical Review Committee
USA	USA Environmental, Inc.
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
UXO	unexploded ordnance

GLOSSARY

Anomaly
Any item that is seen as a subsurface irregularity after geophysical investigation. This irregularity should deviate from the expected subsurface ferrous and non-ferrous material at a site (i.e., pipes, power lines, etc.).

Anomaly Avoidance

Techniques employed on property known or suspected to contain unexploded ordnance (UXO), other munitions that may have experienced abnormal environments (e.g., discarded military munition [DMM]), munitions constituents in high enough concentrations to pose an explosive hazard, or chemical agent (CA), regardless of configuration, to avoid contact with potential surface or subsurface explosive or CA hazards, to allow entry to the area for the performance of required operations.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980
CERCLA authorizes federal action to respond to the release or threatened release of hazardous substances into the environment or a release or threatened release of a pollutant or contaminant into the environment that may present an imminent or substantial danger to public health or welfare.

Construction Support
Assistance provided by United States Department of Defense (DOD) explosive ordnance disposal (EOD) or UXO-qualified personnel and/or by personnel trained and qualified for operations involving CA, regardless of configuration, during intrusive construction activities on property known or suspected to contain UXO, other munitions that may have experienced abnormal environments (e.g., DMM), munitions constituents in high enough concentrations to pose an explosive hazard, or CA, regardless of configuration, to ensure the safety of personnel or resources from any potential explosive or CA hazards.

Covenant Deferral Request
A letter along with a supporting information package known as a Covenant Deferral Request (CDR) is assembled by the Federal landholding to formally request deferral of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) covenant until all remediation has been accomplished prior to transfer. United States Environmental Protection Agency (EPA) requires that the information is: 1) of sufficient quality and quantity to support the request for deferral of the CERCLA Covenant; and 2) that it provides a basis for EPA to make its determination. This information is submitted to EPA in the form of a CDR.

Deferral period
The period of time that the CERCLA covenant warranting that all remedial action is complete before transfer, is deferred through the Early Transfer Authority.

Discarded Military Munitions (DMM)
Generally, military munitions that have been abandoned without proper disposal or removed

from storage in a military magazine or other storage area for the purpose of disposal. The term does not include UXO, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations. (10 U.S.C. 2710(e)(2))

Early Transfers

The transfer by deed of federal property by DOD to a nonfederal entity before all remedial actions on the property have been taken. Section 120 (h)(3)(C) of the CERCLA allows Federal agencies to transfer property before all necessary cleanup actions have been taken. This provision, known as early transfer authority, authorizes the deferral of the CERCLA covenant when the findings required by the statute can be made and the response action assurances required by the statute are given. The Governor of the state where the property is located must concur with the deferral request for property not listed on the National Priorities List (NPL). For NPL property, the deferral must be provided by the EPA with the concurrence of the Governor. Upon approval to defer the covenant, DOD may proceed with the early transfer.

ESCA RP Team

LFR Inc., Weston Solutions, Inc., and Westcliffe Engineers, Inc.

Exclusion Zone

A safety zone established around a MEC work area. Only essential project personnel and authorized, escorted visitors are allowed within the exclusion zone. Examples of exclusion zones are safety zones around MEC intrusive activities and safety zones where MEC are intentionally detonated.

Explosive

A substance or a mixture of substances that is capable by chemical reaction of producing gas at such temperature, pressure, and speed as to cause damage to the surroundings. The term “explosive” includes all substances variously known as high explosives and propellants, together with igniters, primers, initiators, and pyrotechnics (e.g., illuminant, smoke, delay, decoy, flare, and incendiary compositions).

Feasibility Study (FS)

The primary objective of the FS is “to ensure appropriate remedial alternatives are being developed and evaluated and an appropriate remedy selected” [NCP 40 CFR 300.430(e)].

Geophysical Reacquisition

Geophysical Reacquisition involves utilizing both a positioning method (i.e., Global Positioning System [GPS], ultrasonic, or tape from corners) and geophysical instruments to reacquire and pinpoint anomaly locations selected by the geophysical processors. The geophysical instruments include the original instrument used for the digital survey of the grid and the analog instrument being utilized by the UXO teams for intrusive activities. The intended result of this method is to pinpoint the location where the intrusive teams will find the subsurface item causing the anomaly.

Intrusive Activity
An activity that involves or results in the penetration of the ground surface at an area known or suspected to contain MEC. Intrusive activities can be of an investigative or removal action nature.

mag and dig
Utilizing hand held geophysical instruments to detect anomalies and immediately investigating the anomalies (without using collection of digital data and post processing to determine which anomalies to dig) by manual digging or with the assistance of heavy equipment

Material Documented as Safe (MDAS)
Material Potentially Presenting an Explosive Hazard (MPPEH) that has been assessed and documented as not presenting an explosive hazard and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH.

Material Documented as an Explosive Hazard (MDEH)
MPPEH that cannot be documented as MDAS, that has been assessed and documented as to the maximum explosive hazards the material is known or suspected to present, and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH.

Material Potentially Presenting an Explosive Hazard (MPPEH)
Material that, prior to determination of its explosives safety status, potentially contains explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris); or material potentially containing a high enough concentration of explosives such that the material presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated munitions production, demilitarization or disposal operations). Excluded from MPPEH are munitions within DOD's established munitions management system and other hazardous items that may present explosion hazards (e.g., gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions.

Memorandum of Agreement (MOA)
"Memorandum of Agreement Among the Fort Ord Reuse Authority, Monterey County and Cities of Seaside, Monterey, Del Rey Oaks and Marina, California State University Monterey Bay, University of California Santa Cruz, Monterey Peninsula College, and the Department of Toxic Substances Control Concerning Monitoring and Reporting of Environmental Restrictions on the Former Fort Ord, Monterey County, California"

Military Munitions
All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DOD, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives, and

chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components of the above. The term does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, other than non-nuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitization operations under the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) have been completed. (10 U.S.C. 101(e)(4)(A through C)).

Military Munitions Response Program
Department of Defense-established program that manages the environmental, health and safety issues presented by munitions of explosives concern.

Minimum Separation Distance (MSD)
Minimum distance between a potential explosion site (PES) and personnel, assets, or structures, required to provide the appropriate level of protection from a detonation (either intentional or unintentional) at the PES. Munitions and Explosives of Concern (MEC)
A term distinguishing specific categories of military munitions that may pose unique explosives safety risks means: (A) UXO, as defined in 10 U.S.C. 101(e)(5)(A) through (C); (B) Discarded military munitions (DMM), as defined in 10 U.S.C. 2710(e)(2); or (C) Munitions constituents (e.g., TNT, RDX), as defined in 10 U.S.C. 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Munitions Constituents (MC)
Any materials originating from UXO, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (10 U.S.C. 2710).

Munitions Debris (MD)
Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

Munitions Response Area (MRA)
Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges and munitions burial areas. A munitions response area is comprised of one or more munitions response sites.

Munitions Response Site (MRS)
A discrete location within an MRA that is known to require a munitions response.

Ordnance and Explosives (OE)
See MEC.

Quality Assurance (QA)
An integrated system of management activities involving planning, implementation,

assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed to meet project requirements.

Quality Control (QC)

The overall system of operational techniques and activities that measures the attributes and performance of a process, item, or service against defined standards that are used to fulfill requirements for quality.

Record of Decision (ROD)

A ROD is the document used to record the remedial action decision made at a National Priorities List property. The ROD will be maintained in the project Administrative Record and project file.

Remedial Investigation (RI)

The RI is intended to "adequately characterize the site for the purpose of developing and evaluating an effective remedial alternative" (NCP, 40 CFR 300.430(d)). In addition, the RI provides information to assess the risks to human health, safety, and the environment that were identified during risk screening in the site investigation.

Remedial Actions

Those actions consistent with a permanent remedy taken instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health, welfare, or the environment. The term includes but is not limited to such actions at the location of the release as storage; confinement; perimeter protection using dikes, trenches, or ditches; clay cover; neutralization; cleanup of released hazardous substances and associated contaminated materials; recycling or reuse; diversion; destruction; segregation of reactive wastes; dredging or excavations; repair or replacement of leaking containers; collection of leachate and runoff; on-site treatment or incineration; provision of alternative water supplies; and any monitoring reasonably required to assure that such actions protect the public health, welfare, and the environment. The term includes the costs of permanent relocation of residents and businesses and community facilities where the President of the United States determines that, alone or in combination with other measures, such relocation is more cost-effective and environmentally preferable to the transportation, storage, treatment, destruction, or secure disposition off site of hazardous substances, or may otherwise be necessary to protect the public health or welfare. The term includes off-site transport and off-site storage, treatment, destruction, or secure disposition of hazardous substances and associated contaminated materials.

Response Action

Action taken instead of or in addition to a removal action to prevent or minimize the release of MEC so that it does not cause substantial danger to present or future public health or welfare or the environment.

Unexploded Ordnance (UXO)

Military munitions that (A) have been primed, fuzed, armed, or otherwise prepared for action; (B) have been fired, dropped, launched, projected, or placed in such a manner as to constitute

a hazard to operations, installation, personnel, or material; and (C) remain unexploded either by malfunction, design, or any other cause. (10 U.S.C. 101(e)(5)(A) through (C)).

UXO-Qualified Personnel

Personnel who have performed successfully in military EOD positions, or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist, or Senior UXO Supervisor.

UXO Technicians

Personnel who are qualified for and filling Department of Labor, Service Contract Act, Directory of Occupations, contractor positions of UXO Technician I, UXO Technician II, and UXO Technician III.

EXECUTIVE SUMMARY

This Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan ("the Group 4 RI/FS Work Plan") describes the cleanup of munitions and explosives of concern (MEC) on portions of the former Fort Ord in Monterey County, California (Figure 1). Group 4 is composed entirely of the Future East Garrison Munitions Response Area (MRA; Figure 2). The objective of this Group 4 RI/FS Work Plan is to outline the steps that will be taken to: 1) evaluate whether the nature and extent of MEC has been adequately characterized; 2) assess explosives safety risk that may be present; and 3) develop, screen, and evaluate alternatives to reduce the potential explosives safety risk to current and future property owners and the general public. An initial evaluation of the data for the Group 4 MRA was conducted as part of the Summary of Existing Data Report, and the results indicated that the existing data were of sufficient quantity to characterize the MRA for the purpose of completing the RI/FS and no data gaps were identified. However, a portion of the Future East Garrison MRA has not undergone investigation; therefore, additional field investigation activities are planned for selected areas of the MRA. The results of the investigation activities will be presented in the RI/FS report for Group 4.

This Group 4 RI/FS Work Plan presents the tasks to be performed to complete the RI/FS process, including documenting the nature and extent of MEC, completing a risk assessment, and conducting a Feasibility Study (FS) for the Group 4 MRA. In order to complete the RI/FS process for the Group 4 MRA, an assessment of the risk of explosive hazard is required. To properly assess explosives safety risks that may be present at the Group 4 MRA, and to recommend an appropriate remedial alternative, the quality and quantity of existing data for the Group 4 MRA must be evaluated. The existing data will be further analyzed to document that the data are of sufficient quality to support an evaluation of alternatives for the FS and that the removal data are sufficient to be used to support explosives safety risk management decision making.

Once the data are determined to be sufficient, the Group 4 MRA will proceed to the risk assessment phase. The explosives safety risk assessment will be conducted using the specific protocol previously developed to evaluate current and future explosives safety risks at the former Fort Ord. The Fort Ord Ordnance and Explosives Risk Assessment Protocol allows for a comparative review of MEC risks at affected sites. Once the risk is evaluated, remedial action alternatives will be developed and evaluated in the FS against the nine Comprehensive Environmental Response, Compensation, and Liability Act criteria to identify whether remedial action (e.g., further MEC removal and/or land use controls) will be necessary to mitigate any unacceptable risks. The RI/FS tasks that will be performed to make decisions regarding risk and remedial actions during the Group 4 RI/FS were defined by the Administrative Order on Consent (AOC). The AOC tasks presented in the Group 4 RI/FS Work Plan are consistent with those provided in the United States Environmental Protection Agency's current RI/FS guidance document.

Work Plan Organization

The Group 4 RI/FS Work Plan has been divided into two volumes. Volume 1 provides a rationale for the work plan approach including data analysis and validation, summarizes the tasks required to complete the Group 4 RI/FS, and presents an outline for the RI/FS report and an anticipated project schedule for Group 4 field activities and document preparation. Volume 2 presents the Group 4 Sampling and Analysis Plan (G4 SAP) and describes the procedures, methods, and resources that will be used to conduct the field activities associated with the MEC remedial investigation within the Future East Garrison MRA.

Remedial Investigation and Feasibility Study (Volume 1)

Volume 1 presents the tasks to be performed to complete the RI/FS process, including assessing the nature and extent of MEC contamination, conducting a baseline risk assessment, and performing a feasibility study (FS) for Group 4. In order to complete the RI/FS process for Group 4, an assessment of the risk of explosive hazard is required. To properly assess explosives safety risks that may be present at the Future East Garrison MRA and to recommend an appropriate remedial alternative, the quality and quantity of existing data for Group 4, as well as the quality of data collected in the future, must be evaluated. Following the completion of field activities and data collection within the Future East Garrison MRA, the newly collected data and the existing data will be further analyzed to confirm whether the data are of sufficient quality to support an evaluation of alternatives for the FS and whether the removal data are sufficient to be used to support explosives safety risk management decision making.

If the data are determined to be sufficient, Group 4 will proceed to the risk assessment phase. The explosives safety risk assessment will be conducted using the specific protocol previously developed to evaluate current and future explosives safety risks at the former Fort Ord. The Fort Ord Ordnance and Explosives Risk Assessment Protocol allows for a comparative review of MEC risks at affected sites. Once the baseline risk is evaluated, remedial action alternatives will be developed and evaluated in the FS against the nine CERCLA criteria to identify whether remedial action (e.g., further MEC removal and/or land use controls) will be necessary to mitigate any unacceptable risks. The RI/FS tasks that will be performed to make decisions regarding risk and remedial actions during the Group 4 RI/FS were defined by the AOC and are consistent with those provided in the EPA's current RI/FS guidance document.

Sampling and Analysis Plan (Volume 2)

The G4 SAP describes the procedures, methods, and resources that will be used to conduct the field activities associated with the MEC remedial investigation (RI) in the Future East Garrison MRA.

The Future East Garrison MRA areas proposed for investigation in the G4 SAP include Parcels E11b.6.1, E11b.7.1.1, and L20.19.1.1. The objective of this RI is to further define the

nature and extent of MEC contamination within the MRA prior to conducting the risk assessment as part of the RI/FS.

The investigation areas identified in the G4 SAP include property within the Future East Garrison MRA that is designated for future reuse as nonresidential development and habitat reserve. These areas will be investigated utilizing transects and existing trails and sampling grids. The areas will be initially investigated using analog instruments with digital geophysical surveys on those portions where warranted. Anomalies will be excavated to the depth of detection.

Fieldwork will be conducted in accordance with the health and safety requirements identified in the explosives siting plan and the site-specific safety and health plan presented in the G4 SAP. MEC will be handled, stored, and transported in accordance with the guidelines set forth in the explosives management plan, which are based on federal regulations. Data will be collected and managed (including validation and quality control) in accordance with the quality control procedures outlined in the G4 SAP.

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1.0 INTRODUCTION

The former Fort Ord is located near Monterey Bay in the northwestern portion of Monterey County, California. Since 1917, portions of the former Fort Ord were used by infantry units for maneuvers, target ranges, and other purposes. Military munitions were fired into, fired upon, or used on the facility in the form of artillery and mortar projectiles, rockets, and guided missiles, rifle and hand grenades, land mines, pyrotechnics, bombs, and demolition materials. Some of these military munitions are still present at the former Fort Ord as either munitions and explosives of concern (MEC) or munitions debris (MD).

This Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan ("the Group 4 RI/FS Work Plan") was prepared by the Environmental Services Cooperative Agreement Remediation Program (ESCA RP) Team ("the ESCA RP Team") on behalf of the Fort Ord Reuse Authority (FORA) in compliance with an Administrative Order on Consent (AOC), which addresses cleanup of portions of the former Fort Ord in Monterey County, California (Figure 1). Group 4 is composed entirely of the Future East Garrison Munitions Response Area (MRA; Figure 2). The ESCA RP Team consists of FORA's contractors: LFR Inc., Weston Solutions, Inc., and Westcliffe Engineers, Inc.

The AOC was entered into voluntarily by the United States Environmental Protection Agency (EPA) Region 9, the Department of Toxic Substances Control (DTSC), FORA, and the United States Department of Justice Environment and Natural Resources Division (EPA Region 9 CERCLA Docket No. R9-2007-03). This AOC was issued under the authority vested in the President of the United States by Sections 104, 106, and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 United States Code (U.S.C.) §§ 9604, 9606, and 9622.

This Group 4 RI/FS Work Plan outlines the steps to be taken to: 1) evaluate whether the nature and extent of MEC has been adequately characterized; 2) assess explosives safety risk that may be present; and 3) develop, screen, and evaluate alternatives to reduce the potential explosives safety risk to current and future property owners and the general public. The results of the above steps will be documented in the RI/FS report for use by the United States Department of the Army (Army) in developing the proposed plan and making a decision on remedial actions.

This effort was sponsored by the Army, Assistant Chief of Staff Installation Management. The content of the information does not necessarily reflect the position or policy of the Government and no official endorsement should be inferred.

1.1 Work Plan Purpose

The purpose of the Group 4 RI/FS Work Plan as defined under Task 3 of the AOC Scope of Work is to propose methodology to obtain the necessary information identified in the Summary of Existing Data Report (SEDR) to characterize the nature and extent of MEC in order to propose a preferred remediation alternative pursuant to CERCLA. In compliance

with AOC paragraph 25, at a minimum, the Group 4 RI/FS Work Plan includes plans and schedules for the following activities:

- Collection of data and validation of existing data necessary to characterize conditions under previous investigations
- Human health risk assessment
- Development and screening of a range of possible remedial alternatives
- Detailed analysis of alternatives
- Development of sufficient information to enable the Army to select appropriate remedies for each parcel comprising the site

The results of the above activities will be documented in the RI/FS report for use by the Army in developing the proposed plan and making a remedial action decision.

1.2 Work Plan Objectives

The objectives of the Group 4 RI/FS Work Plan are to:

- Present the overall RI/FS process for MEC remediation within the Group 4 MRA
- Provide background information on the Group 4 MRA as it relates to MEC
- Summarize previous MEC investigations, sampling, and/or removal actions in the Group 4 MRA
- Describe the investigative approaches to collect the data necessary to further define the nature and extent of MEC within the MRA prior to conducting the risk assessment as part of the RI/FS
- Provide an initial evaluation of the nature and extent of MEC in the environment and identify the potential receptors and routes of exposure to MEC hazards
- Document data requirements for explosives safety risk and response alternative evaluations

1.3 Former Fort Ord Munitions Response Program

This section summarizes the munitions response program related to MEC cleanup that was previously implemented at the former Fort Ord by the Army and the subsequent program that was implemented to continue MEC remediation in portions of the former Fort Ord by FORA.

1.3.1 Cleanup Program Under the Army

The former Fort Ord was placed on the National Priorities List (NPL) in 1990, primarily because of chemical contamination in soil and groundwater that resulted from past Army occupation. To oversee the cleanup of the base, the Army, DTSC, the Central Coast Regional Water Quality Control Board (RWQCB), and 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 actions were taken as necessary to protect the public health and the environment. In accordance with the FFA, the Army was designated as the lead agency under CERCLA for conducting environmental investigations, making cleanup decisions, and taking cleanup actions at the former Fort Ord. The EPA was designated as the lead regulatory agency for the cleanup, while the DTSC and RWQCB are supporting agencies.

Since the closure of Fort Ord, cleanup operations have been performed to address the presence of MEC and to prepare former Fort Ord property for transfer to federal, state, and local agencies and the surrounding Monterey County communities. The Army conducted a number of MEC survey and clearance activities, including geophysical surveys. The Army performed its activities pursuant to the President of the United States' authority under CERCLA Section 104, as delegated to the Army in accordance with Executive Order 12580 and in compliance with the process set out in CERCLA Section 120.

In November 1998, the Army agreed to evaluate MEC at the former Fort Ord and perform a base-wide Munitions Response RI/FS consistent with CERCLA. The base-wide RI/FS program addressed MEC hazards on the former Fort Ord and evaluated past removal actions as well as recommended future remedial actions deemed necessary to protect human health and the environment under future uses. In April 2000, an agreement was signed between the Army, EPA, and DTSC to evaluate MEC at the former Fort Ord subject to the provisions of the FFA. The signatories agreed that the FFA provided the appropriate framework and process to address the Army's MEC activities. The FFA established schedules for performing RI/FSs, and required that remedial actions be completed expeditiously.

The Army's approach to categorizing areas within the former Fort Ord includes track groupings consisting of Track 0 through Track 3. Specifically, track definitions are as follows:

- Track 0: Areas that contain no evidence of MEC and have never been suspected of having been used for military munitions-related activities. In June 2002, the Army signed a Track 0 Record of Decision (ROD). The Track 0 ROD addresses selected land parcels, and also provides a Plug-In process to address future land parcels that are considered eligible for inclusion into the Track 0 process.
- Track 1: Sites where military munitions were suspected to have been used but, based on results, the sites fall into one of three categories: 1) sites with no evidence to indicate that military munitions were used; 2) sites used for training but military munitions used do not pose an explosive hazard; or 3) sites used for training but military munitions potentially remaining do not pose an unacceptable risk. In April 2005, the Army signed a Track 1 ROD. The Track 1 ROD addresses selected land parcels, and also provides a Plug-In process to address future land parcels that are considered eligible for inclusion into the Track 1 process.
- Track 2: Sites where MEC were present and MEC removal has been conducted.

- Track 3: Sites where MEC are known or suspected but investigations have not been initiated or completed.

In addition, to remain consistent with the federal Endangered Species Act (ESA), the Army has completed consultations with the United States Fish and Wildlife Service on the Army's predisposal actions, including cleanup of MEC. These consultations have resulted in biological opinions that include endangered species incidental take permits. These permits allow impacts to, and incidental take of, listed species during MEC cleanup activities, but require mitigation measures to be implemented during the MEC cleanup activities to reduce and minimize impacts to the protected species and their habitats.

1.3.2 Process for Early Transfer of Former Fort Ord Property

The transfer of a portion of the former Fort Ord, pursuant to CERCLA Section 120(h)(3)(C), was requested by FORA in a letter dated May 18, 2005. Under CERCLA Section 120(h)(3), the United States is required to provide a covenant in deeds conveying the property, warranting that all remedial action necessary to protect human health and the environment has been taken before the date of transfer. For a federal facility listed on the NPL, CERCLA Section 120(h)(3)(C) allows the EPA Administrator, with concurrence of the governor of the state, to defer the CERCLA covenant requirement. These types of transfers under CERCLA Section 120(h)(3)(C) are typically called "Early Transfers," in which the United States provides the warranty after transfer of the property when all of the response actions necessary to protect human health and the environment have been taken. The period between the transfer of title and the making of this final warranty is known as the "deferral period." Early Transfers allow productive reuse of the property through access while final remediation work is being conducted.

The EPA Administrator, with the concurrence of the governor of the state in which the property is located, may defer the CERCLA warranty requirement if the property is determined to be suitable for transfer. In addition, United States Department of Defense (DOD) and Army policy require that the Military Department proposing to transfer property prepare a Finding of Suitability for Early Transfer (FOSET). This FOSET will be submitted as part of the Covenant Deferral Request, in which the Army will seek approval by the EPA Administrator and concurrence by the governor of the state of the Early Transfer.

On March 31, 2007, the Army and FORA entered into an Environmental Services Cooperative Agreement (ESCA) to provide MEC remediation services during the deferral period, thereby allowing the Army to transfer approximately 3,340 acres of property and the responsibility of removing MEC to FORA as an Economic Development Conveyance. The former Fort Ord property being transferred under the ESCA is shown on Figure 1 and is collectively referred to as the Areas Covered by Environmental Services (ACES). The final FOSET for the ACES was signed in November 2007 (Army 2007). In accordance with the ESCA, FORA is responsible for addressing all response actions for the property except for those responsibilities retained by the Army. To accomplish this effort, FORA entered into an agreement with the ESCA RP Team to assist in the completion of the MEC cleanup activities in accordance with the ESCA and the AOC. During the ESCA, FORA is responsible for

administrative and management program elements, while the ESCA RP Team conducts the MEC remediation under FORA oversight.

1.3.3 FORA ESCA Remediation Program

As defined by the ESCA, the Army prepared a Technical Specifications and Requirement Statement to identify the general specifications for the environmental services to be conducted by FORA under the ESCA RP. The purpose of the ESCA RP is to provide the necessary environmental services to FORA, which include characterization, assessment of risk of explosive hazards, Feasibility Study (FS), remediation alternatives analysis, and performance of remediation of hazardous substances, including but not limited to MEC, which pose unacceptable risk to human health and the environment. A primary benefit of the ESCA RP is to facilitate completion of these activities in a manner that is more expeditious than could be performed by the Army.

The primary objective of the ESCA RP is to complete a timely cleanup of the property in accordance with the ESCA and AOC, while promoting and enhancing the public health and safety of current and future users of the property. In addition, the ESCA RP allows remediation activities to be integrated with community reuse objectives, such as the construction of street improvements and backbone utility infrastructure.

1.4 Preliminary RI/FS Scoping and Implementation

Based on an evaluation of the available data, Conceptual Site Models (CSMs), preliminary assessments of risk, and regulatory pathway requirements, the nine MRAs were consolidated into four groups (i.e., Group 1 through Group 4). Each group consists of one or more MRAs that have similar pathway-to-closure characteristics. The four groups are shown on Figure 2. This work plan focuses on the Group 4 MRA.

Group 4 consists only of the Future East Garrison MRA (formerly referred to as the East Garrison MRA; Figures 2, 3, 4, and 5). Surface and/or subsurface MEC removal actions have been conducted within the Group 4 MRA. Military munitions encountered during these actions are consistent with the historical use of the areas. Data from these munitions response actions are available in the Military Munitions Response Program (MMRP) database and after-action reports, and will be used to support the development of an RI/FS along with data collected during additional field investigation activities.

1.4.1 Summary of Existing Data Report

A SEDR was completed for the ACES by the ESCA RP Team as required under Task 2 of the AOC (ESCA RP Team 2008a). In the SEDR, ESCA parcels were combined into nine MRAs to facilitate the implementation of the AOC. The SEDR provided a site overview, evaluation of existing data, identification of data gaps, a CSM including an initial assessment of explosives safety risks, and proposed future use for each MRA. The SEDR also presented conclusions and recommendations for further actions and formed the basis for the Remedial Investigation (RI) planning efforts.

One of the goals of the SEDR was to develop a process to complete the remaining steps in the sequence and phasing of the CERCLA activities, as described in the AOC, within Group 4. The overall process for navigating Group 4 through the CERCLA process and a detailed regulatory pathway to closure was developed and presented in the SEDR. The regulatory pathway to closure, as presented in the SEDR, has been revised to include RI fieldwork that will be conducted to support the development of the RI/FS and is illustrated on Figure 6 of this work plan. The regulatory pathway for Group 4 considers the conclusions and recommendations presented in the CSM for the Group 4 MRA; the CSM is discussed in more detail in Section 3.0 of this work plan.

The proposed pathway to closure for Group 4 is depicted on Figure 6. Group 4 enters the pathway beginning with preparation of this RI/FS Work Plan. Data collected through additional fieldwork, along with existing data and information generated by the Army, will be used to support the development of an RI/FS report. Upon completion of the RI/FS report, an Army proposed plan and ROD will be prepared to document remedial actions necessary to achieve regulatory closure under CERCLA. The Army ROD will be implemented via the AOC process. The ROD implementation will include preparation of a Remedial Design/Remedial Action Work Plan and an Institutional Control Implementation Plan, execution of necessary remedial actions, and preparation of a Remedial Action Completion Report to document that the requirements for closure have been achieved.

1.5 Work Plan Organization

This Group 4 RI/FS Work Plan was prepared in accordance with the EPA "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988b). This Group 4 RI/FS Work Plan is organized in two volumes, which contain the following components:

Volume 1 – Work Plan

- **Executive Summary**
- **Section 1 – Introduction.** This section includes a general explanation of the reasons for the RI/FS and the expected results or goals.
- **Section 2 – History and Physical Setting.** This section provides an overview of the current understanding of the physical setting, history, and condition of the Group 4 MRA.
- **Section 3 – Initial Evaluation.** This section presents an initial characterization of military training activities conducted within the Future East Garrison MRA based on the information documented in the SEDR.
- **Section 4 – Work Plan Rationale.** This section presents the work plan approach, documentation of data requirements for both the explosives safety risk assessment and the alternatives evaluation, and an explanation of how RI/FS tasks will meet Data Quality Objective (DQO) needs.
- **Section 5 – Group 4 RI/FS Tasks.** This section summarizes the 11 tasks for completing an RI/FS.

- **Section 6 – Reporting and Scheduling.** This section includes a generalized outline for the RI/FS report and an anticipated project schedule.
- **Section 7 – References.** This section provides a list of references to pertinent documents cited in this work plan.

Volume 2 – Sampling and Analysis Plan

- **Section 1 – Introduction.** This section includes the general purpose and scope of the Sampling and Analysis Plan (SAP).
- **Section 2 – Technical Management Plan.** This section outlines the procedures and methods that will be used to complete the field investigation removal activities.
- **Section 3 – Explosives Management Plan.** This section provides the minimum procedures and safety and health requirements applicable to the acquisition, storage, accountability, and transportation of demolition materials and MEC.
- **Section 4 – Explosives Siting Plan.** This section outlines the procedures that will be used to perform MEC identification, treatment operations, and storage of explosives.
- **Section 5 – Geophysical Investigation Plan.** This section outlines the geophysical surveys that will be conducted to establish and record the locations of geophysical anomaly targets.
- **Section 6 – Site Safety and Health Plan.** This section establishes the general guidelines and procedures to ensure protection of personnel and the public while performing the field investigation and removal operations.
- **Section 7 – Location Surveys and Mapping Plan.** This section outlines the tools and methodologies that will be used for the efficient and accurate completion of surveying, mapping, and Geographical Information System (GIS) operations.
- **Section 8 – Work Management Plan.** This section provides an anticipated schedule for the completion of the activities presented in the SAP.
- **Section 9 – Property Management Plan.** This section provides procedures for the management of property during the project.
- **Section 10 – Sampling and Analysis Plan.** This section includes a summary of sampling and analysis procedures to be implemented during non-MEC-related activities.
- **Section 11 – Quality Control Plan.** This section establishes and describes the quality requirements for completion of the field investigation and removal operations.
- **Section 12 – Environmental Protection Plan.** This section outlines the procedures that will be implemented to protect natural resources.
- **Section 13 – Investigation-Derived Waste Plan.** This section outlines the procedures for managing wastes that are generated during the field investigation and removal operations.
- **Section 14 – References.** This section provides a list of references to pertinent documents cited in the Group 4 Sampling and Analysis Plan (G4 SAP).

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2.0 HISTORY AND PHYSICAL SETTING

This section provides a summary of the MEC-related history, physical setting, and land use related to the former Fort Ord and the Group 4 MRA. An evaluation of these components is included in Section 3.0 of this work plan.

2.1 MEC-Related History

In 1917, the Army bought a portion of the Main Garrison and East Garrison and nearby lands on the eastern side of the former Fort Ord to use as a maneuver and training ground for field artillery and cavalry troops stationed at the Presidio of Monterey. Prior to acquisition by the Army, the land was in agricultural use. No permanent improvements were constructed until the late 1930s. In the 1940s, more land was purchased to expand the development of the Main Garrison area, and the beach range area was given to the Army. With up to 15,000 active duty military personnel and 5,100 civilians working on site during its active history, the former Fort Ord Garrison areas resembled a mid-sized city, with accompanying family housing, medical facilities, warehouses, office buildings, industrial complexes, and gas stations.

Fort Ord was used to train Army infantry, cavalry, and field artillery units until formal closure. In support of the training of soldiers, military munitions were used at the ranges throughout the former Fort Ord. As a result of the training activities, a wide variety of conventional MEC (related to infantry and artillery training) have been encountered in areas throughout the former Fort Ord. The MEC encountered at the former Fort Ord have been either unexploded ordnance (UXO) or discarded military munitions (DMM).

The Group 4 MRA includes all or portions of several Munitions Response Sites (MRSs), which have been evaluated for the presence of MEC, and portions of property that lie outside the MRS boundaries, which have had little or no evaluation for the presence of MEC. Within the MRS boundaries, these evaluations have included one or more of the following actions: site reconnaissance, surface and/or subsurface MEC investigation, and/or MEC removal actions. The evaluation of those portions of the parcels lying outside of the MRS boundaries included a site assessment. The MEC-related history for the Future East Garrison MRA is summarized in the following paragraphs.

Initial use of the Future East Garrison MRA began in approximately 1917 when the U.S. government purchased more than 15,000 acres of land and designated it as an artillery range. Although no training maps from this time period have been found, pre-World War II-era military munitions have been removed during previous Army response actions within the Future East Garrison MRA.

Known and suspected training sites in the vicinity of the Future East Garrison MRA are shown on Figure 3 and include (USACE 1997a and Parsons 2006):

- Demolition Training Area and Hand Grenade Area
- Mechanic Training Area

- Rifle Grenade Area
- Engineer Training Area "C"
- Suspected impact area for Stokes trench mortars (the locations of possible firing points are unknown)

Three areas of the Future East Garrison MRA were designated as MRSs based on historical information. The MRSs were designated as MRS-11, MRS-23, and MRS-42, which includes an expanded area identified as MRS-42 EXP (Figure 4). The MRSs were identified in the Revised Archive Search Report and subsequent site assessment documents as follows:

- MRS-11 - Demolition Training Area and Hand Grenade Area
- MRS-23 - Engineer Training Area / Field Expedient Area and Mechanic Training Area
- MRS-42 - Rifle Grenade Area

Also, the safety fans for the former East Garrison Small Arms Ranges, located to the northwest, extended onto the MRA (Figure 4).

Several investigation and removal actions were conducted by the Army in the Future East Garrison MRA. These actions included the following:

MRS-11

- A magnetometer assisted visual surface removal across 14.4 acres and a removal action to a depth of 1 foot below ground surface (bgs) on 1.6 acres of roads and trails were planned for the southern portion of the MRS. Fieldwork began on December 2, 1997, but was suspended on December 17, 1997 after completing the removal activities on 27 100-foot by 100-foot grids and partial grids in the southern portion of the MRS. On January 9, 1998, the removal activities were revised to consist of a removal action conducted to a depth of 1 foot bgs across the southern 16 acres of the MRS (the 14.4 acres previously identified for visual surface removal plus the 1.6 acres of roads and trails originally planned for the 1-foot removal action; USA 2001b). The revised removal action to a depth of 1 foot bgs occurred intermittently from February 1998 to July 2000 over a total of 75 100-foot by 100-foot grids and partial grids, including the grids that had previously been cleared only of surface items during the magnetometer assisted visual surface removal operation (USA 2001b).
- Site Stats/Grid Stats (SS/GS) sampling conducted in five 100-foot by 200-foot grids in the northern portion of the MRS in May 1998 (USA 2001b).

MRS-23

- Removal action to a depth of 4 feet bgs in 39 100-foot by 100-foot grids and partial grids in the MRS from November to December 1997 (USA 2001a).

MRS-42/MRS-42 EXP

- Removal action to a depth of 4 feet bgs across approximately 45 acres of the MRS from February 1998 to February 2000 (USA 2001c).

A portion of the Future East Garrison MRA was not previously investigated due to the presence of dense vegetation. Previous investigations and removal actions have, however, been conducted immediately adjacent to these areas, which included MRS-19 and MRS-48 located southwest of the MRA. These previous actions included a SS/GS sampling investigation performed by USA Environmental Inc. (USA) on MRS-48 (USA 2001d), a removal action by CMS Environmental, Inc (CMS) on MRS-19 (CMS 1996), and a sampling survey by Human Factors Applications, Inc.(HFA) on MRS-19 (HFA 1994).

The Army also conducted a site assessment of the area referred to as East Garrison Area 4, a portion of which consists of the Future East Garrison MRA (Parsons 2006). Site assessments were conducted to collect data in MRSs, or areas of interest, that may contain or have contained evidence of military munitions training. Although the portions of East Garrison Area 4 that were subjected to the site assessment were not expected to contain evidence of military munitions training, the area as a whole was designated as an area of interest because it contained the above-referenced MRSs and was in close proximity to other MRSs.

During the removal actions, two burial pits containing MEC were discovered in the northeastern portion of MRS-42 EXP. More detailed information on the MEC-related history and nature and extent of MEC within the Future East Garrison MRA has been presented in the SEDR as a CSM. The CSM from the SEDR is provided in Appendix A of this work plan.

2.2 Physical Setting

The former Fort Ord is located approximately 100 miles south of San Francisco and occupies approximately 28,000 acres 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 installation. Laguna Seca Recreational Area and Toro Regional Park border the former Fort Ord to the south and southeast, respectively, as do several small communities, such as Toro Park Estates and San Benancio (Figure 1).

The Future East Garrison MRA is located in the northeastern portion of the former Fort Ord (Figure 1). The Future East Garrison MRA is wholly contained within the jurisdictional boundaries of Monterey County.

The Future East Garrison MRA encompasses approximately 252 acres related to the four United States Army Corps of Engineers (USACE) property transfer parcels E11b.6.1, E11b.7.1.1, E11b.8, and L20.19.1.1 (Figure 5). The total MRA acreage has been revised to reflect the final property transfer boundaries. The revised property transfer boundary incorporated approximately 8 additional acres of land in the northeastern portion of the MRA. The physical setting for the additional land is consistent with the remainder of the MRA.

The terrain of the Future East Garrison MRA varies from gently sloping in the south and west to steep canyon-like walls in the north and east. The elevation ranges from approximately 170 feet mean sea level (msl) to approximately 480 feet msl. Three ravines exist within the MRA; one ravine extends to the east in the southern portion of the MRA, and two converging ravines extend to the northeast in the northern portion of the MRA. The slope of the terrain in the MRA ranges from relatively flat (3 to 5 percent) within the former Ammunition Supply Point (ASP) to steep (up to 50 percent) along the ravines and in places where vertical cliffs of sandstone top the ravines. The MRA is underlain by several hundred feet of eolian deposits (Aromas Eolian Facies) consisting mostly of weathered dune sand. Surface soil conditions in the Future East Garrison MRA are predominantly weathered dune sand, which provides a relatively conducive environment for conducting geophysical surveys, including electromagnetic and magnetic surveys.

The Future East Garrison MRA primarily consists of maritime chaparral with small areas of oak woodland and grassland (USACE/Jones & Stokes 1992). Vegetation varies from sparsely vegetated areas to dense areas of overgrowth and stands of eucalyptus trees. Past field activities have noted the presence of poison oak in various areas of the MRA.

Groundwater investigations associated with the Basewide RI/FS have resulted in the installation of a number of groundwater monitoring wells on former Fort Ord property near the Future East Garrison MRA. The Salinas Groundwater Basin is the main hydrogeologic unit that underlies the Future East Garrison MRA. The depth to groundwater is estimated to be greater than 100 feet bgs and is not expected to influence geophysical surveys conducted for MEC remediation activities. There are no known wells within the boundaries of the Future East Garrison MRA; however, one monitoring well is located to the north-northwest outside the boundaries of the MRA.

There are a number of small aquatic features (i.e., vernal pools, ponds) located within the boundaries of the Future East Garrison MRA, as well as within 500 feet (approximately 150 meters) of the eastern and northeastern boundaries of the Future East Garrison MRA. Most of these features remain from earlier sand and gravel mining operations. A larger aquatic feature is located approximately 1,300 feet (approximately 340 meters) to the northwest of the boundary of Future East Garrison MRA. A small concrete-lined pool that appears to have been used for tank maneuvers is also located in the MRA.

The Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California (HMP; USACE 1997b) identifies the Future East Garrison MRA as development (which includes residential reuse) and habitat reserve with borderland development areas along a natural resources management area (NRMA) interface. The NRMA separates the development category land from the adjacent habitat reserve area. The NRMA and habitat reserve areas support plant and animal species that require implementation of mitigation measures identified in the HMP to ensure compliance with the ESA and to minimize impacts to listed species.

Threatened or endangered plant species identified as having possible occurrence in the Future East Garrison MRA include sand gilia (endangered) and Monterey spineflower (threatened).

A portion of the Future East Garrison MRA has been designated as critical habitat for the Monterey spineflower by the United States Fish and Wildlife Service (USFWS).

In 2004, the California tiger salamander (CTS) was identified as a threatened species. CTS may be found as far as 2 kilometers (km) from aquatic breeding habitats. It is possible the CTS may be found in the Future East Garrison MRA as the MRA is within 2 km of aquatic features (i.e., vernal pools, ponds) that may provide habitat for the CTS.

FORA will implement the mitigation requirements identified in the HMP for MEC activities in accordance with the biological opinions (BOs; USFWS 1999, 2002, and 2005) developed during formal consultation between the Army and the USFWS under Section 7 of the ESA. For habitat areas, these measures include, but are not limited to, conducting habitat monitoring in compliance with Chapter 3 of the HMP (USACE 1997b). For borderland areas, FORA will follow best management practices while conducting work to prevent the spread of exotic species, limit erosion, and limit access to the NRMA. More detailed information on the geology, vegetation, surface water, and groundwater of the Future East Garrison MRA has been presented in the SEDR as a CSM. The CSM from the SEDR is provided in Appendix A of this work plan. The revised property transfer boundary of the Future East Garrison MRA incorporated additional land in the northeastern portion of the MRA. This area was not incorporated at the time the SEDR was completed, and is therefore not included in Appendix A.

2.3 Land Use

The former Fort Ord consists of both developed and undeveloped land. This section summarizes the current and future land uses for the Future East Garrison MRA. More detailed information on the current and future land uses of the Future East Garrison MRA has been documented in the SEDR as a CSM. The CSM for the Future East Garrison MRA prior to the revised property transfer boundaries is provided as Appendix A of this work plan.

2.3.1 Current Land Use

The Future East Garrison MRA is currently undeveloped and unused, with the exception of the former ASP located in the central portion of the MRA (Figure 5). The former ASP was recently used as a staging area in support of Army MEC removal activities. A number of the bunkers (Buildings 760 through 769) have also been used to store explosives in support of the ESCA MEC removal activities. Other structures on the Future East Garrison MRA were used for equipment and supply storage (i.e., trucks, temporary fencing, sand bags, etc.).

2.3.2 Future Land Use

The Fort Ord Base Reuse Plan, adopted by FORA on June 13, 1997, serves as a general development plan for the former base (FORA 1997). Future land uses for the Future East Garrison MRA are predominantly planned for residential and habitat uses with a development corridor for a roadway. It is important to note that the development land use category encompasses infrastructure activities, such as roadway and utility corridor construction, as

well as borderland activities. The additional land incorporated into the Future East Garrison MRA due to the revised property transfer boundaries is identified as a habitat reserve area.

Special circumstances apply at the Future East Garrison MRA for the following types of reuse areas: (1) habitat reserve areas, and (2) borderlands between habitat reserve areas and development areas. The Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California (HMP; USACE 1997b) 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 Group 4 MRA. The HMP for former Fort Ord was prepared in accordance with the USFWS BOs and establishes the guidelines for the conservation and management of wildlife and plant species and habitats that largely depend on former Fort Ord land for survival (USACE 1997b).

3.0 INITIAL EVALUATION

An initial evaluation of the Future East Garrison MRA was conducted during development of a CSM as presented in the SEDR. Development of the CSM included an evaluation of the known historical military use and associated munitions-related activities, as well as existing information related to previous munitions response actions for the MRA. This evaluation included facility profiles, physical profiles, release profiles, land use profiles, ecological profiles, and pathway analyses, to include identification of source areas, accessibility, receptors, and receptor activities that could result in human health risks related to the potential presence of MEC remaining within the MRA. The CSM also provided recommendations and conclusions, which are summarized in Section 4.0 of this work plan. A copy of the Future East Garrison MRA CSM from the SEDR is provided in Appendix A.

The following is a summary of the initial evaluation for the Future East Garrison MRA to support the work plan rationale presented in Section 4.0 of this work plan.

The documented historical use of the Future East Garrison MRA was primarily as a weapons and troop training area (Appendix A). Previous work in the Future East Garrison MRA conducted by the Army included magnetometer-assisted visual surface and 1-foot removal actions in the southern portion of MRS-11 (USA 2001b); SS/GS sampling in the northern portion of the MRS-11 (USA 2001b); a removal action to a depth of 4 feet in MRS-23 (USA 2001a) and MRS-42/MRS-42 EXP (USA 2001c); and a site assessment of the MRA (Parsons 2006). Previous investigations and removal actions in MRSs adjacent to the Future East Garrison MRA included a sampling survey performed in MRS-19 (HFA 1994); removal action in MRS-19 (CMS 1996); and a SS/GS sampling investigation in MRS-48 (USA2001d).

The MEC and MD encountered to date within the MRA are consistent with its documented historical use primarily as a weapons and troop training area. A majority of the MEC items are associated with munitions that were used for the following purposes:

- Direct and Indirect Firing (37 millimeter [mm] low explosive projectiles, mortar projectiles, M9 antitank rifle grenades, and fragmentation hand grenades)
- Illumination (illumination signal, illumination hand grenade, trip flare, and unknown type flare)
- Smoke (M22 smoke rifle grenades and M2 4.2-inch white phosphorous smoke projectile)
- Igniters (M204 hand grenade fuze)
- Demolition (blasting cap and demolition charge)
- Training (M228 practice hand grenade fuzes, M117 explosive booby trap simulators, and 3-inch Stokes practice mortar projectiles)

During the removal actions, two burial pits were encountered in MRS-42 EXP. The MEC found in the burial pits appeared to be related to troop training. A total of 243 of the 336

MEC items were recovered from these burial pits. One burial pit contained 183 M228 practice hand grenade fuzes and the other burial pit contained 60 M117 explosive booby trap simulators; these munitions items are classified as DMM in the MMRP Database. Appendix A provides more detailed information on the specific types of MEC recovered from these burial pits, as well as the types of MEC found elsewhere at the Future East Garrison MRA. In total, the removal actions in the Future East Garrison MRA resulted in the removal of the following:

- 83 UXO items
- 243 DMM items
- 10 Insufficient Data (ISD) items (could not be definitively classified as UXO, DMM, or MD)
- 4,107 pounds of MD (includes MD [expended] and MD [fragmented] items if weights were documented)

According to the Fort Ord MMRP database, of the 336 MEC items, two items were not assigned a hazard classification, 259 items had a hazard classification of 1 (MEC that will cause an injury or, in extreme cases, could cause major injury or death to an individual if functioned by an individual's activities), one item had a hazard classification of 2 (MEC that will cause major injury or, in extreme cases, could cause death to an individual if functioned by an individual's activities), and 74 items had a hazard classification of 3 (MEC that will kill an individual if detonated by an individual's activities).

The Fort Ord MMRP database indicates that the majority of MEC were found in the central portion of MRS-42 and in the southern portion of MRS-11. Except for the 243 items found in the two burial pits, the majority of MEC removed were located within the upper 6 inches of soil. The MMRP database indicates that the majority of MD was found in the central portion of MRS-42, with lesser amounts to the east and northwest of MRS-42, and in the southeastern portion of MRS-11.

Since the MEC encountered within the Future East Garrison MRA are consistent with the documented historical use as a military weapons training and troop training area, the initial evaluation of previous munitions response actions within the Future East Garrison MRA indicates that the existing data are of sufficient quantity to characterize the MRA for the purpose of conducting the RI/FS. However, a portion of the Future East Garrison MRA has not undergone previous investigation; therefore, additional field investigation activities are planned for selected areas of the MRA. The results of the investigation activities will be incorporated into the Group 4 RI/FS Report.

4.0 WORK PLAN RATIONALE

This Group 4 RI/FS Work Plan outlines the steps to be taken: 1) to fill data gaps; 2) to define the nature and extent of MEC; 3) to assess explosives safety risk that may be present; and 4) to develop, screen, and evaluate alternatives to reduce the potential explosives safety risk to current and future property owners and the general public. The results of the above steps will be documented in the RI/FS report for use by the Army in developing the Proposed Plan and making a decision on remedial action.

This section outlines the components of the Group 4 RI/FS Work Plan that will be used to complete the RI/FS process, develop the RI/FS report, and support an Army remedial action decision. This section also provides a summary of the data needs and information gathering tools that will be used during the RI/FS. The major decision points to be addressed during development of the RI/FS process are as follows:

- Is the site characterization data of known and sufficient quality to adequately characterize the nature and extent of MEC?
- Is the site characterization data of known and sufficient quality to support completion of an explosives safety risk assessment?
- What are the remedial action alternatives, and which alternative(s) meet the nine CERCLA criteria, making it appropriate to mitigate explosives safety risks?

Based on the initial evaluation provided in the SEDR, as summarized in Section 3.0 of this work plan, the following sections describe the RI/FS approaches and data needs for Group 4.

4.1 Summary of the Approach for Group 4

The Army has previously conducted investigations and removal actions within the Future East Garrison MRA. A portion of the Future East Garrison MRA was not accessible at the time of these previous investigations and removal actions due to the presence of dense vegetation. Information from the evaluations of site conditions in MRS-19 and MRS-48, located immediately adjacent to the southwestern portion of the MRA, will therefore be included in the Group 4 RI/FS Report. The data obtained during previous Army actions within the Future East Garrison MRA were reviewed during the development of the SEDR. The initial evaluation of previous munitions response actions within the MRA indicated that the existing data are of sufficient quantity to characterize the MRA. However, a portion of the Future East Garrison MRA has not undergone investigation; therefore, additional field investigation activities are planned for selected areas of the MRA. The results of the investigation activities will be incorporated into the Group 4 RI/FS Report. Data quality review will be performed during the RI for the MRA to confirm that the munitions response data and data collected during field activities are usable for the purposes of the risk assessment and FS.

Additionally, an RQA Pilot Study is being conducted in the Seaside and California State University Monterey Bay (CSUMB) Off-Campus MRAs to assess the potential residual risk, if any, posed by undetected MEC, following MEC removal actions, in a portion of the areas planned for future residential development. The RQA Pilot Study work plan was presented in Volume 2 of the Final Group 1 RI/FS Work Plan, which was submitted for the Group 1 MRAs (ESCA RP Team 2008b). The results of the RQA Pilot Study may be incorporated into the Group 4 RI/FS report as a part of the discussion concerning the effectiveness of previous removal actions.

4.2 Data Quality Objectives

The RI/FS process requires the collection of data for regulatory compliance and decision-making purposes. The data collected must be of sufficient quality and quantity to support decision making.

The DQO process developed by EPA was employed as a systematic planning tool to establish criteria for data quality and for guiding data collection. The results of that planning process are included in the following sections of this work plan.

4.3 Validation of Existing Data

The SEDR identifies and summarizes existing data for the Future East Garrison MRA, including the results of previous investigations and removal actions. The validation of existing data is necessary to establish that the data are of known and sufficient quality to be usable in the RI/FS to support completion of an explosives safety risk assessment and the evaluation of remedial alternatives.

Existing data generally fall into the following three categories:

- Physical Setting and Land Use
- Historical Records and Military History
- MEC Response Actions

The physical setting and land use category data are well understood. Validation efforts will consist of verifying that the information is up to date, accurate, and complete. Historical records, military history, and MEC investigations and removal actions data will be reviewed and validated as described below.

4.3.1 Historical Records and Military History

The Army researched historical records and documented the military history of Fort Ord in a series of Archive Search Reports. Although the initial evaluation indicated that the munitions found during the Army's investigations and removal actions on the Future East Garrison MRA are consistent with previously identified training activities, the ESCA RP Team will review in further detail the Army historical records and military history for the Future East

Garrison MRA to determine if the munitions found during previous munitions response actions are consistent with the initial evaluation of the MRA. The following information will be reviewed, as appropriate:

- Historical Records
  - Archive Search Reports
  - Non-military history of the former Fort Ord
  - Specific military training / use of the MRA
- Military History / Field Manuals
  - Training practices by era
  - Munitions types and use in various operations, during various time periods

4.3.2 MEC Investigations and Removal Actions

The previous munitions response actions that have been performed will be evaluated in order to assess the quality of the response actions and resulting data, using the criteria presented in the following subsections.

4.3.2.1 Equipment Evaluation

An evaluation of the equipment used during previous munitions response actions will focus on how the equipment was employed and maintained. The evaluation will involve checking and reviewing the following items, when available:

- Manufacturer calibration and operating procedures
- Calibration documentation, including frequency and null points
- Calibration records or logs
- Operator training records
- Quality assurance/quality control (QA/QC) of equipment calibration and usage
- Historical evaluations of equipment detection capabilities (i.e., geophysical prove-outs, seeding operations, etc.)

4.3.2.2 Adequacy of Removal Approach

Items that will be evaluated to assess the adequacy of previous removal approaches will include depth of sampling/removal and future land use. In addition, the depth at which items were found will be compared with maximum calculated penetration depths and calculated detection depth limits. Documentation that will be used to evaluate the previous operations includes:

- munitions response reports and associated maps

- reconnaissance and sampling data
- site work plans
- FORA ESCA RP database and/or MMRP database
- field logs and field maps

Additional items not listed above may be reviewed, if they are located and deemed to be relevant to the evaluation of past removal actions.

4.3.2.3 Collection and Management of Field Data

The Army has evaluated the collection and management of field data for previous munitions response actions. The evaluation conducted by the Army will be used to support the validation of data collected by the Army and its contractors, which included the following activities:

- Data quality assurance (QA; if there was no evidence that data QA was conducted, a 10 percent QA effort was performed).
- Parsons, under contract with the Army, performed a 100 percent quality control (QC) review of the data in the MMRP database previously generated from work conducted by prior munitions response contractors. The review followed an approved Standard Operating Procedure (SOP). This evaluation included a review of the field grid records and the MMRP database. It also included a review of Human Factors Application, Inc. (HFA) data provided in the after-action report (HFA 1994). The USACE implemented a QA review of 10 percent of the data reviewed by Parsons. The QA review included a comparison of the data set with the data set reported in the contractor's after-action reports. The requirements of the USACE QA review are described in the SOP. The purpose of the QC data review was to complete a 100 percent check of all available grid records to identify discrepancies between the after-action reports and the grid records, if any. Discrepancies were then researched and appropriate corrections were made in the MMRP database.
- Parsons used a digital process for field data collection, which reduced the data issues associated with the use of grid sheets (such as human errors, inconsistent munitions nomenclature, etc.). Parsons' data were managed in accordance with the quality procedures outlined in its Programmatic Work Plan (Parsons 2004) and had to meet the standards of the MMRP database, managed by USACE, prior to loading the data into the database.

4.3.2.4 Completeness of Existing Records and Data Gaps

The completeness of existing records and the identified data gaps will be evaluated. The records will be reviewed to determine if there is enough defensible data to 1) assess whether or not the work was completed according to contractual requirements, 2) make recommendations on the adequacy of the removal actions, and 3) identify data gaps, if any, that may need to be filled to evaluate the adequacy of the response action.

4.3.2.5 Accuracy of Site Boundaries

Site boundaries are of particular importance to the completion of the RI/FS. Site boundaries were first presented as part of the 1993 Archives Search Report (USACE 1993). These boundaries served as a foundation for the initial investigation under the MMRP. Since that time, site boundaries have been modified based on results of MEC investigations and to support property transfer. The evaluation of previous work will include an evaluation of existing information to determine whether the establishment of site boundaries is accurate, based on historical information and removal data, and whether the surveying method used to delineate the site boundaries was accurate.

4.4 Incorporation of the RQA Pilot Study Results

The Group 1 RI/FS Work Plan included an RQA Pilot Study work plan, which was presented in Volume 2 of the Group 1 RI/FS Work Plan (ESCA RP Team 2008b). It is recognized that a MEC removal action may not successfully acquire and recover all MEC at the site. The regulatory agencies have expressed concern regarding the residual risk that remains after MEC removals have taken place, particularly in areas that are planned for residential development (i.e., unrestricted land use). In an effort to satisfy regulatory concerns, a QA process was developed that will allow the regulators to gain comfort with the acceptability of a parcel, where MEC removal was conducted, for residential use (and other sensitive uses). As specified in the ESCA, FORA and their response contractor were tasked by regulatory agencies to develop a RQA Pilot Study, which includes recommending areas for inclusion in the study and developing success criteria to be used by EPA and DTSC to determine if and when the RQA process will be applied to other designated residential parcels covered by the ESCA. The effort is also intended to satisfy the requirements of the ESCA for a RQA Pilot Study. The relevance and usefulness of the RQA process is being evaluated during the RQA Pilot Study. The results of the RQA Pilot Study may be incorporated into the Group 4 RI/FS report as a part of the discussion concerning the effectiveness of previous removal actions.

4.5 Collect Additional Data

Based on the initial evaluation, it was determined that additional data should be collected to fully characterize the MRA, and to support an explosives safety risk assessment and remedy selection for Group 4. The proposed scope describes collecting additional data sufficient to complete the evaluation of the nature and extent of potential MEC before conducting a risk assessment as part of the RI/FS for Group 4. The DQOs related to the MEC investigation planned in the Future East Garrison MRA are included in Volume 2 of this Group 4 RI/FS Work Plan.

The areas to be investigated include trails, biological transects, fuel breaks, grids, and unpaved access roads. Improved roads will not be intrusively investigated; however, the non-paved western edge of Barloy Canyon Road will be investigated. Investigations will be performed using analog instruments and anomalies will be excavated to the depth of detection. Digital instruments are not anticipated for the investigation activities; however, the operational requirements are included in Volume 2 of this work plan in case they are

used. The use of digital geophysical surveys may be performed on portions of the analog investigation area if warranted, following the initial analog investigation. Considerations for determining if digital geophysical surveys are necessary to collect additional data following completion of the initial analog investigation are presented in Volume 2 of this work plan. The processes and procedures used, as well as the results of the RI, will be detailed in the Group 4 RI/FS report, together with recommended follow-up actions, if any are determined to be necessary.

4.6 Data Analysis

It is necessary to analyze both existing and newly collected data to continuously update the CSM as needed and characterize the Future East Garrison MRA. The following questions will be answered during the RI/FS development:

- Is there a clear understanding of current/future land use and current physical characteristics of the area?
- Does historical information indicate that military munitions may have been used within the MRA?
- Are MEC and MEC-related materials being found consistent with the documented historical usage of the area?
- Was the MEC removal completed in the appropriate area(s) of the site?
- Do MEC found at the site indicate undocumented historical munitions use at the site?
- Should the MRA be subdivided into separate units or areas?
- Were the geophysical instruments used during the investigations and removal actions able to detect the suspected MEC items at the expected depths of penetration?
- Can the removal data be used to support an evaluation of alternatives for the FS?
- Can the removal data be used to support explosives safety risk management decision making?

If the results of the above analysis present a strong weight of evidence to support that the existing data are usable for defining the nature and extent of MEC, as determined by the project team (EPA, DTSC, FORA, and the Army), the MRA will proceed to the risk assessment phase and an explosives safety risk assessment and FS will be prepared.

4.7 Explosives Safety Risk Assessment

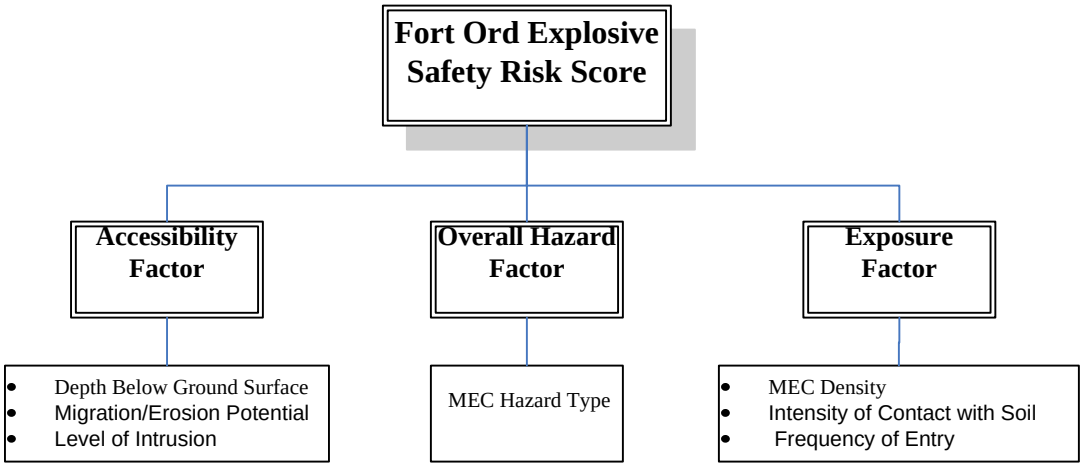
The Fort Ord Ordnance and Explosives Risk Assessment Protocol (“the Protocol") will be used to assess the hazards posed by MEC for receptors based on future land use (Malcolm Pirnie 2002). Unlike typical risk assessments that evaluate potential exposures to hazardous substances in environmental media, the Protocol does not calculate a numerical probability of adverse effects or a hazard index. Rather, it relies on an assumption that an encounter with MEC will result in an adverse effect, and provides a qualitative description of the explosives

safety risk, based on the likelihood of encountering an MEC item combined with the potential of the item to cause a serious injury if it functions. Because the Protocol was designed to be applied to Track 2- and Track 3-type MRSs at the former Fort Ord, it is applicable for areas where MEC are present or were removed. In areas where there is no history of military munitions use or where remedial investigation supports the absence of unacceptable levels of explosive hazard, risk assessment is not required.

The Protocol will be used to assess the risk for portions of the Future East Garrison MRA, based on SEDR and RI data and future land use as identified in the Final Fort Ord Reuse Plan, in order to provide an estimate of the risks posed by current site conditions and assess whether a past (or planned) removal or remedial action was (or will be) effective in reducing those risks.

The Protocol is used to develop and perform a comparative evaluation of various remedial alternatives during the FS. Two matrices combine six of the input factors into overall scores for Accessibility and Exposure. A third matrix combines the scores for Accessibility and Exposure with the seventh input factor, Overall Hazard, to produce a qualitative score for estimating explosives safety risk.

The seven inputs to the explosive safety score are outlined below.



Data needs for the explosives safety risk assessment will be documented in the RI and will include:

- Physical site characteristics
- MEC types, distribution, and previously identified hazard categories
- MEC penetration depths
- Land use (Current/Future)
- Receptors (types/subpopulations, sensitivities, numbers/density, locations, activity levels/patterns)

4.8 Identification of ARARs

Overall, three types of applicable or relevant and appropriate requirements (ARARs) are defined by the EPA (EPA 1988a) and will be considered in the Group 4 RI/FS:

- Chemical-specific or ambient ARARs - Health- or risk-based numerical values for specific hazardous substances or contaminants
- Action-specific ARARs - Technology-based requirements triggered by the type of remedial action under consideration. This category also includes performance- and design-specific requirements, such as restrictions on the appearance of or noise from a remedial system
- Location-specific ARARs - Impose restrictions on certain types of activities or contaminant concentrations in certain environmentally sensitive areas such as wetlands, flood plains, and historic sites

4.8.1 Initial Identification of Potential ARARs

The Army has previously conducted a detailed evaluation and identification of potential ARARs and to-be-considered criteria (TBC) requirements potentially applicable to munitions response actions at the former Fort Ord. The list of potential ARARs was based on existing/previous Army decisions regarding munitions response actions (MACTEC 2007; Harding ESE 2002a; Army 2002). The ESCA RP Team reviewed these previously identified ARARs and selected ARARs for consideration during the Group 4 RI/FS process. This initial list of potential ARARs is included in Table 1. A more detailed analysis will be conducted as part of the Group 4 RI/FS.

4.8.2 Solicitation of ARARs

On behalf of the Army and FORA, the ESCA RP Team will communicate with the DTSC regarding the identification of State of California ARARs and TBC for the Group 4 RI/FS. In accordance with 40 Code of Federal Regulations (CFR) 300.400(g), the state will identify those chemical-, location-, and action-specific ARARs or TBC that are: applicable to the release or remedial action being contemplated; otherwise relevant and appropriate; or advisories, criteria, and guidance useful in developing the remedy.

In addition, the ESCA RP Team will identify federal ARARs and, on behalf of FORA, will obtain a review of the ARARs from the EPA and the Army.

The identification of ARARs or TBC can be an iterative process; therefore, ARARs may be updated throughout the Group 4 RI/FS process, as necessary, and will become final only when the ROD is signed. At a minimum, the initial list of potential ARARs in Table 1 will be reviewed after the initial screening of alternatives has been completed, but before initiation of the detailed analysis of alternatives that will be conducted as part of the FS.

4.9 Identifying Appropriate Remedial Actions to Mitigate Risks

Based on the EPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988b), the preliminary remedial action objectives (RAOs) for the Future East Garrison MRA will be to achieve the EPA's threshold criteria of "Overall Protection of Human Health and the Environment" and "Compliance with ARARs."

Using the results of the RI, explosives safety risk assessment, and potential ARARs, risk management alternatives will be developed and evaluated to support the intended land use.

The AOC indicates that the evaluation of alternatives should consider, at a minimum, the following:

- A no-action alternative
- An alternative that reduces or eliminates the hazard, toxicity, mobility, or volume of contaminants (including treatment)
- An alternative that considers land use controls
- An alternative that considers unrestricted use
- Consideration of innovative technologies

Based on RI/FSs previously developed by the Army for portions of the former Fort Ord, remedial alternatives would likely include one or more of the following:

- No further action
- Land use controls (e.g., administrative and engineering controls)
- Surface clearance
- MEC removal to depth, as required by future land use or other applicable standards
- Construction support
- MEC recognition training
- Combinations of the above

These potentially applicable response actions will be evaluated, screened, and developed into remedial alternatives that will be evaluated using the following nine CERCLA criteria:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction in toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability

7. Cost
8. State (or support agency) acceptance
9. Community acceptance

4.10 Community Relations

Community relations activities for Group 4 are intended to keep communities informed of MEC-related activities at the former Fort Ord, and help supporting agencies respond to community concerns. Community relations activities for the ESCA RP are described in the Community Involvement and Outreach Program (CIOP) Plan (ESCA RP Team 2008c). The CIOP Plan has been approved by the EPA in consultation with the DTSC, and is an addendum to the Army's Community Relations Plan (CRP) Update No. 3 (Army 2006).

The CIOP Plan outlines communication techniques that will be used to keep the affected communities informed throughout the RI process at Group 4. Public participation activities, including fact sheets, public notices, and press releases, will be conducted in accordance with CERCLA.

The following sections summarize the approach outlined for community relations activities in the CIOP Plan that will be used during the RI process.

4.10.1 Community Involvement

The CIOP Plan summarizes the community profile surrounding the former Fort Ord as described in the CRP. The community is considered to consist of:

- residents both on the former Fort Ord and in nearby communities
- present business owners and employees on the former Fort Ord property
- elected local representatives and public agencies
- environmental and special interest groups
- students, faculty, and staff at the CSUMB campus
- recreational users including runners, hikers, bikers, and equestrians

Continuing community involvement will be achieved through a combination of communication, participation, and outreach to affected stakeholders. To achieve this, FORA will use newsletters, community involvement workshops, fact sheets, project announcements, public notices, and website updates to provide information about the RI process. In addition, a dedicated phone line has been established for the FORA ESCA RP. Callers will be able to get project updates and leave messages regarding questions or comments.

4.10.2 Community Relations Strategy

Implementation of community relations for the RI will focus on providing information regarding the timeline, reporting, field activities, and scheduling of RI work. As outlined in the CIOP Plan, several objectives for the CIOP apply to the RI. FORA will do the following:

- Provide timely and accurate FORA ESCA RP information
- Provide opportunities for the public to comment and provide input on technical documents
- Provide transparency in decision making and respect for viewpoints
- Meet regulatory requirements
- Address community concerns in a collaborative fashion through workshops and scheduled meetings

4.10.3 Implementation of Community Relations Activities

Specific community relations activities related to conducting the Group 4 RI include:

- Publish articles in the quarterly newsletters. Newsletters will be mailed to interested parties in the adjacent communities of Del Rey Oaks, Monterey, Seaside, Marina, Spreckles, Sand City, and the Highway 68 corridor of unincorporated Monterey County. Additional interested parties on the FORA ESCA RP mailing list will receive the newsletters. The newsletters will also be posted on the FORA ESCA RP website (http://www.fora-esca-rp.com). A hyperlink to the newsletters posted on the FORA ESCA RP website will also be provided on the Army's Fort Ord Cleanup website (http://www.fortordcleanup.com/community/factsheet.asp). FORA will work with representatives of CSUMB to ensure they are kept apprised of all ESCA-related cleanup activities and have access to relevant information about the ESCA RP. Information about the FORA ESCA RP website will be made available to representatives of CSUMB allowing them to notify their students, staff, and faculty as appropriate. Special emphasis will be placed on coordinating with the university concerning when field construction work will impact access routes, CSUMB cross country trails and other campus sponsored activities. FORA will also participate in CSUMB outreach activities, as appropriate.
- Hold public meetings as necessary to satisfy regulatory requirements.
- Provide briefings and/or updates at Army quarterly Community Involvement Workshops. The Workshops are scheduled for the second Wednesday in January, April, July, and October.
- Provide updates at the Technical Review Committee (TRC) quarterly meetings. The TRC is composed of representatives of local agencies, city governments, and institutions, as well as federal and state agencies with an interest in the cleanup.
- Publish fact sheets distributed by direct mail to local residents, community leaders, minority community organizations, and those who have requested to be on the CIOP mailing list. Fact sheets will also be provided at community involvement activities and

posted on the FORA ESCA RP website. A hyperlink to the newsletters posted on the FORA ESCA RP website will also be provided on the Army's Fort Ord Cleanup website.

- Provide quarterly updates to regional elected officials through FORA Board meetings.
- Provide monthly updates to city managers through FORA Administrative Committee meetings.
- Provide monthly updates to regional emergency service providers through FORA ESCA Emergency Service Providers meetings.
- Publish public notices in local newspapers, and provide press releases to the media announcing the availability of applicable decision documents and opportunities for public comment.
- Respond to comments and inquiries from the community on the RI process or related documents.
- Deliver RI-related documents to the Army for inclusion in the Army-maintained Information Repositories and Administrative Record.

4.10.4 Roles of Federal, State, and Local Authorities

Federal, state, and local government cooperation has included regulatory agency involvement throughout the ESCA RP. FORA and its contractors continue to meet regularly with the regulatory agencies and local jurisdictions with respect to the ongoing munitions response activities.

4.10.5 Public Education

The Army conducts a public education program. The program includes general information related to the hazards associated with MEC, and site-specific information on the history and current status of the property related to MEC. In addition, the USACE developed a school safety program.

4.11 Data Management

Data generated during implementation of the Group 4 RI/FS Work Plan will be managed according to established data management and quality procedures, as presented in Volume 2 of this work plan. New data will be included in the data validation, in terms of a completeness evaluation, identification of data gaps, and site boundary evaluation, as appropriate.

5.0 GROUP 4 RI/FS TASKS

This section outlines standard RI/FS tasks that will be performed to make decisions regarding risk and remedial actions during the Group 4 RI/FS, as defined by the AOC. The AOC tasks presented below are consistent with those provided in the EPA's current RI/FS guidance document (EPA 1988b).

5.1 Task 1 Project Planning

Task 1 includes efforts related to initiating the project and scoping project activities. The majority of project planning will occur during the scoping phase of the Group 4 RI/FS, and include both site planning and project planning. The initial project planning process is documented in the SEDR and this work plan.

5.2 Task 2 Community Relations

Task 2 includes efforts related to the preparation and implementation of the CIOP Plan (ESCA RP Team 2008c). Community relations activities serve to keep stakeholders informed of activities at the former Fort Ord and help the supporting agencies respond to community concerns. The MEC-related community relations programs implemented at the former Fort Ord have been described in the CRP (Army 1998), the CRP Update Number 1 (Army 2000), and the CRP Update Number 2 (Army 2001). The CIOP Plan is an addendum to the Army's former Fort Ord CRP Update Number 3 (Army 2006). Community relations activities began at the start of the ESCA RP and will continue throughout the duration of the ESCA RP.

5.3 Task 3 Field Investigation

Task 3 incorporates efforts related to fieldwork conducted to fill identified data gaps, in order to complete the RI at the Future East Garrison MRA in accordance with Task 4.1 of the AOC. Section 4.5 of this work plan presents the investigation approach for the fieldwork to be performed during the RI. The SAP will present the scope of specific activities for the fieldwork, and the QAPP will provide the detail on the procedures to be followed when carrying out the field activities. The SAP and the QAPP are presented in Volume 2 of this Group 4 RI/FS Work Plan.

5.4 Task 4 Sample Analysis/Validation

Task 4 includes efforts relating to the analysis and validation of samples or data obtained during field investigation, grid sampling, and MEC removal activities in accordance with Task 4.1 of the AOC. The Group 4 RI/FS will evaluate past munitions response activities and field activities performed as part of the RI to support completion of a risk assessment and FS for the area. Specific items to be addressed during the evaluation are provided in the munitions response activity evaluation checklist (Appendix B).

5.5 Task 5 Data Evaluation

Task 5 includes refining and updating the CSM for the Future East Garrison MRA, if needed, to document site characterization results, including physical characteristics, MEC source characteristics, and the nature and extent of MEC in accordance with Task 4.1 of the AOC. If applicable, areas where there is no history of military munitions use, and areas where remedial investigation supports the absence of unacceptable levels of explosive hazard, will be identified. The results of this task will be presented to the regulatory agencies and the Army in a technical memorandum, and/or in a regulatory meeting for review and concurrence prior to proceeding to the risk assessment. Community stakeholders will be apprised of any changes to the CSM and their potential impacts by way of the most appropriate and timely method (e.g., Community Involvement Workshop meeting, ESCA Community meeting, ESCA newsletter, and/or ESCA Fact Sheet). Specific items to be addressed during the evaluation are provided in the munitions response activity evaluation checklist (Appendix B).

5.6 Task 6 Risk Assessment

Task 6 includes efforts related to assessing risks to human health and the environment in accordance with Task 4.2 of the AOC. In general, the objectives of a risk assessment or risk evaluation will be attained by identifying and characterizing the following:

- Potential human and environmental receptors
- Potential exposure routes and extent of actual or expected exposure
- Extent and likelihood of expected impact or threat
- Level of uncertainty associated with the above items

The main purpose of the risk evaluation portion of the Group 4 RI/FS is to provide an estimate of the risks posed by site conditions (i.e., MEC) and to assess whether a past (or planned) removal or remedial action at a site was (or will be) effective in reducing those risks. Risk assessment will be performed for areas of the MRA where MEC hazard is identified. In areas where there is no history of military munitions use or where remedial investigation supports the absence of unacceptable levels of explosive hazard (e.g., contiguous areas where no MEC items were found), risk assessment is not required to be performed. The results of this task will be presented to the regulatory agencies and the Army in a technical memorandum, and/or in a regulatory meeting for review and concurrence prior to proceeding to the development of screening alternatives.

5.7 Task 7 Treatability Studies

Task 7 includes efforts to plan and conduct pilot, bench, or other treatability studies. Treatability studies are conducted primarily to achieve the following:

- Provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the detailed analysis and to support the remedial design of a selected alternative

- Reduce cost and performance uncertainties for treatment alternatives to acceptable levels so that a remedy can be selected

Sufficient information is available to allow screening and evaluation of potentially applicable remedial actions (Section 4.8); therefore, treatability studies are not required.

5.8 Task 8 Remedial Investigation Reports

Task 8 consists of efforts related to preparing the RI findings, once the data have been evaluated. The task includes preparing draft and final RI reports, as well as task management and QC. The results of the risk assessment will be presented to the regulatory agencies and the Army in a technical memorandum, and/or in a regulatory meeting for review and concurrence prior to proceeding to the development of screening alternatives. Pertinent information that will be documented in the RI report is as follows:

- Summary of the work performed as part of the evaluation of previous munitions response activities
- Results of the evaluation of data collected during previous work
- Conclusions regarding the usability of the data
- Evaluation of explosives safety risks

5.9 Tasks 9, 10, and 11 Feasibility Study

Tasks 9, 10, and 11 described below will comprise the FS activities. The FS will be completed using information from the evaluation of munitions response activities. The FS will be conducted in accordance with the EPA's RI/FS guidance document (EPA 1988b) and will use site-specific data to screen, evaluate, and recommend remedial alternatives and long-term risk management measures.

5.9.1 Task 9 Remedial Alternatives Screening

Remedial alternatives screening will be based on the identification of preliminary remediation goals (PRGs) and RAOs in accordance with Task 4.3 of the AOC.

PRGs and RAOs include potential statutory and regulatory requirements, such as ARARs, guidance and advisories (TBC), and risk-based concentrations of chemicals in environmental media that have been brought forward from the risk assessment. Candidate PRGs will be developed during the RI and presented in the FS and ROD. In addition, the National Contingency Plan specifies that RAOs be developed that address: (1) contaminants of concern, (2) media of concern, (3) potential exposure pathways, and (4) remediation goals (40 CFR 300.430(e)(2)(i)).

Numerical cleanup standards are not available for munitions response actions. Therefore, the PRGs for MEC on the surface and in subsurface soil are developed to address detecting MEC

using the most appropriate technologies, to ensure protection of the public consistent with the proposed end use of the property. Chemical-specific (i.e., specific to MEC) ARARs, if any, and the Fort Ord Base Reuse Plan will be considered in the development of PRGs.

The Group 4 RI/FS will contain a discussion of the substantive requirements that will be considered as potential ARARs and TBC identified for munitions response, gathered from state and federal sources. The Superfund Amendments and Reauthorization Act of 1986 requires that cleanup alternatives consider and attain ARARs, which are promulgated under federal or state law. ARARs are designed to be protective of human health and the environment, and to be technically achievable with existing remedial techniques.

Based on the EPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988b), the preliminary RAOs for the Future East Garrison MRA will be to achieve the EPA's threshold criteria of "Overall Protection of Human Health and the Environment" and "Compliance with ARARs." The final acceptable exposure levels will be determined as part of the FS, on the basis of the results of the risk assessment and the evaluation of the expected exposures and associated risks for each alternative, as discussed in Section 5.9.2.2 of this work plan.

5.9.2 Task 10 Remedial Alternatives Evaluation

The evaluation of remedial alternatives will include the development of alternatives, refinement and documentation of RAOs, identification of potential ARARs, development of general response actions, and a detailed analysis of each alternative as described in the following sections of this work plan.

5.9.2.1 Development of Alternatives

During the FS, remedial technologies and their associated implementation, containment, treatment, or disposal requirements will be identified, pre-screened, and then combined into alternatives in accordance with Task 5.1 of the AOC. Information obtained during the RI is considered in developing the list of alternatives for evaluation during the FS. Some technology, implementation, or property use restrictions may become apparent during this step, or may become necessary regardless of which remedy is selected. Evaluation of alternatives should consider, at a minimum, the following:

- A no-action alternative
- An alternative that reduces or eliminates the hazard, toxicity, mobility, or volume of contaminants (including treatment)
- An alternative that considers land use controls
- An alternative that considers unrestricted use
- Consideration of innovative technologies

For any evaluation of response alternatives where a land use control will be imposed, either as a stand-alone response alternative or as one component of a more complex alternative, the evaluation of response alternatives will include the following:

- An analysis of alternative(s) utilizing a land use control
- An analysis at the level of detail appropriate to the size and scope of a response, of alternatives not requiring a land use control (e.g., implementation of a response that allows unrestricted use)

This evaluation will allow consideration of restricted and unrestricted use alternatives in selecting the response action.

For any alternative proposed that includes the use of a land use control, sufficient detail and analysis of the likely control mechanisms that would be used to achieve the objectives will be included in the FS to enable a determination of the long-term effectiveness and reliability of such control mechanisms. Additionally, cost estimates for the establishment, implementation, monitoring, and reporting of the land use controls will be included in the cost estimates for each alternative that includes such controls. If land use controls are a component of the selected remedy, the final types of land use controls will be determined acceptable by FORA, the Army, and EPA, in consultation with the DTSC.

For any alternative proposed that includes additional MEC remediation, sufficient detail and analysis of the impacts that activities associated with the additional MEC remediation (such as extent of vegetation removal, excavation depths, etc.) will have on flora, fauna, cultural resources, and air quality will be considered. Because additional MEC remediation requires the use of geophysical sensing devices that need to be swept over the ground surface, dense vegetation may inhibit this process and vegetation cutting or removal would likely be a component of any additional MEC remediation alternative. A range of vegetation clearance methods that are potentially applicable at the former Fort Ord were described and evaluated in the Evaluation of Vegetation Clearance Methods Technical Memorandum, Ordnance and Explosives Remedial Investigation/Feasibility Study, Former Fort Ord, California ("Vegetation Clearance Technical Memorandum"; Harding ESE 2002b). Table 12 of the Vegetation Clearance Technical Memorandum presents a matrix of vegetation clearance methods that should be retained for further consideration for the range of different plant communities (or types of vegetation) found at the former Fort Ord. The results of the Vegetation Clearance Technical Memorandum will be considered when evaluating any alternatives that involve additional MEC remediation. If additional MEC remediation is a component of the selected remedy, a specific work plan outlining planned vegetation clearance methods and detailed MEC detection and removal methodologies would be prepared and made available for regulatory agency and public review, in accordance with the AOC.

5.9.2.2 Refine and Document RAOs

Based on the explosives safety risk assessment and the results of the RI, site-specific RAOs will be reviewed and modified, if necessary, in accordance with Task 5.2 of the AOC. The

modified RAOs will be documented in a technical memorandum, prior to the completion of the FS. The technical memorandum will be reviewed and approved by the EPA, after consultation with the DTSC. These modified RAOs will specify the contaminants and media of interest, exposure pathways and receptors, hazards, and an acceptable contaminant level or range of levels (at particular locations for each exposure route).

5.9.2.3 Identification of Potential ARARs

ARARs, in conjunction with risk-based levels developed in the risk assessment, will be employed in directing response actions and establishing cleanup goals in accordance with Task 5.3 of the AOC. ARARs are used as a "starting point" in determining the protectiveness of a site remedy. Additional guidance on ARARs is found in EPA/540/G-89/006 (EPA 1988a). An initial list of potential ARARs is provided in Table 1 and is based on Army decisions regarding munitions response actions for the former Fort Ord (Section 4.9).

5.9.2.4 Develop General Response Actions

General response actions will be developed for each parcel defining implementation, containment, removal, or other actions, singly or in combination, as appropriate to satisfy the RAOs in accordance with Task 5.4 of the AOC.

5.9.2.5 Detailed Analysis of Alternatives

A detailed analysis of potential alternatives will be developed, which will consist of an evaluation of each option against the nine CERCLA evaluation criteria and a comparative analysis of all options using the same evaluation criteria in accordance with Task 5.5 of the AOC. The nine CERCLA evaluation criteria will be applied to the assembled remedial alternatives to ensure that the preferred remedial alternative(s) will be protective of human health and the environment; will be in compliance with, or include a waiver of, ARARs; will be cost-effective; will utilize permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable; and will address the statutory preference for treatment as a principal element. The evaluation criteria will include:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction in toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State (or support agency) acceptance
9. Community acceptance

(Note: Criteria 8 and 9 are considered after the Group 4 RI/FS report has been released to the general public and after the proposed plan public comment period.)

The results of the detailed analysis of remedial alternatives will become a major factor in selecting a preferred alternative, after completion of the Group 4 RI/FS. The detailed analysis will include:

- A description of each alternative that outlines the strategy involved and identifies the key ARARs associated with each alternative
- A discussion of the assessment of each alternative against each of the nine CERCLA criteria

A preliminary assessment of Criteria 8 and 9 may be provided at this time, as appropriate, or these will be addressed following the public comment period.

5.9.3 Task 11 Feasibility Study Reports

The collection and evaluation of new data, as well as the results of the data evaluation of previous work, in conjunction with the risk evaluation and FS described above, will serve as the RI/FS for the Future East Garrison MRA. Pertinent information that will be documented in the FS report is as follows:

- FS
- Recommended alternatives
- Long-term explosives safety risk management measures

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6.0 REPORTING AND SCHEDULE

This section provides the general outline of the RI/FS report and the anticipated schedule for implementing and completing the Group 4 RI/FS Work Plan.

6.1 Reporting

The Group 4 RI/FS report will generally be organized as follows:

Volume 1 – Remedial Investigation

This volume provides the results of the Group 4 RI and will likely include the following components:

- **Section 1 – Introduction.** This section will provide the purpose of the report and background information on the Army's MMRP and the FORA ESCA RP.
- **Section 2 – Background.** This section will present the Fort Ord military munitions-related history, physical setting, and background information on the base-wide Munitions Response RI/FS.
- **Section 3 – Group 4 Remedial Investigation.** This section will provide the RI for Group 4 (Future East Garrison MRA), to include background, updates to the CSM, and the results and evaluation of the data collected during previous munitions response activities.
- **Section 4 – References.** This section will provide a list of references for pertinent documents cited in the report.

Volume 2 – Explosives Safety Risk Assessment

This volume provides the results of the Group 4 explosives safety risk assessment, which describes the qualitative and quantitative factors potentially resulting in a receptor encountering an MEC item. The risk assessment is then used to develop and evaluate remedial alternatives during the FS. The Group 4 risk assessment will likely include the following components:

- **Section 1 – Introduction.** This section will provide the purpose and objectives of the risk assessment.
- **Section 2 – Data and Data Usability.** This section will provide an evaluation of the data and data usability to support a risk assessment.
- **Section 3 – Receptors and Reuse Areas.** This section will identify the selected receptors for the various reuse areas of the Group 4 MRA.
- **Section 4 – Risk Assessment Results.** This section will describe the assumptions and results of risk analysis for each of the reuse areas in the Group 4 MRA.

- **Section 5 – Uncertainty.** This section will describe the uncertainties related to the data, input components, and future land use and associated receptors.
- **Section 6 – Conclusions.** This section will present a summary of the risk assessment results and the conclusions.
- **Section 7 – References.** This section will provide a list of references for pertinent documents cited in the report.

Volume 3 – Feasibility Study

This volume provides the results of the Group 4 FS that identifies and selects preferred remedial alternatives to address potential after-action MEC risks. It presents the RAOs, identification of alternatives, screening of alternatives, and selection of alternatives. The FS also describes the proposed plan and ROD process. The Group 4 FS will likely include the following components:

- **Section 1 – Introduction.** This section will describe the purpose and objectives of the FS and present background information on the Group 4 RI/FS process.
- **Section 2 – Remedial Approach.** This section will define the reuse areas for which remedial alternatives will be developed, and will describe the RAOs, application of risk assessment results, ARARs, land use control guidelines that will be applied in the development of remedial alternatives, and ongoing and future MEC-related activities at the former Fort Ord that are components of the Army's base-wide efforts to promote MEC safety.
- **Section 3 – Identification of Applicable Response Actions.** This section will identify the range of applicable response actions for MEC risk management at the Group 4 MRA, such as no further action, land use controls, and additional MEC remediation.
- **Section 4 – Development of Remedial Alternatives.** This section will present long-term management measures specific to implementation and management of the remedial alternatives selected for Group 4, and will also include a screening of response action components, development of remedial alternatives, and identification of potential ARARs associated with implementation.
- **Section 5 – Evaluation and Comparison of Remedial Alternatives.** This section will present an evaluation and comparison of remedial alternatives for each of the reuse areas in the Group 4 MRA.
- **Section 6 – Identification of the Preferred Remedial Alternative.** This section will present and summarize the preferred remedial alternative for each reuse area.
- **Section 7 – Approval Process.** This section will describe the approval process for documenting the preferred alternative(s) for implementation at each of the Group 4 reuse areas in the proposed plan and ROD.
- **Section 8 – References.** This section will provide a list of references for pertinent documents cited in the report.

6.2 Schedule

An anticipated project schedule has been prepared that identifies the key components of the work in chronological order, including document deliverables. The anticipated project schedule for the RI/FS is presented in Appendix C and is currently scheduled for completion prior to the established AOC milestone date for the Group 4 RI/FS report. For planning and reporting purposes, regulatory review periods are included, but are subject to change based on the level of effort required to incorporate review comments and review period extension requests. A summary of the Group 4 project milestone schedule is provided in Table 2.

The associated tasks and project progress will be tracked monthly on the schedule to show actual project status compared to the initial project schedule in order to better evaluate the reasons for progress variances and to identify overall impact to project duration.

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Table 1
Potential Applicable or Relevant and Appropriate Requirements (ARARs)

Source or Authority	Requirement, Standard, or Criterion	Type	Description	Remarks
Federal ARARs				
Endangered Species Act (ESA) (16 United States Code [U.S.C.] §§ 1531-1543)	16 U.S.C. § 1536 (a) and (c); 16 U.S.C. § 1538 (a)(1)	Applicable [1, 2, 3] / Location	Federal agencies are required under Section 7 of the ESA to ensure that their actions do not jeopardize the continued existence of a listed species or result in destruction of or adverse modification of its critical habitat (16 U.S.C. § 1536). If the proposed action may affect the listed species or its critical habitat, consultation with the United States Fish and Wildlife Service (USFWS) and/or California Department of Fish and Game may be required (50 Code of Federal Regulations [CFR] § 402.14). Additionally, Section 9 of the ESA prohibits the illegal taking of a listed species (16 U.S.C. § 1538(a)(1)).	Endangered plant and animal species and critical habitats occur at the former Fort Ord. Each reuse area will be screened for potential impacts to any endangered species identified in the Installation-Wide Multispecies Habitat Management Plan (HMP; USACE 1997) and additional requirements identified in subsequent documents (USFWS 1999, 2002, and 2005; and Zander 2002). The provisions of the HMP and referenced additional requirements satisfy the requirements of the ESA.
Migratory Bird Treaty Act (MBTA)	16 U.S.C. §§ 703-712	Applicable [1, 2, 3] / Location	The statute sections prohibit the taking, possession of, buying, selling, purchasing, or bartering of any migratory bird, including feathers or other parts, nest eggs, or products, except as allowed by regulations.	The requirement includes specific standards of control.
Hazardous Materials & Transportation Act	49 CFR Part 172.101	Applicable [3] / Chemical and Action	These regulations impose procedures and controls on the transportation of hazardous materials.	The regulations include specific standards of control and substantive requirements, criteria, and limitations that may apply to the transport of detonation materials and selected recyclable ordnance materials.
National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122, 123, 124	Relevant and Appropriate [1, 2,] / Action	Regulates the discharge of pollutants to waters of the United States.	The regulations include specific standards of control and substantive requirements, criteria, and limitations that may apply to discharges of pollutants to waters of the United States. Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), procedural requirements such as obtaining a permit while conducting MEC investigation/remediation do not apply.
Federal Resource Conservation and Recovery Act (RCRA), Subpart M (Military Munitions Rule [“the Military Munitions Rule”])	40 CFR Parts 266 and 270	Relevant and Appropriate [2, 3] / Chemical and Action	The regulations identify when military munitions on active ranges become subject to the regulatory definition of “solid waste,” for purposes of RCRA Subtitle C and, if these wastes are hazardous, the management standards that apply.	Portions of the Military Munitions Rule may be relevant and appropriate, but those provisions of the Rule that exclude military munitions from RCRA Subtitle C regulations are not appropriate to the remediation of a closed range. The relevant portions relate to the management of munitions and explosives of concern (MEC), which is recovered, including characterization as hazardous waste and requirements for treatment, storage, and transportation. The Rule provides for the storage and transportation of recovered military munitions in accordance with Department of Defense Explosives Safety Board (DDESB) standards.
State of California ARARs				
California Endangered Species Act	Fish and Game Code §§ 2051 et seq. and §2080	Relevant and Appropriate [1, 2, 3] / Location	The statute sections provide a declaration of policy and definitions. Section 2080 provides that no person shall take, possess, purchase, or sell within this state, any species, or any part or product thereof, that the commission determines to be an endangered species or a threatened species, or attempt any of those acts.	Section 2080 includes specific standards of control with respect to the taking of endangered or threatened species. Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the ESCA RP Team is not required to comply with non-substantive, procedural, and administrative provisions of § 2051.

Table 1
Potential Applicable or Relevant and Appropriate Requirements (ARARs)

Source or Authority	Requirement, Standard, or Criterion	Type	Description	Remarks
California Fish and Game Code	§ 3511	Relevant and Appropriate [1, 2, 3] / Location	This statute section prohibits taking or possessing fully protected birds or parts thereof, listed as: (a) American peregrine falcon *(Falco peregrinus analum)*; (b) Brown pelican; (c) California black rail *(Lateralhus jamaicensis coturniculus)*; (d) California clapper rail *(Rallus longirostris obsoletus)*; (e) California condor *(Gymnogyps californianus)*; (f) California least tern *(Sterna albifrons browni)*; (g) Golden eagle; (h) Greater sandhill crane *(Grus canadensis tabida)*; (i) Light-footed clapper rail *(Rallus longirostris levipes)*; (j) Southern bald eagle *(Haliaeetus leucocephalus leucocephalus)*; (k) Trumpeter swan *(Cygnus buccinator)*; (l) White-tailed kite *(Elanus leucurus)*; and (m) Yuma clapper rail *(Rallus longirostris yumanensis)*.	The requirement includes specific standards of control that may apply to the American peregrine falcon (some possibility), golden eagle (slight possibility), brown pelican (not likely but possible), and California least tern (not likely but possible).
California Fish and Game Code	§ 3513	Relevant and Appropriate [1, 2, 3] / Location	This statute section declares that it is unlawful to take or possess any migratory non-game bird as designated in the MBTA or any part of such migratory non-game bird except as provided by rules and regulations adopted by the Secretary of the Interior under provisions of the MBTA.	The requirement includes specific standards of control.
California Fish and Game Code	§ 3503.5	Relevant and Appropriate [1, 2, 3] / Location	This statute section prohibits the take, possession, or destruction of any birds in the orders of Falconiformes or Strigiformes, or to take, possess, or destroy the nest or eggs of any such bird, except as provided in the code.	The requirement includes specific standards of control that may apply to vultures, hawks, ospreys, falcons, and owls.
California Fish and Game Code	Title 14, California Code of Regulations (CCR) § 472	Relevant and Appropriate [1, 2, 3] / Location	This regulation limits the taking of non-game birds and mammals except for specified species.	The requirement includes specific standards of control that may affect American crows.
California Fish and Game Code	§ 4800 et seq.	Relevant and Appropriate [1, 2, 3] / Location	This statute section declares that it is unlawful to take, injure, possess, transport, or sell any mountain lion.	The requirement includes specific standards of control. Due to the size of vegetation clearance and MEC remediation activities that may be selected for implementation, it is unlikely that mountain lions will be negatively affected.
California Fish and Game Code	Title 14, CCR §§ 40-42	Relevant and Appropriate [1, 2, 3] / Location	These regulations make it unlawful to take, possess, purchase, propagate, sell, transport, import, or export any native reptile or amphibian, unless under special permit.	The requirement includes specific standards of control that may apply to California black legless lizard and coast horned lizard.
California Clean Air Act (Health and Safety Code)	Monterey Bay Unified Air Pollution Control District Rule 438	Relevant and Appropriate [1] / Location and Action	The rule describes permit requirements, allowable days for burning, and restrictions. The rules include both substantive and procedural requirements regarding open burning.	The rule includes specific standards of control. It also includes non-substantive procedural and administrative provisions which would not apply under CERCLA. This potential ARAR would apply to any alternative evaluated that would involve significant vegetation removal in certain areas of the Future East Garrison MRA. Substantive requirements include: §3.3, prohibiting burn on no-burn days. §3.4.10, burns shall be ignited only be devices and methods approved by the California Department of Forestry and Fire Protection. §3.4, materials to be burned shall be dry and reasonably free of dirt, soil, and visible surface moisture prior to burning, and shall be free from combustible impurities such as tires, tar, paper, household rubbish, demolition or construction debris, and other materials not grown on site.

Table 1
Potential Applicable or Relevant and Appropriate Requirements (ARARs)

Source or Authority	Requirement, Standard, or Criterion	Type	Description	Remarks
California Health and Safety Code, Division 20	Title 22, CCR Division 4.5	Applicable [3] / Chemical and Action	The statute and regulations provide for identification of hazardous waste in §§ 66261. If a material is a hazardous waste, Division 4.5 provisions further regulate hazardous waste generators, transporters, and treatment, storage, and disposal facilities.	The Environmental Services Cooperative Agreement Remediation Program (ESCA RP) Team will evaluate discovered items in accordance with the approved work plan to determine the presence of energetic materials or other constituents that would cause it to be characterized as a hazardous waste. Substantive requirements: • Storage: on-site storage of MEC items occur in a designated bunker that meets the standard of DDESB 6055.9 STD, including security measures such as fences, signs, and an alarm system. • Transportation: off-site transportation of small arms ammunition will incorporate applicable manifesting and placarding requirements. Conforms to Defense Reutilization and Marketing Office instruction. • Disposal/recycling: off-site disposal or recycling facility or facilities for small arms ammunition will be state and/or RCRA-authorized.
California Health and Safety Code	Title 22, CCR § 66264.601-603	Relevant and Appropriate [2] / Action	These regulations apply to hazardous waste treatment, which is conducted in a device that does not meet the definition of a "container" in 22 CCR § 66260.10 or is characterized as a "Miscellaneous Unit" subject to the provisions of 22 CCR § 66264.601-603. For activities where detonations are in a device that meets the 22 CCR § 66260.10 definition of a container, the requirements for "temporary units," as set forth in 22 CCR § 66264.553, apply.	The regulations include generally described narrative standards. Compliance with substantive requirements is achieved through regulatory coordination of site-specific work plans in accordance with the CERCLA and Federal Facility Agreement. Under CERCLA, the ESCA RP Team is not required to comply with procedural requirements such as obtaining a permit.
California Health and Safety Code	Title 22, CCR § 66265.382	Relevant and Appropriate [3] / Chemical and Action	Open burning of hazardous waste is prohibited except for the open burning and open detonation (OB/OD) of waste explosives. Waste explosives include waste that has the potential to detonate and bulk military propellants that cannot safely be disposed of through other modes of treatment. Detonation is an explosion in which chemical transformation passes through the material faster than the speed of sound (0.33 kilometer/second at sea level). Owners or operators choosing to open burn or detonate waste explosives shall do so in accordance with the following table and in a manner that does not threaten human health or the environment. Pounds Waste Explosives — Minimum Distance from OB/OD to property 0 to 100 — 204 meters (670 feet) 101 to 1,000 — 380 meters (1,250 feet) 1,001 to 10,000 — 530 meters (1,730 feet) 10,001 to 30,000 — 690 meters (2,260 feet)	The requirement includes specific standards of control and addresses situations similar to those that may be addressed during MEC remediation; detonation of MEC will comply with these requirements.
California Fish and Game Code	§ 1900 et seq.	Relevant and Appropriate [1, 2, 3] / Action	These statute sections sets forth programmatic and administrative provisions and, in § 1908, provides that no person shall import into the state, or take, possess, or sell within this state, except as incident to the possession or sale of the real property on which the plant is growing, any native plant, or any part or product thereof, that the commission determines to be an endangered native plant or rare native plant.	Although the definition of "person" in the statute does not apply to the ESCA RP Team, the standards of control are relevant and appropriate, and the citation is therefore considered as an ARAR.

Table 1
Potential Applicable or Relevant and Appropriate Requirements (ARARs)

Source or Authority	Requirement, Standard, or Criterion	Type	Description	Remarks
California Fish and Game Code	Title 14, CCR § 783 et seq.	Relevant and Appropriate [1, 2, 3] / Action	These regulations provide that no person shall import into the State, export out of the State or take, possess, purchase, or sell within the State, any endangered species, threatened species, or part or product thereof, or attempt any of those acts, except as otherwise provided in the California Endangered Species Act, Fish and Game Code Section 2050, et seq., the Native Plant Protection Act, the Natural Community Conservation Planning Act, the California Desert Native Plants Act, or as authorized under this article in an incidental take permit. The regulations also provide programmatic and administrative procedures for incidental take permits.	The section includes specific standards of control with respect to taking rare or endangered plants. Although the definition of "person" in the statute does not apply to the ESCA RP Team, the standards of control are relevant and appropriate, and the citation is therefore considered as an ARAR.
California Clean Air Act (Health and Safety Code)	Title 17, CCR § 80100 et seq,	Relevant and Appropriate [1] / Action	The regulations provide guidelines, programs, and agency procedures for smoke management plans.	The rule includes specific standards of control. It also includes non-substantive procedural and administrative provisions which would not apply under CERCLA. This potential ARAR would apply to any alternative evaluated that would involve significant vegetation removal in certain areas of the Future East Garrison MRA. Substantive requirements include: §80110(d), prohibiting burn on no-burn days. §80145(o)(l), [local air district smoke management plan or other enforceable mechanisms shall] require the material to be burned shall be free of material that is not produced on the property or in an agricultural or prescribed burning operation. Material not to be burned includes, but is not limited to, tires, rubbish, plastic, treated wood, construction/demolition debris, or material containing asbestos.
Porter Cologne Water Quality Control Act	California Water Code, Division 7, Section 13200	Relevant and Appropriate [1, 2] / Action	Requires submission of Report of Waste Discharge and obtaining waste discharge requirements for specified waste discharges.	Investigation and MEC remediation activities may require submitting Report of Waste Discharge and obtaining waste discharge requirements; this may be addressed as part of NPDES permit requirements. Under CERCLA, procedural requirements such as obtaining a permit while conducting MEC investigation/remediation do not apply.
State of California To-Be-Considered Criteria (TBCs)				
California Fish and Game Commission	Wetlands Resources (pursuant to § 703 of California Fish and Game Code; not a statute)	Policy [1, 2, 3] / Location	This policy: (1) seeks to provide for the protection, preservation, restoration, enhancement, and expansion of wetland habitat in California; (2) strongly discourages development in or conversion of wetlands; and (3) opposes, consistent with its legal authority, any development or conversion that would result in a reduction of wetland acreage or wetland habitat values. To that end, the Commission: (1) opposes wetland development proposals unless, at a minimum, project mitigation assures there will be "no net loss" of either wetland habitat values or acreage; and (2) strongly prefers mitigation that would achieve expansion of wetland acreage and enhancement of wetland habitat values.	The policy provides for the protection of wetland resources.

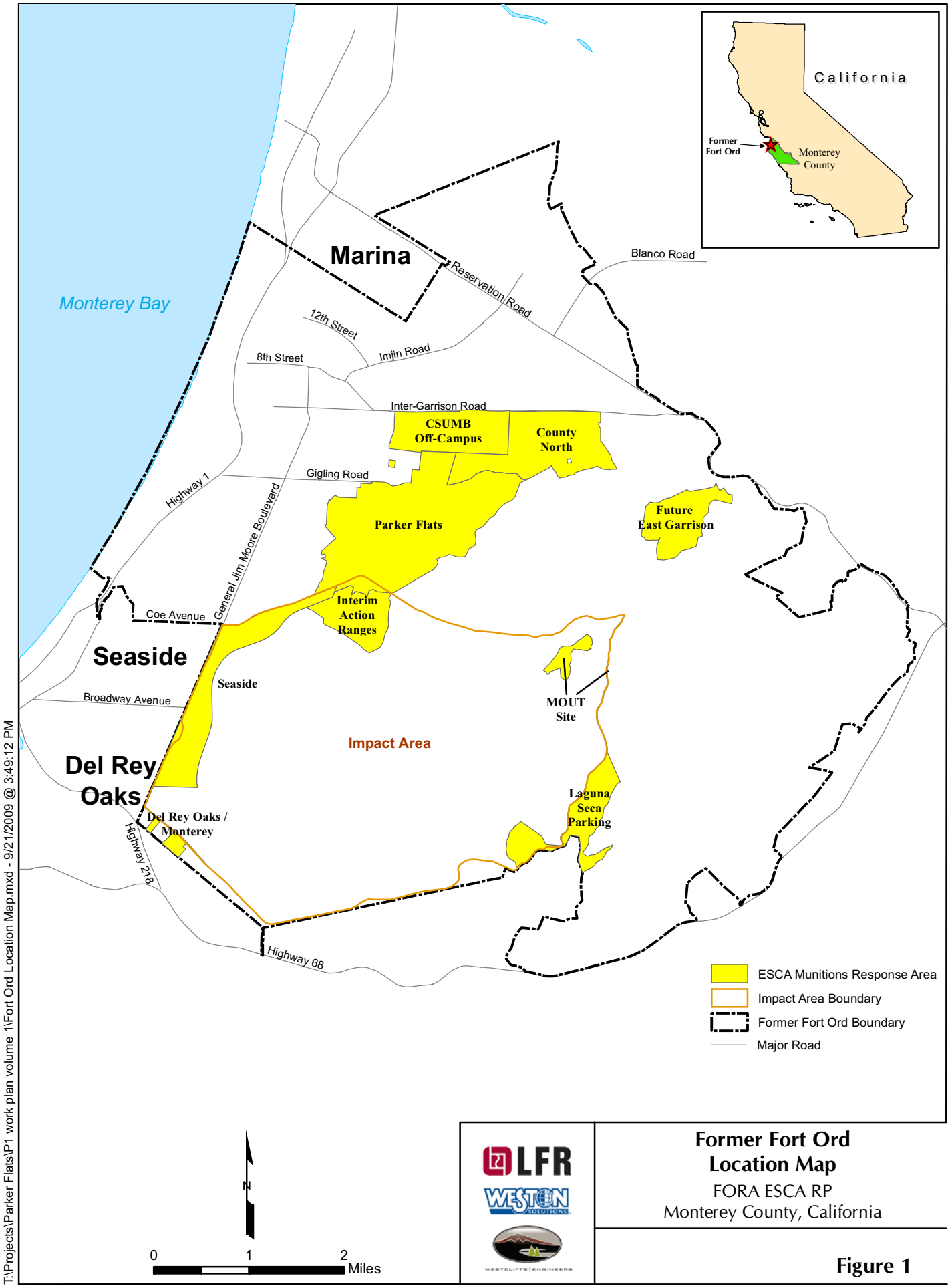
Table 1
Potential Applicable or Relevant and Appropriate Requirements (ARARs)

Source or Authority	Requirement, Standard, or Criterion	Type	Description	Remarks
Regulations that were considered as Potential ARARs but were not considered applicable				
California Fish and Game Code	§ 3005		The statute section prohibits the taking of birds or mammals, except non-game mammals, with any net, pound, cage, trap, set line, or wire, or poisonous substance. Included in the term "taking" is the killing of birds or mammals by poison.	Birds and mammals will be protected by achieving the identified Remedial Action Objectives (RAOs). Further, the scope of the remedial actions does not include intentional taking of birds and mammals with unlawful devices.
California Fish and Game Code	§ 4000 et seq.		This statute section provides that a fur-bearing mammal may be taken only with a trap, firearm, bow and arrow, poison under a proper permit, or with the use of dogs.	The scope of the remedial actions does not involve intentional taking of fur-bearing mammals with unlawful devices.
California Fish and Game Code	Title 14, CCR § 460		This regulation makes it unlawful to take Fisher, marten, river otter, desert kit fox and red fox.	The remedial actions will not result in the take of Fisher, marten, river otter, desert kit fox, and red fox. The species of red fox protected by the State is located in the Sierra Nevada mountain range. The species of red fox located at the former Fort Ord is an introduced species and is not protected by this section.
California Clean Air Act	Health and Safety Code § 41701		This statute section prohibits the discharge into the atmosphere from any source whatsoever any air contaminant for a period or periods aggregated more than three minutes in any one hour that is dark or darker than No. 2 on the Ringelmann Chart or obscures the view to a degree equal to or greater than smoke.	Agricultural burning for which a permit has been granted pursuant to Article 3 (commencing with § 41850, emission limitations for agricultural burning) are exempt from this requirement per § 41704(b). Any prescribed burns that would be conducted for vegetation removal prior to MEC remediation will be conducted under Monterey Bay Unified Air Pollution Control District Rule 407, which implements the requirements of Article 3 (California Health and Safety Code § 41850 et seq.). The exemption applies although the ESCA RP Team is not required to obtain a permit under CERCLA.

Notes:
1. Vegetation Clearance
2. MEC Remediation
3. Detonation of MEC

Table 2
Project Milestone Schedule and Anticipated Completion Dates

MRA Group	Draft Document Name	Submittal Date	AOC Requirement
Group 4 (Future East Garrison MRA)	Draft Remedial Investigation / Feasibility Study Work Plan (RI/FS WP)	19-Oct-09	
	Remedial Investigation Fieldwork	*TBD*	*Not Applicable*
	Draft Remedial Investigation/ Feasibility Study Report (RI/FS Report)	13-Oct-10*	RI Report due 180 days after approval of RI/FS WP FS Report due 120 days after approved of RI Report
	* Proposed milestone target date based on scheduled completion of RI/FS Report within 60 days of completion of remedial investigation fieldwork.		
	Draft Proposed Plan (PP)	*TBD*	*Not Applicable*
	Draft Record of Decision (ROD)	*TBD*	*Not Applicable*
	Draft Remedial Design Scoping Document [1]	01-Oct-11	Due 60 days after signature of the ROD
	Draft Remedial Design / Remedial Action Work Plan [1]	31-Oct-11	Due 30 days after EPA approval of the Remedial Design Scoping Document.
	Draft Institutional Controls Implementation Plan (IC Plan) [1]	31-Oct-11	Due 90 days after signature of ROD
	Draft Operations and Maintenance Plan (O&M Plan) [1]	31-Oct-11	Due 90 days after signature of ROD
	Pre-certification Inspection [1, 2] (if required)	23-Jul-12	Due within 90 days after Respondent concludes that the Remedial Action has been fully performed and the Performance Standards have been attained.
	Draft Remedial Action Completion Report (RACR)[1, 2]	22-Aug-12	Due within 30 days after the pre-certification inspection, if appropriate.
Notes:	[1] Schedule dependent upon approval of ROD.		
	[2]If No Further Action ROD is approved, the Pre-Certification Inspection and RACR will not be required.		
	Italics = Not a required compliance milestone under the AOC.		



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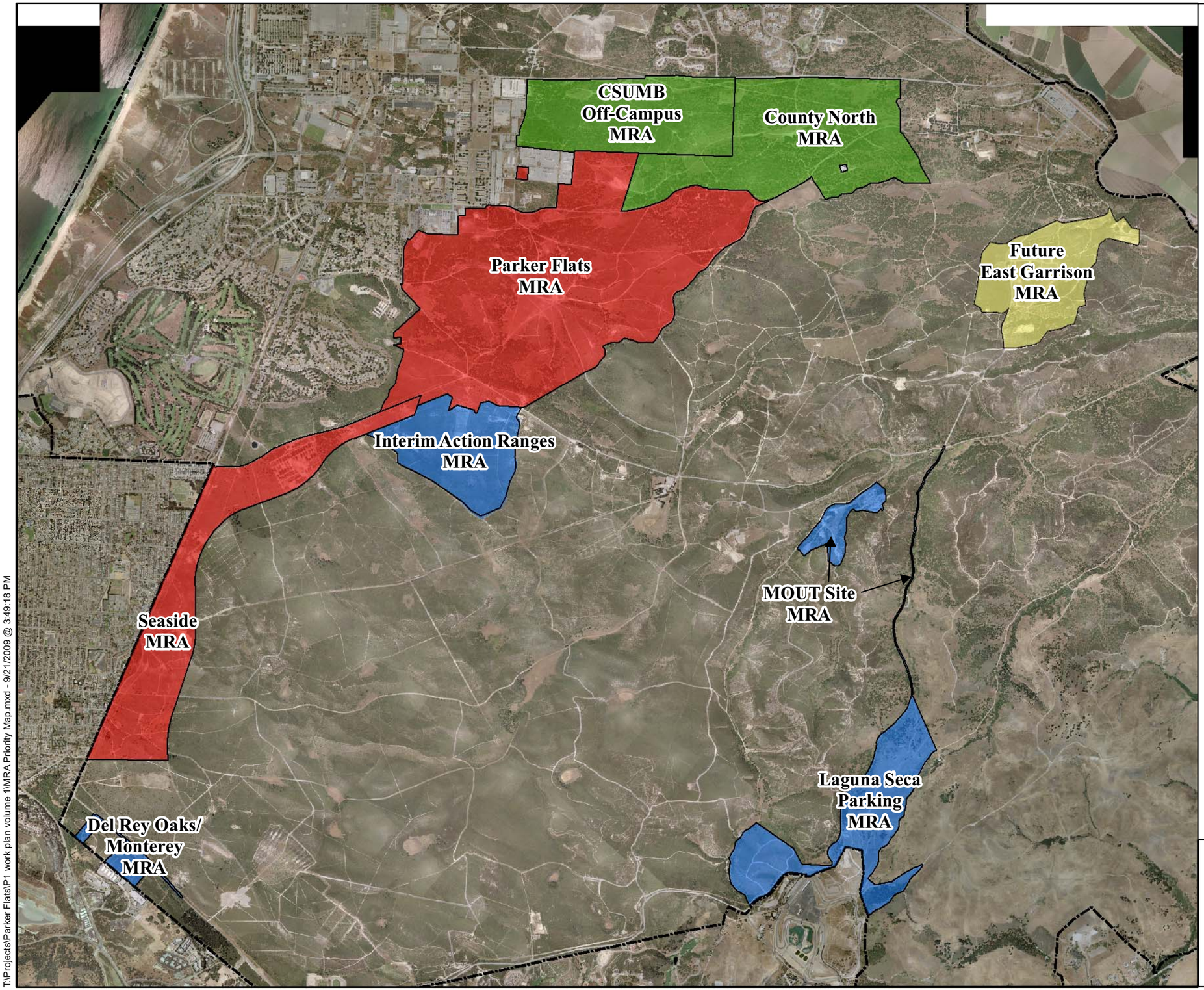
Former Fort Ord Location Map

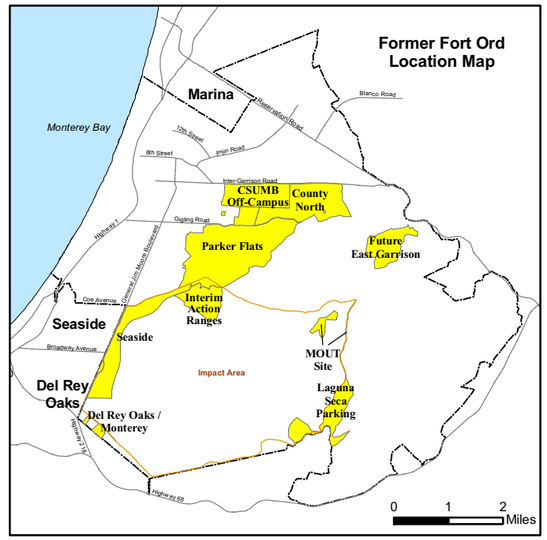
FORA ESCA RP
Monterey County, California

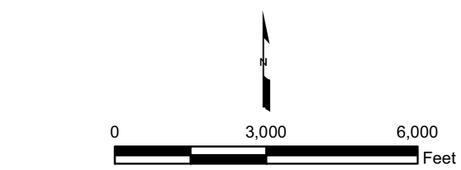
Figure 1



Legend

- Group 1 MRAs
- Group 2 MRAs
- Group 3 MRAs
- Group 4 MRA
- Former Fort Ord Boundary





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Munitions Response Area Groups

FORA ECSA RP
Monterey County, California

Figure 2

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East Garrison
Small Arms Ranges

Demolition
Area

Engineer Training Area/
Field Expedient Area and
Mechanic Training Area

Suspected Stokes
Mortar Range

Barloy Canyon Road

Rifle Grenade
Area

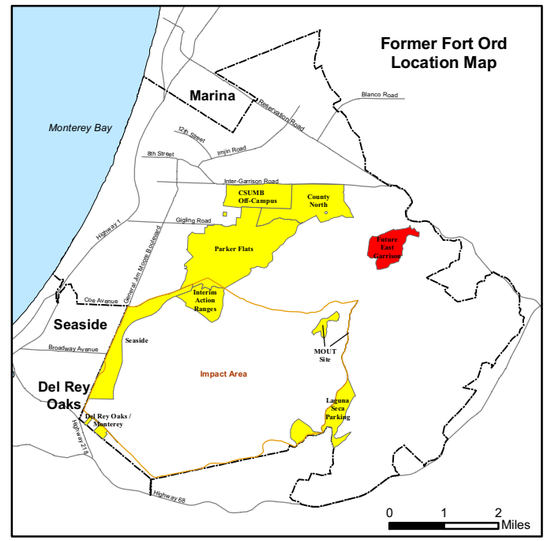
Engineer Training
Area "C"

Demolition Training
Area

Hand Grenade
Area

Legend

- Training Site
- Munitions Response Area
- Major Road
- Fence
- Small Arms Ranges



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0 500 1,000 Feet

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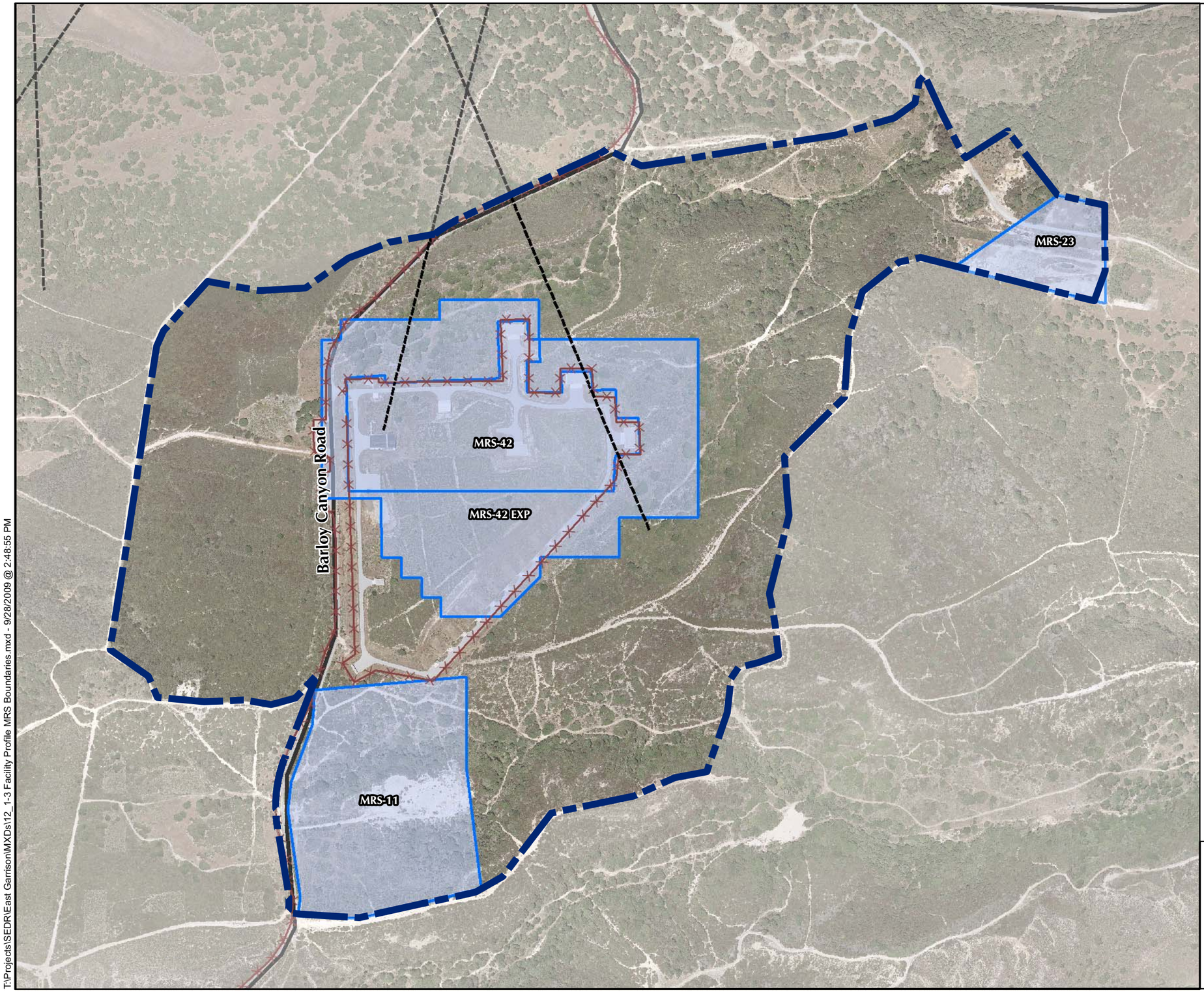
Future East Garrison MRA Facility Profile Ranges and Training Sites

FORA ESCA RP
Monterey County, California

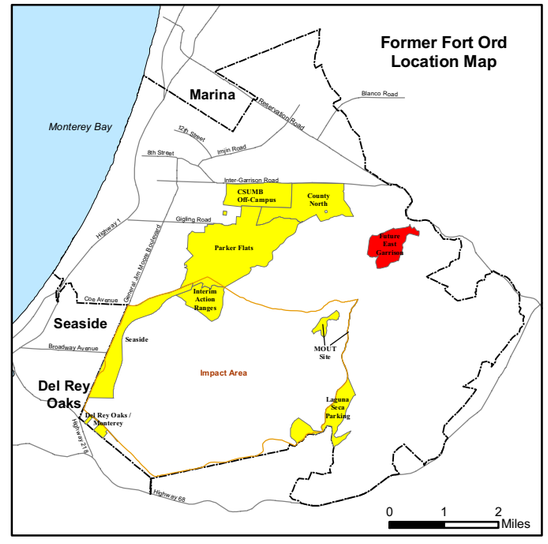
Figure 3

T:\Projects\SEDR\East Garrison\MXDs\12_1-2 Facility Profile Firing Ranges.mxd - 9/29/2009 @ 5:28:13 PM



Legend

- Munitions Response Area
- Major Road
- Fence
- MRS-42 — Munitions Response Site
- Small Arms Ranges



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Future East Garrison MRA
Facility Profile
Munitions Response Site Boundaries

FORA ESCA RP
Monterey County, California

Figure 4

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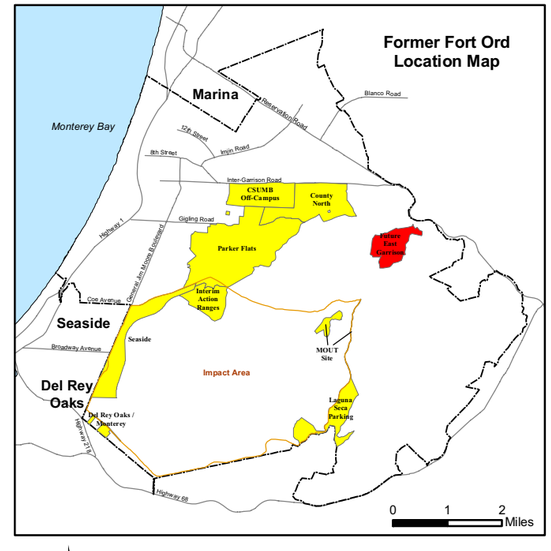
Legend

- School
- Fire Station
- Gate
- Entry Forbidden Sign
- Sign
- Hydrant
- High-Power Transmission Line Tower
- Electrical Line Pole
- Munitions Response Area
- Major Road
- Electrical Line
- Fence
- Gas Line
- Storm Line
- Telephone Line
- Water Line
- Sewer Line
- High-Power Transmission Line and Right of Way
- R9211 Structure
- E23.1 USACE Parcel



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Future East Garrison MRA
Facility Profile
Physical Features

FORA ESCA RP
Monterey County, California

Figure 5

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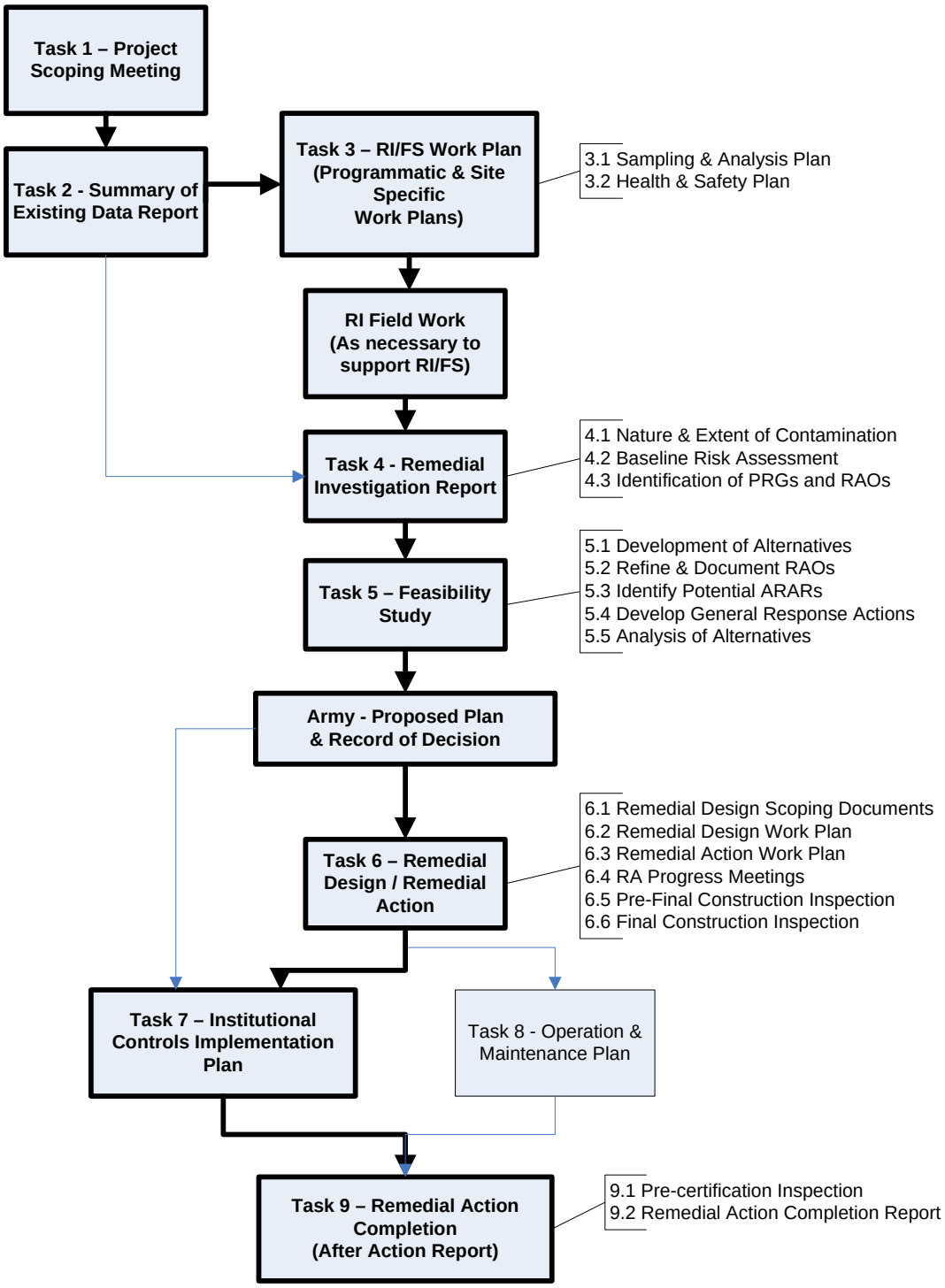

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Regulatory Pathway to Closure Group 4

FORA ESCA RP
Monterey County, California

Figure 6

APPENDIX A

Future East Garrison MRA Conceptual Site Model

12.0 EAST GARRISON MRA CONCEPTUAL SITE MODEL

The East Garrison CSM profiles are based on existing information and data provided by the Army and contained in the Fort Ord Administrative Record. Tables and figures associated with the East Garrison MRA are located at the end of Section 12.0.

12.1 East Garrison MRA Facility Profile

The facility profile provides information on location, physical boundaries, roadways and access, structures and utilities, historical military uses, and administrative controls associated with the MRA.

12.1.1 Boundaries and Access

The East Garrison MRA is located in the northeastern portion of the former Fort Ord (Figure 12.1-1). The East Garrison MRA is wholly contained within the jurisdictional boundaries of Monterey County.

The East Garrison MRA encompasses approximately 244 acres and contains the following four USACE property transfer parcels: E11b.6.1, E11b.7.1.1, E11b.8, and L20.19 1.1 (Table 12.1-1 and Figure 12.1-1).

Barloy Canyon Road is the only major roadway in the MRA (Figure 12.1-1). The western boundary of Barloy Canyon Road is lined with four-strand barbed-wire fencing. This fencing is not complete along the entire length of the roadway, allowing unauthorized access to Parcel E11b.6.1. The eastern boundary of Barloy Canyon Road is not fenced; however, a portion of Parcel E11b.8 contains the former Ammunition Supply Point (ASP), where access is currently restricted by cyclone fencing topped with razor wire (Figure 12.1-1). Vehicle traffic is currently restricted on Barloy Canyon Road by locked gates, barricades with concertina wire, and warning signs across Barloy Canyon Road to the north and by locked gates and barricades across South Boundary Road to the south. Controlled public traffic is only allowed on Barloy Canyon Road during Laguna Seca Raceway events. A number of additional paved and unpaved roadways and dirt trails are located throughout the MRA (Figure 12.1-1). Detailed information on roadways and access is provided in Table 12.1-2.

12.1.2 Structures and Utilities

The East Garrison MRA includes 24 existing buildings and structures; 23 related to the former ASP, which was used by the Army as an explosives storage and ordnance assembly area, and one related to former military operations in the northeastern portion of the MRA (Army 2007; Figure 12.1-1). Detailed information on these structures, consisting of location, size, description of structures, presence of ACM and/or LBP, if evaluated, and year constructed, is provided in Table 12.1-3.

The MRA was served by water, sewer, electrical, and telephone utilities prior to base closure. The sewer services were discontinued, but the utility lines were left in place. Electrical and telephone utilities are also present, but service is not active. A natural gas line crosses the northeastern portion of the MRA. Detailed information on utilities is provided in Table 12.1-2.

12.1.3 Historical Military Use

Initial use of the East Garrison MRA began in approximately 1917 when the U.S. government purchased more than 15,000 acres of land and designated it as an artillery range. Although no training maps from this time period have been found, pre-World War II-era military munitions have been removed during previous Army response actions within the East Garrison MRA.

Figure 12.1-2 shows the locations of known training sites in the vicinity of the MRA. Known and suspected training areas include (USACE 1997a and Parsons 2006c):

- Demolition Training Area and Hand Grenade Area
- Mechanic Training Area
- Rifle Grenade Range
- Engineer Training Area "C"
- An impact area for Stokes trench mortars is suspected of being present in the eastern portion of the East Garrison MRA. The location of possible firing points is unknown.

Three areas of the East Garrison MRA were designated as MRSs based on historical information. The MRSs were designated as MRS-11, MRS-23, and MRS-42, which includes an expanded area identified as MRS-42 EXP (Figure 12.1-3).The MRSs were identified in the Revised Archive Search Report and subsequent site assessment documents as follows:

- MRS-11 - Demolition Training Area and Hand Grenade Area
- MRS-23 - Engineer Training Area / Field Expedient Area and Mechanic Training Area
- MRS-42 - Rifle Grenade Range

Also, the range fans for the former East Garrison Small Arms Ranges, located to the northwest, extended onto the MRA (Figure 12.1-2).

A summary of the historical military use of each MRS is provided in Table 12.1-4.

12.1.4 Administrative Controls

A number of administrative controls have been and will be imposed on the East Garrison MRA, including land use covenants, county ordinances, FORA resolutions, an MOA between FORA and the DTSC, habitat-related requirements, and BOs. The applicable administrative controls are described in detail in Table 12.1-5. These administrative controls are enforceable

and place constraints on field-related activities and future development activities until such time that remediation has been completed and the regulatory agencies have made a determination as to the closure status of the East Garrison MRA.

12.2 East Garrison MRA Physical Profile

The physical profile provides information on topography, geology, vegetation, surface water, and groundwater associated with the MRA that may affect the location, movement, detectability, and recovery of military munitions.

12.2.1 Topography and Geology

The terrain of the East Garrison MRA varies from gently sloping in the south and west to steep canyon-like walls in the north and east. The elevation ranges from approximately 170 to approximately 480 feet msl (Figure 12.2-1). Three ravines exist within the MRA; one ravine extends to the east in the southern portion of the MRA, and two converging ravines extend to the northeast in the northern portion of the MRA. The slope of the terrain in the MRA ranges from relatively flat (3 to 5 percent) within the former ASP to steep (up to 50 percent) along the ravines. The MRA is underlain by several hundred feet of eolian deposits (Aromas Eolian Facies) consisting mostly of weathered dune sand. Surface soil conditions in the East Garrison MRA are predominantly weathered dune sand (Figure 12.2-1), which provides a relatively good environment for conducting geophysical surveys, including electromagnetic and magnetic surveys. Table 12.2-1 provides more detailed information on the geology of the former Fort Ord and soil encountered within the MRA.

12.2.2 Vegetation

The East Garrison MRA primarily consists of maritime chaparral with small areas of oak woodland and grassland (Table 12.2-2 and Figure 12.2-2; USACE/Jones & Stokes 1992). Vegetation varies from sparsely vegetated areas to dense areas of overgrowth. Past field activities have noted the presence of poison oak in various areas of the MRA.

12.2.3 Surface Water and Groundwater

Groundwater investigations associated with the Basewide RI/FS have resulted in the installation of a number of groundwater monitoring wells on former Fort Ord property near the East Garrison MRA. The Salinas Groundwater Basin is the main hydrogeologic unit that underlies the East Garrison MRA. The depth to groundwater is estimated to be greater than 100 feet bgs and is not expected to influence geophysical surveys conducted for MEC remediation activities. There are no known wells within the boundaries of the East Garrison MRA; however, one monitoring well is located to the north-northwest of the MRA (Figure 12.2-1).

There are a number of small aquatic features (i.e., vernal pools, ponds) located within the boundaries, as well as within 500 feet (approximately 150 meters) of the eastern and

northeastern portions of the East Garrison MRA, and a relatively larger aquatic feature located approximately 1,300 feet (approximately 340 meters) to the northwest of the MRA (Figure 12.2.2).

12.3 East Garrison MRA Release Profile

The release profile provides information on the MRA with respect to investigation and removal history, location and extent of military munitions, such as MEC, MPPEH, and MD, and history and conditions of HTW.

12.3.1 Investigation and Removal History

Several investigation and removal actions were conducted by the Army in the East Garrison MRA, which included:

MRS -11

- Magnetometer assisted visual surface (14.4 acres) and 1-foot removal actions on roads and trails (1.6 acres) consisting of 27 100-foot by 100-foot grids and partial grids in the southern portion of the MRS, began on December 2, 1997; the fieldwork was suspended on December 17, 1997 when it was revised to 1-foot removal action (USA 2001g)
- Removal action to a depth of 1 foot over 16 acres in the southern portion of the MRS in May 1998 (USA 2001g)
- SS/GS sampling conducted in five 100-foot by 200-foot grids in the northern portion of the MRS in May 1998 (USA 2001g)

MRS-23

- Removal action to a depth of 4 feet in 39 100-foot by 100-foot grids and partial grids in the MRS from November to December 1997 (USA 2001e)

MRS-42/MRS-42 EXP

- Removal action to a depth of 4 feet across approximately 45 acres of the MRS from February 1998 to February 2000 (USA 2001l)

The Army also conducted a site assessment of the East Garrison MRA (also known as East Garrison Area 4) (Parsons 2006c). Site assessments are conducted to collect data in MRSs or areas of interest that may contain evidence of military munitions training. Although the portions of East Garrison Area 4 that were subjected to the site assessment were not expected to contain any evidence of military munitions training, the area as a whole was designated as an area of interest because it contained the above-referenced MRSs and was in close proximity to other MRSs.

These investigation and removal actions are summarized in Table 12.3-1. During the removal actions, two burial pits containing MEC were discovered to the northeastern portion of MRS-42 EXP (Figure 12.3-2). Table 12.3-2 provides more detailed information on the specific types of MEC recovered from these burial pits. The results of these investigations and removal actions with respect to MEC and MD are summarized in Table 12.3-3 and are shown on Figures 12.3-1, 12.3-2, and 12.3-3.

12.3.2 Types of MEC Recovered and Hazard Classification

Table 12.3-3 includes a summary of types of MEC recovered from the East Garrison MRA and associated hazard classification scores. All MEC removed from the MRA were identified and assigned a hazard classification. Hazard classification scores range from 0 to 3 according to the following descriptions:

Hazard Classification Score	Description
0	Inert MEC that will cause no injury
1	MEC that will cause an injury or, in extreme cases, could cause major injury or death to an individual if functioned by an individual's activities
2	MEC that will cause major injury or, in extreme cases, could cause death to an individual if functioned by an individual's activities
3	MEC that will kill an individual if detonated by an individual's activities

The hazard classification provides a qualitative assessment of risk for MEC. These classifications will be used as inputs in future risk assessments for the East Garrison MRA. It should be noted that SAA is not considered in the risk assessment because SAA poses no explosive risk.

12.3.3 Location of MEC and MD

Figures 12.3-1, 12.3-2, and 12.3-3 show the distribution of MEC and MD within the East Garrison MRA. A summary of the MEC and MD encountered during previous investigations and removal actions in the East Garrison MRA is provided in Table 12.3-4 and included:

- 326 UXO items
- 10 ISD items (MPPEH that could not be classified as UXO, DMM, or MD)
- 4,107 pounds of MD (includes MD-E and MD-F items if weights were documented)

The MMRP database indicates that the majority of MEC items encountered during previous removal actions were in the central portion of MRS-42 and in the southern portion of MRS-11 (Figure 12.3-2). The majority of MEC and MD were encountered within 6 inches bgs. Figure 12.3-4 shows the distribution of MEC recovered at specified depth intervals and

does not include MEC recovered from the burial pits. The two burial pits encountered in MRS-42 EXP contained a total of 243 of the 336 MEC items found within the MRA.

12.3.4 HTW History and Conditions

A BRA was conducted by the Army to evaluate the potential presence of COCs related to HTW at known or suspected small arms ranges, multi-use ranges, and military munitions training sites within the former Fort Ord (Shaw/MACTEC 2006). The areas were identified as HAs. The objectives of the BRA investigation activities were to identify which HAs could be eliminated from consideration for potential remediation related to COCs, and to identify areas that require additional investigation for potential chemical contamination, or should be considered for remediation/habitat mapping related to COCs.

Table 12.3-5 summarizes the findings of the BRA with respect to HTW for each MRS. As stated in the FOSET, based on the BRA, no further action has been recommended for HAs within the MRA (Army 2007).

In addition, IRP Site 41 (Crescent Bluff Fire Drill Area) was investigated and approximately 76 cubic yards of soil were removed; the U.S. EPA and DTSC concurred on the no further action determination for IRP Site 41.

12.3.5 Regulatory Status

Work completed to date has been documented in after action reports, which have received regulatory reviews; however, the regulatory agencies have identified the following outstanding issues:

- The CERCLA process must be completed for the East Garrison MRA, including development of an RI/FS, development of a Proposed Plan, and completion of a ROD

12.4 East Garrison MRA Land Use and Exposure Profile

The land use and exposure profile provides information on the MRA with respect to cultural resources, the current and reasonably foreseeable future uses of the land, and the potential human receptors that may be exposed to military munitions.

12.4.1 Cultural Resources

According to archaeological records, the greater Monterey Peninsula was occupied by Native American groups, including the Ohlone (Costanoan) Indians (EA 1991). Monterey County has designated the southeastern margin of the former Fort Ord as an archaeologically sensitive zone based on two known archaeological sites (EA 1991). The remaining portions of the former Fort Ord have been designated as having low or no archaeological sensitivity. The East Garrison MRA is located in the northeastern portion of the former Fort Ord in an area designated as having low archaeological sensitivity.

Actions to be taken at the East Garrison MRA will be in compliance with the Programmatic Agreement Among the Department of the Army, the Advisory Council on Historic Preservation, and the California State Historic Preservation Officer Regarding the Base Closure and Realignment Actions at Fort Ord, California.

12.4.2 Current Land Use

The East Garrison MRA is currently undeveloped and unused, with the exception of the former ASP located in the central portion of the MRA (Figure 12.1-1). The former ASP was recently used as a staging area in support of Army MEC removal activities. A number of the bunkers (Buildings 760 through 769) have also been used to store explosives in support of the MEC removal activities. Other structures on the East Garrison MRA were used for equipment and supply storage (i.e., trucks, temporary fencing, sand bags, etc.).

12.4.3 Reasonably Foreseeable Future Land Use

Table 12.4-1 and Figure 12.4-1 identify the proposed uses of the MRA by parcel. As indicated in the Base Reuse Plan, this area is predominantly planned for residential and habitat uses with a development corridor for the roadway. It is important to note that the development land use category encompasses infrastructure activities, such as roadway and utility corridor construction, as well as borderland activities.

12.4.4 Potential Receptors

A number of potential human receptors that could come in contact with residual MEC have been identified for current and future land use scenarios. The potential human receptors include:

- Construction Workers (persons conducting surface and subsurface construction activities) – current/future
- Utility Workers (persons installing and maintaining surface and subsurface utilities) - current/future
- Trespassers (persons not authorized to enter or use an area) – current/future
- Firefighters (may require installation of fire breaks) – current/future
- Emergency Response Workers (police and emergency medical technicians conducting surface activities) – current/future
- Ancillary Workers (biologist, archaeologists) – current/future
- Residents (persons conducting surface and subsurface activities) – future
- Recreational Users (persons biking or on foot) – future

12.5 East Garrison MRA Ecological Profile

The ecological profile provides information on the MRA with respect to biological resources, plant communities and habitats, threatened and endangered species, and habitat management. This information is discussed below and provided in Table 12.5-1.

As discussed in Section 12.3.4, COCs related to HTW have been previously addressed and no further action was recommended. Therefore, potential exposure of ecological receptors to the primary risk factors has been mitigated to an acceptable level and ecological receptor exposure is not considered further in this CSM.

The HMP identifies the East Garrison MRA as development (which includes residential reuse) with a borderland development buffer area along the interface with an NRMA designated as habitat reserve (Figure 12.5-1). The setback requirements for the borderland buffer were defined in the Draft HCP as being 200 feet wide. The NRMA interface separates the development category land within the East Garrison MRA from the adjacent habitat reserve areas. The NRMA and habitat reserve areas support plant and animal species that require implementation of mitigation measures identified in the HMP to ensure compliance with the ESA and to minimize impacts to listed species.

FORA will implement the mitigation requirements identified in the HMP for MEC activities in accordance with the BOs developed during formal consultation between the Army and the USFWS under Section 7 of the ESA. For habitat areas, these measures include conducting habitat monitoring in compliance with Chapter 3 of the HMP (USACE 1997b). For borderland areas, FORA will follow best management practices while conducting work to prevent the spread of exotic species, limit erosion, and limit access to the NRMA.

12.5.1 Major Plant Communities and Ecological Habitats

The East Garrison MRA primarily consists of maritime chaparral with small areas of oak woodland and grassland (Figure 12.2-2 and Table 12.2-2; USACE/Jones & Stokes 1992). Vegetation varies from sparsely vegetated areas to dense areas of overgrowth. Past field activities have noted the presence of poison oak in various areas of the MRA.

12.5.2 Threatened and Endangered Species and Critical Habitat

The USFWS BO required that an HMP be developed and implemented to reduce the incidental take of listed species and loss of habitat that supports these species. The HMP for the former Fort Ord complies with the USFWS BO and establishes the guidelines for the conservation and management of wildlife and plant species and habitats that largely depend on former Fort Ord land for survival (USACE 1997b). The HMP incorporated conservation measures pursuant to USFWS BOs dated prior to issuance of the HMP in April 1997. Since April 1997, three additional BOs have been issued that are relevant to MEC removal activities (USFWS 1999, 2002, and 2005). Future MEC remediation is required to be consistent with the applicable conservation measures.

The East Garrison MRA is identified within the HMP to require special management for the boundaries between developed areas and the NRMA. The requirements have both interim and long-term maintenance implications.

Threatened or endangered plant species identified as having possible occurrence in the East Garrison MRA include sand gilia (endangered) and Monterey spineflower (threatened). A portion of the East Garrison MRA has been designated as critical habitat for the Monterey spineflower by the USFWS.

In 2004, the CTS was identified as a threatened species. CTS may be found as far as 2 km from aquatic breeding habitats. CTS may occur within the East Garrison MRA due to the presence of several aquatic features within and adjacent to the MRA that may provide suitable breeding habitat (Figure 12.5.1).

12.5.3 Other Communities and Species of Concern

As identified in the HMP, there are a number of species that could be found on the East Garrison MRA, which have been identified by parcel in Table 12.5-2. The following species are identified in the HMP as having possible occurrence in the East Garrison MRA: toro manzanita, sandmat manzanita, Monterey ceanothus, Eastwood's ericameria, Seaside bird's beak, Hooker's manzanita, and Monterey ornate shrew.

12.6 East Garrison MRA Pathway Analysis

As discussed in Sections 12.3.4 and 12.4, potential exposure of human and ecological receptors to COCs related to the HTW program has been evaluated by the Army. Based on the Army's evaluation in the FOSET, no further action relative to the COCs is required under the ESCA RP. Therefore, no further discussion of potential exposure to human or ecological receptors to COCs relative to the HTW program is presented in this pathway analysis. The primary focus of the exposure pathway analysis is for human health risk from MEC that are potentially present.

12.6.1 Exposure Pathways

An exposure pathway analysis was conducted for the East Garrison MRA using the information gathered in the CSM profiles. Exposure pathways include a source, access, receptor, and activity. The likelihood of exposure, however, has been significantly reduced as a result of previous removal actions by the Army. Exposure pathways for the East Garrison MRA are presented on Figure 12.6-1 and discussed below.

Source

Most of the source areas within the East Garrison MRA were addressed during the Army's previous removal actions. The historical source areas within the East Garrison MRA are shown on Figures 12.1-3, and recovered MEC and MD from these areas are shown on Figures 12.3-1, 12.3-2, and 12.3-3. The source areas include target areas, firing points, and

range safety fans for military weapons training activities at MRS-11, MRS-42, and the Stokes trench mortar range to the east of MRS-42. Previous investigations by the Army concluded that MRS-23 is not a source area (Parsons 2006c).

Figure 12.6-2 illustrates the most likely release mechanisms for MEC being found in the East Garrison MRA, which include:

- Mishandling/Loss, Abandonment, and Burial (Military Weapons Training)
- Direct and Indirect Firing and Thrown (Military Weapons Training)
- Intentional Placement, Mishandling/Loss, Abandonment, and Burial (Troop Training and Maneuvers)

Access

Access is not restricted to MRS-23 and MRS-11. Access is restricted to MRS-42 as it is contained within the fence surrounding the former ASP.

Receptor / Activity

Table 12.6-1 identifies the receptors and exposure media as Ground Surface or Below Grade.

12.6.2 Exposure Pathway Analysis

As discussed above, Figure 12.6-1 graphically presents the exposure pathways analysis for the East Garrison MRA. The graphic shows the current and future potentially complete pathways for activities in the East Garrison MRA. These exposure pathways exist because investigations and removal actions were not completed in the MRA.

12.7 East Garrison MRA Conclusions and Recommendations

Potential exposure of human and ecological receptors to COCs related to the HTW program has been evaluated by the Army. Based on the Army's evaluation in the FOSET, no further action relative to the COCs is required under the ESCA RP. The CSM has identified a potential for human health risk associated with residual (or potentially present) MEC in East Garrison MRA.

As required by the AOC, the SEDR provides conclusions and recommendations for each MRA. Generally, the SEDR recommendations identify that a particular MRA falls into one or more of the following categories:

- No response action or no further response action is appropriate
- Response action is necessary
- Additional data are required to fill data gaps
- Proceed to RI

The MEC encountered at the East Garrison MRA are consistent with the historical military use as a weapons and troop training area. Army has conducted investigations and removal action is this MRA, which provide sufficient information to support an RI/FS report. Therefore, the East Garrison MRA falls into the category of proceed to RI. Based on the existing data for the East Garrison MRA, the recommendation is:

- Proceed with Documentation – Prepare RI/FS Report and subsequent ROD.

The proposed pathway to regulatory closure incorporating the above recommendations is presented in Section 13.0 of this SEDR.

Table 12.1-1
East Garrison MRA –Parcel Numbers, Acreage, and MRS Identifiers

USACE Parcel Number (for land transfer)	Acreage (approximate)	MRS Identifier
E11b.6.1	48	No related MRS
E11b.7.1.1	122	MRS-11, MRS-23
E11b.8	68	MRS-42, MRS-42 EXP
L20.19.1.1	6	No related MRS
MRA TOTAL	244	

Table 12.1-2
East Garrison MRA – Site Features

Feature	Description
Roadways	• Barloy Canyon Road is the only major roadway in the MRA. • Barloy Canyon Road is a two-lane roadway oriented in a north-south direction and crosses the western portion of the MRA. • Vehicle traffic is currently restricted on Barloy Canyon Road, with the exception of controlled traffic during Laguna Seca Raceway events. • Other paved and unpaved roadways and dirt trails also exist throughout the MRA.
Fencing and Access	• The western side of Barloy Canyon Road is lined with four-strand barbed-wire fencing. This fencing is not complete along the entire length of the roadway, allowing unauthorized access to Parcel E11b.6.1. • The eastern side of Barloy Canyon Road is not fenced; however, a portion of Parcel E11b.8 contains the former ASP, where access is restricted by cyclone fencing topped with razor wire. • Access to the MRA is restricted by locked gates, barricades with concertina, and warning signs across Barloy Canyon Road to the north and by locked gates and barricades across South Boundary Road to the south.
Structures and Utilities	• The MRA includes 23 buildings and structures related to the former ASP, which was used as an explosives storage and ordnance assembly area, and one structure in the northeasternmost portion of the MRA. The MRA was served by water, sewer, electrical, and telephone utilities prior to base closure. • Water and sewer services were discontinued, but the utility lines were left in place. • Electrical and telephone utilities are also present, but service is not active. • Two storm-water lines exist at the former ASP, which convey storm-water runoff to the northeast. • A natural gas line crosses the northeastern portion of the MRA.

Table 12.1-3
East Garrison MRA – Existing Structures and Buildings

Parcel Number	Facility Number	Area (square feet)	Description	Asbestos-Containing Material	Lead-Based Paint	Year Built
E11b.7.1.1	610	1,585	Vehicle Area	Not surveyed	Unknown	Unknown
E11b.8	725	4,095	Storehouse	rated 6 to 13	NO	1991
E11b.8	727	4,053	Storehouse	rated 6 to 13	NO	1991
E11b.8	730	4,714	Storehouse	rated 6 to 13	NO	1991
E11b.8	735	4,393	Storehouse	rated 6 to 13	NO	1991
E11b.8	740	829	Ordnance Admin Building	no ACM	NO	1991
E11b.8	741	498	Vehicle Maintenance Shop	no ACM	NO	1991
E11b.8	742	729	Sentry Station	unknown	NO	1991
E11b.8	744	2,208	Storehouse	unknown	NO	1991
E11b.8	745	722	Liquid Gas Storage Facility	no ACM	NO	1991
E11b.8	746	7,960	Ammo Surveillance Facility	no ACM	NO	1991
E11b.8	747	723	Standby Generator	unknown	NO	1991
E11b.8	750	1,230	Storehouse	unknown	NO	1991
E11b.8	752	1,927	General Purpose Magazine	unknown	NO	1991
E11b.8	760	1,935	Igloo Storage	no ACM	NO	1991
E11b.8	761	3,163	Igloo Storage	unknown	NO	1991
E11b.8	762	3,191	Igloo Storage	unknown	NO	1991
E11b.8	763	3,176	Igloo Storage	unknown	NO	1991
E11b.8	764	3,191	Igloo Storage	no ACM	NO	1991
E11b.8	765	3,176	Igloo Storage	no ACM	NO	1991
E11b.8	766	3,176	Igloo Storage	no ACM	NO	1991
E11b.8	767	3,163	Igloo Storage	no ACM	NO	1991
E11b.8	768	3,170	Igloo Storage	no ACM	NO	1991
E11b.8	769	3,170	Igloo Storage	no ACM	NO	1991

Table 12.1-4
East Garrison MRA – Historical Military Use

Location	Historical Military Use
MRS-11	• This area was defined as a 5- to 15-acre Demolition Training Area (USACE 1997a). • This area was also identified as an old EOD range; however, the exact location was unknown (USACE 1997a). Based on the results of previous investigations, the EOD range was believed to be located west of this area (USA 2001g). • A historical map (Master Plan Fort Ord) from 1946 shows a live hand grenade training range in the vicinity (USACE 1997a). • A historical map (Fort Ord Training Areas & Facilities) from 1957 identifies a "Frag Zone" and "Engineer Training Area C" in the same area (USACE 1997a). • Items found in this area included hand grenades, flare and illuminating signals, one 4.2-inch projectile, and one 37mm projectile.
MRS-23	• This area is listed as an Engineer Training Area and Field Expedient Area (USACE 1997a). • A concrete pit in this area was identified as an amphibious training area used to test whether a vehicle's engine would continue to run under water (USACE 1997a). • This area reportedly contained demolition blow holes, which were later determined to be burn pits for fire drills (USA 2001e). • One item was found in this area, which was a demolition charge.
MRS-42 and MRS-42 EXP	• This area was identified as a Rifle Grenade Area (USACE 1997a). • A historical map (Master Plan Fort Ord) from 1946 indicates "rifle grenade" at the approximate location of this area (USACE 1997a). • The area was also known as the ASP Rifle Grenade Area and Site OE-42 Explosives Storage Location (USA 2001l). • Items found in this area include rifle grenades and one 3-inch Stokes mortar.

Table 12.1-5
East Garrison MRA – Administrative Controls

Type	Description
Land Use Covenants	• To further ensure protection of human health and the environment, the Army has agreed to enter into CRUPs with the State of California. The CRUPs place additional use restrictions on all of the transferring property, as appropriate. • Due to Fort Ord's former use as a military installation, the property may contain MEC and there remains a risk of encountering subsurface MEC. Any person conducting ground disturbing or intrusive activities (e.g., digging or drilling) must comply with the applicable municipal code. Any alterations, additions, or improvements to the property in any way that may violate excavation restrictions are prohibited. No actual or potential hazard exists on the surface of the property from MEC that may be in the subsurface of the property provided the CRUPs are adhered to (Army 2007). • The CRUPs are defined in the "Memorandum of Agreement Among the Fort Ord Reuse Authority, Monterey County and Cities of Seaside, Monterey, Del Rey Oaks and Marina, California State University Monterey Bay, University of California Santa Cruz, Monterey Peninsula College, and the Department of Toxics Substances Control Concerning the Monitoring and Reporting of Environmental Restrictions on the Former Fort Ord, Monterey County, California." • These restrictions involve the enforcement of site review and reporting requirements and agency cost recovery/ reimbursement requirements as imposed by the DTSC.
Restrictions to Digging / Excavation	• Monterey County Ordinance 16.10 prohibits excavation, digging, development or ground disturbance of any type on the former Fort Ord that involves the displacement of 10 cubic yards or more of soil without approval.
FORA Resolution 98-1	• An approved FORA resolution that contains proposed and suggested measures to avoid or minimize hazardous material impact.
ESCA MOA	• MOA between FORA and the jurisdictions for the purpose of defining terms of an agreement for holding and managing (ownership and responsibilities) property while remedial work is accomplished under an ESCA. • The MOA establishes FORA's ownership during MEC Remediation Period; identifies that jurisdictions need to provide public safety response from police, fire, and other emergency personnel as needed; establishes control of access to ESCA properties during MEC remediation period; and agreement that access to properties will be governed by the restrictions included in the Land Use Covenant accompanying the transfer of the property.
Habitat Management Plan	• The HMP incorporated conservation measures pursuant USFWS BOs dated prior to issuance of the HMP in April 1997. Specific MEC activities were addressed in Chapter 3 of the HMP (USACE 1997b).
Biological Opinions/ Critical Habitat	• Since HMP release, three additional BOs have been issued that are relevant to the MEC remediation period (USFWS 1999, 2002, and 2005). Accordingly, some information has been updated and additions have been made to the sections that address MEC activities. • A portion of the East Garrison MRA has been designated as Critical Habitat for the Monterey spineflower by the USFWS. • Future MEC work is required to be consistent with the applicable conservation measures.

Table 12.2-1
East Garrison MRA – Geology and Soils

Type	Description
Geology	• The former Fort Ord is located within the Coast Ranges Geomorphic Province, which consists of northwest-trending mountain ranges, broad basins, and elongated valleys generally paralleling the major geologic structures. • The former Fort Ord is located at the transition between the mountains of the Santa Lucia Range and the Sierra de la Salinas to the south and southeast, respectively, and the lowlands of the Salinas River Valley to the north. • The geology of the former Fort Ord generally reflects this transitional condition. Older, consolidated rocks are characteristically exposed in the mountains near the southern base boundary but are buried under a northward-thickening sequence of younger, unconsolidated alluvial fan and fluvial sediments in the valleys and lowlands to the north. In the coastal lowlands, these younger sediments commonly interfinger with marine deposits. • The former Fort Ord and the adjacent areas are underlain, from depth to ground surface, by one or more of the following older, consolidated units: Mesozoic granite and metamorphic rocks; Miocene marine sedimentary rocks of the Monterey Formation; and upper Miocene to lower Pliocene marine sandstone of the Santa Margarita Formation (and possibly the Pancho Rico and/or Purisima Formations) • Locally, these units are overlain and obscured by geologically younger sediments, including: Pliocene-Pleistocene alluvial fan, lake, and fluvial deposits of the Paso Robles Formation; Pleistocene eolian and fluvial sands of the Aromas Sand; Pleistocene to Holocene valley fill deposits consisting of poorly consolidated gravel, sand, silt, and clay; Pleistocene and Holocene dune sands; recent beach sand and alluvium. • The East Garrison MRA includes deposits from the Paso Robles Formation and sand and gravel deposits of Aromas Sandstone.
Topography and Soils	• Terrain varies from gently sloping in the south and west to steep canyon-like walls in the north and east. • Elevation ranges from approximately 170 to approximately 480 feet msl. • Three ravines exist within the MRA; one ravine extends to the east in the southern portion of the MRA, and two converging ravines extend to the northeast in the northern portion of the MRA. • Soils consist predominantly of the following: Arnold-Santa Ynez Complex, dissected Xerorthents, and Arnold Sandy Loam.

References: EA 1991, HLA 1995, and the Fort Ord MMRP Database

Table 12.2.2
East Garrison MRA – Vegetation

USACE Parcel Number	MRS Identifier	Vegetation
E11b.6.1	No related MRSs	Maritime chaparral.
E11b.7.1.1	MRS-11, MRS-23	Maritime chaparral with a small area of grassland in the southwestern portion of the parcel.
E11b.8	MRS-42	Maritime chaparral surrounding the former ASP with inland coast live oak woodland to the north. Vegetation is not defined within the former ASP because this portion of the parcel is developed / disturbed.
L20.19.1.1	No related MRSs	No vegetation; parcel is developed with an existing roadway (Barloy Canyon Road)

Reference: USACE/Jones & Stokes 1992

Table 12.3-1
East Garrison MRA – Investigation, Sampling, and Removal Activities

Activity	Summary
MRS-11	• In 1994, the USACE OESS deferred a planned sampling operation when a live MK2 hand grenade was found during survey operations. At that time, it was reported that the MRS was littered with fragments of MK2 hand grenades. The Archive Search Report Supplement then recommended that Site OE-11 be expanded to a much larger area, based on the discovery of MK2 hand grenades in eroded gullies as far as 300 yards north of the site boundary (just south of the ASP) (USACE 1994). • In 1997, a magnetometer-assisted visual surface and 1-foot removal operation of roads and trails in MRS-11 was suspended after one UXO fragmentation grenade was found at a depth of 13 inches in the roads and trails area and 47 ordnance scrap grenade fuzes were encountered on the surface in the MRS. Operations were accomplished over 27 100- by 100-foot grids and partial grids, all of which were located in the southern portion of MRS-11 (USA 2001g). • In 1998, MRS-11 underwent a 1-foot removal action over 16 acres in the southern half of the MRS. The removal operation included the grids that had been previously cleared of surface MEC and all of the grids that had been partially cleared to 1 foot during the previous roads and trails removal operation (USA 2001g). • In 1998, five 100-foot by 200-foot grids in the northern half of MRS-11 were sampled using SS/GS sampling methodology. No MEC were found during SS/GS sampling. Based on the results of the sampling and removal operations, additional investigation was recommended within MRS-11 and to the east of the MRS (USA 2001g).
MRS-23	• From November to December 1997, a 4-foot removal action was completed on 39 100-foot by 100-foot grids and partial grids in MRS-23 (USA 2001e).
MRS-42 and MRS-42 EXP	• From February 1998 to February 2000, a 4-foot removal action was conducted on approximately 45 acres in MRS-42. Approximately 6 acres of land planned for removal action were not complete due to reprogramming of funds (USA 2001l).
East Garrison MRA Site Assessment	• Between 2005 and 2006, a site assessment was conducted in the East Garrison MRA (also known as East Garrison Area 4). Site assessments are conducted to collect data in MRSs or areas of interest that may contain evidence of military munitions training. Although the portions of the East Garrison MRA that were subjected to the site assessment were not expected to contain any evidence of military munitions training, 17 anomalies resulted in military munitions or evidence of military munitions. Of the 17 items, two were identified as MEC: an MKI illumination hand grenade and an M125 series illumination signal. The other 15 items were MD, including MD-E items, expended SAA and inert military munitions, and MD-F (Parsons 2006c).

Table 12.3-2
East Garrison MRA – Burial Pits Containing MEC

Location	Grid	Pit No. *	Type	Item Description	Qty	Depth (inches bgs)
MRS-42 EXP	C4F5J9	1	UXO	Fuze, Grenade, Hand, Practice, M228	183	14
		2	UXO	Simulator, Explosive Booby Trap, Flash, M117	60	12

Notes: * If more than one pit was found in a grid.

Reference: Fort Ord MMRP Database

Please note: Munitions descriptions have been taken directly from the Army's MMRP Database and/or other historical documents. Any errors in terminology, filler type, and/or discrepancies between model number and caliber/size are a result of misinformation from the data sources.

Table 12.3-3
East Garrison MRA – Types of MEC Removed and Hazard Classification

MEC ITEMS	UXO	DMM	ISD	Hazard Classification
Cap, blasting, electric, M6	1	0	0	1
Charge, 0.5 pound, demolition, TNT	1	0	0	2
Flare, surface, trip, M49 series	1	0	0	1
Fuze, grenade, hand, M204 series	1	0	0	1
Fuze, grenade, hand, practice, M228	183	0	0	1
Grenade, hand, fragmentation, MK II	9	0	0	3
Grenade, hand, illumination, MK I	1	0	0	1
Grenade, rifle, antitank, M9 series	63	0	0	3
Grenade, rifle, smoke, M22 series	2	0	0	1
Projectile, 37mm, low explosive, MK I	2	0	0	3
Projectile, 3-inch, trench mortar, practice, MK I (Stokes)	0	0	9	1
Signal, ground, rifle, parachute, M17 series	1	0	0	1
Simulator, explosive booby trap, flash, M117	60	0	0	1
Projectile, 4.2-inch, smoke, white phosphorous, M2, with fuze, point detonating	0	0	1	0
Flare, type unknown	1	0	0	0
MRA TOTAL	**326**	**0**	**10**	

Reference: Fort Ord MMRP Database

Please note: Munitions descriptions have been taken directly from the Army's MMRP Database and/or other historical documents. Any errors in terminology, filler type, and/or discrepancies between model number and caliber/size are a result of misinformation from the data sources.

Table 12.3-4
East Garrison MRA – Summary of Recovered MEC and MD

Type	Summary
UXO	326 items
ISD	10 items (MPPEH that could not be classified as UXO, DMM, or MD)
MD	4,107 pounds (includes MD-E and MD-F items if weights were documented)
Aerial Extent	• The majority of MEC items encountered during previous removal actions were in the central portion of MRS-42 and in the southern portion of MRS-11. • The majority of the MD encountered during previous removal actions were in the central portion of MRS-42 with lesser amounts to the east and northwest of MRS-42, and in the southeastern portion of MRS-11.
Vertical Extent	• The majority of MEC were encountered within 6 inches bgs. • Two burial pits in the northeastern portion of MRS-42 EXP contained a total of 243 MEC items.

Table 12.3-5
East Garrison MRA – HTW History and Conditions

Type	Summary
MRS-11	• The assessment of HA-100 (MRS-11) included site reconnaissance and site investigation soil sampling. Perchlorate and TNT were detected at low concentrations. Based on these results, the recommendation that HA-100 should be evaluated further as part of a remedial phase was made in the BRA. Step-out and biased soil sampling was conducted in 2004. The results of the 2004 soil sampling indicated that detected COCs were below the appropriate characterization goals and that no further action was recommended for HA-100. • As identified in the FOSET, hazardous substances were stored for one year or more, released or disposed of on Parcel Ellb.7.1.1 (MRS-11 and MRS-23) in excess of reportable quantities specified in 40 CFR Part 373. All hazardous substance storage operations have been terminated on this parcel.
MRS-23	• The interim action at IRP Site 41 (Crescent Bluff Fire Drill Area) included the excavation and removal of approximately 76 cubic yards of soil from three former burn pits. Results of the confirmation sampling indicated that soils with chemical concentrations above the target cleanup concentrations were removed. Results of the confirmation sampling and subsequent risk evaluation indicated that no further threat to human health, the environment, or groundwater was anticipated, and no further investigation or remediation was recommended. The U.S. EPA concurred that no further action was necessary at Site 41 in its letters dated April 14, 1997 and March 10, 2006. • As identified in the FOSET, hazardous substances were stored for one year or more, released, or disposed of on Parcel Ellb.7.1.1 (MRS-11 and MRS-23) in excess of reportable quantities specified in 40 CFR Part 373. All hazardous substance storage operations have been terminated on this parcel.
MRS-42	• Building 746 is one of 230 buildings suspected of having been used to store radioactive commodities, but no storage documentation is available. Twenty percent of the 230 suspect buildings (including Building 746) were randomly sampled, no radiological health hazards were identified, and it was recommended that all 230 buildings be released for unrestricted use. After reviewing the sampling results, the California Department of Health Services released all 230 buildings for unrestricted use on October 1, 1997. • As part of the site assessment of HA-172 (MRS-42), sampling was recommended to evaluate the possibility of residue related to the military munitions that had been identified at the MRS. Soil samples were collected in July 2002. Perchlorate and explosive compounds were included in the sample analyses, but were not detected in any of the soil samples. Based on the analytical results that indicate no residue of explosive compounds in soil, no further action is recommended. • As identified in the FOSET, there is no evidence that non-munitions-related hazardous substances were stored, released, or disposed of on Parcels E11b.8 (MRS-42).

Reference: Army 2007

Table 12.4-1
East Garrison MRA- Future Land Use by Parcel

USACE Parcel Number	MRS Number	Land Use Category	Description	Acreage
E11b.6.1	No Related MRS	Habitat	Reserve	48
E11b.7.1.1	MRS-11	Habitat	Reserve	8
E11b.7.1.1	MRS-11	Habitat	Reserve	15
E11b.7.1.1	No Related MRS	Habitat	Reserve	99
E11b.8	No Related MRS	Development	Residential	39
E11b.8	No Related MRS	Development	Residential	10
E11b.8	MRS-42	Development	Residential	19
L20.19.1.1	No Related MRS	Development	Roadway	6
MRA TOTAL				**244**

Table 12.5-1
East Garrison MRA – Ecological Information

Type	Summary
Biological	• Vegetation varies from sparsely vegetated areas to dense areas of overgrowth. • Past field activities have noted the presence of poison oak in various areas of the site. A number of sampling and removal actions have been performed at the East Garrison MRA requiring vegetation removal, which has been predominantly cleared by manual methods. One exception is within the grassland areas to the south, which was mechanically cleared. For future MEC removal activities within habitat areas of maritime chaparral, the preferred method for vegetation clearance will be burning. • Consists primarily of maritime chaparral with small areas of oak woodland and grassland. These biological communities are described below: • Maritime chaparral is one of the dominant vegetation type within Fort Ord, characterized by a wide variety of evergreen, sclerophyllus (hard-leaved) shrubs occurring in moderate to high density on sandy, well-drained substrates within the zone of coastal fog. This community is primarily dominated by shaggy-barked manzanita. Other species found in the shrub layer include chamise, toro manzanita, sandmat manzanita, toyon, blue blossom ceanothus and Monterey ceanothus. The greatest diversity of wildlife species at former Fort Ord occurs in the chaparral. Birds such as orange-crowned warbler, rufous-sided towhee, and California quail nest in the chaparral. Small mammals such as California mouse and brush rabbit forage in this habitat and serve as prey for gray fox, bobcat, spotted skunk, and western rattlesnake. • Grasslands - Annual grasslands dominated by introduced species such as slender wild oats, soft chess, and ripgut brome are the most common grassland community within the Plan Area. Perennial grasslands are of two types at former Fort Ord: valley needlegrass grassland and blue wildrye. Common wildlife species include California ground squirrel, Heerman's kangaroo rat, narrow-faced kangaroo rat, western meadowlark, and kestrel. • Coast Live Oak Woodland and Savanna - The live oak woodland is an open-canopied to nearly closed-canopied community with a grass or sparsely scattered shrub understory. Oaks provide nesting sites and cover for birds and cover for many mammals. Common wildlife species in coast live oak woodlands include black-tailed deer, California mouse, raccoon, California quail, scrub jay, and Nuttall's woodpecker. Red-tailed hawks and great-horned owls nest and roost in the inland coast live oaks, but probably make little use of the coastal oaks because the tightly spaced branches discourage them from entering the tree canopies.
Habitat Management Plan / Biological Opinions	• The USFWS BO required that an HMP be developed and implemented to reduce the incidental take of listed species and loss of habitat that supports these species. The HMP for former Fort Ord complies with the USFWS BO and establishes the guidelines for the conservation and management of wildlife and plant species and habitats that largely depend on former Fort Ord land for survival. The HMP incorporated conservation measures pursuant to USFWS BOs dated prior to issuance of the HMP in April 1997. • To maintain compliance with habitat management and monitoring requirements presented in the HMP, biological resources are monitored after MEC removal activities have been completed. The HMP specifies mitigation measures to monitor the successful regeneration of species and habitat following removal of MEC. Monitoring includes conducting follow-up monitoring for a period of 5 years after MEC removal to document habitat conditions. Since the inception of the MEC removal program, the Army had elected to augment the monitoring program, where feasible, to include the collection of baseline data prior to MEC removal. Baseline data have been collected to provide additional information on preexisting species composition and distribution of herbaceous annual sensitive species. Both baseline and follow-up data are used to compare community

Table 12.5-1
East Garrison MRA – Ecological Information

Type	Summary
	regeneration to HMP success criteria. • The HMP identifies the area as development and habitat reserve with borderland development areas along an NRMA interface. The NRMA separates the development category land from the adjacent habitat reserve area. The NRMA and habitat reserve areas support plant and animal species that require implementation of mitigation measures identified in the HMP to ensure compliance with the ESA and to minimize impacts to listed species. • FORA will implement the mitigation requirements identified in the HMP in accordance with the BO developed during formal consultation between the Army and the USFWS under Section 7 of the ESA. For habitat areas, these measures include conducting habitat monitoring in compliance with Chapter 3 of the HMP (USACE 1997b). For borderland areas, FORA will follow best management practices while conducting work to prevent the spread of exotic species, limit erosion, and limit access to the NRMA. • Since April 1997, a number of BOs have been issued that are relevant to MEC remediation activities (USFWS 1999, 2002, and 2005). Future MEC remediation is required to be consistent with the applicable conservation measures. • The HMP identified principal management categories. The East Garrison MRA is identified as development (including residential), habitat, and borderlands interface. These principal management categories are defined as: ◦ Development - lands in which no management restrictions are contained under the HMP although future landowners will still be required to comply with environmental laws enforced by the federal, state, and local agencies, including the ESA. Some plans for salvage of biological resources for these parcels may be specified. ◦ Habitat Reserve – land in which no development is allowed. Management goals for the area are conservation and enhancement of threatened and endangered species. ◦ Borderland Development Area – lands abutting the Natural Resources Management Area that are slated for development. Management of these lands includes no restrictions except along the development/reserve interface.
Threatened and Endangered Species / Critical Habitat	• Special-status biological resources are those resources, including plant, wildlife, and native biological communities that receive various levels of protection under local, state, or federal laws, regulations, or policies. The closure and disposal of former Fort Ord is considered a major federal action that could affect several species proposed for listing or listed as threatened or endangered under the federal ESA. • Threatened or endangered plant species identified as having possible occurrence in the East Garrison MRA include sand gilia (endangered) and Monterey spineflower (threatened). • In 2004, the CTS was identified as a threatened species. CTS may be found as far as 2 km from aquatic breeding habitats. East Garrison MRA contains several aquatic features as well as several features within 1 km of the MRA which provide suitable breeding habitat for CTS. • A portion of the East Garrison MRA has been designated as Critical Habitat for the Monterey spineflower by the USFWS.

Table 12.5-2
East Garrison MRA - HMP Category by Parcel and Possible Occurrence of HMP Species

USACE Parcel Number	HMP Designated Use	HMP Species
E11b.6.1	Habitat Reserve	Monterey spineflower, toro manzanita, sandmat manzanita, Monterey ceanothus, Eastwood's ericameria, Monterey ornate shrew, California tiger salamander
E11b.7.1.1	Habitat Reserve	sand gilia, Seaside bird's beak, toro manzanita, Monterey ceanothus, Eastwood's ericameria, Hooker's manzanita, Monterey ornate shrew, California tiger salamander
E11b.8	Development (Residential) and Borderland	toro manzanita, Monterey ceanothus, Eastwood's ericameria, Hooker's manzanita, Monterey ornate shrew, California tiger salamander
L20.19.1.1	Development (Roadway) and Borderland Development Area	toro manzanita, Monterey ceanothus, Eastwood's ericameria, Hooker's manzanita, Monterey ornate shrew, California tiger salamander

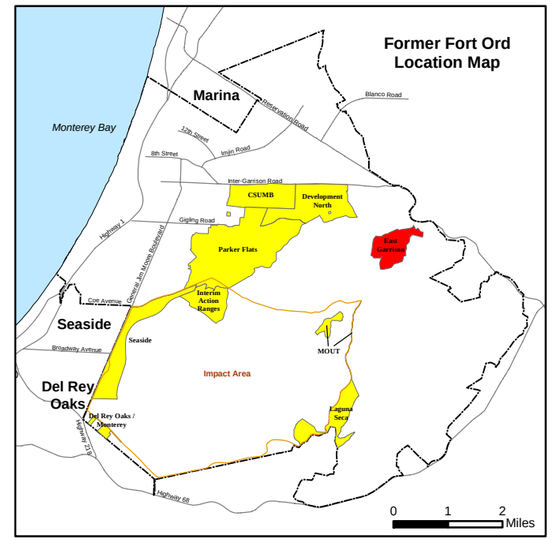
Reference: USACE 1997b

Table 12.6-1
East Garrison MRA – Potential Receptors and Exposure Media

Potential Receptor	Exposure Media			Exposure Media		
	Current	Ground Surface	Below Grade	Future	Ground Surface	Below Grade
Construction Workers	✓	✓	✓	✓	✓	✓
Utility Workers	✓	✓	✓	✓	✓	✓
Trespassers	✓	✓		✓	✓	
Firefighters	✓	✓	✓	✓	✓	✓
Emergency Response Workers	✓	✓		✓	✓	
Ancillary Workers	✓	✓	✓	✓	✓	✓
Residents				✓	✓	✓
Recreational Users				✓	✓	✓

Legend

- School
- Fire Station
- Gate
- Entry Forbidden Sign
- Sign
- Hydrant
- High-Power Transmission Line Tower
- Electrical Line Pole
- Munitions Response Area
- Major Road
- Electrical Line
- Fence
- Gas Line
- Storm Line
- Telephone Line
- Water Line
- Sewer Line
- High-Power Transmission Line and Right of Way
- R9211 — Structure
- E23.1 — USACE Parcel



N

0 500 1,000 Feet

LFR

WESTON SOLUTIONS

Westcliffe Engineers, Inc.

East Garrison MRA
Facility Profile
Physical Features

FORA ESCA RP
Monterey County, California

Figure 12.1-1

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East Garrison
Small Arms Ranges

Demolition
Area

Engineer Training Area/
Field Expedient Area and
Mechanic Training Area

Suspected Stokes
Mortar Range

Rifle Grenade
Area

Barloy Canyon Road

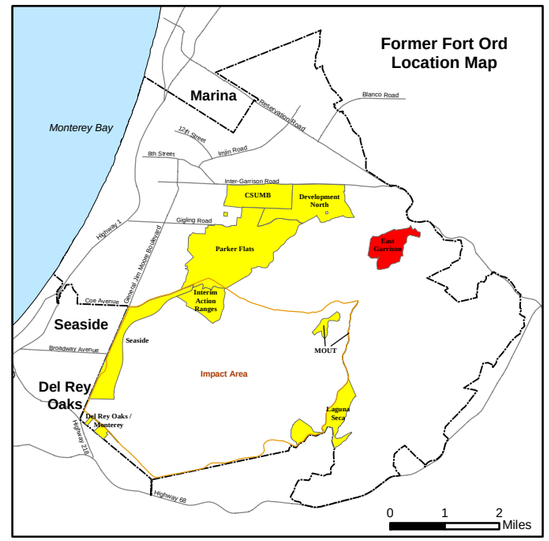
Engineer Training
Area "C"

Demolition Training
Area

Hand Grenade
Area

Legend

- Training Site
- Munitions Response Area
- Major Road
- Fence



N

0 500 1,000 Feet

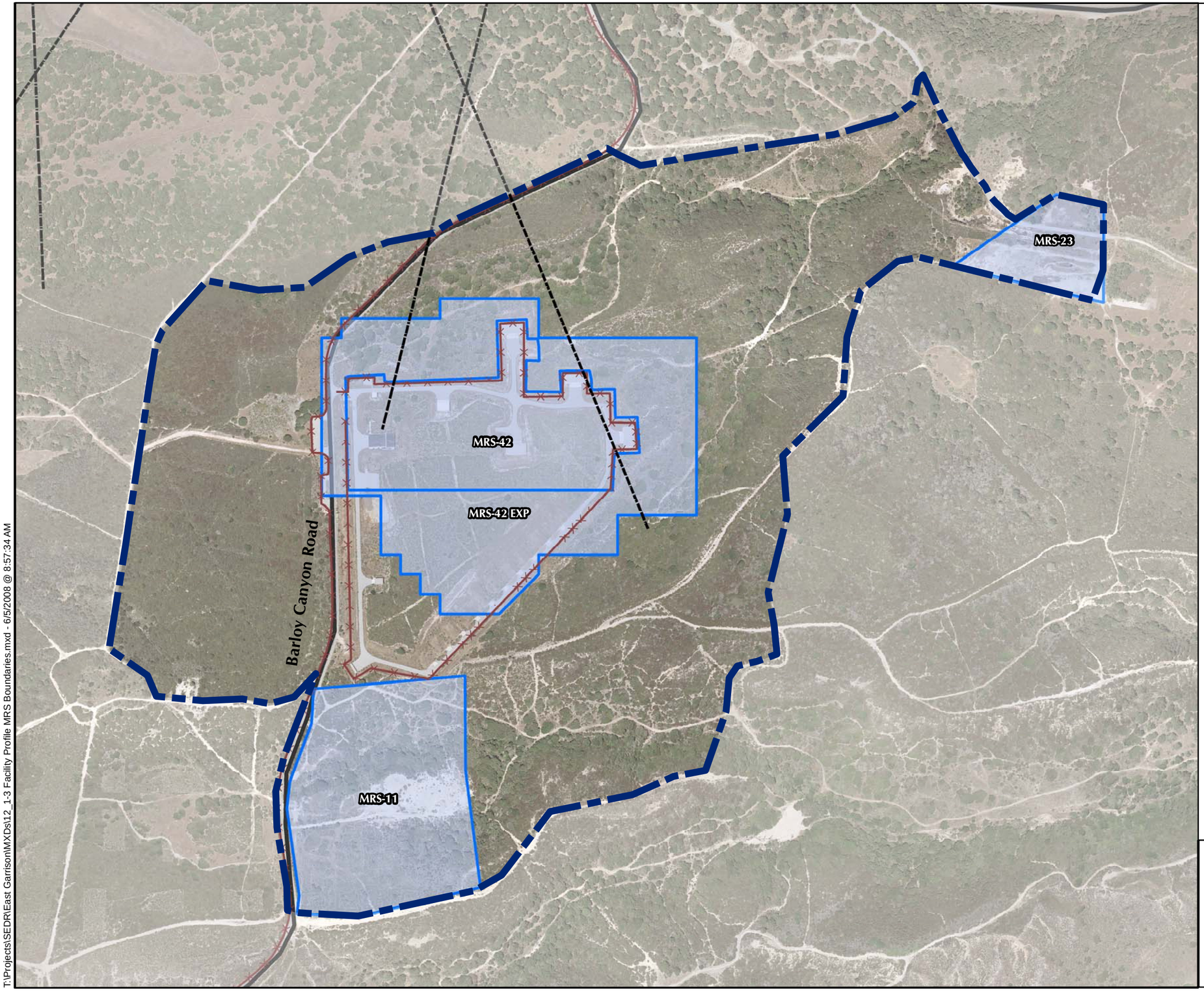
LFR
WESTON SOLUTIONS
Westcliffe Engineers, Inc.

East Garrison MRA Facility Profile Ranges and Training Sites

FORA ESCA RP
Monterey County, California

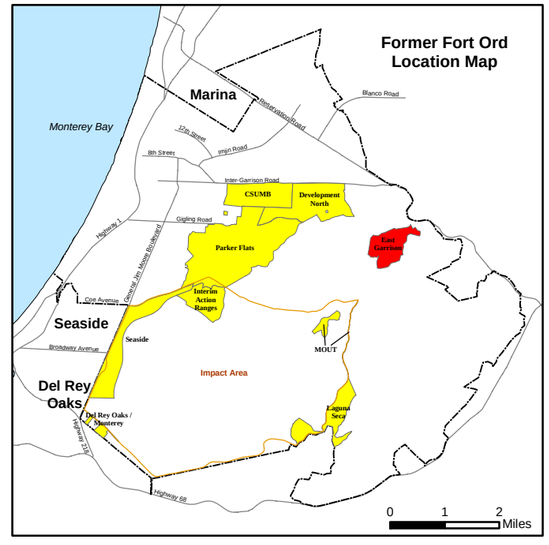
Figure 12.1-2

T:\Projects\SEDR\East Garrison\MXDs\12_1-2 Facility Profile Firing Ranges.mxd - 6/5/2008 @ 8:55:50 AM



Legend

- Munitions Response Area
- Major Road
- Fence
- MRS-42 — Munitions Response Site



0 500 1,000 Feet

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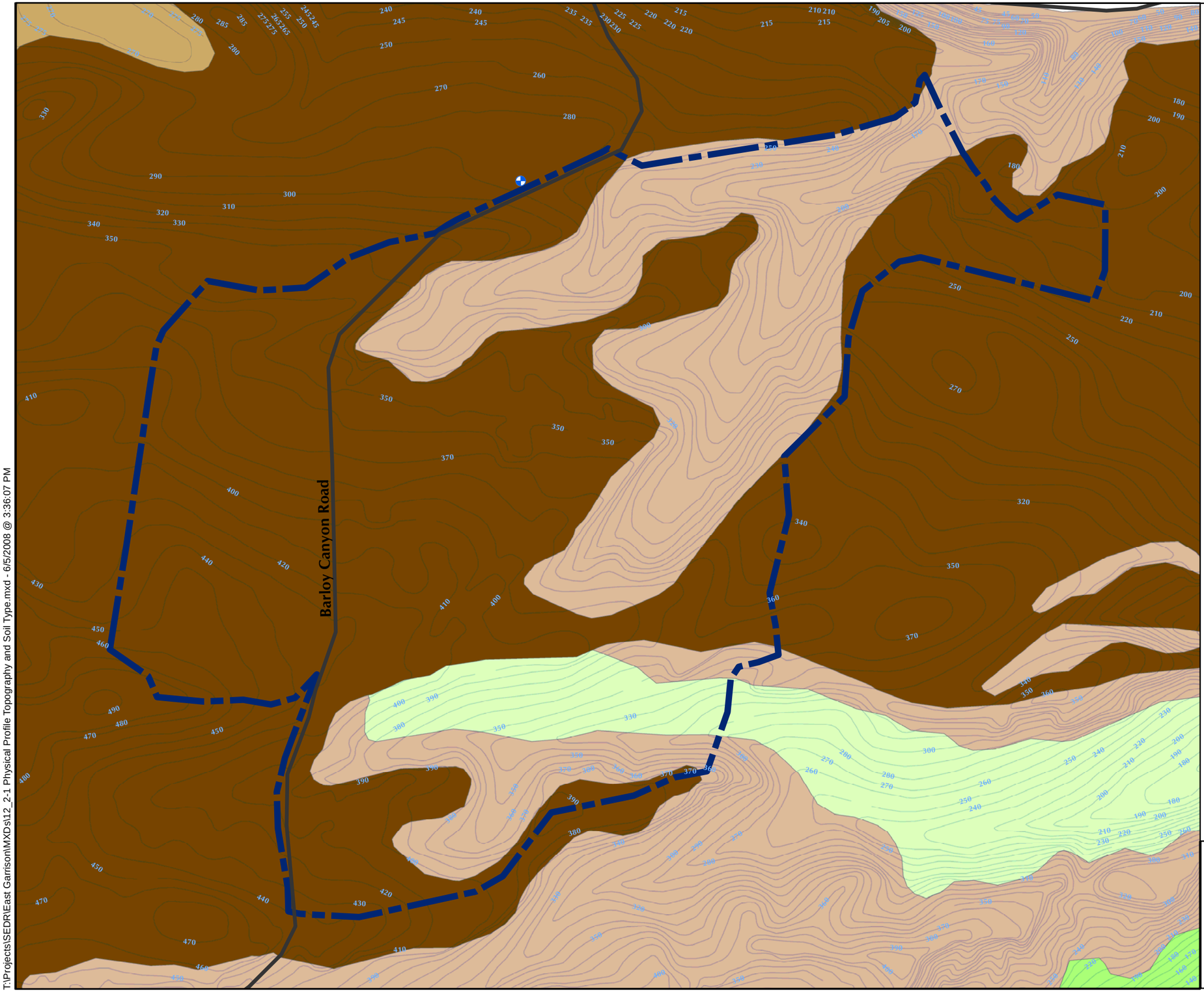
East Garrison MRA Facility Profile
Munitions Response Site Boundaries

FORA ESCA RP
Monterey County, California

Figure 12.1-3

T:\Projects\SEDR\East Garrison\MXDs\12_1-3 Facility Profile MRS Boundaries.mxd - 6/5/2008 @ 8:57:34 AM



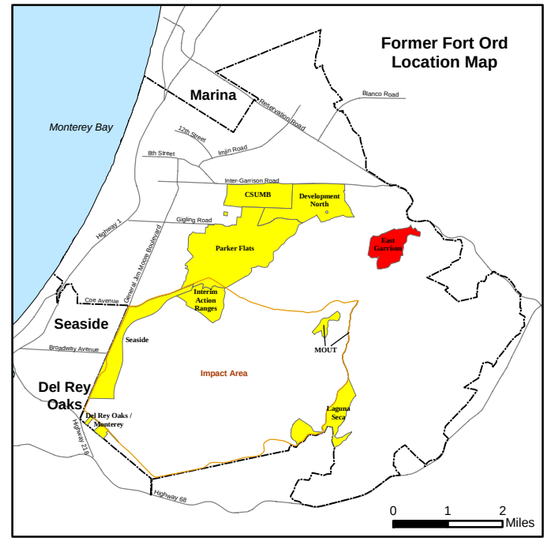
T:\Projects\SEDR\East Garrison\MXDs\12_2-1 Physical Profile Topography and Soil Type.mxd - 6/5/2008 @ 3:36:07 PM

Legend

- Environmental Well
- Abandoned Well
- Water Supply Well
- Munitions Response Area
- Major Road
- 540 Topography 10 ft

Soil Type

- Arnold-Santa Ynez Complex
- Xerorthents, Dissected
- Arnold Loamy Sand, 15 to 50 Percent Slopes
- Arnold Loamy Sand, 9 to 15 Percent Slopes
- Santa Ynez Fine Sandy Loam, 15 to 30 Percent Slopes
- Antioch Very Fine Sandy Loam, 2 to 9 Percent Slopes



N

0 500 1,000 Feet

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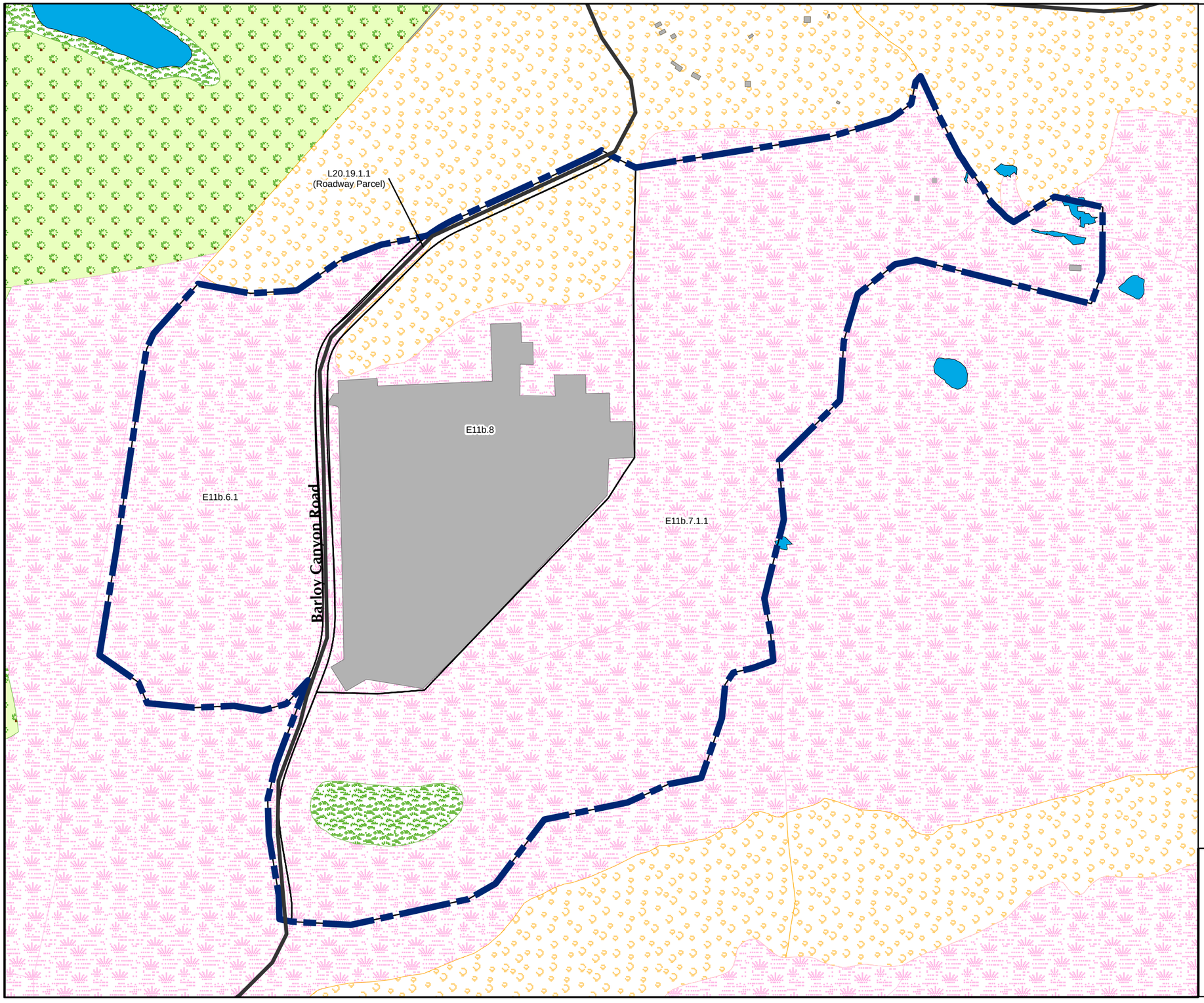
East Garrison MRA Physical Profile Topography and Soil Type

FORA ESCA RP
Monterey County, California

Figure 12.2-1



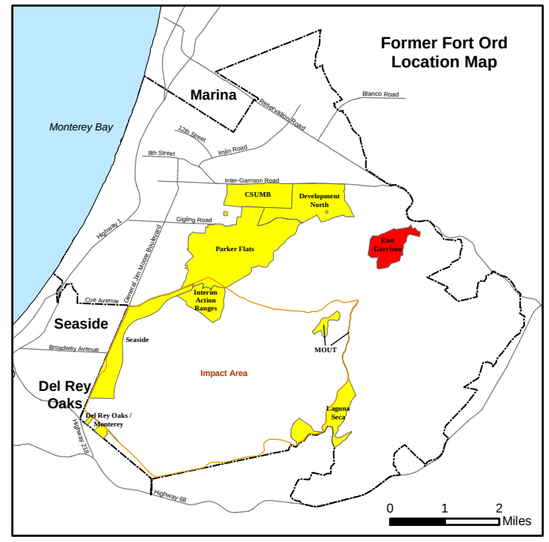
Legend

- Munitions Response Area
- Major Road
- E11b.8 — USACE Parcel

Vegetation Type

- Grassland
- Maritime Chaparral
- Inland Coast Live Oak Woodland
- Coastal Coast Live Oak Woodland
- Aquatic Feature
- Developed / Disturbed

Source: Flora and Fauna Baseline Study of Fort Ord, California, Jones and Stokes Association Inc., December 1992.



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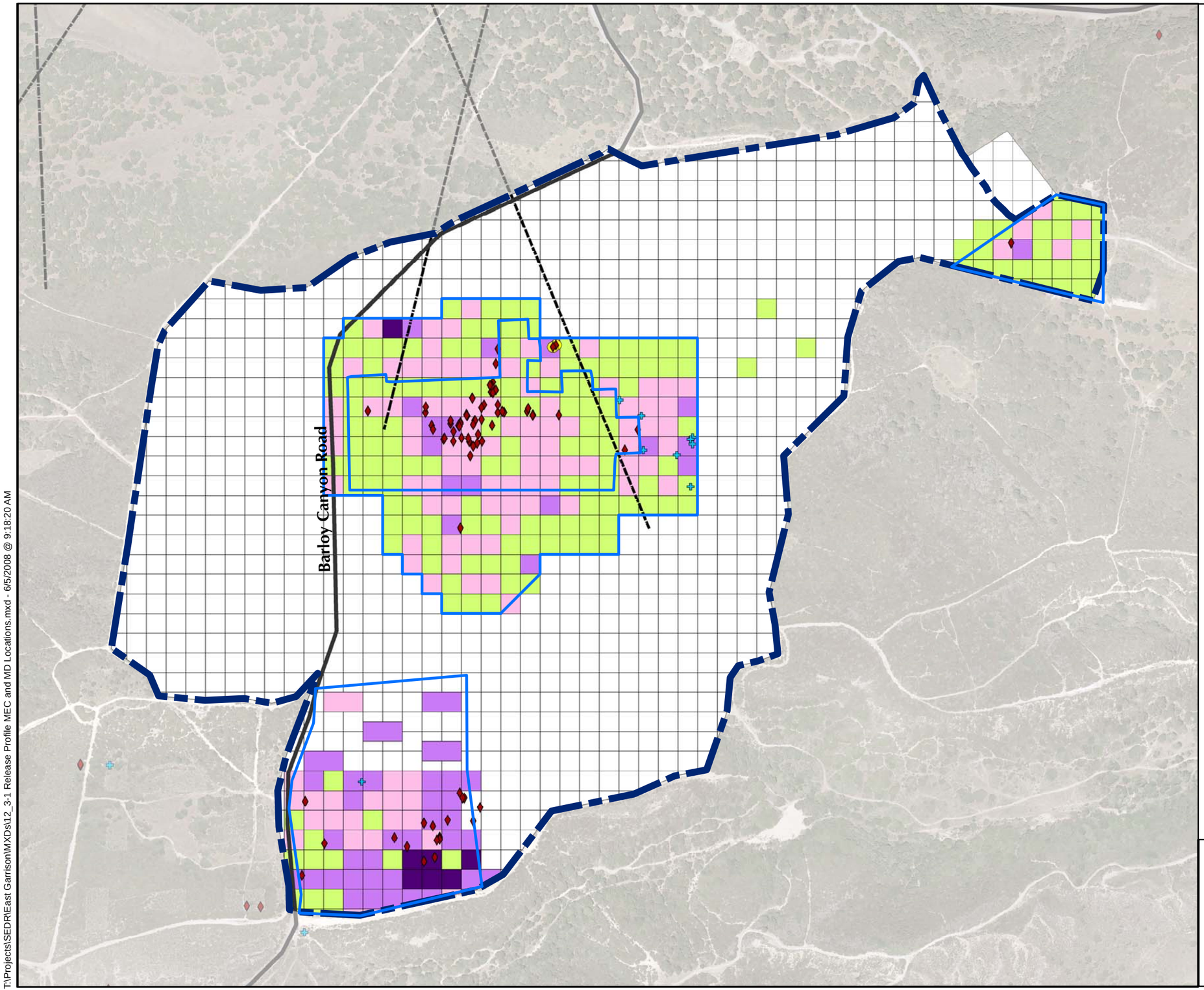
East Garrison MRA Physical Profile
Generalized Vegetation Communities

FORA ESCA RP
Monterey County, California

Figure 12.2-2

T:\Projects\SEDR\East Garrison\MXDS\12_2-2 Facility Profile Vegetation Communities.mxd - 6/5/2008 @ 4:39:16 PM



Legend

- Munitions Response Area
- Firing Range
- Munitions Response Site
- Major Road

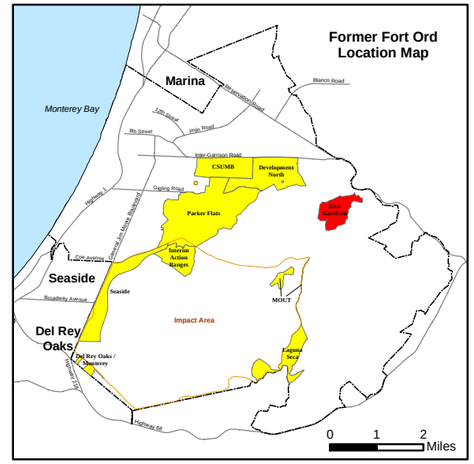
MEC Type

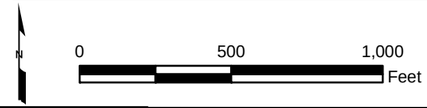
- Unexploded Ordnance (UXO)
- Discarded Military Munition (DMM)
- Insufficient Data (ISD)
- Burial Pit Containing MEC

Munitions Debris (MD) by Weight (total pounds per grid)

- No Data
- 0
- < 10
- 10 to 100
- > 100

Note: Munitions Debris (MD) includes scrap related to small arms ammunition.





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East Garrison MRA Release Profile MEC and MD Locations

FORA ESCA RP
Monterey County, California

Figure 12.3-1

T:\Projects\SEDR\East Garrison\MXDs\12_3-1 Release Profile MEC and MD Locations.mxd - 6/5/2008 @ 9:18:20 AM

Barloy Canyon Road

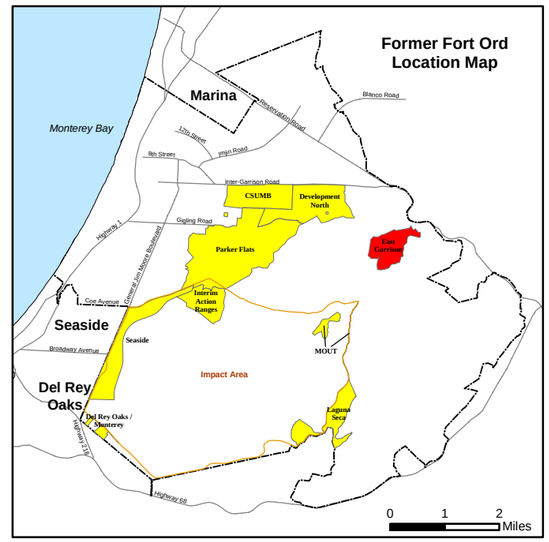
Legend

- Munitions Response Area
- Munitions Response Site
- Firing Range
- Major Road

MEC Type

- Unexploded Ordnance (UXO)
- Discarded Military Munition (DMM)
- Insufficient Data (ISD)
- Burial Pit Containing MEC

Note: MEC locations may include more than one item.



N

0 500 1,000 Feet

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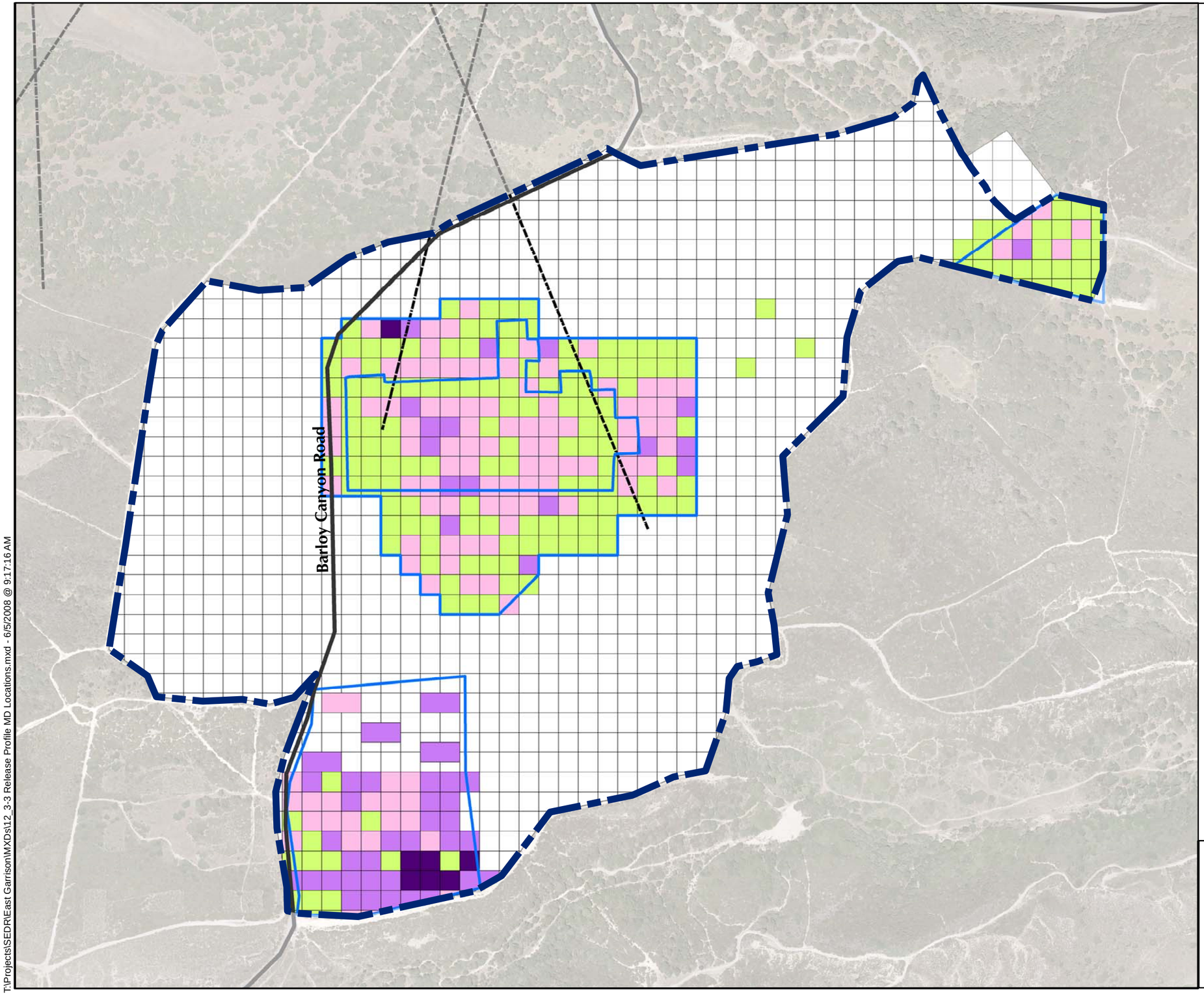
East Garrison MRA Release Profile MEC Locations

FORA ESCA RP
Monterey County, California

Figure 12.3-2

T:\Projects\SEDR\East Garrison\MXDs\12_3-2 Release Profile MEC Locations.mxd - 6/5/2008 @ 9:16:37 AM



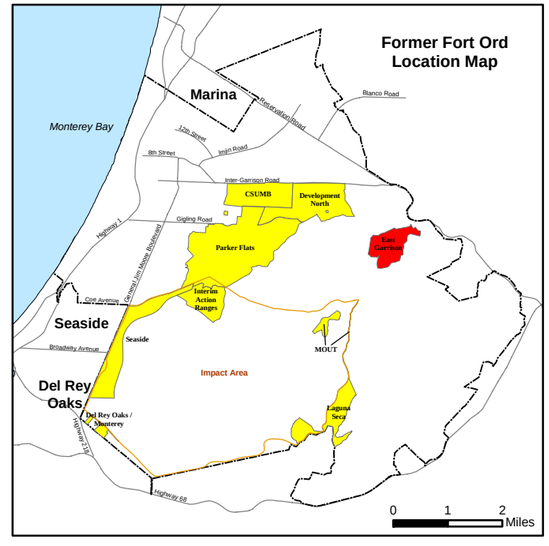
Legend

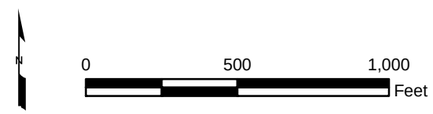
- Munitions Response Area
- Munitions Response Site
- Firing Range
- Major Road

Munitions Debris (MD) by Weight (total pounds per grid)

- No Data
- 0
- < 10
- 10 to 100
- > 100

Note: Munitions Debris (MD) includes scrap related to small arms ammunition.





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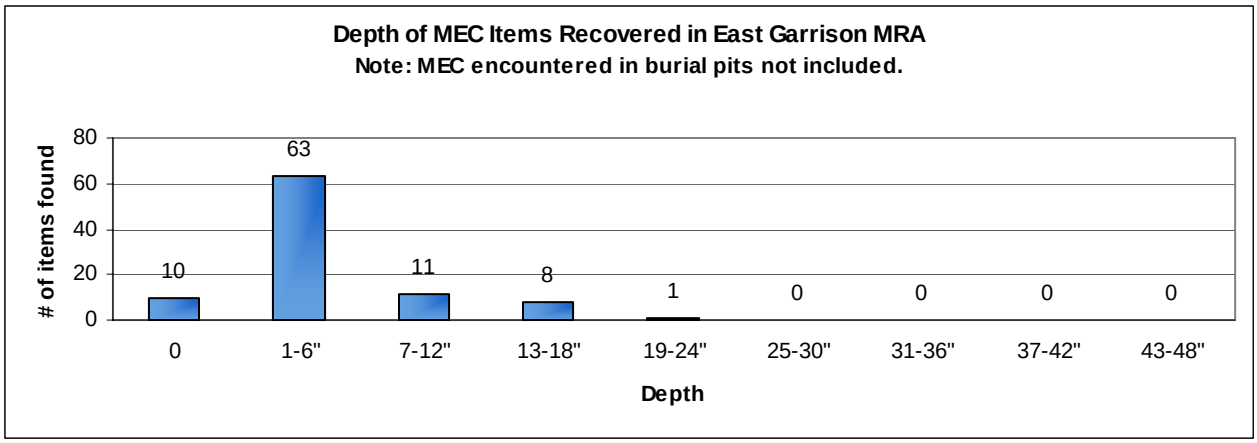
East Garrison MRA Release Profile MD Locations

FORA ESCA RP
Monterey County, California

Figure 12.3-3

T:\Projects\SEDR\East Garrison\MXDs\12_3-3 Release Profile MD Locations.mxd - 6/5/2008 @ 9:17:16 AM



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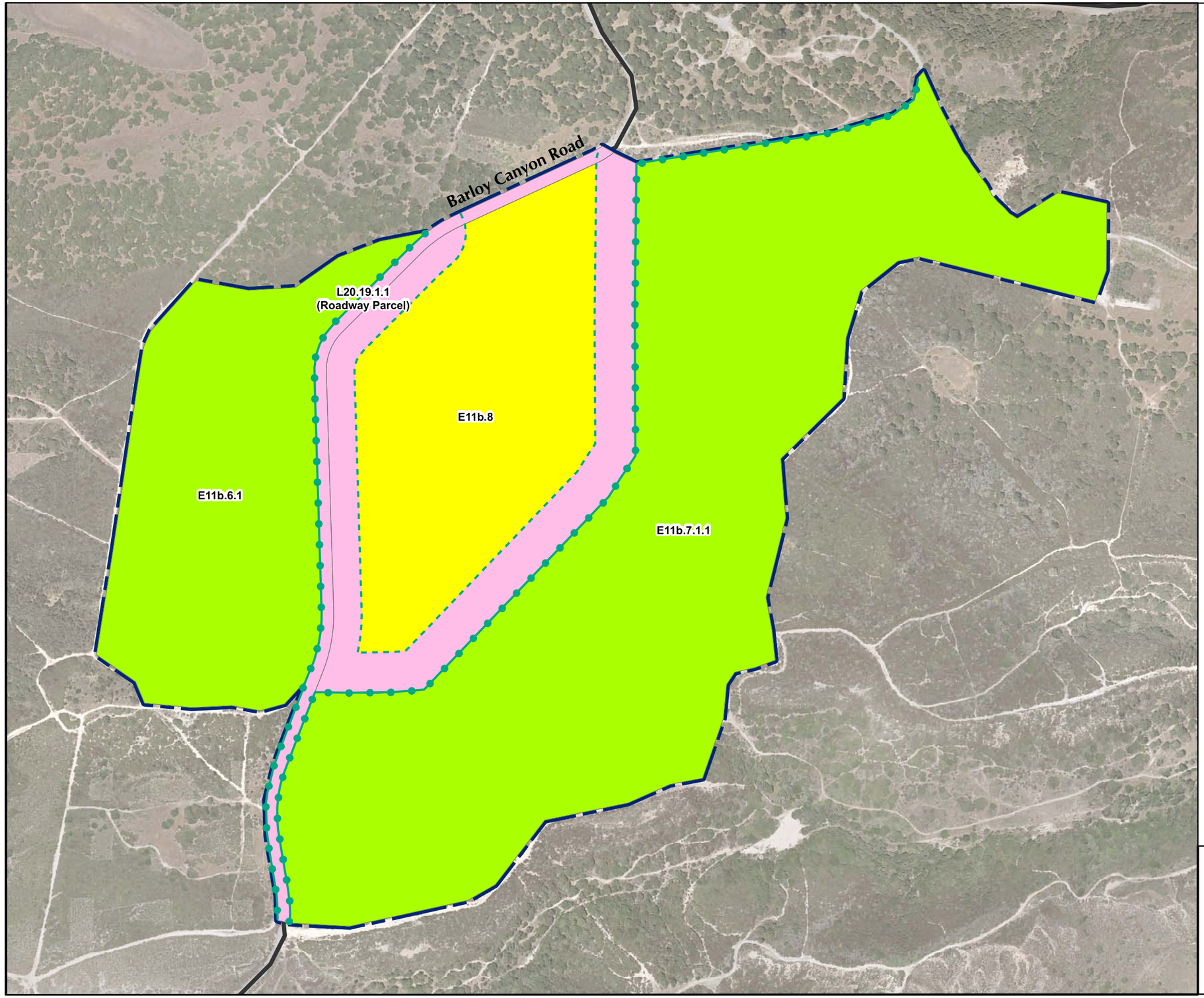
East Garrison MRA
Distribution of MEC Recovered by Depth Interval

FORA ESCA RP
Monterey County, California

Figure 12.3-4

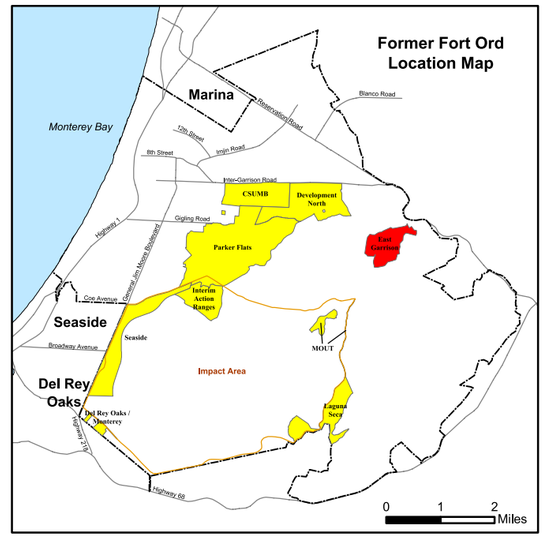


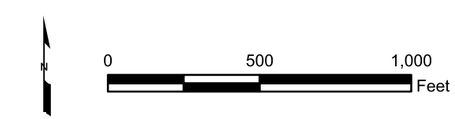
Legend

- Munitions Response Area
- Major Road
- E11b.8 — USACE Parcel

Future Land Use

- Residential
- Non-Residential
- Habitat Reserve
- Borderland Interface
- 200-Foot Buffer from Borderland Interface





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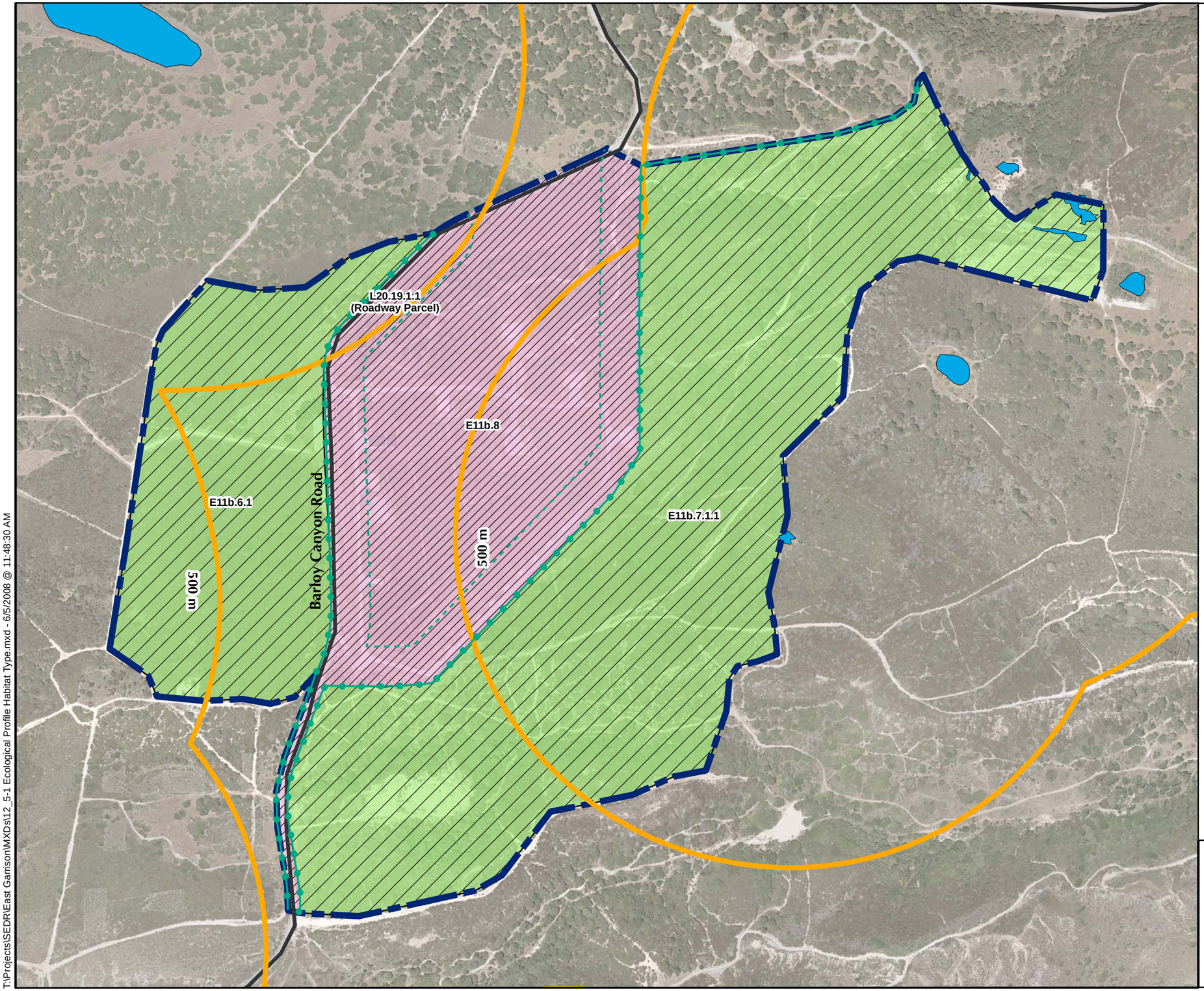
East Garrison MRA
Land Use Profile
Reuse Plan
FORA ESCA RP
Monterey County, California

Figure 12.4-1

T:\Projects\SEDR\East Garrison\MXDs\12_4-1 Land Use Profile Reuse Plan.mxd - 6/5/2008 @ 4:59:12 PM

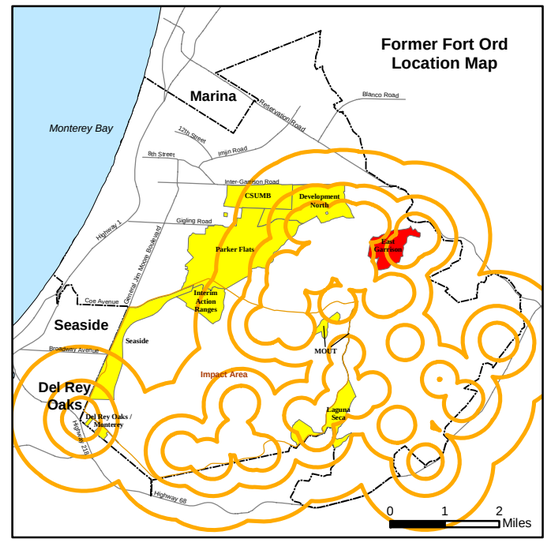


Legend

- Munitions Response Area
- California Tiger Salamander Buffer
- Major Road
- Borderland Interface
- 200-Foot Buffer from Borderland Interface
- Aquatic Features

Habitat Management Plan Category

- Development (includes future Residential and Non-Residential areas)
- Development with Reserve or Restrictions
- Habitat Corridor
- Habitat Corridor with Development
- Habitat Reserve



N

0 500 1,000 Feet

LFR

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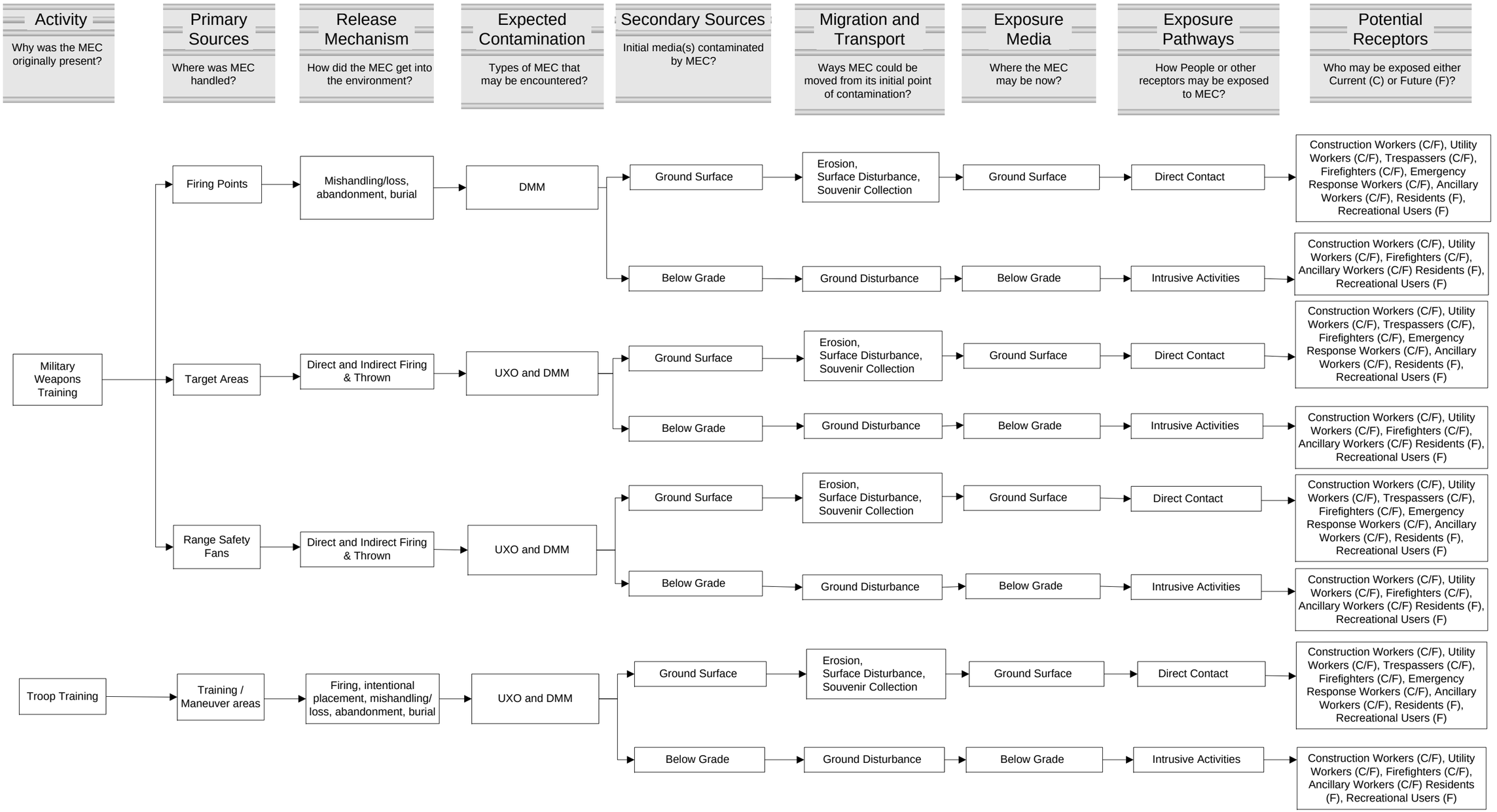
East Garrison MRA
Ecological Profile
Habitat Type

FORA ESCA RP
Monterey County, California

Figure 12.5-1

T:\Projects\SEDR\East Garrison\MXDs\12_5-1 Ecological Profile Habitat Type.mxd - 6/5/2008 @ 11:48:30 AM



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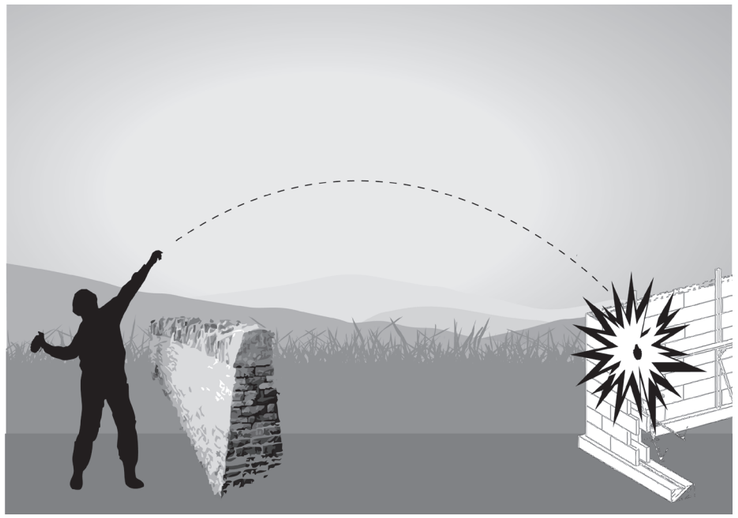
East Garrison MRA Pathway Analysis Flowchart

FORA ESCA RP
Monterey County, California

Figure 12.6-1



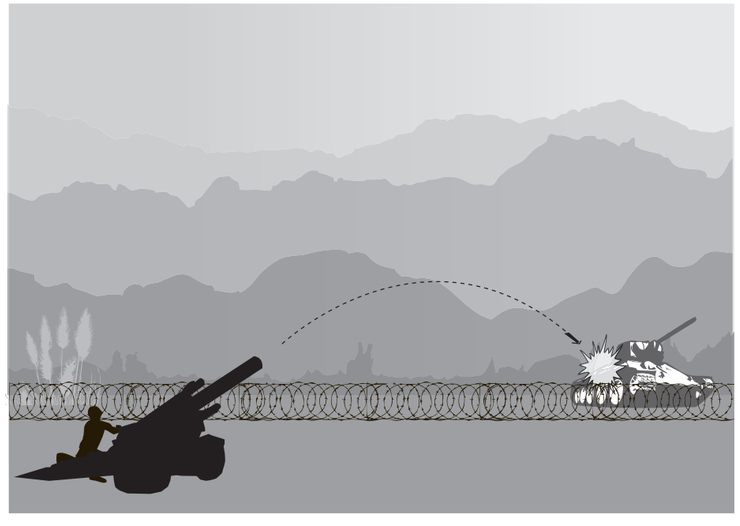
Thrown Ordnance

Intentional Placement / Burial / Mishandling / Loss

Firing

Direct Fire

Indirect Fire



Indirect Fire

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East Garrison MRA
Release Mechanism Illustrations

FORA ESCA RP
Monterey County, California

Figure 12.6-2

APPENDIX B

Munitions Response Activity Evaluation Checklists

Appendix B
Munitions Response Activity Evaluation Checklists
Part 1: Literature Review

	Yes	No	Inconclusive
TYPE OF TRAINING AND MILITARY MUNITIONS EXPECTED			
1. Is there evidence that the site was used as an impact area (i.e., fired military munitions such as mortars, projectiles, rifle grenades, or other launched ordnance)?			
Sources reviewed and comments:			
2. Is there historical evidence that training involved use of High Explosive (HE) or Low Explosive (LE) items?			
Sources reviewed and comments:			
3. Is there historical evidence that training involved use of pyrotechnic and/or smoke-producing items (e.g., simulators, flares, smoke grenades) but not explosives?			
Sources reviewed and comments:			
DEVELOPMENT AND USE OF SURROUNDING AREA			
4. Does subsequent development or use of the area indicate that military munitions would have been used at the site?			
Sources reviewed and comments:			
5. Does use of area surrounding the site indicate that military munitions would have been used at the site?			
Sources reviewed and comments:			

Appendix B
Munitions Response Activity Evaluation Checklists
Part 1: Literature Review

	Yes	No	Inconclusive
ESTABLISHMENT OF SITE BOUNDARIES			
6. Is there evidence of training areas on aerial photographs that could be used to establish site boundaries?			
Sources reviewed and comments:			
7. Is there evidence of training on historical training maps that could be used to establish boundaries?			
Sources reviewed and comments:			
8. Should current boundaries be revised?			
Sources reviewed and comments:			
RESULTS OF LITERATURE EVALUATION			
9. Does the literature review provide sufficient evidence to warrant further investigation?			
Sources reviewed and comments:			

Appendix B
Munitions Response Activity Evaluation Checklists
Part 2: Removal Evaluation

	Yes	No	Inconclusive
HISTORICAL INFORMATION			
1. Is there evidence that the site was used as an impact area (i.e., fired military munitions such as mortars, projectiles, rifle grenades, or other launched ordnance)?			
Sources reviewed and comments:			
References:			
2. Is there evidence that training involved use of explosive items?			
Sources reviewed and comments:			
References:			
3. Is there evidence that training involved use of pyrotechnic and/or smoke-producing items (e.g., simulators, flares, smoke grenades) but not explosives?			
Sources reviewed and comments:			
References:			
REMOVAL RESULTS			
4. Was removal performed within the appropriate area?			
Sources reviewed and comments:			
References:			

Appendix B
Munitions Response Activity Evaluation Checklists
Part 2: Removal Evaluation

	Yes	No	Inconclusive
5. Were the type(s) of items found consistent with the type of training identified for the site?			

Sources reviewed and comments:

References:

6. Were the type(s) of items found consistent with the era(s) in which training was identified?			

Sources reviewed and comments:

References:

7. Was High Explosive (HE) fragmentation found?			

Sources reviewed and comments:

References:

8. Were HEs found?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 2: Removal Evaluation

	Yes	No	Inconclusive
9. Were Low Explosives (LEs) found?			

Sources reviewed and comments:

References:

10. Were pyrotechnics found?			

Sources reviewed and comments:

References:

11. Were smoke-producing items found?			

Sources reviewed and comments:

References:

12. Were explosive items found (e.g., rocket motors with explosive components, fuzes with explosive components)?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 2: Removal Evaluation

	Yes	No	Inconclusive
13. Do items found in the area indicate training would have included use of training items with other energetic components?			

Sources reviewed and comments:

References:

14. Were items found in a localized area (possibly the remnants of a cleanup action)?			

Sources reviewed and comments:

References:

SITE INVESTIGATION DESIGN

15. Was the site divided into subareas to focus on areas of common usage, similar topography and vegetation, and/or other unique site features?			

Sources reviewed and comments:

References:

16. Should the site be divided into subareas based on the above features?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 2: Removal Evaluation

	Yes	No	Inconclusive
17. Should current site boundaries be revised based on sampling results?			

Sources reviewed and comments:

References:

EQUIPMENT REVIEW

18. Was equipment used capable of detecting items suspected at the site at the maximum expected depth?			

Sources reviewed and comments:

References:

19. Was equipment used capable of detecting the types of items (e.g., non-ferrous) suspected at the site?			

Sources reviewed and comments:

References:

20. Do the results of the Ordnance Detection and Discrimination Study (ODDS) indicate that items suspected at the site would have been detected by the instrument used at the time of investigation?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 2: Removal Evaluation

	Yes	No	Inconclusive
21. Do results of the investigation indicate that suspected items could be detected with a high level of confidence at observed and expected depth ranges?			

Sources reviewed and comments:

References:

22. Were all the instruments used to evaluate the site maintained and calibrated in accordance with associated work plan and manufacturers' specifications?			

Sources reviewed and comments:

References:

DATA PROCESSING AND DATA MANAGEMENT

23. Was the appropriate data processing scheme used for the site, and how were the data processed?			

Sources reviewed and comments:

References:

24. Have the field data been collected and managed in accordance with quality control standards established for the project?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 2: Removal Evaluation

	Yes	No	Inconclusive
RESULTS OF REMOVAL EVALUATION			
A. Can the data be used to perform a risk assessment?			

Comments:

References:

B. Can the data be used to perform a feasibility study?			

Comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 3: Sampling Evaluation

	Yes	No	Inconclusive
HISTORICAL INFORMATION			
1. Is there evidence that the site was used as an impact area (i.e., fired military munitions such as mortars, projectiles, rifle grenades, or other launched ordnance)?			

Sources reviewed and comments:

References:

2. Is there evidence that training involved use of explosive items?			

Sources reviewed and comments:

References:

3. Is there evidence that training involved use of pyrotechnic and/or smoke-producing items (e.g., simulators, flares, smoke grenades) but not explosives?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 3: Sampling Evaluation

	Yes	No	Inconclusive
SAMPLING RESULTS			
4. Was sampling performed within the appropriate area?			

Sources reviewed and comments:

References:

5. Does sampling indicate that MEC or munitions debris are present at the site?			

Sources reviewed and comments:

References:

6. Were the type(s) of items found consistent with the type of training identified for the site?			

Sources reviewed and comments:

References:

7. Were the type(s) of items found consistent with the era(s) in which training was identified?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 3: Sampling Evaluation

	Yes	No	Inconclusive
8. Was High Explosive (HE) fragmentation found?			

Sources reviewed and comments:

References:

9. Was HE found?			

Sources reviewed and comments:

References:

10. Were Low Explosives (LEs) found?			

Sources reviewed and comments:

References:

11. Were pyrotechnics found?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 3: Sampling Evaluation

	Yes	No	Inconclusive
12. Were smoke-producing items found?			

Sources reviewed and comments:

References:

13. Were explosive items found (e.g., rocket motors with explosive components, fuzes with explosive components)?			

Sources reviewed and comments:

References:

14. Do items found in the area indicate training would have included use of training items with energetic components?			

Sources reviewed and comments:

References:

15. Were items found in a localized area (possibly the remnants of a cleanup action)?			Inconclusive

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 3: Sampling Evaluation

	Yes	No	Inconclusive
SITE INVESTIGATION DESIGN			
16. Was the site divided into subareas to focus on areas of common usage, similar topography and vegetation, and/or other unique site features?			
Sources reviewed and comments:			
References:			
17. Should current site boundaries be revised based on sampling results?			
Sources reviewed and comments:			
References:			
EQUIPMENT REVIEW			
18. Was equipment used capable of detecting items suspected at the site at the maximum expected depth?			
Sources reviewed and comments:			
References:			

Appendix B
Munitions Response Activity Evaluation Checklists
Part 3: Sampling Evaluation

	Yes	No	Inconclusive
19. Was equipment used capable of detecting the types of items (e.g., non-ferrous) suspected at the site?			

Sources reviewed and comments:

References:

20. Do the results of the Ordnance Detection and Discrimination Study (ODDS) indicate that items suspected at the site would have been detected by the instrument used at the time of investigation?			

Sources reviewed and comments:

References:

21. Do results of the investigation indicate that suspected items could be detected with a high level of confidence at observed and expected depth ranges?			

Sources reviewed and comments:

References:

22. Were all the instruments used to evaluate the site maintained and calibrated in accordance with associated work plan and manufacturers' specifications?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 3: Sampling Evaluation

	Yes	No	Inconclusive
23. Based on the anticipated target density (MEC items per acre) has the minimal amount of sampling acreage been completed in accordance with the scope of work or contractor plan?			

Sources reviewed and comments:

References:

24. Based on the sampling procedure (e.g., grids, transects, and/or random walks) was a percentage of the site completed to provide 95% confidence in a MEC density estimate, and if so provide total area investigated and the MEC density estimates?			

Sources reviewed and comments:

References:

25. What percentage of the anomalies were intrusively investigated?			

Sources reviewed and comments:

References:

Appendix B
Munitions Response Activity Evaluation Checklists
Part 3: Sampling Evaluation

	Yes	No	Inconclusive
DATA PROCESSING AND DATA MANAGEMENT			
26. Was the appropriate data processing scheme used for the site, and how were the data processed?			

Sources reviewed and comments:

References:

27. Have the field data been collected and managed in accordance with quality control standards established for the project?			

Sources reviewed and comments:

References:

RESULTS OF REMOVAL EVALUATION			
28. Does the sampling evaluation provide sufficient evidence to warrant further investigation?			

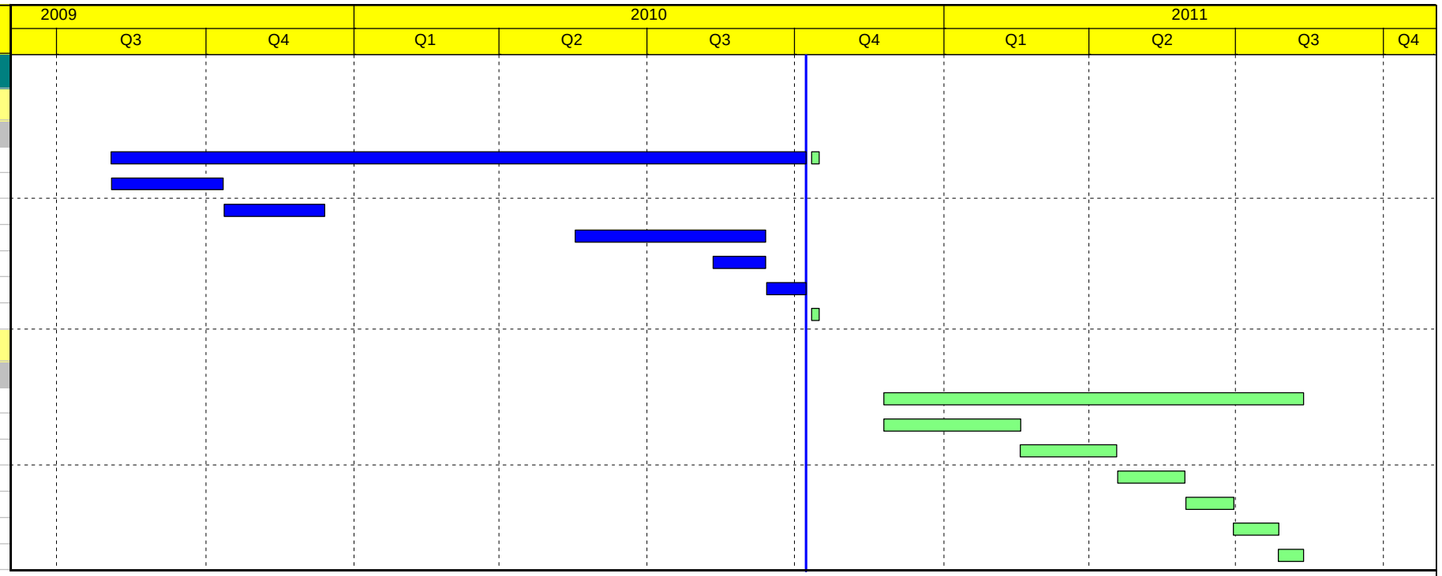
Comments:

References:

APPENDIX C

Anticipated Project Schedule

Activity ID	Activity Name	Original Duration	Start	Finish
Group 4 - Future East Garrison MRA				
Initial Project Documentation				
RIFS Work Plan				
03.082	Group 4 RIFS WP	214	04-Aug-09 A	15-Oct-10
03.082.100	Draft G4 RIFS WP	38	04-Aug-09 A	12-Oct-09 A
03.082.104	Reg Review - Draft G4 RIFS Work Plan	60	13-Oct-09 A	14-Dec-09 A
03.082.120	Draft Final G4 RIFS Work Plan	70	18-May-10 A	13-Sep-10 A
03.082.130	Reg Rev - Draft Final G4 RIFS Work Plan	30	12-Aug-10 A	13-Sep-10 A
03.082.180	Final G4 RIFS Work Plan	30	14-Sep-10 A	08-Oct-10 A
03.082.190	Reg Rev/Approve Final G4 RIFS Work Plan	5	11-Oct-10*	15-Oct-10
Project Documentation				
RI/FS Report				
03.082.00	Group 4 RI/FS	186	25-Nov-10	11-Aug-11
03.082.10	Draft G4 RIFS	61	25-Nov-10	17-Feb-11
03.082.15	Regulatory Review - Draft G4 RIFS	60	18-Feb-11	18-Apr-11
03.082.20	Draft Final G4 RIFS	30	19-Apr-11	30-May-11
03.082.25	Regulatory Review - Draft Final G4 RIFS	30	31-May-11	29-Jun-11
03.082.30	Final G4 RIFS	20	30-Jun-11	27-Jul-11
03.082.35	Reg. Review/Approval - Final G4 RIFS	15	28-Jul-11	11-Aug-11



Actual Level of Effort
Remaining Level of Effort
Actual Work
Remaining Work

Start Date 04-Aug-09
Finish Date 11-Aug-11
Data Date 08-Oct-10
Run Date 07-Oct-10

FORA ESCA Remediation Program
Anticipated Project Schedule

Date	Revision	Checked	Approved

APPENDIX D

Response to Comments

Response to Comments
Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, dated October 9, 2009
Review Comments provided by Gail Youngblood of the Army, dated October 29, 2009

No.	Comment Type / Report Section	Comment/Response
1	Specific Comment, p. 2-3, Section 2.2 Physical Setting	**Comment:** Third paragraph notes that the total acreage of the Future East Garrison MRA has been revised to reflect the final property transfer boundaries. The Army is pleased that the MRA boundary was updated to include all of the East Garrison property that was transferred to Fort Ord Reuse Authority (FORA) in connection with the Environmental Services Cooperative Agreement (ESCA). However, the report does not describe the designated future land use and habitat type (HMP category) for the additional acreage. Please update the text and/or figures to provide this information. **Response:** The following text has been added to the end of the first paragraph in Section 2.3.2, Future Land Use, explaining the future land use of the additional acreage: "***The additional land incorporated into the Future East Garrison MRA due to the revised property transfer boundaries is identified as a habitat reserve area.***" In addition, the following text has been added to the end of the third paragraph in Section 2.2, Physical Setting, to provide clarification: "***The revised property transfer boundary incorporated approximately 8 additional acres of land in the northeastern portion of the MRA. The physical setting for the additional land is consistent with the remainder of the MRA.***" The figures included in Appendix A depicting future land use and habitat types in the Future East Garrison MRA are presented as an excerpt from the Final Summary of Existing Data Report (SEDR). Therefore, these figures have not been updated for the Group 4 RI/FS Work Plan. In response to the comment, the following text was added to the end of Section 2.2 to provide clarification: "***The revised property transfer boundary of the Future East Garrison MRA incorporated additional land in the northeastern portion of the MRA. This area was not incorporated at the time the SEDR was completed, and is therefore not included in Appendix A.***" Also, the last sentence in Section 2.3 has been revised as follows: "The CSM for the Future East Garrison MRA ***prior to the revised property transfer boundaries*** ~~from the SEDR~~ is provided as Appendix A of this work

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No.	Comment Type / Report Section	Comment/Response
		plan."
2	Specific Comment, p.2-5, Section 2.2 Physical Settings	**Comment**: The fourth last sentence states "For habitat areas, these measures include conducting habitat monitoring in compliance with Chapter 3 of the HMP (USACE 1997b)." Because Chapter 3 of the HMP requires many more mitigation measures during environmental investigation and remediation activities within habitat reserve areas, we recommend inserting text ", but are not limited to" to read "…these measures include, but are not limited to, conducting habitat monitoring…" **Response**: The cited sentence has been revised as follows: "For habitat areas, these measures include***, but are not limited to,*** conducting habitat monitoring in compliance with Chapter 3 of the HMP (USACE 1997b)."
3	Specific Comment, p.4-1, Section 4.1 Summary of Approach for Group 4	**Comment**: The first paragraph discusses that additional data collection is not necessary because the existing data are of sufficient quantity to characterize the Future East Garrison MRA. As described elsewhere in the document, the Army has conducted several munitions response investigations and removal actions within the Future East Garrison MRA, resulting in a significant quantity of data being available for the RI/FS evaluation. However, it should be noted that in previous investigations, a portion of the subject MRA directly adjacent to munitions response sites (MRSs) 48 and 19, where RI/FS evaluation has not been completed, was not readily accessible due to dense vegetation. Please include an evaluation of adjacent site conditions as part of the detailed analysis of the MRA in the RI/FS as it may provide additional relevant data. **Response**: An evaluation of the investigations conducted in MRS-19 and MRS-48 and their respective site conditions will be included as part of the detailed analysis in the Group 4 RI/FS Report. In addition, due to the portion of the Future East Garrison MRA that has not undergone MEC investigation, additional field investigation activities are now planned for selected areas of the MRA. Therefore, the Group 4 RI/FS Work Plan has been modified to include two volumes: Volume 1 provides a rationale for the work plan approach; and the newly-added Volume 2 presents the sampling and analysis plan for the investigation. Volume 1 was revised in numerous areas to reflect the addition of a sampling and analysis plan (Volume 2).

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		In response to the specific comment, the first paragraph of Section 4.1 has been revised as follows: "The Army has previously conducted investigations and removal actions within the Future East Garrison MRA. ***A portion of the Future East Garrison MRA was not accessible at the time of these previous investigations and removal actions due to the presence of dense vegetation. Information from the evaluations of site conditions in MRS-19 and MRS-48, located immediately adjacent to the southwestern portion of the MRA, will therefore be included in the Group 4 RI/FS Report.*** The data obtained during previous Army actions ***within the Future East Garrison MRA*** were reviewed during the development of the SEDR. The initial evaluation of previous munitions response actions within the MRA indicated that the existing data are of sufficient quantity to characterize the MRA. ***However, a portion of the Future East Garrison MRA has not undergone investigation; therefore, additional field investigation activities are planned for selected areas of the MRA. The results of the investigation activities will be incorporated into the Group 4 RI/FS Report.*** ~~Therefore, additional field data will not be collected to complete the RI for this MRA.~~ Data quality review will be performed during the RI for the MRA to confirm that the munitions response data ***and data collected during field activities*** are usable for the purposes of the risk assessment and FS." A summary of the previous investigations and removal actions has also been added to Section 2.1, MEC-Related History, and Section 3.0, Initial Evaluation, as follows: <u>Section 2.1 (new paragraph)</u> "***A portion of the Future East Garrison MRA was not previously investigated due to the presence of dense vegetation. Previous investigations and removal actions have, however, been conducted immediately adjacent to these areas, which included MRS-19 and MRS-48 located to the southwest of the MRA. These previous actions included a SS/GS sampling investigation performed by USA Environmental Inc. (USA) on MRS-48 (USA 2001d), a removal action by CMS Environmental, Inc (CMS) on MRS-19 (CMS 1996), and a sampling survey by Human Factors Applications, Inc.(HFA) on MRS-19 (HFA 1994).***" <u>Section 3.0 (added to the end of the third paragraph)</u> "***Previous investigations and removal actions in MRSs adjacent to the Future East Garrison MRA included a sampling survey performed in MRS-19 (HFA 1994); removal action in MRS-19 (CMS 1996); and a SS/GS sampling investigation in MRS-48 (USA2001d).***"

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		Section 3.0 (added to the end of the last paragraph) "***However, a portion of the Future East Garrison MRA has not undergone previous investigation; therefore, additional field investigation activities are planned for selected areas of the MRA. The results of the investigation activities will be incorporated into the Group 4 RI/FS Report.***"
4	Specific Comment, p.4-11, Section 4.9.3 Implementation of Community Relations Activities	**Comment**: The third last bullet indicates that public notices would be issued in local newspapers to announce the availability of RI-related documents and opportunities for public comment. Please note that, unlike the Proposed Plan, newspaper public notices of availability of RI/FS reports and associated work plans are not required under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or the National Contingency Plan (NCP). The Army utilizes a variety of other methods to communicate with the public with regard to the development and review of these types of documents, as described in the current Community Relations Plan for the former Fort Ord. Without further clarification, a reader may erroneously conclude that similar notices would be provided by the Army on other Fort Ord RI/FSs that may be developed in the future. Please provide a clarification on this point or delete the text regarding public notices. **Response**: The cited bullet has been revised as follows: "Publish public notices in local newspapers, and provide press releases to the media announcing the availability of ***applicable decision*** ~~RI-related~~ documents and opportunities for public comment."

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Review Comments provided by Judy Huang of EPA, dated December 10, 2009

No.	Comment Type / Report Section	Comment/Response
1	General Comment	**Comment:** The Draft Group 4 Remedial Investigation/Feasibility Study Work Plan, Future East Garrison Munitions Response Area, Former Fort Ord, Monterey, California, dated October 9, 2009 (hereinafter referred to as the Draft Group 4 RI/FS WP), contains a number of questionable entries concerning munitions and explosives of concern (MEC) discovered on the MRS. Section 3.0, Initial Evaluation, notes in the last paragraph on page 3-1 that, "During the removal actions, two burial pits were encountered in MRS-42 EXP. The MEC found in the burial pits appeared to be related to troop training (M228 practice hand grenade fuzes and M117 explosive booby trap simulators). A total of 243 of the 336 MEC items were recovered from these burial pits." Common practice and logic indicates that it is very unlikely that all 243 of the items were unexploded ordnance (UXO), since the failure to function of 243 munitions items would be cause for a Department of Defense (DoD)-wide malfunction investigation of the munitions lots involved. Also, it is unlikely that supervisory personnel would agree with the collection and burial of 243 munitions items classed as UXO due to the potential hazards involved. It would, therefore, appear that all or a majority of the items discovered in the burial pits were most likely discarded military munitions (DMM) and not UXO. However, the same section lists more or all of these items as UXO in the first bullet on page 3-2. This categorization is repeated in Appendix A, Future East Garrison MRA Conceptual Site Model, in Table 12.3-3, East Garrison MRA-Types of MEC Removed and Hazard Classification, where the same items are obviously listed as UXO, since there are no items classified as DMM found in the table. This table does, however, contain a nomenclature footnote explaining the reason for the apparent erroneous categorization of the MEC. To avoid potential confusion as to the correct categories of the MEC items found in the cited burial pits, it would be advisable if a footnote or other explanatory text were provided at the initial mention of the buried MEC discovered in the two pits found on the MRS. Please make this correction at the noted locations and elsewhere in the Draft Group 4 RI/FS WP as deemed necessary. **Response:** Based on review of available information, the Army has revised the classification for these items in the MMRP Database from UXO to DMM. Therefore, the following revisions have been made to the above-referenced paragraph of Section 3.0:

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No.	Comment Type / Report Section	Comment/Response
		"During the removal actions, two burial pits were encountered in MRS-42 EXP. The MEC found in the burial pits appeared to be related to troop training ~~(M228 practice hand grenade fuzes and M117explosive booby trap simulators)~~. A total of 243 of the 336 MEC items were recovered from these burial pits. **One burial pit contained 183 M228 practice hand grenade fuzes and the other burial pit contained 60 M117 explosive booby trap simulators; these munitions items are classified as DMM in the MMRP Database. "** In addition, the first bullet on Page 3-2 has been revised to two bullet items as follows: • **83**~~326~~ UXO items • **243 DMM items** Lastly, Table 12.3-3, East Garrison MRA-Types of MEC Removed and Hazard Classification, in Appendix A, Future East Garrison MRA Conceptual Site Model, is presented as an excerpt from the SEDR and will not be updated for the Group 4 RI/FS Work Plan.
1	Specific Comment, Page vii, Glossary	**Comment**: The definition of Construction Support found here does not match that found in the Department of Defense Ammunition and Explosives Safety Standards (DoD 6055.09-STD). The correct definition is as follows: **Construction Support.** Assistance provided by DoD explosive ordnance disposal (EOD) or UXO-qualified personnel and/or by personnel trained and qualified for operations involving CA, regardless of configuration, during intrusive construction activities on property known or suspected to contain UXO, other munitions that may have experienced abnormal environments (e.g., DMM), munitions constituents in high enough concentrations to pose an explosive hazard, or CA, regardless of configuration, to ensure the safety of personnel or resources from any potential explosive or CA hazards. In addition, the definition provided in the Glossary section of Volume 1 indicates that "qualified UXO personnel" may provide this support, which is not always the case. Care must be taken in the use of the terms "UXO Personnel," "UXO Technicians," "qualified UXO personnel," and "UXO-Qualified Personnel," as they are not necessarily interchangeable. In some instances, they appear to be used in a manner that may conflict with Department of Defense Explosives Safety Board (DDESB) Technical Paper

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		18 (Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel). The following are the related definitions presented in that document: • UXO-Qualified Personnel: Personnel who have performed successfully in military EOD positions, or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist or Senior UXO Supervisor. • UXO Technician: Personnel who are qualified for and filling Department of Labor, Service Contract Act, Directory of Occupations, contractor positions of UXO Technician I, UXO Technician II, and UXO Technician III. The term "UXO Sweep Personnel" is not formally defined, although the training and functions thereof are outlined in the DDESB Technical Paper 18. However, it is listed under the heading of "UXO Related Position Titles and Tasks" in that Technical Paper, as are the UXO Technician I, UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist and Senior UXO Supervisor. These positions are UXO personnel per the title of Technical Paper 18. The term "qualified UXO personnel" can mean any of these individuals that are qualified to perform their UXO related functions (including UXO Technician I and UXO Sweep Personnel). However, the term "UXO-Qualified" does not include UXO Sweep Personnel or UXO Technician I by definition. Care must be exercised in the use of these terms to avoid the presentation of incorrect information by their misuse. This could result in individuals performing functions that they are not fully qualified to perform. This issue is compounded by the use of the term "unexploded ordnance (UXO) personnel" in the definition of "Anomaly Avoidance" that is found in the Glossary. As this definition does not match that found in DoD 6055.09-STD, it should be replaced by the official definition, which does not use the term "unexploded ordnance (UXO) personnel." Please replace the noted definitions found in the Glossary Section with those found in the current version of DoD 6055.09-STD. Also, please review the use of the noted UXO Personnel terms in the remainder of the Draft GP 4 RI/FS WP and correct them as necessary to comply with the definitions found in DDESB Technical Paper 18.

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		Response: The definition for Construction Support provided in the glossary of the Group 4 RI/FS Work Plan has been replaced with the DoD standard definition as stated above. The definition for Anomaly Avoidance has also been revised to agree with the DOD standard definition as follows: **Anomaly Avoidance** Techniques employed on property known or suspected to contain unexploded ordnance (UXO), other munitions that may have experienced abnormal environments (e.g., discarded military munition (DMM)), munitions constituents in high enough concentrations to pose an explosive hazard, or chemical agent (CA), regardless of configuration, to avoid contact with potential surface or subsurface explosive or CA hazards, to allow entry to the area for the performance of required operations. The terms "UXO Personnel," "UXO Technician," "qualified UXO personnel," and "UXO-Qualified Personnel," have been reviewed throughout the Group 4 RI/FS Work Plan and have been revised where necessary to comply with the definitions stated in the Department of Defense Explosives Safety Board (DDESB) Technical Paper 18. Given the revision of the definition in the glossary for Anomaly Avoidance, the term "unexploded ordnance (UXO) personnel" is no longer used in the document.
2	Specific Comment, Section 3.0, Initial Evaluation, Page3-2	**Comment**: The first two paragraphs of this section on the cited page state that, "In total, the removal actions in the Future East Garrison MRA resulted in the removal of the following: • 326 UXO items • 10 Insufficient Data (ISD) items (material potentially presenting an explosive hazard [MPPEH] that could not be classified as UXO, DMM, or MD) • 4,107 pounds of MD (includes MD [expended] and MD [fragmented] items if weights were documented) According to the Fort Ord MMRP database, of the 336 MEC items, two items had a hazard classification of 0 (inert munitions item that will cause no injury), 259 items had a hazard classification of 1 (MEC that will cause an injury or, in extreme cases, could cause major injury or death to an individual

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		if functioned by an individual's activities), one item had a hazard classification of 2 (MEC that will cause major injury or, in extreme cases, could cause death to an individual if functioned by an individual's activities), and 74 items had a hazard classification of 3 (MEC that will kill an individual if detonated by an individual's activities)." There are some issues with the cited verbiage. These include: • The 10 items categorized as "MPPEH" should not be classified as such if they are to be included in the 336 MEC items recovered, particularly since it is stated that they could be MD. If the intent is to state that these items were MEC of an undetermined category (see definition of MEC found in the Glossary section), then do not call them MPPEH. MEC by definition always presents an explosive hazard, not a potential one as MPPEH does by definition. List them as MEC items with insufficient data (ID) to place them in a subclass (i.e., UXO, DMM, or MC present in high enough concentrations to present an explosive hazard). • The statement that, "According to the Fort Ord MMRP database, of the 336 MEC items, two items had a hazard classification of 0 (inert munitions item that will cause no injury),…" By definition, there is no such thing as inert MEC. MEC is explosive; therefore, it cannot be inert. This should be explained in the text or in a footnote, as is done in the previously cited Table 12.3-3 of Appendix A. Please correct the cited text as noted. **Response**: In response to the first bulleted comment, there is agreement that "MPPEH" is inappropriately used when referring to munitions items with Insufficient Data (ISD). The term ISD was created to identify munitions items that could not be definitively classified as UXO, DMM, or MD. Where there was uncertainty, the item was classified as ISD. Therefore, the bullet description of the munitions items with ISD has been revised as follows: • 10 Insufficient Data (ISD) items (~~material potentially presenting an explosive hazard [MPPEH] that~~ could not be **definitively** classified as UXO, DMM, or MD) For the purposes of reporting for the ESCA, the ISD items will be considered MEC.

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No.	Comment Type / Report Section	Comment/Response
		In response to the second bulleted comment, the two items designated as MEC with a hazard classification of 0 is incorrect. The two MEC items were not assigned a hazard classification in the Army's MMRP database. However, in the SEDR, a default hazard classification of zero was entered into the table summarizing the data if a value was not specified in the Army's MMRP database (Table 12.3-3; ESCA RP Team 2008a). Table 12.3-3, provided in the SEDR (and reproduced in Appendix A of this report), contains hazard classifications of zero that were not specified for items in the Army's MMRP database. As part of the Group 4 remedial investigation and risk assessment activities, items with unassigned hazard classifications in the Army's MMRP database will be further evaluated by the ESCA RP and the most conservative hazard classifications will be assigned to the items. Therefore, the text for the paragraph in Section 3.0 referenced in the second bulleted comment has been revised as follows: "According to the Fort Ord MMRP database, of the 336 MEC items, two items ***were not assigned*** ~~had~~ a hazard classification ~~of 0 (inert munitions item that will cause no injury)~~, 259 items had a hazard classification of 1 (MEC that will cause an injury or, in extreme cases, could cause major injury or death to an individual if functioned by an individual's activities), one item had a hazard classification of 2 (MEC that will cause major injury or, in extreme cases, could cause death to an individual if functioned by an individual's activities), and 74 items had a hazard classification of 3 (MEC that will kill an individual if detonated by an individual's activities)."
3	Specific Comment, Appendix A, Future East Garrison MRA Conceptual Site Model, Page 12-19	**Comment**: This CSM contains a Table 12.3-3, East Garrison MRA – Types of MEC Removed and Hazard Classification, which lists a "Flare, type unknown" as UXO and assigns a hazard class of 0 (zero). This cannot be correct, as an item classified as UXO cannot be inert by definition, and the hazard classification of 0 is reserved for inert items. Please review the cited table and correct the noted listing as necessary. **Response**: The hazard classifications of one, two, and three presented in Table 12.3-3 are consistent with the Army's MMRP Database. In the SEDR, a default hazard classification of zero was entered into the table summarizing the data if a value was not specified in the Army's MMRP database (Table 12.3-3; ESCA RP Team 2008a). Table 12.3-3, provided in the SEDR (and reproduced in Appendix A of this report), contains hazard classifications of zero that are not specified for items in the Army's MMRP database. A footnote is provided with the table that states that discrepancies in the data are a result of misinformation from the data sources, however a footnote was not included in the SEDR to clarify that the hazard classification of zero was assigned to items where no hazard classification was included in the Army's

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		MMRP database. Given that Table 12.3-3 is presented as an excerpt from the SEDR, no changes have been made to the table. As mentioned in the response to Specific Comment No. 2, a statement referring to the two items with a hazard classification of zero (flare, type unknown and Projectile, 4.2-inch) has been added to Section 3.0 to clarify that the hazard classification of zero was assigned to these items as a default hazard classification.

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No.	Comment Type / Report Section	Comment/Response
1	General Comment	**Comment:** The rationale for dividing the Fort Ord Superfund Site into nine group areas, this report focusing on group 4, isn't clear. However, perhaps it has something to do with LFR's advertised "Wide Area Assessment Technology"? The area here is a stated 244 acres. It lies within the unincorporated area of Monterey County. We see no distribution of this document to the Monterey County Planning Department. **Response:** The nine MRAs were developed based on property transfer parcels and were categorized into four groups (Group 1 through Group 4) based on an evaluation of the available data, Conceptual Site Models, preliminary assessments of risk, and regulatory pathway requirements. Each group consists of one or more MRAs that have similar pathway-to-closure characteristics. This explanation was presented in Section 1.4, Preliminary RI/FS Scoping and Implementation, of the Group 4 RI/FS Work Plan and in greater detail in Section 13.0, Program Implementation, of the Summary of Existing Data Report (SEDR). The draft, draft final, and final versions of the SEDR were provided directly to you using a package tracking delivery service and posted to the Administrative Record in February, June, and November 2008, respectively, for public review. There is no requirement to provide the Group 4 RI/FS Work Plan to the Monterey County Planning Department. No changes have been incorporated into the report based on this comment.
2	General Comment	**Comment**: Data from previous site sampling from approximately the years 1996 to as late as the year 2000 (in some cases) is used as justification for your conclusion on page 5-1 that "…no additional field investigation activities are anticipated for the Future East Garrison MRA prior to conducting the RI/FS." **Response**: The Group 4 RI/FS Work Plan has been revised to include additional investigation in selected areas of the Future East Garrison MRA as part of the development of a RI/FS report. The initial evaluation of data for the Future East Garrison MRA conducted as part of the SEDR indicated that existing data was of sufficient quantity and quality to characterize the MRA for the purpose of completing the RI/FS. However, due to the portion of the Future East Garrison MRA that has not undergone previous investigation, additional field investigation activities are planned for selected areas of the MRA. A second volume has been added to the Group 4 RI/FS Work Plan to present the Group 4 Sampling and Analysis Plan and Quality Assurance Project Plan.

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		The results of the additional investigation activities will be incorporated into the RI/FS report for Group 4.
3	General Comment	**Comment**: Old sampling, done with Schonstadt's, and some sample digging to respective depths of one foot and four feet, are apparently being considered adequate for anointing approximately 68 acres of the area as being ok for residential housing. How dense this housing is to be, or the type of housing anticipated, is not disclosed. **Response**: The adequacy of the geophysical instruments used during investigation activities on the Future East Garrison MRA (i.e., Schonstedt magnetometers) will be evaluated in the Group 4 RI/FS report as described in Section 4.3.2.1, Equipment Evaluation, of the Group 4 RI/FS Work Plan. In addition, the Group 4 RI/FS Work Plan focuses on MEC investigation in support of a RI/FS, Proposed Plan, and Record of Decision. The ESCA Remediation Program does not determine housing density and types. No changes have been incorporated into the report based on this comment.
4	General Comment	**Comment**: The printed, anticipated project schedule, located at the back of this document is presumptuous for a "draft work plan". It's pre-determined, or, also known as reverse engineering. **Response**: The anticipated project schedule is a required element of the Group 4 RI/FS Work Plan as outlined in Section 2.3.1 of the EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (APE/540/G-89/001). No changes have been incorporated into the report based on this comment.
5	General Comment	**Comment**: Has the baseline risk assessment as required by CERCLA statute been completed for your Group 4 designated area? How can an RI/FS process go forward without such essential information? **Response**: This subject was raised in the FOCAG Position Paper dated August 12, 2008. The response from the Army, DTSC, EPA, and FORA to this concern and

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		others was presented to FOCAG in a letter from the Army, dated November 17, 2008 (Fort Ord Administrative No. ESCA-0126). The potential presence of soil contamination at known or suspected small arms ranges, multi-use ranges, and military munitions training areas were evaluated by the Army and reported in the Final Comprehensive Basewide Range Assessment Report, Former Fort Ord, California, Revision 1, June 9 (Fort Ord Administrative Record No. BW-2300J). No changes have been incorporated into the report based on this comment.
6	General Comment	**Comment**: The areas of Group 4 are in the vicinity of the portion of Fort Ord first purchased by the Army in 1919. There is little information on training uses, and no maps at all are available that we are aware of, showing pre-1945 uses. Group 4 is just east of, and in proximity to listed Combat Ranges on a 1945 map we are including as an attachment. **Response**: As presented in the Group 4 RI/FS Work Plan, the Group 4 RI/FS report will include a review of site historical records (including historical aerial photographs and facility training maps), military history, and archives search reports to determine the documented historical land use and known historical military practices conducted on and surrounding the Future East Garrison MRA. No changes have been incorporated into the report based on this comment.
7	General Comment	**Comment**: We find the ordnance sampling done to be minimal, and used the sub-standard Schonstadt. There has been no investigation of deeply buried penetrating ordnance. Two burial pits are revealed as having been found in this draft work plan report. From my visits as a boy to former Fort Ord, when it was an active Army training base, burial pits were up to ten feet deep. Indeed they would often be dug about ten feet deep and the bulldozer would be left nearby, unmanned, until such time as the bulk of the most current training exercise was dumped or pushed into the burial pit, then it would be covered up and over with dirt. Some of these large burial pits I witnessed were about half filled, approximately five feet deep. **Response**: The adequacy of the geophysical instruments used during investigation and removal action activities on the Future East Garrison MRA (i.e., Schonstedt magnetometers) will be evaluated in the Group 4 RI/FS report as described in Section 4.3.2.1, Equipment Evaluation, of the Group 4 RI/FS Work Plan. The adequacy of investigations and removal actions will also be evaluated in the

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No.	Comment Type / Report Section	Comment/Response
		Group 4 RI/FS report as described in Section 4.3.2.2 of the Group 4 RI/FS Work Plan. No changes have been incorporated into the report based on this comment.
8	General Comment	**Comment**: Regarding residual chemical contamination, aka, COC's Chemicals of Concern: Where is the risk assessment? Of the approximately 200 potential constituents, what was looked for? Where was it specifically looked for? When was it looked for? Who did the sampling? **Response**: This subject was raised in the FOCAG Position Paper dated August 12, 2008. The response from the Army, DTSC, EPA, and FORA to this concern and others was presented to FOCAG in a letter from the Army, dated November 17, 2008 (Fort Ord Administrative No. ESCA-0126). This comment is outside of the intended scope of the Group 4 RI/FS Work Plan under the AOC. The purpose of the Group 4 RI/FS Work Plan as defined under Task 3 of the AOC Scope of Work is to propose methodology to obtain the necessary information identified in the SEDR to characterize the nature and extent of MEC in order to propose a preferred remediation alternative pursuant to CERCLA. No changes have been incorporated into the report based on this comment.

Response to Comments
Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
1	Volume 2 – Sampling and Analysis Plan, p. 2-3, Section 2.2.1 Future East Garrison MRA Remedial Investigation Areas	**Comment:** Rationale for selecting Grids 1 and 2 for investigation. The text suggests that these grids were located to the south of an area identified by the Army as a potential practice mortar range. However, no such area was previously identified in the suggested location. A suspected stokes mortar range was identified "to the east of MRS-42" and "between Barloy Canyon Road and Crescent Bluff Road" in Final Site Assessment East Garrison Area 4 Site Report (Administrative Record number: OE-0556J) based on the finding of expended MKI practice Stokes trench mortars (munitions debris [MD]). Therefore, it is suggested to replace text "to the south of" with "in the vicinity of" to avoid potential confusion. **Response:** The bulleted text has been revised as follows: • Grids 1 and 2 were selected at the top and bottom of a ridge in the northern portion of the MRA. These grids are ~~to the south~~ ***in the vicinity*** of an area identified by the Army as a potential practice mortar range. The grids are placed to capture data in potential impact areas.
2	Volume 2 – Sampling and Analysis Plan, p.2-8, Section 2.3.2 Analog Investigation	**Comment:** The fourth paragraph includes a sentence "MD will be collected and an estimated weight of material per grid will be recorded by the UXO Technicians." The statement is followed by paragraphs that provide for collection of additional data on MD that may be recovered during intrusive investigation. The text is currently unclear as to what information will be recorded for recovered MD. Please clarify. **Response:** The section has been revised as follows: "MEC items encountered ~~on the surface~~ will be immediately reported to the SUXOS, surveyed with a GPS unit for documentation purposes, and handled in accordance with the proper handling procedures. ~~MD will be collected and an estimated weight of material per grid will be recorded by the UXO Technicians.~~ ***If the anomaly is a MEC item or MD that can be identified, the type of munitions, approximate weight, and inclination and declination of the item will be recorded in accordance with the QAPP presented in Appendix D of this G4 SAP. If the anomaly yields a non-military munitions item or fragments or pieces of MEC items that are not intact and cannot be positively identified, then the approximate total weight and depth***

Response to Comments
Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
		of the item(s) will be recorded, but the type of MEC item(s) and the inclination and declination of MEC item(s) will not be recorded. The UXO Teams will be provided with the appropriate forms to record relevant data related to their ~~intrusive~~ investigation and will be provided information needed to excavate the "mag and dig" anomalies. Annotations will be recorded for MEC and MD that can be positively identified. Annotations will include site name, instrument used, easting and northing coordinates (in local NAD 1983 State Plane Coordinates, California Zone IV, U.S. survey feet), grid number, instrument response and units, source type of response, description, weight, depth, and subsequent actions taken. ~~If the anomaly yields a non-military munitions item or fragments or pieces of MEC items that are not intact and cannot be positively identified, then the approximate total weight and depth of the item(s) will be recorded, but the type of MEC item(s) and the inclination and declination of MEC item(s) will not be recorded.~~ ~~If the anomaly is an MEC item or MD that can be identified, the type of munitions, approximate weight and inclination and declination of the item will be recorded in accordance with the QAPP presented in Appendix D of this G4 SAP.~~ The MEC items encountered will be initially classified as materials potentially presenting an explosive hazard (MPPEH) until the items are fully inspected and can be identified as MEC, MD, or metal scrap. MD and metal scrap will be transported from the investigation area and stored until it can be disposed of by a foundry and/or recycler, where it will be processed through a smelter, shredder, or furnace prior to resale or release. Prior to leaving the MRA, the MD and metal scrap will be inspected by a SUXOS and a UXOQCS to verify that it is FFE. The MD will be shredded and recycled at an authorized recycler.
3	Volume 2 – Sampling and Analysis Plan, p.2-11, Section 2.4.2 DGM Surveys	**Comment:** In this section, the use of EM61-MK2 mounted on FORA ESCA Sled is proposed as the instrument of choice in the event that digital geophysical investigation is desired in a portion of the investigation areas. Previous uses of the FORA ESCA Sled in other MRAs within the ESCA required extensive site preparation, such as vegetation removal to the extent beyond what would

Response to Comments
Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
		be typically conducted to support analog investigation. Please provide a brief description of additional site preparation that may be expected to be required if the FORA ESCA Sled were to be used as part of the investigation in the Future East Garrison MRA. **Response:** No additional site preparation is expected for use of the FORA ESCA Sled in the Future East Garrison MRA. Based on sled weight and design, past experience has shown that the FORA ESCA Sled can be effectively employed in brush as high as 6 inches above the ground surface; therefore, vegetation will be cut using the methods described in Section 2.3.1.4 of the work plan to within 6 inches or less of the ground surface in areas that are easily accessible and relatively flat, leaving the ground surface and root structure intact. These areas would typically include roads and trails provided a GPS signal lock can be achieved and open areas that have been more heavily used for military training, such as portions of the grids selected in the hand grenade training area and the demolition training area of MRS-11 (Grids 19 through 23). No changes have been incorporated into the report based on this comment.
4	Volume 2 – Sampling and Analysis Plan, p.2-13, Section 2.4.6 Soil Screening Operations	**Comment:** This section describes that, in the event that soil containing high density of small metallic debris or other sources that cause noise interference for the digital geophysical investigation is encountered, intrusive investigation would utilize soil excavation in 3-inch lifts and soil screening. Soil screening in habitat reserve areas will require preparation of a habitat restoration and monitoring plan to ensure the success criteria outlined in the Installation-wide Multispecies Habitat Management Plan (HMP) will be met. Please include this information in appropriate section(s) of the document. **Response:** The following text has been added to the end of Section 2.4.6: ***"In habitat reserve parcels, excavated areas will be allowed to revegetate naturally. Soil screening will be implemented under this G4 SAP only if extensive metal debris is encountered that prevents a specific location from being cleared by "mag and dig" technique. It is anticipated that few, if any, of the areas to be investigated will contain extensive metal debris. If soil screening is implemented, it is not expected to exceed 10,000 square feet of area in any one location. The total area affected by soil disturbance in the Future East Garrison MRA is expected to be less than 1% of the total area of the MRA. Soil disturbance of areas equal to or less than 10,000 square***

Response to Comments
Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
		feet is considered "de minimis" relative to the total area in the habitat parcel; furthermore, many of the areas being investigated are within or along already disturbed areas (i.e., trails or roads) that do not contain fully developed vegetation. An exception to this general statement is the known locations of sand gilia and Monterey spineflower within or alongside trails and roads, where appropriate mitigation measures (i.e., replacement of surface soil) will be implemented as discussed elsewhere in Section 12.3.5.3 of this G4 SAP. Given that these investigation areas are surrounded by unaffected robust vegetation, passive (i.e., natural) recruitment into them is expected to occur from adjacent plants. ***The information presented above satisfies the requirements of the HMP regarding monitoring and restoration. The Army's vegetation monitoring protocol specifically excludes trails and roads from shrub monitoring. Focus species (i.e., sand gilia and Monterey spineflower) areas that are disturbed will be monitored to confirm that the mitigation measures are implemented in the field."*** Section 12.3.3 Post-Fieldwork Monitoring on Page 12-3 describes the activities for monitoring habitat restoration in consultation with the Fort Ord BRAC Wildlife Biologist.
5	Volume 2 – Sampling and Analysis Plan, p. 12-5, Section 12.3.5.3 Site Restoration and Monitoring for Invasive Weeds	**Comment:** The second numbered paragraph. The listed requirement is based on the Site 39 habitat restoration plan. Please revise the first sentence to read "In habitat reserve parcels, excavated areas will ...." **Response:** The numbered paragraph has been revised as follows: 2. ~~Per the HMP, i~~***I***n habitat reserve parcels, excavated areas will be allowed to revegetate naturally. If the excavation disturbs an area more than 1 acre and more than 100 feet in width, passive and active restoration with follow-up monitoring will be conducted.
6	Volume 2 – Sampling and Analysis Plan, p.12-5, Section 12.3.5.3 Site Restoration and Monitoring for Invasive	**Comment**: The third numbered paragraph states that excavations that result in steep-sided depressions in vicinity of potential California tiger salamander breeding sites will be filled with soil. Please note that regrading is preferred, and that no fill soil is required. **Response**: The numbered paragraph has been revised as follows:

Response to Comments
Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
	Weeds	3. ***If*** ~~E~~***e***xcavations ~~that~~ result in steep-sided depressions without a gently sloping egress area ~~that occur~~ within 2 kilometers of a potential CTS breeding site, ***the edges of the excavations will be sloped*** ~~will be filled with soil to approximately match adjacent ground level~~ to prevent trapping ~~or breeding~~ of CTS during the wet season.

DEPARTMENT OF THE ARMY
FORT ORD OFFICE, ARMY BASE REALIGNMENT AND CLOSURE
P.O. BOX 5008, BUILDING #4463 GIGLING ROAD
MONTEREY, CALIFORNIA 93944-5008

REPLY TO
ATTENTION OF

OCT 29 2009

Base Realignment and Closure

Stan Cook
ESCA Remediation Program Manager
Fort Ord Reuse Authority
100 12th Street, Building 2880
Marina, CA 93933

Subject: *Draft Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Future East Garrison Munitions Response Area(MRA)*, dated October 9, 2009, received on October 12, 2009.

Dear Mr. Cook:

Thank you for an opportunity to review and comment on the subject document. The Army's comments are enclosed. Please note our comments are focused on "big picture" issues such as the consistency with documents previously produced under the Army's cleanup program. A copy of this letter will be furnished to U.S. Environmental Protection Agency (Judy Huang) and California Department of Toxic Substances Control (Roman Racca).

Sincerely,

Gail Youngblood
BRAC Environmental Coordinator
Fort Ord Field Office

Enclosure

DRAFT Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Future East Garrison Munitions Response Area (MRA)

Dated October 9, 2009

Army Comments:

1. p.2-3, Section 2.2 Physical Setting. Third paragraph notes that the total acreage of the Future East Garrison MRA has been revised to reflect the final property transfer boundaries. The Army is pleased that the MRA boundary was updated to include all of the East Garrison property that was transferred to Fort Ord Reuse Authority (FORA) in connection with the Environmental Services Cooperative Agreement (ESCA). However, the report does not describe the designated future land use and habitat type (HMP category) for the additional acreage. Please update the text and/or figures to provide this information.

2. p.2-5, at the end of Section 2.2 Physical Setting. The fourth last sentence states "For habitat areas, these measures include conducting habitat monitoring in compliance with Chapter 3 of the HMP (USACE 1997b)." Because Chapter 3 of the HMP requires many more mitigation measures during environmental investigation and remediation activities within habitat reserve areas, we recommend inserting text ", but are not limited to" to read "...these measures include, but are not limited to, conducting habitat monitoring...."

3. p.4-1, Section 4.1 Summary of the Approach for Group 4. The first paragraph discusses that additional data collection is not necessary because the existing data are of sufficient quantity to characterize the Future East Garrison MRA. As described elsewhere in the document, the Army has conducted several munitions response investigations and removal actions within the Future East Garrison MRA, resulting in a significant quantity of data being available for the RI/FS evaluation. However, it should be noted that in previous investigations, a portion of the subject MRA directly adjacent to munitions response sites (MRSs) 48 and 19, where RI/FS evaluation has not been completed, was not readily accessible due to dense vegetation. Please include an evaluation of adjacent site conditions as part of the detailed analysis of the MRA in the RI/FS as it may provide additional relevant data.

4. p. 4-11, Section 4.9.3 Implementation of Community Relations Activities. The third last bullet indicates that public notices would be issued in local newspapers to announce the availability of RI-related documents and opportunities for public comment. Please note that, unlike the Proposed Plan, newspaper public notices of availability of RI/FS reports and associated work plans are not required under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or the National Contingency Plan (NCP). The Army utilizes a variety of other methods to communicate with the public with regard to the development and review of these types of documents, as described in the current Community Relations Plan for the former Fort Ord. Without further clarification, a reader may erroneously conclude that similar notices would be provided by the Army on other Fort Ord RI/FSs that may be developed in the future. Please provide a clarification on this point or delete the text regarding public notices.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

December 10, 2009

Mr. Stan Cook
Fort Ord Reuse Authority
100 12th Street, Building 2880
Marina, CA 93933

Re: EPA Comments on the Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, Future East Garrison Munitions Response Areas, Former Fort Ord, Monterey County, California, Dated October 9, 2009

Dear Stan:

Attached are EPA's comments on the *Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, Future East Garrison Munitions Response Areas, Former Fort Ord, Monterey County, California*, dated October 9, 2009.

If you have any questions, please do not hesitate to call me at (415) 972-3681 or e-mail me at huang.judy@epa.gov.

Sincerely,

Judy C. Huang, P.E.
Remedial Project Manager

cc:

Roman Racca (DTSC)
Site Mitigation/Office of Military Facilities
8800 Cal Center Drive
Sacramento, CA 95826

Kristie Reimer, AICP
Principal Planner
BRAC / Federal Programs
LFR Inc.
1900 Powell Street, 12th Floor
Emeryville, CA 94608

Ms. Gail Youngblood
Fort Ord Base Realignment and Closure Office
P.O. Box 5008
Monterey, CA 93944-5004

Mr. Thomas Hall (via E-mail)

REVIEW OF THE DRAFT GROUP 4
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
FUTURE EAST GARRISON MUNITIONS RESPONSE AREAS
FORMER FORT ORD, CALIFORNIA
OCTOBER 9, 2009

GENERAL COMMENTS

1. The Draft Group 4 Remedial Investigation/Feasibility Study Work Plan, Future East Garrison Munitions Response Area, Former Fort Ord, Monterey, California, dated October 9, 2009 (hereinafter referred to as the Draft Group 4 RI/FS WP), contains a number of questionable entries concerning munitions and explosives of concern (MEC) discovered on the MRS. Section 3.0, Initial Evaluation, notes in the last paragraph on page 3-1 that, "During the removal actions, two burial pits were encountered in MRS-42 EXP. The MEC found in the burial pits appeared to be related to troop training (M228 practice hand grenade fuzes and M117 explosive booby trap simulators). A total of 243 of the 336 MEC items were recovered from these burial pits." Common practice and logic indicates that it is very unlikely that all 243 of the items were unexploded ordnance (UXO), since the failure to function of 243 munitions items would be cause for a Department of Defense (DoD)-wide malfunction investigation of the munitions lots involved. Also, it is unlikely that supervisory personnel would agree with the collection and burial of 243 munitions items classed as UXO due to the potential hazards involved. It would, therefore, appear that all or a majority of the items discovered in the burial pits were most likely discarded military munitions (DMM) and not UXO.

   However, the same section lists most or all of these items as UXO in the first bullet on page 3-2. This categorization is repeated in Appendix A, Future East Garrison MRA Conceptual Site Model, in Table 12.3-3, East Garrison MRA-Types of MEC Removed and Hazard Classification, where the same items are obviously listed as UXO, since there are no items classified as DMM found in the table. This table does, however, contain a nomenclature footnote explaining the reason for the apparent erroneous categorization of the MEC.

   To avoid potential confusion as to the correct categories of the MEC items found in the cited burial pits, it would be advisable if a footnote or other explanatory text were provided at the initial mention of the buried MEC discovered in the two pits found on the MRS. Please make this correction at the noted locations and elsewhere in the Draft Group 4 RI/FS WP as deemed necessary.

SPECIFIC COMMENTS

1. **Glossary, Page vii:** The definition of Construction Support found here does not match that found in the Department of Defense Ammunition and Explosives Safety Standards (DoD 6055.09-STD). The correct definition is as follows:

   > **Construction Support.** Assistance provided by DoD explosive ordnance disposal (EOD) or UXO-qualified personnel and/or by personnel trained and qualified for operations involving CA, regardless of configuration, during intrusive construction activities on property known or suspected to contain UXO, other munitions that may

have experienced abnormal environments (e.g., DMM), munitions constituents in high enough concentrations to pose an explosive hazard, or CA, regardless of configuration, to ensure the safety of personnel or resources from any potential explosive or CA hazards.

In addition, the definition provided in the Glossary section of Volume 1 indicates that "qualified UXO personnel" may provide this support, which is not always the case. Care must be taken in the use of the terms "UXO Personnel," "UXO Technicians," "qualified UXO personnel," and "UXO-Qualified Personnel," as they are not necessarily interchangeable. In some instances, they appear to be used in a manner that may conflict with Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel). The following are the related definitions presented in that document:

- UXO-Qualified Personnel: Personnel who have performed successfully in military EOD positions, or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist or Senior UXO Supervisor.

- UXO Technician: Personnel who are qualified for and filling Department of Labor, Service Contract Act, Directory of Occupations, contractor positions of UXO Technician I, UXO Technician II, and UXO Technician III.

The term "UXO Sweep Personnel" is not formally defined, although the training and functions thereof are outlined in the DDESB Technical Paper 18. However, it is listed under the heading of "UXO Related Position Titles and Tasks" in that Technical Paper, as are the UXO Technician I, UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist and Senior UXO Supervisor. These positions are UXO personnel per the title of Technical Paper 18. The term "qualified UXO personnel" can mean any of these individuals that are qualified to perform their UXO-related functions (including UXO Technician I and UXO Sweep Personnel). However, the term "UXO-Qualified" does not include UXO Sweep Personnel or UXO Technician I by definition. Care must be exercised in the use of these terms to avoid the presentation of incorrect information by their misuse. This could result in individuals performing functions that they are not fully qualified to perform.

This issue is compounded by the use of the term "unexploded ordnance (UXO) personnel" in the definition of "Anomaly Avoidance" that is found in the Glossary. As this definition does not match that found in DoD 6055.09-STD, it should be replaced by the official definition, which does not use the term "unexploded ordnance (UXO) personnel."

Please replace the noted definitions found in the Glossary Section with those found in the current version of DoD 6055.09-STD. Also, please review the use of the noted UXO Personnel terms in the remainder of the Draft GP 4 RI/FS WP and correct them as necessary to comply with the definitions found in DDESB Technical Paper 18.

2. **Section 3.0, Initial Evaluation, Page 3-2:** The first two paragraphs of this section on the cited page state that, "In total, the removal actions in the Future East Garrison MRA resulted in the removal of the following:

   - 326 UXO items
   - 10 Insufficient Data (ISD) items (material potentially presenting an explosive hazard [MPPEH] that could not be classified as UXO, DMM, or MD)
   - 4,107 pounds of MD (includes MD [expended] and MD [fragmented] items if weights were documented)

   According to the Fort Ord MMRP database, of the 336 MEC items, two items had a hazard classification of 0 (inert munitions item that will cause no injury), 259 items had a hazard classification of 1 (MEC that will cause an injury or, in extreme cases, could cause major injury or death to an individual if functioned by an individual's activities), one item had a hazard classification of 2 (MEC that will cause major injury or, in extreme cases, could cause death to an individual if functioned by an individual's activities), and 74 items had a hazard classification of 3 (MEC that will kill an individual if detonated by an individual's activities)."

   There are some issues with the cited verbiage. These include:

   - The 10 items categorized as "MPPEH" should not be classified as such if they are to be included in the 336 MEC items recovered, particularly since it is stated that they could be MD. If the intent is to state that these items were MEC of an undetermined category (see definition of MEC found in the Glossary section), then do not call them MPPEH. MEC by definition always presents an explosive hazard, not a potential one as MPPEH does by definition. List them as MEC items with insufficient data (ID) to place them in a subclass (i.e., UXO, DMM, or MC present in high enough concentrations to present an explosive hazard).
   - The statement that, "According to the Fort Ord MMRP database, of the 336 MEC items, two items had a hazard classification of 0 (inert munitions item that will cause no injury),…" By definition, there is no such thing as inert MEC. MEC is explosive; therefore, it cannot be inert. This should be explained in the text or in a footnote, as is done in the previously cited Table 12.3-3 of Appendix A.

   Please correct the cited text as noted.

3. **Appendix A, Future East Garrison MRA Conceptual Site Model, Page 12-19:** This CSM contains a Table 12.3-3, East Garrison MRA – Types of MEC Removed and Hazard Classification, which lists a "Flare, type unknown" as UXO and assigns a hazard class of 0 (zero). This cannot be correct, as an item classified as UXO cannot be inert by definition, and the hazard classification of 0 is reserved for inert items. Please review the cited table and correct the noted listing as necessary.

Fort Ord Community Advisory Group
P.O. Box 696
Seaside, CA 93955
email: focagemail@yahoo.com

SCB

FOR A
c/o Stan Cook, ESCA Program Manager
100 12th St., Building 2880
Marina, CA 93933
Via fax: (831) 883-3675, hard copy to follow via U.S. Mail

BRAC
c/o Gail Youngblood
Building #4463
Gigling Road
Monterey, CA 93940
Via fax: (831) 393-9188, hard copy to follow via U.S. Mail

Response to:
Draft Group 4 Remedial Investigation/Feasibility Study Work Plan
FOR A ESCA Remediation Program, Former Fort Ord, Monterey County, California

FOR THE ADMINISTRATIVE RECORD

December 11, 2009

Dear Mr. Cook and Ms. Youngblood,

The FOCAG has had the opportunity to read this work plan. With all due respect for what appears to be a large effort, the result, so far, is a rather pedantic exercise that is a rehash of selective older data. The rationale for dividing the Fort Ord Superfund Site into nine group areas, this report focusing on group 4, isn't clear. However, perhaps it has something to do with LFR's advertised "Wide Area Assessment Technology"? The area here is a stated 244 acres. It lies within the unincorporated area of Monterey County. We see no distribution of this document to the Monterey County Planning Department.

Data from previous site sampling from approximately the years 1996 to as late as the year 2000 (in some cases) is used as justification for your conclusion on page 5-1 that "...,no additional field investigation activities are anticipated for the Future East Garrison MRA prior to conducting the RI/FS."

Old sampling, done with Schonstadt's, and some sample digging to respective depths of one foot and four feet, are apparently being considered adequate for anointing approximately 68 acres of the area as being ok for residential housing.

5

How dense this housing is to be, or the type of housing anticipated, is not disclosed.

The printed, anticipated project schedule, located at the back of this document is presumptuous for a "draft work plan". It's pre-determined, or, also known as reverse engineering.

Has the baseline risk assessment as required by CERCLA statute been completed for your Group 4 designated area?

How can an RI/FS process go forward without such essential information?

The areas of Group 4 are in the vicinity of the portion of Fort Ord first purchased by the Army in 1919. There is little information on training uses, and no maps at all are available that we are aware of, showing pre-1945 uses. Group 4 is just east of, and in proximity to listed Combat Ranges on a 1945 map we are including as an attachment.

We find the ordnance sampling done to be minimal, and used the sub-standard Schonstadt. There has been no investigation of deeply buried penetrating ordnance. Two burial pits are revealed as having been found in this draft work plan report. From my visits as a boy to former Fort Ord, when it was an active Army training base, burial pits were up to ten feet deep. Indeed they would often be dug about ten feet deep and the bulldozer would be left nearby, unmanned, until such time as the bulk of the most current training exercise was dumped or pushed into the burial pit, then it would be covered up and over with dirt. Some of these large burial pits I witnessed were about half filled, approximately five feet deep.

Regarding residual chemical contamination, aka, COC's Chemicals Of Concern:
Where is the risk assessment?
Of the approximately 200 potential constituents, what was looked for?
Where was it specifically looked for?
When was it looked for?
Who did the sampling?

The FOCAG is including, as an attachment, a copy of a letter from Dr. Gunnar Heuser dated May 9, 2002. It is as pertinent today as it was when he wrote it seven and a half years ago. He addresses:
Is Fort Ord Toxic?
Comments on Exposure Limits
Comments on Dose-Effect
Health Studies and Effects
Suggested Health Studies
Conclusions

This Group 4 area is a proposed area to include residential housing based on the

1997 Fort Ord Reuse Plan. The area contains dangerous former Army training ranges. The FOCAG is alarmed that a rehash of some previous sample data is being used as justification to go forward with a pre-determined schedule. We don't believe it to be a good plan. Community Support is an important part of the Superfund Clean Up Process. It is hard to find it here.

Sincerely,

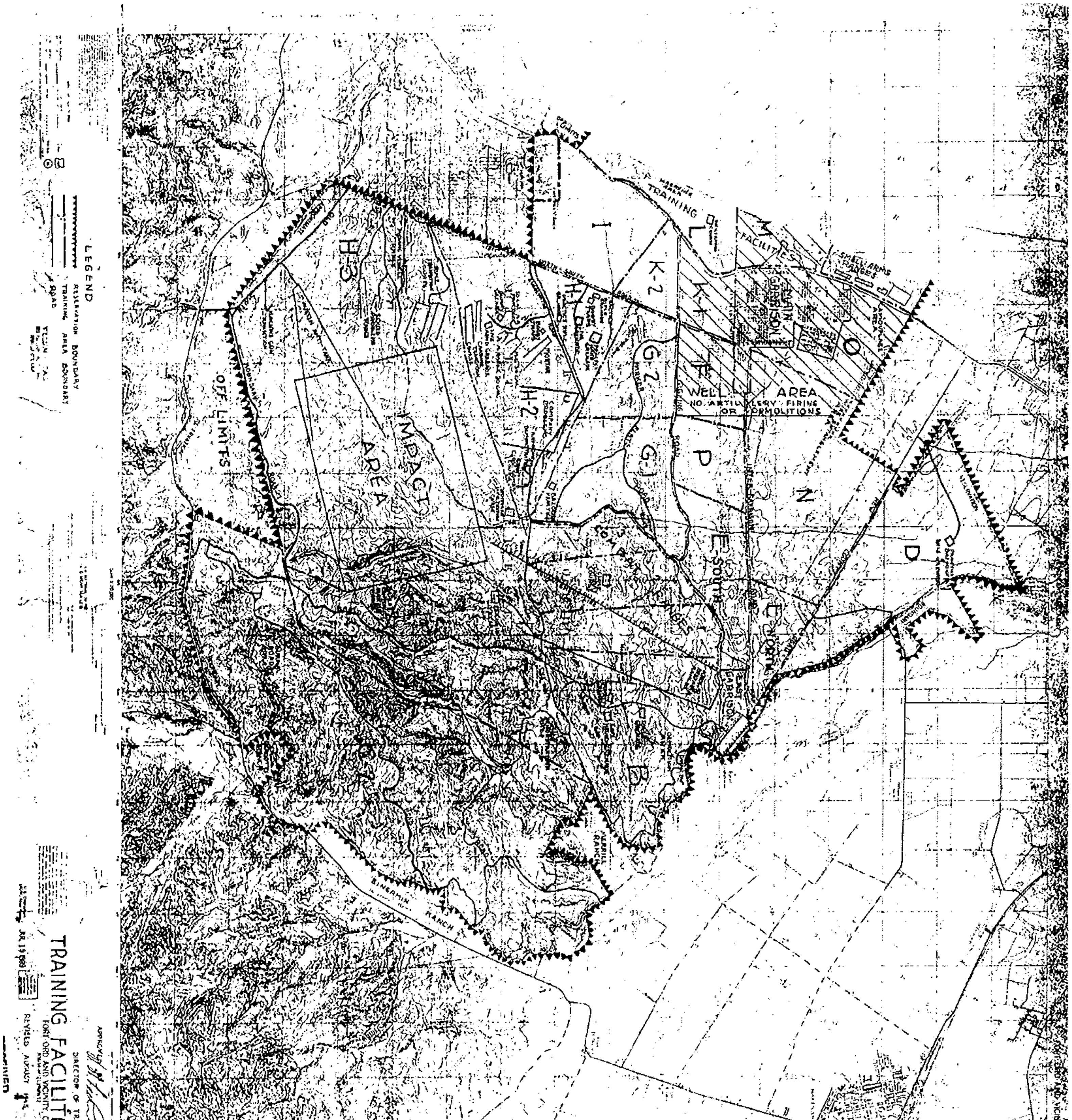
Mike Weaver

Mike Weaver
Co-Chair, Fort Ord Community Advisory Group.
P.O. Box 696
Seaside, CA 93955
Email: focagemail@yahoo.com

c.c.
USEPA
DTSC
Federal, State, and County elected representatives with oversight of this National/State/County Superfund Site and it's reuse.

Attachments:
1945 Fort Ord Training Facilities map
Letter from Dr. Gunnar Heuser regarding Fort Ord toxics, dated May 9, 2002 (23 pages)

ATTACHMENT 1



1945 MAP

ATTACHMENT 2

GUNNAR HEUSER, M.D., Ph.D., F.A.C.P., F.A.C.F.E., B.C.F.E.
NeuroMed and NeuroTox Associates
A Medical Group

Fellow, American College of Physicians
Fellow, American EEG Society

Diplomate (McGill University), Internal Medicine
Diplomate, American College of Forensic Examiners

NEUROTOXICOLOGY

IMMUNOTOXICOLOGY

May 9, 2002

RE: Review of the Army's Proposed Plan – Interim Action

To Whom It May Concern:

I was asked to function as a TA regarding health issues at Fort Ord. In preparation for my evaluation and for suggestions I reviewed more than twenty pounds of records, some of them consisting of the ones mentioned in the contract I signed on 5/4/02. Additional records were reviewed and are incorporated in my opinion.

I saw it as my first task to review reports which address the potential toxicity of materials above ground, in the ground, and in the water table below Fort Ord. Such an assessment would of course give one an idea as to whether or not Fort Ord is indeed toxic.

My second task was to assess the potential health effects of the toxicity and to comment on what if anything has been done to address these health effects.

I saw it as my third task to make suggestions as to how potential health effects can be addressed.

Is Fort Ord Toxic?

Multiple documents were reviewed and all show that potentially toxic chemicals have been and are still being found on Fort Ord grounds. It should be stressed that many of these potentially toxic compounds are known toxic metals. In addition, there is evidence that depleted uranium was used for training purposes. However, the extent of this use is not known at this time. Similarly, chemical warfare materials were found in the field on Fort Ord on the firing ranges.

Fort Ord was evaluated many times and in my opinion the toxicity present is well documented. It should be stressed that Fort Ord has been declared a Super Fund site by the EPA.

The Army suggested that the site be detoxified by burning the vegetation (mostly chaparral) and that ordnance be exploded. The Army contends that this type of cleanup would basically result in elimination of all potentially toxic compounds some of which would be evaporated into the air. The Army contends that it can direct the smoke high enough into the air to not bother local residents. The Army did not comment on the fact that smoke will pollute the air elsewhere if not locally.

The Army has looked at one single chemical compound or one single metal at a time and contends that they will not be generated in toxic amounts.

The Army did not consider the fact that a mix of toxic compounds can have unexpected health effects.

Comments on Exposure Limits

Regulatory agencies have suggested exposure limits for many potentially toxic chemicals.

It should be stressed that exposure limits apply to healthy adult males who are working an eight to twelve hour workday. Exposure limits are therefore not applicable to females, children, and nor to acutely or chronically ill individuals.

Exposure limits are suggestions only and not binding since even the regulatory agencies admit that some adult males are sensitive to exposure below the allowed limit.

None of the suggested exposure limits apply to mixes of chemicals. The problem of predicting the potentially toxic effects of mixes is addressed in a textbook which is referenced below.

It is quite accepted in the literature that mixes of chemicals can dramatically increase the toxic effects which one would have expected from just considering one chemical at a time.

Comments on Dose-Effect

A basic tenet of toxicology is the consideration of dose-effect. While there are exceptions, it is generally true that the higher the dose the more toxic a given compound can be.

It is often assumed that a chemical can have no toxic effects if it is present below the regulatory exposure limits. This is obviously not true if one considers females, children, and acutely or chronically ill adults.

If one considers the potential toxic effects of mixes, a given patient could become ill even if the individual compounds in a mix are present at levels which are less than the official exposure limit. In view of the above, a statement that the absence of toxic levels of a given chemical mix could not possibly be toxic to human beings is blatantly wrong.

In order to assess the dose-effect relationship, one also has to look at the effect. If the effect has all the hallmarks of toxicity, one must reach the conclusion that the dose was toxic.

Toxic exposure and it's effects can be shown to effect brain function, immune function, lung function, and many other body organs and systems.

I have enclosed a protocol paper of mine which suggests measurements needed to document toxic effects of chemicals.

It should be noted at this time that I am not aware of any studies done on human beings living or working near Fort Ord. While a newspaper article mentioned that students on the nearby campus reported ill effects, no documentation of these ill effects have to my knowledge been done.

I am also not aware of any epidemiological studies which would study nearby populations and possibly compare them with a non-exposed population.

In view of the above no statement can be made at this time as to what if any health effects resulted from exposure to toxic chemicals at Fort Ord.

Health Studies and Effects

After reviewing more than twenty pounds of documents, I had to conclude that no health study of any kind has been done by any representative of the Army or any other agency.

Studies of the health of the surrounding population, including the students at the college, have apparently been suggested many times, yet, none have been done. Worse, I am not aware of any planned studies of potential or real health effects in the surrounding population.

No health studies have been done right before and after a burn.

The incidence of cancer including leukemia in the nearby population has not been determined and compared with a control population, nor has the incidence of birth defects and miscarriages.

It is strange that no studies were done nor are they planned, apparently because the Army thinks that the toxic compounds are individually present in amounts too small to have any health effects.

Suggested Health Studies

Blood can be sampled and solvent panels can be done. These would tell us whether or not the students and nearby populations have unusual amounts of solvents in their blood.

A representative sample of the student population could be compared with a matched sample from the University of Santa Cruz students who live on campus. These could be matched by sex, age, and other criteria so that the two populations become as similar as at all possible.

The two student populations should also be examined by a knowledgeable physician and should fill in questionnaires regarding their health.

Rather simple and inexpensive tests are available to study brain function, immune function, pulmonary function, and others.

Brain function and pulmonary function can be measured on site with portable instrumentation. Blood samples can be taken on site and then sent to appropriate laboratories.

When the Army plans to burn and explode potentially toxic compounds at Fort Ord, a sample of the surrounding population could be examined in the above fashion before and after the burn and explosion.

An epidemiologist would ideally work with the physician in charge of the above evaluations.

An epidemiologist would definitely be needed to sample enough of the population so as to be able to conclude whether or not there are clusters of cancer, leukemia, and other

diseases in the nearby population. Populations would have to be compared with a controlled population elsewhere.

The evaluation outlined above could also benefit from studies already done in the Boston area at another toxic site.

Conclusions

Fort Ord is a toxic site which deserves to be a Super Fund site.

No health studies have been done at all. No individual evaluation of health effects have been documented nor any epidemiological study.

Epidemiological and health evaluations are mandatory. I will be glad to provide a detailed protocol.

Gunnar Heuser, M.D.

GH:cr

P.S. Statements and suggestions made in this report will be addressed in more detail and also be documented upon request.

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DEFINING CHEMICAL INJURY: A DIAGNOSTIC PROTOCOL AND PROFILE OF CHEMICALLY INJURED CIVILIANS, INDUSTRIAL WORKERS AND GULF WAR VETERANS

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INTRODUCTION

Chemical injury can cause severe, often disabling multi-system complaints which may persist for months and at times years after chemical exposure has ceased. Physicians who see chemically injured patients are frequently baffled when they face a patient with multiple complaints which do not fit into a known diagnostic disease category. Furthermore, regular laboratory tests (e.g. CBC, liver function tests, sedimentation rate, urinalysis) are often normal as is a cursory physical examination.

The diagnostic exploration of a chemically injured patient is a new field which is difficult for the inexperienced physician. Chemically injured patients often complain of impaired cognitive and memory functions, intermittent confusion and disorientation, changes in behavior and mood, word-finding problems, sleep disorders, decreased libido and potency. At times they complain of seizure-like events. They also often report recurrent flu-like symptoms, fatigue and exhaustion, malaise, headaches, and chronic pain. Skin rashes, gastrointestinal complaints, and other health effects may also be present. Different patients may react differently to a given chemical or group of chemicals.

Toxic effects cannot be objectively evaluated unless every involved system is studied with advanced and sophisticated methodology. Without benefit of that process, a chemically injured patient will be dismissed with a diagnosis of post- traumatic stress disorder, somatization disorder or other labels implying that "it's all in their heads" [Davidoff, et al., 2000]. The largest patient population to have received such a diagnosis is that of the Persian Gulf War Veterans. As of the writing of this article, nine years after the armed conflict, several hundred thousand veterans still suffer from a host of symptoms called "Persian Gulf War Illness" which may in large part be due to chemical injury [Jamal, 1998; Everson et al., 1999].

The authors understand that war time in Iraq exposed people not only to chemicals but also to uranium 238, aka depleted uranium, electromagnetic radiation, experimental vaccines, pyridostigmine bromide, biological warfare agents, and diseases and parasites indigenous to the Middle East e.g. leishmaniasis and brucellosis. Any of these toxins and infectious agents, individually or in combination, may carry with it a host of health effects. The purpose of this paper is not to dismiss those impacts but rather to offer currently available diagnostic techniques which, if applied correctly, will help both patient and physician assess how a toxic environment alone may contribute to illness otherwise dismissed as psychosomatic.

In this paper we will guide the reader through a diagnostic protocol which the senior author has developed and used on thousands of his chemically injured patients. We propose tests and consultations (from experts in their respective fields) which from our experience and research are most helpful in documenting and at times the effects of toxic chemical exposure. In discussing our approach, we will take one organ system at a time, discuss and select

diagnostic tools and tests appropriate to the evaluation of a given system.

Single abnormalities in a single system can have many causes. Abnormalities in multiple systems can also have many etiologies. However, a careful differential diagnosis (using this suggested protocol) will arrive at a tenable diagnostic impression of chemical injury if multiple objective abnormalities are found and cannot be explained on any other basis. Thus, a diagnosis of chemical injury is arrived at in part by exclusion of other diseases which may have predated the toxic exposure in question.

In the experience of the authors there is no doubt that chemical exposure (solvents, pesticides, chemical weapons, others) occurred during the Gulf War. In this sense, Gulf War Veterans deserve the same careful evaluation which is indicated in patients who have been exposed to chemicals at home, at work, or elsewhere (e.g. commuting) here in the USA.

The protocol begins with an exhaustive case history, to be followed by a careful physical examination, laboratory tests, and specialty consultations. Patient and doctor should seek out consultants who display interest rather than indifference. Generally an enthusiastic, curious and interested consultant specialist will be a better member of the evaluation team and bring his or her methodology to bear when tackling the problem of diagnosing chemical injury.

The evaluation process ends with case definition and a better understanding of the patient's problems and needs. Most importantly, this process will lay the foundation for rational and compassionate treatment.

This paper does not address the experienced clinical toxicologist. Rather, it is meant to help the personal physician to follow a road map of investigation when facing a patient who presents with a history of chemical injury.

This paper is also meant to help the educated lay-person who has been chemically injured and is being told that nothing is wrong since nothing abnormal can be found (on minimal testing only!).

In our experience, both the general physician and the educated patient need a guide to follow when trying to understand and evaluate a toxic situation. This paper is meant to function as such a guide.

The need for a road map is especially urgent since society is pressured by some of its segments to attach a psychiatric diagnosis to some patients and to then hospitalize them with that diagnosis.

HISTORY

The history as well as the physical examination are meant to guide the clinician into the process of a differential diagnosis in which certain conditions are tentatively accepted or rejected. Appropriate testing will then follow and rule in or out conditions and diseases in a given patient.

An individual and family history must be carefully obtained from the patient. Past and present conditions and diseases (incl. those of childhood and connected with occupation), as well as past and current occupational, incidental or accidental chemical exposures should be listed. Short-term memory loss is present in many patients and therefore at times makes them poor historians. Thus it is desirable to engage support from family members and significant others to participate in the history which may then be more correct and complete.

Patients should be encouraged to list what appear to be "allergic" or "sensitive" reactions to chemical substances which were previously not experienced as harmful. These include chemicals such as gasoline, fumes and perfumes, household cleaners and other chemicals in everyday use. Reactions to these chemicals may include skin rashes, hives, eye and throat irritations, sinus problems, nausea, dizziness, and flu-like symptoms. These may have developed during the initial chemical exposure but may also recur when a patient has become chemically sensitive and now reacts to

even low amounts of a given chemical or chemical mixture. This reaction to low level exposure is called Multiple Chemical Sensitivity (MCS) [Cullen, 1987]. If not carefully evaluated, MCS patients will easily be misdiagnosed as suffering from somatization disorder, post-traumatic stress disorder or other psychiatric labels.

Patients with a history of chemical injury may develop chronic fatigue [Behan, 1996; Bell et al, 1998; Buskila, 1999; Dunstan et al, 1995; Heuser, 1993; Tirelli, 1998] (incl. Chronic Fatigue Immune Dysfunction Syndrome (CFIDS), chronic pain (incl. headaches and fibromyalgia), intermittent dizziness and faintness (especially after prolonged standing), and other significant and at times disabling symptoms. A complete history should list all of the above and all additional problems the patient has.

Patients should also be asked to obtain all existing civilian and/or Department of Defense and Veteran Affairs medical records for review.

In the case of Persian Gulf or other veterans, special consideration should be given to wartime duties and experiences including known or suspected chemical exposures, number of sick bay calls in theater and out, number of times the veteran was ordered to don chemical protective gear, and number of unexplained sightings of dead animals or deceased humans.

PHYSICAL EXAMINATION

A chemically injured patient deserves a very careful physical and especially neurological examination.

The skin should be examined for rashes and scratch marks. Flushing (suggesting a mast cell disorder) should be noted if present during the physical examination. Submandibular lymph node swelling and parotid gland swelling should be noted.

Blood pressure should be examined for orthostatic hypotension, if possible after quiet standing for twenty to thirty minutes (while being attended by a competent observer).

A detailed comprehensive neurological exam should document balance and sway (often impaired), the rapidity and smoothness of rapidly alternating movements (often impaired), and coordination (also often impaired).

If abnormalities are suspected or actually found, the patient should be referred to a specialist for more objective tests.

CENTRAL NERVOUS SYSTEM

Neurotoxic chemicals can reach the brain via the blood following inhalation, ingestion, or through skin absorption. A different route of entry is via the nasal passages into the roof of the nose and then through the nerves in the cribriform plate into the olfactory bulb and beyond (e.g. limbic system, neuroendocrine system and others).

Every patient who complains of impaired cognitive, memory, and other central nervous system functions deserves a detailed neurological evaluation. So does the patient who complains of impaired balance, coordination, speech, and sensory and/or motor nerve function. Finally, a neurological evaluation is also indicated in patients who suffer from tremor, chronic headaches, chronic pain, and intermittent impairment of consciousness. It should be noted that some patients are unaware of their deficits. Therefore, every chemically injured patient deserves a comprehensive neurological and neuropsychological evaluation.

No single test, not even a neuropsychological evaluation, can tell the whole story. This is why one has to rely on history obtained from the patient and witnesses, record review, observation during office visits, a neurological examination, and evaluation of brain function with tests which are added to the neuropsychological evaluation. The choice of these additional tests (e.g. Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), evoked response studies) depends not only on the clinical indications but also on the availability of advanced technology and interested and knowledgeable expert physicians [Heuser, 1992].

Neurological and neuropsychological functions may fluctuate, making challenge tests desirable whenever possible. Trying to solve mathematical or other problems can constitute such a challenge.

Structural effect on the brain is assessed by Magnetic Resonance Imaging (MRI). In some cases (e.g. in suspected multiple sclerosis and brain and pituitary tumors) a more sensitive evaluation uses the MRI after injection of a contrast medium (e.g. gadolinium) which "lights up" the affected part of the brain.

Lesions resembling those seen in multiple sclerosis and vascular (ischemic) disease are often seen in patients after chemical injury.

MRI scanning of the brain should be done in every patient with neurological problems. MRI is preferable to Computed Tomography (CT) since an MRI sees soft tissue (e.g. brain) better than CT and also avoids exposure to radiation.

In our experience SPECT and/or PET are often abnormal while MRI is more often within normal limits. Certainly, functional impairment far exceeds structural impairment in chemically injured patients.

It is commonly assumed that brain function is symmetrically affected by chemical exposure. In our experience, this is not true. More often then not, abnormalities are asymmetrical in distribution [Heuser and Mena, 1998].

Function of the brain can be assessed by a variety of tests. The choice of these tests is often dictated by their availability in a given community and by VA , DOD or civilian insurance coverage.

A brief discussion of available functional tests follows:

A neuropsychological evaluation [Hartman, 1995] is mandatory in each patient after neurotoxic exposure. A competent neuropsychologist will also be able to test for malingering and for a psychiatric disorder. In addition he or she will be able to predict which areas of the brain are most likely effected. This prediction can then be correlated with other function tests.

The EEG sees only activity of the cortical layers of the brain. Therefore, it is unable to detect abnormalities deep inside the brain. Recording time should be at least thirty minutes and may well have to extend to an hour or longer. Routinely, recording is done while the patient is alert, during spontaneous sleep, and before, during and after hyperventilation and photic stimulation. All these conditions and measurers can bring out abnormalities which may not be seen during a resting EEG. While the tracing is subjectively "eyeballed" by the examiner, it is obtained over a considerable time interval and may therefore detect abnormalities which are not seen during other tests. A well executed EEG will give valuable information about left-right hemisphere differences, normal vs. abnormal frequencies, and episodic discharges (e.g. seizure activity). EEG abnormalities may be asymmetrical after chemical exposure which can cause slowing, dysrhythmia, and also occasionally seizure activity. Long-term effects were first described by Duffy et al. in 1979. If seizure activity is suspected, an EEG together with PET scanning is the optimal approach. The senior author has found hypermetabolism, raising the suggestion of seizure activity, in the deep subcortical (e.g. amygdala) areas of the brain after chemical exposure [Heuser, 1999; Heuser and Wu, 1999, 2000].

EEG, PET and also prolactin levels should be done as close (in time) as possible to an actual or suspected seizure. Prolactin levels have been described as being elevated shortly after a seizure [Bauer, 1996].

EEG studies during sleep are necessary if a sleep disorder (esp. sleep apnea) is suspected. This can occur after chemical exposure [Ulfberg et al.,1997] and can cause elevation of blood pressure, chronic fatigue, headaches, and other symptoms.

A quantitative EEG (qEEG) analyses a short epoch of a given EEG tracing by computer. Very few investigators are properly trained in analyzing

a qEEG. Also, no published data are available after toxic exposure.

Evoked response studies measure the speed of electrical conduction of a given stimulus (e.g. a light flash or sound click or electrical stimulus) to the appropriate brain region. The resultant electrical activity in the target area of the brain builds itself into a wave form which has positive and negative peaks. These normally occur after a given number of milliseconds. Abnormalities can be seen after neurotoxic exposure when symmetrical or asymmetrical delay of peaks and change in wave forms can occur.

A different evoked response evaluation is the P300 study in which regularly occurring clicks are interrupted by a random click. The positive deviation of the curve - which normally occurs 300 milliseconds after the auditory click - then becomes a measure of central nervous system function. This is a well-studied response which is known to correlate with cognitive function. Dysfunction can be found after neurotoxic exposure [Morrow et al., 1992].

SPECT consists of inhalation and/or subsequent intravenous administration of a radioactive compound. As the compound circulates through the brain, the computer constructs a color image in which colors have been calibrated to represent varying blood flows (perfusion) through the region of interest. A typical finding after neurotoxic exposure may be hypoperfusion in the frontal, temporal and parietal areas of the brain, usually in an asymmetrical distribution [Heuser and Mena, 1998]. This finding in chemically injured patients is indicative of impaired blood flow and oxygen delivery to a given part of the brain. Hypoperfusion of the temporal lobes can be correlated with impairment of short-term memory which is known to be laid down in the temporal lobes. Of particular interest to Persian Gulf Veterans is the work of Dr. John Vento who found a high percentage of SPECT abnormalities amongst his memory and cognitively impaired Gulf War veteran population [Vento et al. 1997]

PET yields an additional measure of brain function. It provides color scale imaging of an intravenously injected radioactive compound (commonly a glucose derivative). As the brain requires glucose for its activity, its accumulation in various parts of the brain is a measure of brain function. Decreased activity is often seen in the cortical areas while increased activity may be seen in the deep sub-cortical areas in chemically injured patients [Heuser, 1999; Heuser and Wu, 1999, 2000].

Magnetic Resonance Spectroscopy (MRS) is a procedure developed to display the presence of neurotransmitters in the brain [Ross et al., 1992]. This is an evolving specialty which has a lot of promise. Recently, yet unpublished definite abnormalities were described in Gulf War Veterans. [Haley et al., 2000]

Functional MRI (fMRI) is a research tool which does not require the administration of a radioactive compound. As yet, no data are available on the effects of neurotoxic exposure.

Prior to any functional testing, the patient should again be asked what drugs or other preparations he or she is on. Since they may affect the function tests, they should be discontinued if at all possible. Most investigators will be satisfied when a patient has not taken any nonessential drugs for one week. Ideally, the patient should be off all nonessential drugs for more then a month prior to any functional testing.

PERIPHERAL NERVOUS SYSTEM

Frequent complaints after neurotoxic exposure are numbness, tingling, burning and crawling sensations, weakness and pain.

The standard approach is to test peripheral nerve function by doing ElectroMyoGram (EMG) and nerve conduction studies. We have found however that Current Perception Threshold (CPT) studies constitute a more comprehensive approach. While the literature on the use of CPT after neurotoxic exposure is still sparse [Bleecker et al, 1997], CPT is well established as a test for peripheral sensory nerve function [Katims, 1998]. In our opinion, CPT is a more sensitive test of peripheral nerve function since it also examines

small (e.g. C) fibers which cannot be examined by nerve conduction velocity studies. The most recent CPT equipment employs a double blind approach and has therefore become increasingly objective.

Biopsy of the sural nerve may supply additional information.

AUTONOMIC NERVOUS SYSTEM

The autonomic nervous system controls functions such as temperature, perspiration, vascular tone (including blood pressure), heart rate, smooth muscle tone (including intestinal and bladder) and others.

The hypothalamus (i.e. neuro-endocrine system) interacts with the autonomic nervous system. Both hypothalamic and autonomic nervous system functions can be impaired by chemicals.

Till table testing [Rowe and Calkins, 1998] is becoming a recognized test for assessment of autonomic nervous system function, especially in patients with CFIDS which often develops as a result of chemical injury.

EYES

An eye examination is recommended for every patient with a history of chemical injury.

Patients frequently complain of eye irritation after toxic chemical exposure. While this may simply be due to an inflammatory response to the irritating chemical, it can also be due to dryness.

Intermittently blurred vision is another frequent complaint which can be due to a dry eye syndrome. In our patient population, Sjogren's syndrome is very rare, while dry eye syndrome secondary to chemical exposure is frequent.

After studying (unpublished data) several hundred patients we have found that tear quantity and tear quality are impaired in more then one half of chemically injured patients.

Quality tears are produced by the goblet cells. Their quantity can be assessed by the Schirmer test, their quality by examining tear break-up time [Franck and Boge, 1993; Sommer et al., 1994; Bulbulia et al., 1995].

Goblet cell mucous secretions enhance tear quality by providing viscosity and eye lubrication independent of the lacrimal tear gland which provides tears for crying. Therefore, a patient can still cry copious tears even with a dry eye syndrome. It should be understood that in our experience (Sadun and Heuser, unpublished data) dry-eye syndrome may continue for years, may be life-long, and can best be relieved with the use of artificial tears. Chemically produced dry eye syndrome should not be confused with Sjogren's syndrome which also causes dry eyes and can be ruled out with appropriate tests [Bell et al., 1999; Manoussakis and Moutsopoulos, 1999; Rice, 1999].

A routine eye examination does not include a test for dry eye syndrome which therefore often goes undiagnosed. Typically, tear quantity is measured by the Schirmer test in which a filter paper is placed between the globe of the eye and the lower lid. A yellow liquid (fluorescein sodium and benoxinate hydrochloride ophthalmic solution) is dropped into the eye and its advance on the filter paper is measured after a five-minute interval. An advance of less than 10 millimeters indicates insufficient tear production.

Color vision is also often affected after chemical exposure. This however has to be tested by using the Lanthony D-15 [Mergler et al., 1987; Mergler, 1994] rather then the usual tests for color blindness.

Visual field defects, increased electric and sunlight sensitivity, accommodation inertia and other abnormalities have been described and other should therefore always be tested for.

EARS, NOSE, AND THROAT (ENT)

Patients frequently complain of intermittent nose bleeds, sore throats, dryness, change in sense of smell, congestion, intermittent cough, impairment

of voice (hoarseness), sinus problems, and other ENT symptoms. Vertigo and dizziness are also frequent complaints.
When complaints persist, a competent ENT evaluation is mandatory. Here again, some patients are unaware of their deficits. Thus, every patient should ideally be tested after toxic exposure. This will involve:

Inspection of the nasal mucosa which is often atrophic, brittle, dry, and shows a cobblestone pattern [Meggs et al., 1996].

A nasal smear, especially for eosinophils. These cells are typical of allergy and are not typically found after chemical exposure.

Biopsy of the mucosa of the middle turbinate. This will distinguish between a chemical and an allergic change. One change occasionally seen on nasal mucosal biopsy is the presence of squamous metaplasia. This is definitely not a sign of allergy but is a sign of chemical exposure. Patients with this finding deserve close follow-up since squamous metaplasia may potentially develop into cancer.

Videolaryngoscopy. This will examine vocal cord appearance and function. Both may be impaired from chemical exposure and/or reflux but also because of impaired function of the nerves supplying the vocal cords.

Platformography and other sophisticated tests to evaluate a patient for balance problems and vertigo.

ElectroNystagmoGram (ENG) and other specialized tests for evaluation of dizziness. Vestibular dysfunction was recently described [Roland et al., 2000] in Gulf War Syndrome.

CT scanning of the sinuses if sinusitis is suspected.

IgA content of saliva. One function of the inner lining of the nose, the throat, the lungs, the gut and the bladder is to defend the body against intruders. IgA (an immune antibody) is one of these defense mechanisms. A saliva specimen is usually representative in the sense that IgA levels measured in the saliva may be assumed to be similar all the way through the mucosal system. Salivary IgA is often decreased after chemical exposure [Ewers et al., 1982]. This decrease may explain the low defense of a given individual against external intruders.

A saccharin test by which saccharin is placed inside the nose and beyond the middle turbinate. One then asks the patient when he or she first notices a sweet taste. The time elapsed between the placement of a small saccharin crystal and the sweet taste is an indicator of mucociliary function which is often impaired after chemical exposure [Andersen et al., 1974; Capellier et al., 1997; Schafer et al., 1999].

NASAL AND PULMONARY PASSAGES

Patients frequently complain of:

Shortness of breath and dyspnea on exertion which can be due to nasal congestion with a Reactive Upper Airway Dysfunction Syndrome (RUDS), Vocal Cord Dysfunction (VCD) with Reactive Laryngeal Dysfunction Syndrome (RLDS), and hyperreactive airways (incl. Reactive Airways Dysfunction Syndrome (RADS), and of course other conditions contributing to shortness of breath (e.g. anemia, heart disease, and others).

Cough (intermittent) which can also be due to RLDS, bronchitis, and asthma (including RADS) and other conditions. Here again a careful differential diagnosis is mandatory.

Pulmonary function may be impaired as a result of chemical exposure.

Hyperreactive airways with abnormalities suggestive of obstructive impairment are often found. The most sensitive indicator is the Forced Expiratory Flow (FEF) 25 -75% measurement which is part of a complete pulmonary function test. This measurement is often decreased after chemical irritant exposure and has the additional advantage of being generally independent of the

effort the patient makes. This indicator is of course only one measure of a necessary comprehensive pulmonary function test.
A methacholine test will often help to diagnose hyperreactive airways.

Restrictive airways from impairment of the elasticity of the lungs leading to reduced ability to take a deep breath are also often found after chemical irritant exposure. Asbestosis is a disease which typically causes restrictive and also obstructive airways disease.

A chest x-ray will be part of the process of the *differential diagnosis*.

A CT scan of the lungs is indicated whenever restrictive disease is suspected.

In the 1980s a number of patients were described who had suffered from very short exposure to inhaled irritating chemicals and then developed an asthma-like condition for years thereafter. This has been termed RADS [Brooks et al., 1985, Brooks, 1995). In some cases, RADS has been found to continue for more than ten years after short term exposure [Piirila et al., 1996].

When the upper nasal airways have become reactive from a previous chemical exposure, the term RUDS has been introduced [Meggs, 1994; Meggs et al., 1996].

When shortness of breath is caused by problems within the vocal cord area (vocal cord dysfunction), the term RLDS (Reactive Laryngeal Dysfunction Syndrome) applies. This term was introduced by the senior author [Heuser et al., 1998] to describe patients who have voice problems after an initial chemical irritant exposure and then continue, sometimes for years, to have voice problems whenever exposed to even small amounts of irritating chemicals. In addition, these patients may develop shortness of breath.

One of the functions of the lungs is exchange of oxygen. The resultant level of oxygen saturation in the blood can be measured by oximetry. This may be low when lung function is impaired (and also for other reasons). Therefore, oximetry is routine in our office in all patients who have a history of toxic inhalation exposure.

GASTROINTESTINAL SYSTEM

Patients often have acid indigestion incl. GastroEsophageal Reflux Disease (GERD), irritable bowels incl. Irritable Bowel Syndrome (IBS), and food allergies . These conditions are frequently diagnosed but are not specific for chemical exposure.

Additional complaints include abdominal cramping, intermittent constipation and/or diarrhea, and also intermittent nausea and vomiting. Unfortunately, a given toxic chemical leaves no diagnostic signature in the gastrointestinal system. Therefore all the above complaints are usually considered as nonspecific. Nevertheless, the term Reactive Intestinal Dysfunction Syndrome (RIDS) has recently been introduced [Lieberman and Craven, 1998].

Malabsorption with weight loss may occur in some patients after chemical exposure. In this context, patients should be evaluated for non-tropical sprue [Murray, 1999].

Liver function tests should always be done on every patient who gives a history of past or ongoing chemical exposure. Here again, toxic chemicals do not usually leave a signature which is diagnostic of chemical exposure.

Low salivary IgA levels may be representative of an impaired mucosal intestinal defense mechanism after chemical exposure.

KIDNEYS AND URINARY SYSTEM

After chemical exposure patients often complain of urinary frequency and urinary discoloration. The former is not usually due to diabetes insipidus nor urinary infection and therefore remains unexplained at this time in these patients.

Chemicals can cause hematuria, often microscopic [Gun et al., 1998]. Kidney function can be affected after chemical exposure [Lauwerys and Bernard, 1987; Mutti et al. 1992;

Fowler, 1993; Hook and Goldstein, 1993) which in the extreme can cause kidney failure.

Creatinine clearance and twenty-four hour urine collections for protein (incl. globulin fractions) may become necessary to follow patients with significant impair...

SKIN

Recurrent rashes (with or without itching), hives, welts, "blood blisters" and other skin changes (incl. visible flushing) are frequent complaints after chemical exposure and can continue for a long time after exposure has ceased.

Here again, inspection reveals no signature which would be specific for toxic exposure.

Many of our patients carry a diagnosis of rosacea. This is usually considered to be of unknown origin. If chemically induced or aggravated rosacea indeed exists it has no distinguishing characteristics from a diagnostic point of view.

Also of note is in our observation that chemical exposure of the skin appears to at times accelerate sun induced ageing of the exposed skin.

In addition to inspection our consulting dermatologists will also obtain a skin biopsy in unaffected areas. This frequently shows perivascular dermatitis and the presence of mast cells. The latter may be indicative of a mast cell disorder which can develop after chemical exposure and then explain allergies, sensitivities to chemicals, sun light and ultraviolet light, and other reactions (incl. flushing) which may all be found in our patient group [Heuser and Kent, 1996; Heuser, 2000].

Contact and other dermatitis should be evaluated with appropriate tests [Marks and DeLeo, 1997; O'Malley, 1997]. Dermal uptake of solvents was studied by Brooke et al. (1998) and others.

Very sophisticated dermatopathological changes after exposure were described by Prof. Johansson's group [Gangi and Johansson, 1997; Liang et al, 1998; Rossi and Johansson, 1998].

IMMUNE FUNCTION

Sensitivity to allergens (incl. foods) and/or chemicals (incl. drugs) is a frequent complaint in our patient population. This can be further analyzed with appropriate tests. However, changes in immune function are often not clearly related to specific symptoms and signs and yet may be so profound that they should always be tested for.

When patients develop allergies after chemical exposure these should be evaluated by an allergist with skin testing and other appropriate tests.

We routinely order total IgE and check for eosinophils. If elevated in blood (IgE, eosinophils) and nasal smears and/or biopsy specimens (eosinophils), a diagnosis of allergy is justified.

The immune system consists of many cells which can be counted in a blood sample. Function of these cells (e.g. mitogenesis, natural killer cell function) can be tested only in specialized laboratories.

A rapid increase in TA1 (CD3+,CD26+) and T3 positive (CD3) cells can be a very sensitive indicator of chemical exposure. While increased TA1 cells can be seen in auto-immune disease (e.g. multiple sclerosis), they more frequently show a temporary increase after exposure, particularly if the patient is sensitive to chemicals [Heuser et al., 1992].

It should be stated at this time that different organ systems can have a different sensitivity to chemical exposure. For instance, the immune system may react much more than the brain and other organs (or vice versa).

Among immune function tests the test for natural killer cell function is particularly important. This function is measured by bringing live natural killer cells in contact with live human leukemia cells.

Normally aggressive natural killer cells will attach to these leukemia cells and dissolve them. The result is expressed in lytic units and often shows impairment of this function after chemical exposure. Long-term impairment increases cancer risk. This is why we routinely test for killer cell function. If impairment is found, it may be corrected with vitamin C [Heuser and Vojdani, 1997].

The immune system also releases certain cytokines and other factors which may become indicators of chemical exposure. In our experience and that of others [Blackwell, 1999; Luster et al., 1999; Scheumann and Tiegs, 1999] this is true of Tumor Necrosis Factor (TNF-alpha) which is elevated in many of our patients after toxic exposure.

When chemicals attach themselves to some of the body's proteins, the immune response may become confused and become an autoimmune response. This is frequently found after immunotoxic exposure [Bigazzi, 1997; Rich, 1996]. A positive ANA titer, positive rheumatoid factor, and positive tissue (e.g. thyroid, myelin, smooth muscle, parietal cells, and others) antibodies are examples of that response [Gard and Heuser, 1990; Heuser et al., 1992]. It is important to realize that auto- antibodies may appear after chemical exposure but may go away once the exposure has ceased (Heuser, unpublished data).

Interestingly, full-blown autoimmune disease (e.g. Systemic Lupus Erythematosus and Multiple Sclerosis) is rarely found in our patients after chemical exposure which however seems to push patients in the direction of such diseases.

After chemical exposure, gamma globulins may be low. This is why we often obtain IgG subclasses. If abnormal, the patient may benefit from i.v. gamma globulin infusions.

Typically the sedimentation rate (ESR) is normal or even low normal after chemical exposure unless infections or autoimmune disease are the result.

Antibodies to certain chemicals can also be looked for and may, if positive, constitute a lead as to what exposure has caused the immune system to react [Thrasher et al., 1987].

In our opinion, immune system testing and testing for auto-immunity should be routine in all patents after toxic exposure.

ENDOCRINE SYSTEM

Chemical exposure can cause significant, at times disabling, chronic fatigue. While these patients usually end up with a diagnosis of CFIDS, one should nevertheless consider other causes of chronic fatigue. In this context, hypothyroidism has to be ruled out with appropriate tests (e.g. TSH, thyroid antibodies) which may have to be repeated.

While hypothyroidism seems to be a relatively frequent occurrence after chemical exposure, adrenal insufficiency is rare. However, we have seen cases of chemical sensitivity which could in retrospect be explained on the basis of a well documented adrenal insufficiency. When this was adequately treated, the chemical sensitivity disappeared. An early morning cortisol level is a good screening test, so is a twenty-four hour urine collection for this compound. More detailed testing and consultations by endocrinologists will be necessary, particularly if the patient complains not only of severe fatigue and exhaustion and weakness but also allergies, nausea and headaches.

Women often complain of loss of sex drive and of irregular menstrual bleeding. The latter can sometimes be explained by the estrogen-like effects of many chemicals (solvents, pesticides) [Colborn et al., 1997; Barnard and Heuser, 1998].

DeHydro-Epi-Androsterone (DHEA) levels are frequently low in patients who suffer from chronic fatigue. This often responds to appropriate replacement therapy.

Men frequently complain of loss of libido and potency.

The most striking finding in our male population is a high percentage of abnormal shapes on examination of sperm in the ejaculate. Abnormal morphology is a more frequent finding then a low sperm count [Heuser and Marik, 1998]. A number of authors have addressed changes in sperm in this context [Auger et al., 1995; Bujan, 1998; Indulski and Sitarek, 1997; Tielemans et al., 1999, Var. authors, 1995].

Prolactin levels may be increased shortly after a seizure [Bauer, 1996]. They may also be chronically increased in some patients with pituitary tumors and hypothyroidism.

Most endocrine glands are governed by the pituitary master gland. This in turn depends on the hypothalamus for its function. The hypothalamus has connections to all other parts of the brain and therefore is subject to impaired function after neurotoxic exposure.

Nasal pathways transport a neurotoxic stimulus and/or chemical into the olfactory bulb and then on to the limbic system and hypothalamus resulting in neuroendocrine problems after neurotoxic exposure.

REGULAR LABORATORY STUDIES

An astute clinician will carefully select tests needed to go through a differential diagnosis of a patient's complaints. Of particular importance are conditions and diseases which can cause multi-system complaints similar to those of toxically exposed patients.

Some infections occur independent of toxic exposure (e.g. Lyme disease, HIV and others). Others (e.g. viral, fungal) have been postulated to be the result of chemical exposure as have mycoplasma infections [Baseman and Tully, 1997; Vojdani et al, 1998].

Anemia, diabetes mellitus, hepatitis, and other conditions can cause chronic fatigue.

Vitamin B12 deficiency can cause neurological problems.

While porphyria is very rare in our patient population, abnormalities of porphyrin metabolism [Downey, 1999] are relatively frequent but usually not severe enough to explain symptoms. A study of porphyrin metabolism is in our opinion more meaningful if it is done more then once and is timed in relation to exposure.

The above are just a few of the conditions and diseases which have to be considered and ruled out in order to arrive at a correct diagnosis. A comprehensive laboratory evaluation is a necessary part of the differential diagnosis and therefore mandatory in our patient population.

Laboratory technicians should be advised of possible allergic responses to alcohol, band-aid tape, metallic and/or rubbers materials employed in blood drawing and other techniques.

TOXICOLOGICAL CONSIDERATIONS

Route of entry. Chemicals can be absorbed by inhalation, swallowing, and via the skin. It should be stressed that chemicals can irritate and/or enter the brain via the intranasal route to the olfactory bulb and on to other structures including the limbic system and the hypothalamus.

Dose-response. Most pure toxicologists stress the dose while we, as clinicians, stress the response part of the dose-response curve. Regulatory agencies (e.g. OSHA) suggest certain limits of exposure. These limits apply to healthy adult males who work an average eight-hour day for five days a week. They do not apply to females, children, the elderly, and any already impaired individuals. Nor do they apply to individuals who spend most of their days and all night at home where they might be exposed.

In view of the above, a low dose (even below government suggested limits) exposure can cause significant health affects in some people.

When there is ongoing toxic chemical exposure, blood, urine or fat tissue measurements of suspected chemicals or their metabolites are in order. Once time has passed, these measurements may lose their significance.

Certainly, long term disabling conditions can develop and continue after the triggering chemical has long disappeared from body fluids and tissues.

Chemical sensitivity (incl. MCS) and intolerance are defined as a recurrent temporary impairment of function after exposure to a low concentration of chemicals (so low that it does not effect the normal population).

Sensitization and kindling. Some chemicals are known sensitizers and thus become damaging in even very small doses. Neurophysiological research has shown that pain pathways can be sensitized [Willis and Westlund, 1997]. As a result, a patient can perceive pain even when the stimulus is very small.

Kindling [Bell et al. 1997] refers to the fact that repeated stimulation with subthreshold electrical current can eventually bring about a seizure disorder in animal models. Certain chemicals can result in similar effects when repeatedly administered into the extended amygdala region of experimental animals in subthreshold doses [Albertson et al., 1985; Gilbert, 1995]. Our PET findings may support a kindling mechanism [Heuser and Wu, 1999, 2000] and also explain the emotional changes found in patients after chemical injury [Aggleton, 1992]. Considering these findings, one should be much more carefull to diagnose functional disorders [Barsky and Borus, 1999] in chemically injured patients. Furthermore, cytokines are released after chemical exposure and may in turn cause behavior changes [Anisman and Merali, 1999].

The above are but a few examples of the fact that low dose exposure can cause significant health effects in some patients. These patients deserve the full protocol even if the dose has remained ill defined or was considered to be too low to have caused health effects.

Chemical injury versus chemical sensitivity. In our experience almost all patients who claim MCS have objective evidence of chemical injury in one or more organ systems. This is why our protocol will usually detect objective abnormalities in these patients.

Chemical injury is defined as a long lasting impairment of a given function during and/or after toxic exposure.
While MCS needs to be documented by using challenge tests, evidence of chemical injury is almost always present in these patients and can therefore be documented at any time by using the protocol developed by the senior author.

Chemical mixtures. In real life situations most patients are exposed to mixtures of chemicals rather that a single chemical. In this case guidelines given by OSHA, NIOSH and other agencies may not apply since interaction between chemicals in the chemical mixture may have unexpected or exaggerated effects [Feldman et al.; 1999, Pollak, 1993; Yang 1994].

CONCLUSIONS

Patients who have suffered a chemical insult may develop long-lasting, at times disabling conditions. If the examination is limited and cursory, a chemically injured patient will be mislabeled as suffering from a somatization disorder, conversion reaction, psychosomatic or psychiatric illness. This then is a tragic mistake and misdiagnosis.

Frequently, patients with a history of toxic exposure and continuing symptoms develop multi-system impairment. It is the resulting constellation of symptoms and impairment which in the opinion of the senior author is typical of toxic exposure (incl. Persian Gulf War Illness).

A diagnosis of toxic chemical injury can be made if:

- Impairment developed during or after toxic exposure(s).
- A typical constellation of multi-system impairment is established with objective tests. Rarely (e.g. in RADS) only one system is effected.
- Other diseases and conditions which are known to cause multi-system impairment have been ruled out.

The protocol presented in this paper, using a comprehensive evaluation, will prove or disprove, with objective and recognized tests, the presence of physical injury after toxic chemical exposure.

SUMMARY

In this paper a comprehensive protocol for the clinical evaluation of a chemically injured patient is described.

It is noted that an in depth evaluation often shows objective evidence of physical injury while a limited cursory examination may not.

It is stressed that exposure to toxic chemicals can cause severe functional impairment in many organ systems while the organ structure may remain intact. This impairment may continue for months or years after exposure has ceased.

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ABBREVIATIONS

ALS	Amyotrophic Lateral Sclerosis
ANA	Anti-Nuclear Antibody
CBC	Complete Blood Count
CFIDS	Chronic Fatigue Immune Dysfunction Syndrome
CPT	Current Perception Threshold
CT	Computed Tomography
DHEA	DeHydro-Epi-Androsterone
EEG	ElectroEncephaloGram
EKG	ElectroKardioGram
EMG	ElectroMyoGram
ENG	ElectroNystagmoGram
ENT	Ears, Nose, Throat
qEEG	Quantitative ElectroEncephaloGram
FSH	Follicle Stimulating Hormone
GERD	GastroEsophageal Reflux Disease
IBS	Irritable Bowel Syndrome
IgA	Immunoglobulin A
LH	Luteinizing Hormone
MCS	Multiple Chemical Sensitivity
MRI	Magnetic Resonance Imaging
fMRI	Functional Magnetic Resonance Imaging
MRS	Magnetic Resonance Spectroscopy
MS	Multiple Sclerosis
OSHA	Occupational Safety and Health Administration
PET	Positron Emission Tomography
RADS	Reactive Airways Dysfunction Syndrome
RIDS	Reactive Intestinal Dysfunction Syndrome
RLDS	Reactive Laryngeal Dysfunction Syndrome
RUDS	Reactive Upper airway Dysfunction Syndrome
SLE	Systemic Lupus Erythematosus
SPECT	Single Photon Emission Computed Tomography
TNF	Tumor Necrosis Factor
TSH	Thyroid Stimulating Hormone
VCD	Vocal Cord Dysfunction

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ABOUT THE AUTHORS

Dr. Heuser practices clinical toxicology. He has seen thousands of patients after toxic chemical exposure and over time developed and used a diagnostic protocol which objectively documents chemical injury and impairment.

Heuser has published many peer reviewed articles, contributed book chapters, and has been internationally recognized in his field. He has been invited to present his diagnostic protocol in Australia, before the German government (Bundestag) in Bonn, at the Karolinska Institute in Stockholm (Sweden), and before the Annual Conference of the National Gulf War Resource Center.

Patricia Axelrod directs The Desert Storm Think Tank and Veterans Advocate which is an ad-hoc association of active duty, reserve and retired soldiers, scientists, and researchers working together to assess the impacts and consequences of war in general with a specific emphasis on The Persian Gulf War. Axelrod's work has assisted in American, German and United Kingdom governmental investigation and reform. Her work has received a Project Censored Award from the Sonoma State University, Sonoma, California. She is also the recipient of a 1990-91 John D. and Catherine T. MacArthur Foundation Research and Writing Grant which helped seed The Desert Storm Think Tank. Her 1993 ground breaking article. "Research Guide for Desert Storm Syndrome (International Perspectives in Public Health Vol. 10, 1994) has been entered into the records of a number of U.S. funded committees for the investigation of Persian Gulf War illness, including those conducted by Senator Donald Reigle, the National Institutes of Health, and the Presidential Advisory and Oversight Committees. In preparation for this article Axelrod traveled to and from post-war Baghdad, Iraq. In addition she has interviewed and debriefed hundreds of Persian Gulf Veterans.

Both Heuser and Axelrod are founding members of the State of California, Reserve Officer Association committee on Persian Gulf War Illness.

Sylvia Heuser is president of EMRIC (Environmental Medical Research and Information Center) which is based in Dr. Heuser's office and supports all his research and writing projects with ideas, literature search, and review of patient files.

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REPLY TO
ATTENTION OF

SC
LB

Fort Ord BRAC Field Office

Stan Cook
ESCA Remediation Program Manager
Fort Ord Reuse Authority
100 12th Street, Building 2880
Marina, CA 93933

Subject: *Draft Final Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Future East Garrison Munitions Response Area (MRA)*, dated August 11, 2010.

Dear Mr. Cook:

Thank you for an opportunity to review and comment on the subject document. The Army's comments are enclosed. Please note our comments are focused on "big picture" issues such as the consistency with documents previously produced under the Army's cleanup program. A copy of this letter will be furnished to U.S. Environmental Protection Agency (Judy Huang) and California Department of Toxic Substances Control (Roman Racca).

Sincerely,

Gail Youngblood
BRAC Environmental Coordinator

Enclosure

S

DRAFT FINAL Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Future East Garrison Munitions Response Area (MRA)

Dated August 11, 2010

Army Comments:

Volume 2 – Sampling and Analysis Plan

1. P.2-3, Section 2.2.1 Future East Garrison MRA Remedial Investigation Areas. Rationale for selecting Grids 1 and 2 for investigation. The text suggests that these grids were located to the south of an area identified by the Army as a potential practice mortar range. However, no such area was previously identified in the suggested location. A suspected stokes mortar range was identified "to the east of MRS-42" and "between Barloy Canyon Road and Crescent Bluff Road" in *Final Site Assessment East Garrison Area 4 Site Report* (Administrative Record number: OE-0556J) based on the finding of expended MKI practice Stokes trench mortars (munitions debris [MD]). Therefore, it is suggested to replace text "to the south of" with "in the vicinity of" to avoid potential confusion.

2. p.2-8, Section 2.3.2 Analog Investigation. The fourth paragraph includes a sentence "MD will be collected and an estimated weight of material per grid will be recorded by the UXO Technicians." The statement is followed by paragraphs that provide for collection of additional data on MD that may be recovered during intrusive investigation. The text is currently unclear as to what information will be recorded for recovered MD. Please clarify.

3. p.2-11, Section 2.4.2 DGM Surveys. In this section, the use of EM61-MK2 mounted on FORA ESCA Sled is proposed as the instrument of choice in the event that digital geophysical investigation is desired in a portion of the investigation areas. Previous uses of the FORA ESCA Sled in other MRAs within the ESCA required extensive site preparation, such as vegetation removal to the extent beyond what would be typically conducted to support analog investigation. Please provide a brief description of additional site preparation that may be expected to be required if the FORA ESCA Sled were to be used as part of the investigation in the Future East Garrison MRA.

4. p.2-13, Section 2.4.6 Soil Screening Operations. This section describes that, in the event that soil containing high density of small metallic debris or other sources that cause noise interference for the digital geophysical investigation is encountered, intrusive investigation would utilize soil excavation in 3-inch lifts and soil screening. Soil screening in habitat reserve areas will require preparation of a habitat restoration and monitoring plan to ensure the success criteria outlined in the Installation-wide Multispecies Habitat Management Plan (HMP) will be met. Please include this information in appropriate section(s) of the document.

5. p. 12-5, Section 12.3.5.3 Site Restoration and Monitoring for Invasive Weeds. The second numbered paragraph. The listed requirement is based on the Site 39 habitat restoration plan. Please revise the first sentence to read "In habitat reserve parcels, excavated areas will...."

6. P.12-5, Section 12.3.5.3 Site Restoration and Monitoring for Invasive Weeds. The third numbered paragraph states that excavations that result in steep-sided depressions in vicinity of potential California tiger salamander breeding sites will be filled with soil. Please note that regrading is preferred, and that no fill soil is required.

APPENDIX E

Distribution List

Print	CD	Name	Organization	Address	City and State	Zip
1	1	Stan Cook	Fort Ord Reuse Authority	100 12th Street, Bldg. 2880	Marina, CA	93933
1	1	Michael Houlemard	Fort Ord Reuse Authority	100 12th Street, Bldg. 2880	Marina, CA	93933
1	1	Judy Huang	U.S. Environmental Protection Agency	75 Hawthorne Street, Mail SFD-8-3	San Francisco, CA	94105
1	1	Tom Hall	TechLaw, Inc.	7 Shore Point Road	North Little Rock, AR	72116
1	1	Roman Racca	California Department of Toxic Substances Control	8800 California Center Drive	Sacramento, CA	95826
2	2	Gail Youngblood	Department of the Army	BRAC, Bldg. #4463 Gigling Road	Seaside, CA	93955
1	1	Lindsay Alexander	Fort Ord Administrative Record	BRAC, Bldg. #4463 Gigling Road	Seaside, CA	93955
1	1	LeVonne Stone	Fort Ord Environmental Justice Network	P.O. Box 361	Marina, CA	93933
1	1	Mike Weaver	Fort Ord Community Advisory Group	52 Corral de Tierra Road	Salinas, CA	93908
1	1	Richard Bailey	Fort Ord Community Advisory Group	440 Ramona Avenue, Apt 16	Monterey, CA	93940
1	1	Nancy Amadeo	Marina in Motion	P.O. Box 1641	Marina, CA	93933
1	1	Linda Millerick	Save Our Air Resources (SOAR)	751 Montery - Salinas Highway	Salinas, CA	93908
1	1	Nick Nichols	Monterey County, Resources Management Agency Office of Housing & Redevelopment	168 West Alisal Street, Third Floor	Salinas, CA	93901
1	1	Project File	LFR Inc. Attention: Jennifer Johnson	1900 Powell Street, 12th Floor	Emeryville, CA	94608
1	1	Project Library	LFR / Weston Project Office	100 12th Street, Bldg. 2903	Marina, CA	93933

Approved:

Christopher G. Spill, P.G.
ESCA Technical Project Manager
LFR Inc.