Final Work Plan
MRS-16 Munitions and Explosives of Concern Removal
Former Fort Ord, California

Total Environmental Restoration Contract
Contract No. DACW05-96-D-0011
Task Order No. 016

Submitted to:
U.S. Department of the Army
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Revision 1

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Acronyms and Abbreviations

°F	Fahrenheit
4WD	4-wheel drive
AR	Army Regulation
Army	U.S. Department of the Army
APP	Accident Prevention Plan
ASCII	American Standard Code for Information Interchange
ATF	Bureau of Alcohol, Tobacco, Firearms, and Explosives
BIP	Blow in place
BLM	Bureau of Land Management
BRAC	Base Realignment and Closure
CAD	Computer-aided design
CAP	Corrective action plan
CAR	Corrective action request
CD	Compact disc
CD-ROM	Compact disc read-only memory
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CESPK	Sacramento District USACE
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
cm	Centimeter
CMC	Central maritime chaparral
COR	Contracting Officer's Representative
CPR	Cost and Performance Report
CQCSM	Contractor Quality Control System Manager
CTS	California Tiger Salamander
CWM	Chemical warfare material
DDESB	Department of Defense Explosive Safety Board
DGM	Digital geophysical mapping
DID	Data Item Description
DoD	Department of Defense
DQO	Data quality objectives
DTSC	Department of Toxic Substances Control
EM	Engineering Manual
ENG	Engineering Form
EOD	Explosive Ordnance Disposal
EP	Engineering Pamphlet
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
ER	Engineer Regulation
ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute
ESS	Explosives Safety Submission
EZ	Exclusion zone

FAA	Federal Aviation Administration
FFA	Federal Facility Agreement
FS	Feasibility Studies
GIP	Geophysical Investigation Plan
GIS	Geographic Information System
GPO	Geophysical prove-out
GPS	Global Positioning System
HE	High explosives
HEAT	High explosive anti-tank
HLA	Harding Lawson Associates (now known as Mactec)
HMP	Habitat Management Plan
HTRW	Hazardous, Toxic, and Radioactive Waste
Hz	Hertz
IA	Interim action
IDWP	Investigation Derived Waste Plan
MCX	Mandatory Center of Expertise
MD	Munitions debris
MEC	Munitions and Explosives of Concern
MGFD	Munition with the Greatest Fragmentation Distance
mm	Millimeter
MMRP	Military Munitions Response Program
mph	Miles Per Hour
MPPEH	Material Potentially Presenting an Explosive Hazard
MR	Munitions Response
MRA	Munitions Response Area
MRS	Munitions Response Site
MSD	Minimum Separation Distance
mV	Millivolt
NAD83	1983 North American Datum
NONEL	Non-electric
nT	NanoTeslas
ODDS	Ordnance Detection and Discrimination Study
OE	Ordnance and Explosives
pdf	Portable Document Format
PC	Personal Computer
PCMCIA	Personal Computer Memory Card International Association
PCQCP	Program Contractor Quality Control Plan
PM	Project Manager
PMP	Property Management Plan
POMFD	Presidio of Monterey Fire Department
ppm	Parts per Million
PQCSM	Program Quality Control System Manager
PZ	Piezoelectric

QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
RCWM	Recovered Chemical Warfare Materiel
RI	Remedial Investigation
ROD	Record of Decision
RTK	Real Time Kinematic
RTS	Robotic Total Station
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SQL	Structured Query Language
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SSWP	Site Specific Work Plan
SUXOS	Senior Unexploded Ordnance Supervisor
TBD	To be decided
TCRA	Time Critical Removal Action
TD	Time Domain
TERC	Total Environmental Restoration Contract
TMP	Technical Management Plan
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering Support Center, Huntsville
USFWS	United States Fish and Wildlife Service
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
X-Ray	Radiographic Unit
WP	White Phosphorus
WWII	World War II

Definitions[1]

Discarded Military Munitions (DMM) - 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 unexploded ordnance, 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)).

Military Munitions - Military munitions means 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 Department of Defense, 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 thereof.

The term does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, except that the term does include 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)**Munitions Constituents (MC)** – Any materials originating from unexploded ordnance (UXO), discarded military munitions (DMM), or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 U.S.C. 2710 (e)(3))

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

Munitions and Explosives of Concern (MEC)[2]– This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means: (A) Unexploded Ordnance (UXO), as defined in 10 U.S.C. 101 (e) (5); (B) Discarded military munitions (DMM), as defined in 10 U.S.C. 2710 (e) (2); or

1 Official definitions provided in the April 21, 2005 memorandum from the Office of the Assistant Secretary of the Army (Installations and Environment), "Munitions Response Terminology"

2 For the purposes of the basewide Military Munitions Response Program (MMRP) being conducted for the former Fort Ord, DMM [MEC, UXO] does not include small arms ammunition .50 caliber and below.

(C) Munitions constituents (e.g., TNT, RDX) as defined in U.S.C. 2710 (e)(3), present in high enough concentrations to pose an explosive hazard

Munitions Response – Response actions, including investigation, removal and remedial actions to address the explosives safety, human health, or environmental risks presented by unexploded ordnance (UXO), discarded military munitions (DMM), or by munitions constituents (MC) or to support a determination that no removal or remedial action is required

Material Potentially Presenting an Explosive Hazard (MPPEH) - Material potentially containing 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 with 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.

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 a MRA that is known to require a munitions response

Range-related Debris – Debris, other than munitions debris, collected from operational ranges or from former ranges (e.g. target debris, military munitions packaging and crating material).

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, installations, 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)

1.0 Introduction

1.1 Purpose

The overall scope of work for this task involves activities at the Munitions Response Site (MRS) 16 area at the former Fort Ord. A munitions response (MR) will be conducted to remove Munitions and Explosives of Concern (MEC) in this area.

Shaw Environmental, Inc. (Shaw) prepared this Site Specific Work Plan (SSWP) for the U.S. Department of the Army (Army) under the Total Environmental Restoration Contract II (TERC) No. DACW05-96-D-0011. The work will be conducted in accordance with the SSWP and established TERC technical and administrative procedures.

Procedures for removal of MEC are presented in this SSWP in Section 2.0. The Army has determined that an Explosives Safety Submission (ESS) is not required for this work because the Land Disposal Site Plan addresses this site.

The MEC removal will be conducted in accordance with this work plan following approval by the Army and regulatory agencies.

1.2 Site Location

Fort Ord is a former military installation that comprises approximately 46 square miles in northwestern Monterey County, California, and is located approximately 120 miles south of San Francisco. Monterey Bay forms the western boundary of the former Fort Ord, and the Santa Lucia Range bounds the former Fort Ord to the south. The cities of Marina and Seaside, and the Salinas Valley are northwest, southwest, and east of the former Fort Ord, respectively.

Munitions Response Site-16 is located immediately north of the former Fort Ord Impact Area between Eucalyptus and Parker Flats roads and bounded by Watkins Gate Road to the east (Figure 1-1).

1.3 Population, Proximity, and Access

Munitions Response Site-16 is currently enclosed by a 6-foot high chain link fence and access is restricted to authorized personnel only. The fence is maintained through an inter-service support agreement with the Bureau of Land Management (BLM) and security is governed by the MRS Security Program (Army, 2005) implemented by the Army. Personnel from the Army, BLM and U.S. Army Corps of Engineers (USACE) routinely check the MRS-16 fences to ensure that they remain in good condition and to identify/complete needed repairs in a timely manner.

The inset of Appendix B, Plate B1 shows the location of MRS-16 relative to surrounding communities and schools. The area is in close proximity (approximately one mile) to a residential neighborhood (Fitch Park) on the former Fort Ord. MRS-16 is also located adjacent to the Impact Area and land that has been transferred to BLM. The immediately adjacent BLM land is open to the public for hiking, biking, jogging, and horseback riding.

Existing access deterrents such as the chain link fence posted with warning signs approximately every 500 feet discourage, but do not prevent entry into the area. Several instances of unauthorized access by persons into the adjacent Impact Area have been documented. Five incidents of trespassing into the Impact Area adjacent to MRS-16 occurred within the last three years. Although no one was injured, these incidents substantiate the premise that fences posted with warning signs deter, but do not prevent entry.

1.4 Reuse

The land that includes MRS-16 will be transferred to the BLM (USACE, 1995a) and will be maintained as undeveloped habitat reserve under the *Installation-Wide Multispecies Habitat Management Plan* (HMP) *for former Fort Ord* (USACE, 1997a), which describes special land restrictions and habitat management requirements within habitat reserve areas. MRS-16 is located in Transfer Parcel F1.3, which the HMP identifies as a habitat reserve area that will be maintained as open space and will not be developed. Habitat reserve areas support plant and animal species that require implementation of mitigation measures identified in the HMP to ensure compliance with the Endangered Species Act (ESA) and to minimize potential adverse impacts to listed species.

1.5 Vegetation Habitat

Baseline vegetation conditions for MRS-16 have been previously documented in the 1996 Annual Monitoring Report (Harding ESE, 1996), and consist primarily of mature central maritime chaparral (CMC) with some grassland areas and coast live oak areas. CMC is a key habitat at Fort Ord and is an extremely rare plant community. Approximately 85 percent of the worldwide distribution of rare and endangered plants in CMC habitat exist at Fort Ord and are protected by the ESA. Along the southern edge of MRS-16, portions of the site contain grassland habitat; many of the access roads are overgrown with vegetation. In general, dense vegetation obscures the presence of MEC on the ground surface, and MEC can also be found aboveground in branches and brush. The dominant shrub species observed at MRS-16 occur in mature habitat that includes shaggy-barked manzanita, chamise, Monterey and tooth-leafed ceanothus, black sage, and sandmat manzanita. These species contribute approximately 63 percent of the overall vegetative cover. Surveys for HMP herbaceous annual species conducted at MRS-16 in 1996 identified low densities of Monterey spineflower at the edges of coast live oak woodland and grasslands and in openings in coastal scrub and chaparral (Harding ESE, 1996).

The land that includes MRS-16 will be transferred to the BLM and will remain undeveloped as habitat reserve. Chapter 3 of the HMP (USACE, 1997a) describes mitigation measures that must be implemented during MEC investigation and remediation. In addition, there are three biological opinions that contain terms and conditions and reasonable and prudent measures that need to be implemented during MEC activities to minimize and reduce impacts to listed species. Future management of the habitat reserve will fall under the jurisdiction of the BLM. MRS-16 will become habitat reserve and will remain undeveloped. The BLM land immediately adjacent is open to the public for hiking, biking, jogging, and horseback riding.

1.6 Climate

The area's climate is characterized by warm, dry summers and cool, rainy winters. The Pacific Ocean is the principal influence on the climate at the former Fort Ord, causing fog and onshore winds that moderate temperature extremes. Daily ambient air temperatures typically range from 40 to 70 degrees Fahrenheit (°F), but temperatures in the low 100 °F have occurred. Thick fog is common in the morning throughout the year. Winds are generally from the west. The average annual rainfall of 14 inches occurs almost entirely between November and April.

1.7 Regulatory Status

Since it was established in 1917, Fort Ord primarily served as a training and staging facility for infantry troops. From 1947 to 1975, Fort Ord was a basic training center. After 1975, the 7th Infantry Division was based at Fort Ord. Fort Ord was selected for closure in 1991. The majority of the soldiers were reassigned to other Army posts in 1993. There is no longer an active Army division stationed at the former Fort Ord.

Fort Ord was placed on the National Priorities List of Superfund sites by U.S. Environmental Protection Agency (EPA) on February 21, 1990, due to evidence of contaminated soil and groundwater. A Federal Facility Agreement (FFA) was signed by the EPA, Department of Toxic Substances Control (DTSC), and Regional Water Quality Control Board, a part of the California EPA. The FFA established procedures and schedules for conducting remedial investigations (RIs) and feasibility studies (FSs) and requires remedial actions be completed as expeditiously as possible. The former Fort Ord was selected in 1991 for base realignment and closure (BRAC), and the base was officially closed in September 1994. The Army began investigating and removing MEC at the former Fort Ord after the BRAC listing and an Munitions Response (MR) RI/FS began in 1998. 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 April 2000 agreement also formalized the regulatory agencies' roles in the Military Munitions Response Program (MMRP) at Fort Ord.

The Army, as the lead agency, has determined that an interim action (IA) is appropriate for three sites including MRS-16 at the former Fort Ord. The remedial alternatives were evaluated in the *Final Interim Action OE Remedial Investigation/Feasibility Study for Ranges 43-48, Range 30A, Site OE-16* (Harding ESE, 2002). The rationale for taking an IA and the selected remedies are documented in the *Record of Decision, Interim Action for Ordnance and Explosives at Ranges 43-48, Range 30A, and Site OE-16, Former Fort Ord, California* (Army, 2002). The selected remedies for the IA sites including MRS-16 [formerly Site Ordnance and Explosives (OE)-16] are (1) vegetation clearance via prescribed burning, (2) MEC remedial action via surface and subsurface MEC removal, and (3) detonation of MEC with engineering controls.

The Army will offer relocation to Monterey County residents during the conduct of the prescribed burn. The MRS-16 Relocation/Notification Plan is included as Appendix M to this Work Plan.

1.8 MMRP-Related Information

This section provides a summary of MMRP-related information for MRS-16.

1.8.1 Site Features and History of Military Munitions Use

Munitions Response Site-16 is a World War II (WWII)-era 2.36-inch rocket range identified as a "bazooka practice" area on Fort Ord Training Facilities maps dating from 1945 and 1946. Available information indicates that MRS-16 was used for training and live fire exercises from approximately the 1940s until the time the base was officially closed in 1994. According to Fort Ord Range Control, this range was probably used as an anti-tank rocket range during and shortly after WWII (Harding ESE, 1994). The anti-tank range was reported to cover an area approximately 400 meters long and 300 meters wide. A portion of a narrow gauge railroad track used to carry moving targets is present on the western end of the range. Other training sites in this area identified on later training maps include a "squad tactics" site (1954 through 1958), a "recoilless rifle training area" (1964 through 1972), a "bivouac area" (1964 through 1984), "concurrent mortar training area" (1972 through 1976), and an "anti-armor training area" (1978 through 1987). According to a range control officer, "concurrent training" referred to "dry fire" (nonfiring) exercises performed prior to conducting live fire training in the Impact Area, south of Eucalyptus Road.

Available information indicates MRS-16 had been used for training and live fire exercises with practice and high explosives (HE) rockets and rifle grenades in the 1940s and possibly the early 1950s. The site was later used for a portion of time as an anti-armor training area based on available documentation and the presence of training structures and practice landmines. MEC is known or expected to be distributed throughout the site on the surface and in the subsurface. Other potential sources of MEC could include firing lines and burial pits, which have yet to be

evaluated. Documentation regarding the use of the eastern portion of the site is limited, but correspondence and edited maps indicate that numerous rifle grenades may have been found there in the early 1990s.

Features identified on a 1949 aerial photo include what appear to be six firing points and five targets in a row down range with an additional single target further down range (Appendix B, Plate B1). Disturbed vegetation patterns forming streaks from the firing points to and beyond the targets indicate that low angle firing and/or vegetation clearance for target visibility occurred in that area. Although maps showing the configuration of range fan(s) and direction of fire are not available, features on the aerial photo and the locations of MEC and munitions debris (MD) indicate firing was to the north. Evidence shows that both practice and high explosive anti-tank (HEAT) rockets were used at the site. Practice and HEAT rifle grenades have also been found at the site and appear to be of the same general period (WWII and Korean War era). However, available information does not indicate in which direction the rifle grenades were fired.

Subsequent uses of the area or portions thereof have included squad tactics, recoilless rifle training, bivouac, and concurrent mortar training. The term "concurrent mortar training" indicates nonfiring practice. The recoilless rifle training area is indicated on maps from approximately 1964 through 1972. The area is expected to have been for concurrent training, based on conversations with the USACE OE Safety Specialist (the area is too small for live fire), and the absence of MEC related to recoilless rifles.

It appears that the last use of the area before base closure was as an anti-armor training area (Appendix B, Plate B1). Range control diagrams and aerial photos show numerous obstacles, berms, entanglements, and other mock-battlefield structures designed to train troops in moving in the vicinity of and attacking armored vehicles. Several practice anti-tank mines have been found on the site, which is consistent with this type of training. A portion of a narrow gauge track approximately 90 feet long is present in the western portion of the site. It appears that the track extended further to the east based on the berm extending beyond the existing track. The track was originally thought to have been part of the bazooka range mentioned above. However, during the recent removal of the tracks, the MEC contractor discovered hundreds of buried 2.36-inch practice rockets beneath the tracks, which indicates the tracks were installed after use as a bazooka range and were likely part of the anti-armor training course.

1.8.2 Summary of MEC-Related Activities and Data Collected to Date

Various MEC cleanup, site characterization, and limited MEC sampling and removal activities have been performed at MRS-16 as part of the activities described below:

- In 1991, during a controlled burn of land immediately adjacent (to the northeast) of MRS-16, numerous 2.36-inch rockets and rifle grenades were found, some of which

contained high explosive filler. On the basis of this discovery, a recommendation was made to perform a MEC removal over the burned area. Approximately 1,000 rockets were removed as a result of this action.

- In 1998, a 30-foot wide fuel break composed of contiguous 30- by 110-foot grids placed around the perimeter of the site boundary at that time were subjected to a complete removal to a depth of four feet over each grid (Appendix B, Plate B1). Numerous MEC and munitions debris items were found during this removal activity, including HE and practice 2.36-inch rockets; practice anti-tank mines; HEAT, practice, and smoke projectiles, 37 millimeter (mm) projectiles, rifle grenades, grenade fuzes; and illumination signals.

- A portion of MRS-16 was investigated as part of the Field Trial Sites phase of the Ordnance Detection and Discrimination Study (ODDS) (Parsons, 2002b)

- Site characterization data was presented in the IA RI/FS that included a literature review and evaluation of previous MR work (Harding ESE, 2002);

- A Time Critical Removal Action (TCRA) of surface MEC in accessible areas was conducted (Parsons, 2002a) as the first phase of implementing the IA MEC removals described in the IA RI/FS (Harding ESE, 2002). Global Positioning System (GPS) Tracking Points were recorded to determine areas covered during the TCRA (Appendix B, Plate B3).

1.8.3 Interim Action RI/FS and Record of Decision

Based on the results of the IA RI/FS (Harding ESE, 2002), the Army determined that a threat to human health (public safety) or welfare or the environment existed at three IA Sites—MRS-16, Range 30A, and Ranges 43-48. An IA to address these threats was required at MRS-16 for the following reasons:

- The area within MRS-16 is known to contain highly dangerous MEC in the form of 2.36-inch rockets and rifle grenades. Because of their light weight and low trajectory, they are expected to be present on the ground surface or predominantly within the uppermost one foot of soil.

- MRS-16 is located adjacent to BLM-managed recreational lands and can easily be accessed from Eucalyptus Road (Figure 1-2). The southeast corner of the site is located directly across Eucalyptus Road from the BLM headquarters. The immediately adjacent BLM land is open to the public for hiking, biking, jogging, and horseback riding.

- Existing access deterrents such as temporary 6-foot high chain link fencing and a chain link gate posted with warning signs approximately every 500 feet discourage, but do not prevent entry into the sites. Trespassers may knowingly or unknowingly come in contact with MEC and cause it to detonate.

- Trespassers may have contact with MEC present at MRS-16 through intentional disturbance such as picking up an item, or unintentional contact through ground pressure as they walk over the item. Recent exposures (without injuries) were documented through instances of unauthorized access by persons, including children, into the adjacent Impact Area and removal of munitions debris. In 2001, an incidence of persons trespassing within the Impact Area adjacent to MRS-16 was reported, and five other incidences of trespassing in this area were documented in the prior three years.

The IA ROD selected an IA alternative for implementation that consisted of three components: (1) vegetation clearance via prescribed burning, (2) MEC remedial action via surface and subsurface MEC removal, and (3) MEC detonation via detonation with engineering controls (Army, 2002).

Since the ROD was approved, the Army's contractors have been performing MEC removals at the IA sites using a phased approach based on the presence of vegetation and accessibility in portions of the sites. To date, surface and subsurface MEC removals have been performed at Ranges 43-48. At MRS-16, a TCRA was performed. This effort entailed a surface MEC removal in accessible portions of the site conducted to address the immediate threat of visually exposed MEC on the surface. The results of the surface MEC removal and previous MEC-related characterization, sampling and removal activities performed at MRS-16 and in adjacent areas are described below.

1.8.4 Results of MEC Characterization, Sampling, and Removal Activities

A detailed list of the MEC and munitions debris items discovered and removed to date within and adjacent to MRS-16 is provided in Table B1. Approximately 119 unexploded ordnance (UXO), Discarded Military Munitions, and insufficient data items (assumed to be UXO to be conservative) and over 8,600 MD items were found during these activities; the locations of MEC items are shown on Appendix B, Plate B1.

As described above, initial MEC-related information for MRS-16 was generated during wildland fire-fighting training activities that occurred nearby in 1991. During a controlled burn of land immediately adjacent (to the northeast) of MRS-16, numerous 2.36-inch rockets and rifle grenades were found, some of which contained high explosive filler. On the basis of this discovery, a recommendation was made to perform a MEC removal over the burned area. Approximately 1,000 rockets were removed as a result of the removal. Munitions information from this action is not included in Table B1 as the action pre-dated the Fort Ord MMRP, and the items found are not included in the munitions database.

Prior to the IA activities, two MEC-related investigations were completed:

- In 1998 a 4-foot MEC removal was conducted to establish fuel breaks around the perimeter of MRS-16 over 3.5 acres (Harding ESE, 2002). A 30-foot wide fuel break, composed of contiguous 30- by 110-foot grids placed around the perimeter of the site, was subjected to a complete removal to a depth of four feet over each grid (Appendix B, Plate B1). Numerous MEC and MD items including HE and practice 2.36-inch rockets, practice antitank mines, HEAT, practice, and smoke projectiles (37mm and rifle grenades), grenade fuzes, and illumination signals, were found during this removal activity (Appendix B, Table B1).

- A portion of MRS-16 was investigated and a 4-foot MEC removal was conducted as part of the Field Trial Sites phase of the ODDS (Parsons, 2002b). Four 100- by 100-foot grids were investigated within MRS-16, including the area around the narrow gauge railroad track (Appendix B, Plate B1). Several MEC items including four HEAT rifle grenades, one rifle grenade fuze, and one HE 2.36-inch rocket, as well as hundreds of MD items (predominantly practice 2.36-inch rockets) were found and removed (Appendix B, Table B1).

As the first phase of the IA selected for MRS-16 in the IA ROD (Army, 2002), a TCRA was conducted at MRS-16 to remove surface MEC easily accessible to trespassers (Parsons, 2002c). For safety reasons, MEC crews were limited to accessing areas with little or no vegetation. During the TCRA, MEC items found and removed included one HEAT rocket, one practice rocket, two antitank missile launching simulators, and one artillery simulator. Two MD items (expended practice rockets) were also removed (Table B1).

Surface removal operations conducted during the TCRA were performed by visually locating MEC in the site's open and accessible areas without the use of geophysical equipment. The MEC surface removal was performed in areas that were accessible through trails or open areas; no vegetation was cleared or foraged. All the open areas adjacent to the public access roads that were within a 200-foot minimum separation distance (MSD) were cleared first, if possible in accordance with the U.S. Army Engineering and Support Center, Huntsville Division, Huntsville (CEHNC), Alabama, guidelines for establishing the MSD during non-intrusive activities. The MEC removal teams removed, destroyed, and recorded the location and type of any MEC and MD items that were encountered using differentially corrected handheld GPS units, and recorded the weight of items per grid.

The MEC surface removal was initially conducted over the trails, paths, and accessible areas within an 18-acre portion of MRS-16 within the previously established fuel break. When MEC was found near the site boundary, the surface removal operations extended outside the site boundary in 200-foot increments from the MEC that was found near the site boundary. The operations continued until no MEC was found within a 200-foot extension or until the operations

reached approximately 1,200 feet from the MRS-16 firing line. The operations did not extend into the Impact Area.

A total of seven suspected MEC items were encountered during the limited surface removal. Of the seven suspected MEC items, five were determined to be MEC items and were detonated; two of the items were X-rayed and then determined to be MD (Appendix B, Table B1; Plate B1). In addition, 514 pounds of MD were collected (not including the two suspected MEC items that were determined to be inert/expended after demolition operations were completed). The MD scrap that was encountered was comprised primarily of 2.36-inch M7 practice rockets.

1.9 Changes to the Work Plan

This SSWP was prepared after careful evaluation and is based on the best available information. However, during execution of the work, unforeseen circumstances or events may arise that require modification to the procedures discussed herein. The following approach will be followed should the need arise to modify this SSWP:

- An initial assessment will occur by the Shaw Project Manager (PM) who will discuss a potential modification with the USACE PM. The Shaw PM will determine and document via memorandum to the USACE PM and Installation MMRP Project Manager for the Fort Ord BRAC office whether the change is material or procedural and how it will be implemented.
- Under no circumstances will any change to this SSWP be executed unless specifically approved by the USACE and Shaw PMs.
- If the circumstances requiring the change are material and involve a safety or quality concern, the Shaw PM will immediately suspend work affected by the unforeseen condition or activity until the cause is investigated and approved procedures are in place. The Shaw PM will also immediately notify the USACE PM and, if appropriate, the Installation MMRP Project Manager for the Fort Ord BRAC office and regulators.
- Shaw will develop and submit the required changes to USACE PM for review and approval/acceptance. Approved modifications will be incorporated into this SSWP and briefed to installation-specific personnel and the regulators prior to implementation.
- Changes to the SSWP will be identified through the use of "changed pages."

This process applies to the SSWP and all Appendices except Appendix K, Prescribed Burn Plan.

2.0 Technical Management Plan

2.1 Purpose

This Technical Management Plan (TMP) identifies the approach, methods, and operational procedures to be employed during the MR at MRS-16 at the former Fort Ord. The scope includes investigation and removal of MEC as necessary to depth.

The Data Item Descriptions (DIDs) developed by the USACE MEC Mandatory Center of Expertise (MCX) describe requirements for various aspects of MEC work utilized during the preparation of this document. The following DIDs apply to the MR at MRS-16:

- Type II Work Plan MR-005-01
- TMP MR-005-02
- Explosives Management Plan MR-005-03
- Explosives Siting Plan MR-005-04
- Geophysical Investigation Plan (GIP) MR-005-05
- Geophysical Prove-Out (GPO) Plan MR-005-05A
- Accident Prevention Plan (APP) MR-005-06
- Geospatial Information and Electronic Submittals MR-005-07
- Work, Data, and Cost Management Plan MR-005-08
- Property Management Plan (PMP) MR-005-09
- Munitions Constituents Chemical Data Quality Deliverables MR-005-10
- Quality Control Plan (QCP) MR-005-11
- Environmental Protection Plan (EPP) MR-005-12
- Investigation Derived Waste Plan (IDWP) MR-005-13
- Accident/Incident Reports MR-015
- Personnel Resumes MR-025
- Site Specific Final Report MR-030
- Report/Minutes, Record of Meetings MR-045
- Telephone Conversations / Correspondence Records MR-055
- Conventional ESS MR-060
- Monthly Status Report MR-080
- Project Status Report MR-085

This plan was developed in accordance with DID MR-005-01, Type II Work Plan.

2.2 General Requirements

This section presents the general requirements for MEC activities at the MRS-16 area.

2.2.1 Regulatory Guidance

The work will be performed under the USACE TERC requirements and USACE standard operating procedures (SOPs). In addition the following general references are applicable:

- Engineer Regulation (ER) 1110-1-8153, Engineering and Design - MEC Response
- Engineering Manual (EM) 1110-1-4009, Engineering and Design - MEC Response
- Department of Defense (DoD) 6055.9-STD, Ammunition and Explosives Safety Standards
- Army Regulations (AR) 385-64, U.S. Army ESP
- DA Pam 385-64, Ammunition and Explosives Safety Standards
- Engineering Pamphlet (EP) 1110-1-18, MEC Response
- EP 385-1-95a, Basic Safety Concepts and Considerations for MEC Operations
- EP 385-1-95b, Explosive Safety Submittals
- AR 75-15, Responsibilities and Procedures for Explosive Ordnance Disposal
- EP 75-1-2, UXO Support during Hazardous, Toxic, and Radioactive Waste (HTRW) and Construction Activities
- EM 385-1-1, Safety and Health Requirements Manual
- AR 385-10, Army Safety Program
- AR 200-1, Environmental Protection and Enhancement

2.2.2 Chemical Warfare Materiel

Chemical warfare materiel (CWM) is not expected to be encountered at the site based on historical research and previous investigations. However, in the event that suspected CWM is encountered, the following standard procedures will be followed:

- The discoverer will immediately notify the Unexploded Ordnance Safety Officer (UXOSO) and Senior Unexploded Ordnance Supervisor (SUXOS).
- The SUXOS or UXOSO will immediately direct the work team to stop work and evacuate the site along cleared paths in an upwind direction. The initial exclusion zone (EZ) for CWM is 450 meters upwind.
- The SUXOS will note the location of the suspected CWM to help with its identification and relocation.
- The SUXOS will designate a minimum of two UXO qualified individuals to position themselves upwind as far as possible to prevent unauthorized personnel from accidental exposure.
- The SUXOS will immediately notify the on-site USACE OE Safety Specialist, the PM, the Installation Point of Contact (Lyle Shurtleff) and the Contracting Officer's Representative (COR). If a USACE OE Safety Specialist is not present, the SUXOS will contact the South Pacific Division's Range Support Center MEC Safety Administrator and MEC Technical Lead. The USACE will initiate CWM response.

- The SUXOS will account for all field personnel and notify the Shaw PM.
- The SUXOS will ensure the area is secured until properly relieved by active duty Explosives Ordnance Disposal (EOD) personnel, Technical Escort Unit, or local authority. The SUXOS will direct Shaw personnel to support such personnel as appropriate.
- The SUXOS will submit a Suspect CWM report to the USACE OE Safety Specialist that contains the following information: date and time of event; location; preliminary identification of suspect CWM including quantity and type of munition(s) or container(s); description of events; description of any property damage, personnel casualties and/or injuries; description of whether medical services or facilities were required; list of immediate notification and support requirements identified during initial emergency response assessment; and any other pertinent information.
- Before work resumes, the site plans will be reviewed for adequacy in consideration of this newly discovered hazard.

Further details regarding procedures to be followed in the event of the discovery of a suspect CWM item are included in Appendix Q: USACE Interim Guidance, 23 Apr 2004, Notification Procedures for Discovery of Recovered Chemical Warfare Materiel (RCWM) During USACE Projects.

2.2.3 Procedures when MEC cannot be Disposed or MEC are Unidentified

In the event that MEC is encountered that cannot be disposed of or readily identified, the USACE OE Safety Specialist will be notified. If the USACE OE Safety Specialist is unable to identify the MEC item, 787th EOD personnel will be notified. Contact information is provided in Appendix C. The SUXOS will ensure the area is secured until properly relieved by active duty EOD personnel.

2.2.4 Expected Number of Excavations

Munitions Response Site-16 may contain highly dangerous MEC, such as HEAT projectiles, present on the ground surface or at shallow depths below the ground. During recent surface removals conducted at MRS-16 and other sites as a TCRA, hundreds of MEC items, including expended and live 2.36-inch rockets (practice and HEAT), practice anti-tank mines, rifle grenades and hand grenade fuzes were recovered, along with large quantities of MD.

Since this area was used extensively from the 1940s until the time the base was officially closed in 1994, a relatively large number of excavations may be required.

2.3 Project Personnel, Organization, Communication and Reporting

Shaw's organizational structure for this removal action is depicted in Figure 2-1 showing primary Shaw management and supervisory staff. A list of local contacts for non-Shaw personnel

is included in Appendix C. The duties and responsibilities of members of the Shaw project organization are described below.

2.3.1 UXO Personnel, Responsibilities and Authorities

The following UXO positions will be regarded as key UXO personnel:

- Senior UXO Supervisor (SUXOS, Tim Mathisen)
- UXO Quality Control (QC) Specialist [UXOQCS, to be decided (TBD)]
- UXO Safety Officer (UXOSO, TBD)

It should be noted that the UXOQCS and UXOSO may be dual-hatted if less than 15 UXO Techs are working at the site. Resumes and/or CEHNC Resume Database number for UXO and other project individuals to be assigned to the project will be submitted to the USACE OE Safety Specialist for approval and maintained in the project files.

The following individuals are regarded as key personnel to the project, but are not included as key UXO personnel.

- Geographic Information System (GIS) Manager (Trisha Smith)
- Project Geophysicist (Mary Miele)
- QC Geophysicist

2.3.1.1 Senior UXO Supervisor

The SUXOS is the most senior UXO Technician on-site. He directly controls the operations of all field teams performing MEC activities and will spend most of the day in the field monitoring their performance and assisting them in achieving maximum operational safety and efficiency. He reports directly to the PM and receives guidance from the Shaw Range Services and MR Center concerning technical MEC and operational issues. He will implement the approved plans in the field and must review and approve any changes to the approved MEC plans. He will supervise all UXO teams on a project, not to exceed a total of 10. The SUXOS has the authority to temporarily stop work to correct an unsafe condition or procedure.

The SUXOS is Tim Mathisen. Mr. Mathisen's experience exceeds the requirements of Department of Defense Explosive Safety Board (DDESB) TP-18, 2004.

2.3.1.2 Unexploded Ordnance Quality Control Specialist

The UXOQCS will implement MEC-related sections of the QC, conduct QC inspections of all MEC and explosives operations for compliance with established procedures, and direct and approve all corrective actions to ensure all MEC-related work complies with contractual requirements. The UXOQCS has the authority to temporarily stop work to correct an unsafe condition or procedure. The UXOQCS will report independent of project management to the Program Quality Control System Manager (PQCSM).

The UXOQCS is not known at this time. The UXOQCS's experience will meet the requirements of DDESB TP-18, 2004.

2.3.1.3 Unexploded Ordnance Safety Officer

The UXOSO will be responsible for implementing the Basewide Site Safety and Health Plan (SSHP) for activities at MEC sites and will verify compliance with applicable safety and health requirements, presented as Appendix D. The UXOSO will report independent of project management to the Program Certified Industrial Hygienist (CIH). The UXOSO will implement the approved explosives and MEC safety program in compliance with all DoD, federal, state, and local statutes and codes; analyze MEC and explosives operational risks, hazards, and safety requirements; establish and ensure compliance with all site-specific safety requirements for MEC and explosives operations; enforce personnel limits and safety EZs for MEC removal operations, MEC and explosives transportation, storage, and destruction; conduct safety inspections to ensure compliance with MEC and explosives safety codes; and operate and maintain air monitoring equipment required at site for airborne contaminants. The UXOSO has the authority to temporarily stop work to correct an unsafe condition or procedure.

The UXOSO is not known at this time. The UXOSO's experience will meet the requirements of DDESB TP-18, 2004.

2.3.1.4 Geographic Information System Manager

The GIS Manager will be responsible for developing and managing all aspects of data management, including the geographic information database. The GIS manager will ensure that all field data are collected in a consistent manner for incorporation into the Fort Ord project database. The GIS Manager will interface extensively with USACE and the PM.

The GIS Manager will be Trisha Smith.

2.3.1.5 Project Geophysicist

The Project Geophysicist will establish and approve technical procedures, ensure Data Quality Objectives (DQOs) are met, communicate with the geophysical crew on a daily basis to guide the progress of the investigation, serve as a main point of contact with the USACE Geophysicist, and approve the geophysical report.

The Project Geophysicist will be Marty Miele.

2.3.1.6 QC Geophysicist

The QC Geophysicist will conduct QC procedures on the data already collected to document that DQOs are met and also document that the data is of high quality. Additionally, the QC Geophysicist will be responsible for placement of blind seeded items.

The QC Geophysicist will be Jeremy Flemer.

2.3.2 Composition and Management of UXO Teams

This plan has been developed to address all potential scenarios for encountering MEC. Shaw will mobilize up to 13 UXO qualified individuals. Staffing will include the SUXOS, UXOSO, UXOQCS, plus 10 UXO Technician III or UXO Technician II personnel. UXO Technician I or sweep personnel may be employed to conduct surface sweep activities, working under the direct supervision of UXO Technician II or III personnel. The UXOQC and UXOSO may be dual hatted if less than 15 UXO Techs are working at the site. Staffing of UXO personnel will be in accordance with DDESB TP-18, 2004. Specific responsibilities are delineated below:

Senior UXO Supervisor The SUXOS takes MEC policy directions from the Shaw Range Services and MR Center and Shaw PM, and provides operational tasking. The SUXOS is the senior UXO technician on site and plans coordinates and directs all UXO activities.

UXO Technician III personnel, also referred to as field team leaders, are responsible for the safety and efficiency of the performance of their assigned field team, and report directly to the SUXOS. The UXO Technician III can temporarily stop work in order to bring an unsafe condition or procedure to the attention of the SUXOS. The UXO Technician III directs the actions of a project UXO team in accordance with an approved work plan or UXO site safety plan and daily verbal direction of the Senior UXO Supervisor. The responsibilities of the UXO Technician III include, but are not limited to, the following:

- Authority to stop work
- Consult with and coordinate with the Site Safety and Health Officer (SSHO) regarding any modification to project documentation
- Compliance with all Federal and State regulations
- Equipment and on-site vehicles
- Explosive Safety
- Daily inspection of emergency equipment
- Supervision and direction of MEC field activities for assigned tasks

Unexploded Ordnance Technician II personnel report directly to their assigned UXO Technician III and are responsible for the safe and efficient performance of specific field tasks as assigned by the UXO Technician III. They are also responsible for complete familiarity with the approved plans and for adherence to the procedures described in the plans. UXO Technician II has the authority to temporarily stop work in order to bring an unsafe condition or procedure to the attention of their assigned UXO Technician III. This individual has stop work authority. Responsibilities include, but are not limited to, the following:

- Compliance with all safety and work related documentation

- Work under the supervision of the UXO Technician III
- Operates MEC detection equipment
- Assists in the identification of MEC items
- Prepares explosive charges for blow in place (BIP) procedures
- Has stop work authority.

Qualifications for UXO technicians will meet or exceed the requirements of DDESB TP-18, 2004. UXO personnel new to the site must be pre-approved by the Contracting Officer or COR prior to mobilization of the personnel.

Unexploded Ordnance Technician I or sweep personnel may be used for surface sweep activities, working under the direct supervision of UXO Technicians II or III.

Essential personnel for the MR clearance work may also include a backhoe operator and GPS technicians who may or may not be qualified UXO technicians.

2.3.3 General Work Schedule

Operations will be conducted during daylight hours only. UXO personnel will work four 10-hour days, generally 0630 to 1700, per work week. Two fifteen minute breaks will be authorized to all UXO personnel, one in the morning and one in the afternoon. One thirty minute lunch break per day will be authorized to all UXO personnel, generally from 1130 to 1200. In no case will hourly UXO personnel work more than ten hours in any one day, or more than forty hours in any one week unless specifically authorized by the USACE OE Safety Specialist and Contracting Officer.

2.3.4 Safety Meeting/Briefing Schedule

Three distinct safety meetings and briefings will be conducted: the daily general briefing, the daily tailgate safety briefing, and the supervisor safety meeting. All visitors to the site will also receive a safety briefing and orientation. Additionally, if at any time conditions are deemed unsafe or a safety issue warrants review, the Project Manager, UXOSO, or SUXOS may hold a safety stand-down.

- **Daily General Briefing:** The UXOSO and SUXOS will conduct the daily general briefing for all personnel at the support compound prior to beginning work in the field. This briefing will take place at approximately 0630 each morning. The briefing will cover general hazards for the project and any new safety issues or hazards identified since the last briefing. A written record of this briefing will be kept by the UXOSO with each individual in attendance signing the training record.
- **Daily Tailgate Safety Briefing:** The supervisor in charge of each operating team will conduct a tailgate safety meeting with the team prior to starting work. A written record of this training and the signatures of personnel will be maintained. The training will focus on the specific hazards anticipated at the team's work site during that day's

operations and the safety measures used to eliminate or mitigate those hazards. The briefing will also address other teams and operations within the area whose proximity may have safety impacts. If during the workday the team's location changes within a site or from site-to-site, corresponding changes in ingress/egress routes and emergency evacuation routes will also be reviewed during a tailgate safety meeting. The UXOSO and UXOQCS will randomly monitor these briefings.

- **Supervisor Safety Meeting:** The UXOSO will hold a weekly safety briefing for all supervisors. This meeting focuses on safety and operational issues and any required safety or operational refresher training. Although scheduled weekly, these meetings may be held anytime there is a significant change in site hazards or upon modification of site safety procedures.
- **Visitor(s) Safety Briefing:** Site visitors will receive a safety briefing prior to entering the operating area and must be escorted at all times by a UXO Technician, UXOSO, UXOQC, SUXOS, or the USACE OE Safety Specialist. The Visitor Site Safety Briefing will be documented and a record of the briefing will be maintained by the UXOSO.

2.3.5 Other Contract Personnel

Other personnel in addition to those designated as key personnel for MEC operations will play important roles in the management of this project.

2.3.5.1 Program Manager

The Program Manager, Mr. Nels Johnson, has program-level management authority and responsibility for the work performed. The Program Manager directs the program management organization as a central resource for management, continuity, and control of all program activities. The centralized program management is organized to facilitate communication with and reporting to USACE and to expedite and support project execution. The Program Manager has total authority, responsibility, and accountability for managing the contract. He will be involved in the decision-making process, and oversight of the management of the project.

2.3.5.2 Project Manager

The PM, Mr. Peter Kelsall, reports to the Program Manager. He is responsible for ensuring that activities performed by Shaw at Fort Ord are conducted in accordance with contractual specifications and approved work plans. The PM will also coordinate with the USACE PM. The PM is responsible for management of operations conducted for the project and for coordination between MEC and other site activities. The PM is responsible for overall cost and schedule performance and contract compliance and will monitor the budget and schedule to ensure availability of necessary personnel, equipment, subcontractors, and services. He will participate in the development of the field program, evaluation of data, and reporting.

2.3.5.3 Task Manager

The Task Manager, Mr. Kevin Siemann, reports to the Project Manager. He will oversee field activities and assist the PM in ensuring activities performed by Shaw are conducted in accordance with contractual specifications and approved work plans. He will coordinate the development of the field program, evaluation of data, and reporting.

2.3.5.4 Program Certified Industrial Hygienist

Mr. Rudy Von Burg, CIH, will oversee the development and implementation of the SSHP to ensure that it meets all specific needs of the project and that appropriate health and safety requirements are defined.

2.3.5.5 Site Safety and Health Officer

The SSHO, Mr. Charles Luckie, will coordinate with the UXOSO for non-MEC safety issues. The SSHO will report independent of project management to the CIH. The SSHO will not work within the MRS-16 site.

2.3.6 Project Administration

The PM will oversee contract administration and project management for all project activities. The existing administrative staff located at Fort Ord will be used and will coordinate with home office administrative functions located in Concord, California.

2.3.7 Roles and Responsibilities of Subcontractors

Shaw may use subcontractors for portions of the work. When this work is subcontracted, it will be done in accordance with the TERC contract requirements. Subcontracted work will be identified in a task-specific procurement plan.

At this time, it is not expected that subcontractors will be used to provide UXO Technicians.

2.4 Technical Scope

The overall scope of work for this task involves MEC removal at the MRS-16 area. The removal action for this area will require the following tasks:

- Mobilization and project setup.
- Support the prescribed burn to be conducted by Presidio of Monterey Fire Department (POMFD) for vegetation clearance. This will include creation of fuel breaks by mechanical cutting with MEC construction support prior to the prescribed burn and pre- and post-burn environmental sampling and air monitoring during the burn.
- Following the prescribed burn, provide construction support for any additional vegetation clearance that may be required to remove remnant vegetation in the burn area. After vegetation clearance, perform a magnetometer-assisted surface removal of

MEC and other metallic debris. The objective will be to remove items that would impede and geophysical surveys.

- Perform digital geophysical mapping (DGM) with EM-61 to locate subsurface anomalies. During this step, anomalies will be resolved to depth. A DGM survey will be made after the vegetation clearance and magnetometer assisted surface removal, and will include the entire site. Additional DGM surveys may occur once the first data have been interpreted and the targets excavated, and will be used to verify the excavation results. Additional DGM surveys may not be required in areas where anomaly density during the first survey is low.
- In areas where anomaly density is high as shown by the initial DGM, mechanical excavation and sifting may be conducted to locate and remove subsurface anomalies prior to the second DGM survey. Sifting is not expected not expected to be required at the site. Procedures for mechanical excavation and sifting will be developed and provided to the MR BCT prior to conduct of any sifting operations.
- Disposal of MEC by detonation with engineering controls.
- Offsite disposal of materials recovered during removal action. MD obtained during the initial removal and the EM-61 removal will be segregated, collected, weighed, certified free of explosives, and disposed at an approved recycler.
- Demobilization.
- Provision of an on-site roving security patrol when UXO teams are not working and access to the site is prevented only by temporary fencing.

Each of these steps is detailed in the following subsections.

2.4.1 Mobilization and Project Setup

This section presents the requirements for mobilization and project setup.

2.4.1.1 Pre-Mobilization

Prior to mobilization, the following actions are required:

- Finalize procurement actions for items and services needed during the mobilization;
- Coordinate with the USACE Safety Officer for approvals or notifications to other agencies:
- Ensure accuracy of route maps for emergency facilities
- Notify local response agencies (fire department, hospital) of upcoming project activities
- Submit Huntsville UXO Data Base numbers for all UXO personnel for client approval.

2.4.1.2 Mobilization

A mobilization period will be necessary to mobilize, organize, and train the staff, as well as mobilize equipment. Mobilization activities related to mobilization of the full crew after the prescribed burn will include:

- Transport and assembly of the work force at the former Fort Ord
- Comply with Fort Ord MRS Security Program guidance by providing personnel access rosters and identification for personnel and vehicles operating on controlled roadways and in restricted areas.
- Conduct site-specific training on the work plan, SSHP, MEC procedures and hazards, HMP requirements, and community relations
- Ship and inventory project equipment
- Coordinate with local agencies including police, hospital, and fire department, as appropriate
- Organize support facilities and test communication equipment
- Test and inspect equipment
- Establish detailed mapping and GIS procedures
- Inspect field conditions, and as appropriate establish survey controls.

Two mobilizations will occur for this project. The first will take place prior to the prescribed burning and will include only those staff required to support the burn efforts. The second mobilization will occur after the prescribed burn when the personnel and equipment required to support the MR will be mobilized to the site.

2.4.1.3 Field Office

Shaw will use the building at 4522 Joe Lloyd Way as a field office. This field office will be the central command location for direction and coordination of MEC activities. Personnel will report to the field office at the beginning of each workday for the daily health and safety briefing. The field office will be the central point of communications for the project. Health and safety records will also be maintained in the field office. Temporary break and sanitation facilities will be established at the work site.

2.4.1.4 Preparatory Phase Inspection

A preparatory phase inspection is performed prior to beginning each definable feature of work as part of the three-phase inspection process. The purposes are to review applicable work plans, processes, and specifications and verify that the necessary resources, conditions, and controls are in place and compliant before the start of work activities. The UXOQCS is to verify that lessons

learned during previous, similar work have been incorporated, as appropriate, into the project procedures to prevent recurrence of past problems. The UXOQCS shall generate and use a Preparatory Inspection Checklist provided in the Control Plan, and designed to fit the specific scope of work and site conditions. Work plans and operating procedures are to be reviewed by the UXOQCS to ensure they describe pre-qualifying requirements or conditions, equipment and materials, appropriate work sequences, methodology, hold/witness points, and QC provisions. The UXOQCS shall verify that:

- The required plans and procedures have been prepared and approved and are available to the field staff
- Construction materials meet required specifications
- Field equipment is appropriate for intended use, available, functional, and calibrated
- Work responsibilities have been assigned and communicated
- Field staff have the necessary qualifications, knowledge, expertise, and information to perform their jobs
- Arrangements for support services (such as on-site testing and off-site testing laboratories)
- Prerequisite site work has been completed.

Discrepancies between existing conditions and approved plans/procedures are to be resolved. Corrective actions for unsatisfactory and nonconforming conditions identified during a preparatory inspection are to be verified by the UXOQCS or designee prior to granting approval to begin work.

U.S. Army Corps of Engineers notification is required at least 48 hours prior to conducting preparatory inspections. Results are to be documented on the Preparatory Inspection Checklist, entered in the QC log, and summarized in the Daily QC Report.

2.4.1.5 Kickoff/Safety Meeting

During mobilization, a kickoff/site safety meeting will be conducted which will include a review of the work plan and the review and acknowledgment of the SSHP by all site personnel. Two kickoff meetings will occur: one prior to the prescribed burn and one following.

2.4.2 Prescribed Burn Support Activities

Prescribed burning will be performed for vegetation clearance by the POMFD. The Prescribed Burn Plan is provided as Appendix K to this SSWP. In addition, an Air Monitoring Sampling and Analysis Plan (SAP) is included as Appendix L to this SSWP. The SAP addresses requirements, processes, and procedures for performing particulate matter (PM10) sampling. A

Notification Plan that addresses notification of the local residents about the prescribed burn and subsequent MR is provided as Appendix M to this SSWP.

The prescribed burning support activities include five specific tasks: vernal pool sampling and monitoring, fuel break habitat monitoring, removal and replacement of fencing, fuel break site preparation, and prescribed burn support. Each of these is described below.

2.4.2.1 Vernal Pool Sampling and Monitoring

Monitoring of vernal pools or ponds will be performed per the requirements of the *Biological Opinion, Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields (1-8-04-F-25R)* (Biological Opinion) (USFWS, 2005). The purpose of this monitoring is to determine if there is any impact on vernal pools from the prescribed burn, for example as a result of the use of foam retardants. Details of the sampling and analytical requirements are presented in Appendix N. Baseline monitoring of the vernal pool in close proximity to MRS-16 was conducted in early March 2006.

2.4.2.2 Fuel break Habitat Monitoring

Habitat monitoring in the fuel break area will be performed in accordance with the site-specific *Biological Monitoring Plan* included as Appendix O to this SSWP. This plan was prepared in consultation with the Installation Biologist, Mr. Bill Collins of the Fort Ord BRAC Office to evaluate biological monitoring requirements as they pertain to MRS-16.

2.4.2.3 Removal and Replacement of Fencing

The fence removal will be performed as a two stage process. The first stage will be performed for the vegetation removal and blacklining process associated with fuel break construction. Blacklining is a tool used to establish and reinforce fuel breaks. Blacklining involves burning existing vegetation within fuel breaks, either in lieu of or after mechanical and manual vegetation removal, in order to further reduce fuel loads within fuel breaks. If blacklining is conducted, it will be done during a period of higher fuel moisture content in order to minimize the threat of a wildfire starting from the blacklining process. During this stage, sections of the 6-foot chain link fence will be cut to allow access/exit as necessary for the day's activities. At the end of each day, the fence will be re-secured. The second stage will be performed for the prescribed burn and MEC removal activities. Prior to commencing these activities, the 6-foot chain link fence will be removed. After the burn is conducted, the 6-foot chain link fence will be replaced with temporary fencing. In addition, danger signs will be posted on or behind the temporary fencing.

2.4.2.4 Fuel Break Site Preparation

Shaw will conduct a 150 feet vegetation clearance around the perimeter of the site to serve as a primary containment line for the prescribed burn. Blacklining within the primary containment

line may be performed by POMFD. The UXO teams will create fuel breaks on the four sides of the site (Figure 1-2). Mechanical vegetation clearance equipment will be used to cut the vegetation. Manual tools such as brush hogs and trimmers may be used in areas where the mechanical cutter cannot gain access, or to trim tree branches. In areas with heavy vegetation that obscures visual inspection of the ground surface, a first cut will be made to a height between 18 and 24 inches above the ground. After visual inspection for MEC, a second cut will be made to a height of no more than 6 inches above ground.. In areas with medium to light vegetation where the ground surface can be readily observed before cutting, the vegetation will be cut in one stage to a height of no more than 6 inches above ground. Vegetation cut manually from the fuel breaks will be stockpiled in the burn area as directed by the POMFD.

The UXO team will provide construction support during vegetation clearance in heavily vegetated areas by first conducting a visual survey of the area to be cut to the extent possible and then moving outside of the MSD prior to equipment startup. If during vegetation clearance MEC or an unknown item is encountered, then vegetation clearance will stop and the UXO technician will return to investigate the item. In areas with medium to light vegetation that does not obscure the ground surface, a magnetometer will be used in conjunction with a visual survey of the ground surface for MEC.

The POMFD may complete the fuel break construction by blacklining. If blacklining is performed within the primary containment line, Shaw will delineate the extent of blacklining activities using GPS for future biological monitoring purposes.

In addition to the vegetation removal, timber and rails will be removed from the site as part of the site preparations prior to the burn. Surface debris (e.g., targets) that will impede the geophysical investigation will also be removed.

2.4.2.5 Prescribed Burn Support

Shaw will provide construction support as requested by the POMFD before, during and immediately following the burn.

2.4.3 Surface MEC Removal Procedures

Following the prescribed burn, the UXO team will conduct a surface survey and provide construction support for any additional vegetation clearance that may be required to remove remnant vegetation in the burn area. After vegetation clearance, the UXO team will perform a magnetometer-assisted surface removal of MEC and other metallic debris. The objective will be to remove items that would impede geophysical surveys.

2.4.3.1 Site Set Up

Site setup will include establishing survey control in the field. The border survey delineating the burn boundary will be provided to Shaw by USACE. Shaw will perform a 100' X 100' grid survey of the burn area. Site setup will be performed by the SUXOS, UXOQCS, and one GPS technician. EZs will be established in accordance with Section 2.4.4.9.

2.4.3.2 Geophysical Test Plot for Schonstedt Magnetometers

The purpose of these procedures is to ensure that the Schonstedt magnetometers and metal detectors are functioning properly and optimized for field use. A cleared area will be established, near the administrative office area, where each geophysical instrument intended for use will be tested before and after every field deployment. Simulated MEC items, of the approximate the size and weight of a 37 mm projectile, 75 mm projectile, a rifle grenade, and a 2.36" rocket, will be buried at various depths and orientations within the calibration area to facilitate the calibration and system control check activities, and to document system performance (see Section 5.0).

Seeded items will be painted orange and identified by a unique Shaw number so that they cannot be mistaken for actual field items. Seeded items will be removed upon completion of the project activities.

2.4.3.3 Magnetometer/Metal Detector Check-Out Procedures

Prior to field use, all magnetometers and metal detectors will be set up following the guidelines in the manufacturer's operating manual for the specific instrument used. Magnetometer instruments used for this project will be Schonstedt GA 52CX magnetometers. All equipment will be operated in a manner consistent with instructions contained in the appropriate operator's manual. All equipment will be function-tested prior to use. Checkout procedures will include:

- Once the instrument has been determined to be working according to the manufacturer's operating manual, the operator will perform a function test using the detection methods described in the manual. A function test will consist of using the instrument over a minimum of two test sources.
- The test sources will be simulants or inert ordnance including 2.36-inch rockets (practice and HEAT), a rifle grenade, and a M48 75mm projectile buried at varying depths to the depth of detection required (see Section 5.0),
- The same sources will be used during each function test to ensure consistency. The instrument detection indication, as described in the operator's manual, will be noted in the instrument logbook.
- Instruments that fail to reproduce a detection indication consistent with previous tests will be checked to ensure that the power supply or batteries are sufficient. If the power

supply is determined to be sufficient and the operator cannot find a fault in accordance with the operator's manual, the instrument will be tagged and removed from service.

- Function tests will be performed each morning before the equipment is put into service.
- If an instrument is determined to be working improperly, the SUXOS and the PM will be immediately notified. Any activities performed using that instrument since its last positive test procedure will be considered invalid and will require reevaluation.
- Upon completion of the function test, the results of the function test will be recorded in the operator's Field Activity Daily Log.

After an instrument has been function-tested at the beginning of each day, the instrument will be checked at least once during every hour of use or each time the instrument is turned on after having been turned off. The instrument indication will be compared to the indication produced during the morning function test. Instruments that fail to produce a consistent indication will be checked and removed from service as required.

2.4.3.4 Vegetation Clearance

Following the prescribed burn, it may be necessary to remove remnant vegetation that did not burn. The UXO team will first conduct a survey to determine that it is safe to enter areas that require vegetation clearance, and will then provide construction support during all vegetation clearance.

Vegetation removal will be accomplished with a combination of mechanical and hand held brush cutting equipment. Brush will be cut as close to ground surface as possible, but no higher than 6 inches to permit proper use of the EM 61 geophysical equipment. Oak trees will not be removed but branches may be trimmed. Manually cut vegetation shall be removed from the area.

2.4.3.5 Surface Removal

Following vegetation clearance, the UXO Team will perform a magnetometer-assisted removal over the whole surface of the fuel breaks and burn area. The removal consists of removing all MEC items and any other metallic object removable by hand encountered on the surface.

The UXO Team will include the following personnel:

- SUXOS
- UXOQCS
- UXOSO
- 1 GPS specialist
- 2 UXO Technician III Team Leaders
- 8 UXO Technicians

The GPS specialist may be a qualified UXO technician, or a survey specialist working alongside a qualified UXO technician. Non-UXO personnel may be used to support UXO technicians for the surface survey and sweep, but the sweep team will be directed and supervised by at least one UXO Tech III. A UXO Tech II will also be included as part of the sweep team. This individual will be responsible for identifying all MEC encountered, and will record the location of the items located during the surface survey and sweep.

The work area will be divided into 100 foot by 100 foot grids. Wooden stakes will clearly mark each grid corner and each grid will be labeled to identify the grid number. The UXO Team leader will use 100 foot lines (rope) to mark out search lanes. Each search lane will be approximately 5 feet wide and the UXO Team Leader will ensure that each lane is swept in a manner that will cover the entire lane width and overlap into lanes on each side.

The work will be referenced to the existing 100 by 100 foot grids in the Fort Ord GIS. The sweep will locate and remove MEC and metallic scrap from the whole MRS-16 area, including both the fuel breaks and the prescribed burn area. Because one objective for this phase of the work is to remove material that could interfere with the geophysical survey, all visible metallic debris will be removed. Visual inspection will be supplemented by use of hand held magnetometers in areas where surface MEC could be hidden. MD will be segregated from other debris and collected in buckets that will be labeled by grid number for later weighing. MD will be managed as described in Section 2.4.4.17.

Hand held magnetometers used on this site will be the Schonstedt GA-52CX type.

If a MEC item is found during the surface sweep, the location will be conspicuously marked with a red pin flag. Additionally, UXO personnel will complete the Shaw "MEC Information Form" (Appendix F, Form M-1). The location of all MEC items requiring disposal by detonation will be surveyed by GPS. After daily survey by GPS, the red pin flags will be removed. MEC disposal operations will be scheduled weekly or as required through the USACE OE Safety Specialist. It should be noted that a security guard will be present on-site during all hours that UXO crews are not present. MEC disposal procedures are described in Section 2.8.

Metal detectors may be used as required to assist in identifying non-ferrous and ferrous materials. All equipment will be operated as specified in the appropriate operator's manual. All equipment will be function tested in the geophysical test plot prior to each daily use in accordance with the operator's instructions.

General debris such as soda cans, paint containers, barrels, etc. will be collected for disposal as trash. In addition, any remaining surface debris that was not removed prior to the burn that will impede the geophysical investigation (e.g., targets) will also be removed.

2.4.4 Subsurface MEC Removal Procedures

The on site geophysics specialist augmented by the UXO Team will perform DGM with EM-61 to locate subsurface anomalies. During this step, anomalies will be resolved to depth. If an excavation depth of four feet is reached and no source of anomaly located, the USACE OE Safety Specialist will be consulted by the UXOSO to determine if further excavation is safe and warranted. If for any reason an anomaly is abandoned prior to resolution, the anomaly location will be surveyed using GPS.

In areas where anomaly density is high as shown by the initial DGM, mag and dig or dig and sift operations may be conducted to locate and remove subsurface anomalies prior to the second DGM survey. The area requiring removal to depth is the planned burn area plus the fuel breaks, approximately 80 acres.

During the EM-61 removal, subsurface anomalies identified by geophysics will be resolved by excavation to depth. MEC will be identified and surveyed using GPS. If for any reason an anomaly is abandoned prior to resolution, the anomaly location will be surveyed using GPS. The work will be referenced to the existing 100 by 100 foot grids in the Fort Ord GIS. Hazardous MEC will be destroyed by detonation, either blown in place or collected for consolidation shots. MEC disposal operations will be scheduled weekly or as required through the USACE OE Safety Specialist. MEC disposal procedures and notifications are described in Section 2.4.4.8. MD greater than 2 inches minimum dimension will be removed and weighed, and the weight will be recorded for each 100 by 100-foot grid. Additionally, UXO personnel will complete the Shaw "MEC Information Form" (Appendix F, Form M-1). MD will be certified as free of explosives, and disposed at an approved recycler.

This section discusses the procedures that will be performed by UXO-qualified personnel during geophysical support and subsurface MEC removal operations. This section includes procedures for excavating anomalies, identifying MEC, transportation and demolition of MEC, and required engineering controls.

2.4.4.1 Responsibilities of Personnel

The UXO Team will include the following personnel:

- SUXOS
- UXOQCS
- UXOSO
- 10 UXO Technicians

General responsibilities of personnel are discussed in Section 2.3 of this document.

2.4.4.2 Geophysical Prove Out

A GPO will be performed for the digital geophysical instruments as described in Section 5.0.

2.4.4.3 Statistical Sampling

Statistical MEC sampling will not be conducted as part of this scope of work.

2.4.4.4 Overall Safety Precautions

The general work practices defined by CEHNC will be followed. This includes limiting the work periods for field UXO personnel to 10 hours per day and 40 hours per week. Exceptions to this requirement will only be made in the event that public safety is at imminent risk and with the concurrence of the USACE OE Safety Specialist and Contracting Officer.

2.4.4.5 Geophysical Survey

Following prescribed burning and a surface MEC removal, a 100 percent geophysical survey will be performed (Section 6.0). Portions of MRS-16 will be surveyed with DGM twice. The first DGM survey will be made following vegetation clearance and surface removal. The second DGM survey will occur once the first data have been interpreted and the targets excavated, and will be used to verify the excavation results. In areas where anomaly density is high as shown by the initial DGM, mag and dig or dig and sift operations may be conducted to locate and remove subsurface anomalies prior to the second DGM survey. Areas with limited or no subsurface anomalies may not require a second DGM survey.

2.4.4.6 Reacquire Anomalies

Following data processing during both the initial DGM and QC DGM, the geophysical crew will reacquire identified anomalies. Anomaly maps will be produced and dig sheets assigned to the UXO crew. Anomalies will be investigated under the direction of the SUXOS. Ten qualified UXO technicians, SUXOS, UXOQC, and UXOSO will provide support during the geophysical field work.

2.4.4.7 Remove Anomalies

The UXO teams will excavate all anomalies identified by digital geophysical surveys. Further discussion of the process for defining anomalies is included in Section 5.0. The UXO teams will remove all MEC items and any other metallic object greater than two inches in any dimension. The field crew for this effort will include 10 UXO technicians.

Small hand tools such as shovels, spades, trowels, and pry bars will be used to uncover potential MEC. Hand tools will be used for the majority of items, which are generally found near the surface. Anomaly excavation will be performed to depthIf the UXO team has dug to a depth of 4 feet and not recovered the anomaly, they will request direction from the USACE OE Safety Specialist. An evaluation of whether to continue excavation will be made based on site-specific

conditions and the nature of the anomaly. If the decision is made to discontinue excavation, the UXO team will backfill the hole, record the location and document in a field variance that no anomaly was detected to the depth excavated.

It is the Army's intent to resolve all anomalies. The location and properties of any unresolved anomalies will be documented in the Site Specific After-Action report.

The following basic technique will be used for anomaly excavation:

1. The anomaly will be located with an EM-61. A magnetometer may also be used to assist in anomaly location.

2. Until the anomaly is otherwise identified, it will be assumed that the anomaly is MEC. Excavation will be initiated adjacent to the anomaly. The excavation will continue down until the excavated area has reached a depth below the top of the anomaly as determined by frequent inspection with a magnetometer.

3. Using progressively smaller and more delicate tools to carefully remove the soil, the excavation team will expand the sidewall to expose the metallic item in the wall of the excavation for inspection and identification without moving or disturbing the item.

4. Once the item is exposed for inspection, the excavation team will determine if it is MEC. If the item is not MEC, it will be removed and the area will be rechecked to ensure that a hazardous item is not hidden beneath it. The excavation team will then annotate the results of the excavation on the Anomaly Tracking Sheet forms (Appendix F, Form M-8) and move on to the next marked subsurface anomaly.

Although not specifically planned to be used in this project, a commercial backhoe may be used if required by the UXO team to carefully excavate anomalies if believed to be at a greater depth than can be efficiently excavated by hand. If utilized, the backhoe will be used no closer than 1 foot lateral from anomalies located during excavation. A team consisting of at least a UXO Technician II and an equipment operator will perform the anomaly excavation. The UXO Technician III may assign additional workers to assist with the excavation if deemed necessary. The excavation will be conducted similarly to hand excavation.

1. Upon arrival at the anomaly site, the excavation team will reacquire the anomaly, and the equipment operator will begin the excavation under the direction of the UXO Technician II. The equipment operator will excavate near the location, but not directly on top of the anomaly.

2. To prevent contacting the anomaly with the backhoe, the UXO Technician II will frequently monitor the excavation to ensure that the equipment operator does not dig directly over the anomaly. The objective of the direction by the UXO Technician II is to remove the soil from a selected area adjacent to the anomaly, while ensuring that the backhoe bucket does not disturb the anomaly.

3. The UXO Technician II will direct the equipment operator to stop excavation when the soil has been removed to within 1 foot of the anomaly as estimated by the response from the metal detector or the post-processed geophysical data.

The backhoe will then be shut down, the backhoe operator will move away from the anomaly location, and the excavation will be completed using hand tools as previously described for hand excavation.

2.4.4.8 MEC Discovery, Notification, and Reporting

It is essential that the discovery of all MEC is immediately reported to the appropriate on-site personnel, accurately documented and communicated to USACE.

2.4.4.9 Exclusion Zone

The EZ is designed to protect the public during munitions removal activities (Figure 2-2). The Munition with the Greatest Fragmentation Distance (MGFD) for MRS-16 is the 2.36" rocket (case only) with a MSD of 809 feet. This distance was computed in accordance with DDESB TP 16, 2003. Engineering controls can be used to reduce the MSD when evacuation perimeters around the work site(s) do not permit establishment of the needed 360 degree EZ. Use of engineering controls can serve as an alternative to evacuation to the full MSD for the MGFD, but decreases work production rates, requires additional equipment and materials, and site approvals for use. Reducing the EZ with engineering controls is based on tests that follow the guidelines described in the following CEHNC memoranda.

HNC-ED-CS-S-98-8, 1998 provides guidelines for use of the Miniature Open Front Barricade (MOFB, commonly referred to as the "Bud-Lite") for use during intrusive operations such as MEC investigation and anomaly excavations. This equipment authorized for use by DDESB TP 15, 2004 mitigates fragmentation range in 3 directions (sides and front) in the event of unintentional detonations, but offers no blast mitigation capability.

HNC-ED-CS-S-98-7, 1998 provides guidelines for use of sandbags to mitigate blast and fragmentation effects during intentional detonations. DDESB TP 15, 2004 authorizes use of this equipment during removal actions when appropriately used in accordance with established guidelines.

HNC-ED-CS-S-96-8, 1997 provides guidelines for use of soil, water tamping or other forms of barricading during demolition operations to reduce fragmentation and/or blast range. DDESB TP 15, 2004 authorizes use of these forms of barricading when appropriately used in accordance with established guidelines.

The MSD will be applied to various MR activities when operations are occurring in MRS-16 as follows:

- 809 feet for vegetation removal using mechanical methods
- 809 feet during the prescribed burn (a larger setback distance may be established by the POMFD)
- 809 feet during MEC investigation and anomaly excavation without engineering controls
- 200 feet to the sides and rear of a MOFB and 809 feet from the front of the MOFB during MEC investigation and anomaly excavation with appropriate engineering controls for unintentional detonations
- 200 feet between UXO and geophysics teams when no intrusive activities are occurring
- 200 feet during intentional detonations with appropriate engineering controls
- 809 feet for intentional detonations without appropriate engineering controls

Special consideration is required with regard to the BLM property adjacent to the south east corner of MRS-16. Work will be scheduled to reduce the inconvenience to BLM to the extent practicable.

Only personnel essential to the project and authorized visitors will be permitted access into the EZ when MR operations are being conducted. Essential personnel are limited to those listed in Section 2.3.2. All non-essential personnel (authorized visitors) who require entry into the EZ will require a UXO escort in accordance with CEHNC-MMRP-CX Memorandum, 21 April 2004.

If MEC larger than a 2.36" rocket is discovered, or if warranted by the quantity of MEC discovered, all work will be halted and a new EZ will be designated based on the item found. If demolition operations are to be performed, the SUXOS will compute a safety zone based on the type of MEC involved and the quantity of explosives required to destroy that type of MEC. The USACE OE Safety Specialist will approve this computation before demolition activities can be performed.

The EZ will be established based on the K328 value for the quantity of the explosives used obtained from DoD 6055.9-STD (Chapter C9).

2.4.4.10 MEC Identification

Unexploded Ordnance Technicians will make every effort to identify MEC through visual examination of the item for markings and other identifying features such as shape, size, and external fittings. Items will not be moved during the inspection/identification until the fuze

condition can be ascertained. If the condition is questionable, the UXO Technicians will consider the fuze to be armed. The fuze is considered the most hazardous component of MEC, regardless of type or condition. The SUXOS and the USACE OE Safety Specialist will agree on the positive identification of the item and the disposition of the item prior to implementing any disposal operations. The following general ordnance safety guidelines will be followed:

- In general, a projectile containing a base-detonating fuze is to be considered armed if the projectile has been fired.
- Arming wires and pop out pins on unarmed fuzes will be secured by taping in place prior to movement.
- Do not rely on the color-coding of MEC for positive identification of contents. Munitions having incomplete or improper color-coding have been encountered. (This is especially true with regard to the 40 mm family of ordnance).
- Avoid the area forward of the nose of a munition until it can be ascertained the item does not contain a shaped charge. The explosive jet can be fatal at great distances forward of the longitudinal axis of the item. Assume any shaped charge munitions to contain a piezoelectric (PZ) fuzing system until the fuzing system is positively identified. A PZ fuze is extremely sensitive, can function at the slightest physical change, and may remain hazardous for an indefinite period of time.
- Examine a projectile for the presence or absence of an unfired tracer. Also examine the item for the presence or absence of a rotating band and its condition.
- Assume a practice MEC contains a live charge until it can be determined otherwise. Expended pyrotechnic/practice devices may contain red/white phosphorus (WP) residue. Due to incomplete combustion, phosphorus may be present and re-ignite spontaneously if subjected to friction or the crust is broken and the contents exposed to air.
- Do not approach smoking WP MEC. Burning WP may detonate the burster or dispersal explosive charge at any time.
- Procedures in Chapter 13, Technical Manual 9-1300-214, Military Explosives, or other approved explosives analysis shall be used to identify the explosives.

If feasible, when circumstances prevent use of methods that require less time on potentially live UXO (e.g. BIP), and when approved by the USACE OE Safety Specialist, a field Radiographic Unit (X-Ray) will be used to identify MEC items that otherwise cannot be identified as inert or live. The X-ray may be used if the following conditions apply:

- No positive identification features are noticeable.
- No intrusive activities or minor intrusive activities are required to place and use X-ray unit.

- Weather conditions do not affect X-ray unit capabilities.
- Terrain conditions support the use of the X-ray unit.

The X-ray will be operated in accordance with the SOP (Appendix J).

2.4.4.11 Transportation

It is not anticipated that there will be any movement or transportation off site of any MEC found on this site.

2.4.4.12 Demolition Operations

The safest and most expeditious methods of demolition will be utilized in every case. Verification of the UXO filler shall be required prior to demolition to determine demolition procedures. Hazardous MEC found will be disposed the day on which encountered, if possible. Daily demolition operations may not be feasible due to availability of POMFD. If an item cannot be immediately disposed, it may be left in place, covered and the location marked via GPS or moved to a secure consolidation point on site. The UXO Technician III will present a proposed course of action to the SUXOS. If the SUXOS and the USACE OE Safety Specialist approve the plan, the UXO Technician III will then implement the plan. The usual and normal method of MEC disposal will be BIP. If the area cannot withstand a high-order detonation and the MEC is not safe to be moved, render safe procedures by military EOD will be required. If render safe or movement is not an option, then design and implementation of engineering controls to mitigate the effects of a high-order detonation must be implemented. Coordination with and approval by the USACE OE Safety Specialist is required before detonating a MEC item under such circumstances.

Fort Ord Detonation Notification Procedure

Prior to any detonation, the appropriate notification and approval procedure will be initiated. The approval procedure includes notification to, and approval from the BRAC Environmental Coordinator (Appendix F, Form M-3) and the POMFD (Appendix F, Form M-5). A list of local Points of Contact is included in Appendix C.

As soon as it is determined that a detonation will be required, the SUXOS will initiate this procedure. The SUXOS will schedule the demolition to allow sufficient time to complete all notifications and approvals.

Consolidated Shots

Consolidated shots will only be performed with authorization from the on-site USACE OE Safety Specialist. Movement of MEC items can be performed with his approval. Consolidated shots may be performed in the Impact Area at a location designated by the USACE OE Safety Specialist.

Demolition Procedures

During demolition activities, the SUXOS will have overall control of the site. An EZ will be established around the demolition-site. Only the SUXOS, the UXO Team, and UXO qualified safety personnel will be allowed within the EZ once the disposal operations have begun. The UXOSO and other assigned UXO Safety personnel will ensure safe work practices are observed, and the UXO Technician III will perform the necessary steps to safely dispose the MEC. Road guards will be placed around the work site area outside the EZ to ensure that unauthorized personnel do not enter the EZ.

Notification procedures will be conducted as follows:

- The appropriate MEC Disposal Checklists and notifications (Appendix F, Forms M-1 through M-5) will be completed for each disposal operation.
- Request the POMFD to come to the site and perform a fire risk assessment (Appendix F, Form M-5). All requests for risk assessment will require a 3-day notification and all demolition shots will require a 5-day notification.
- Complete a Detonation Approval Checklist/Risk Assessment (Appendix F, Form M-3) and submit to Lyle Shurtleff for approval by the BRAC Environmental Coordinator.
- Mass detonations require coordination with the Federal Aviation Administration (FAA), but are not expected for this project. If necessary, the USACE OE Safety Specialist will contact FAA for air clearance and will hold on line until the shot is fired.

The following technical procedures will be followed for all disposals by detonation:

- Explosive materials will be ordered from the Government (Section 3.1) and delivered to the site for use on the day designated.
- The UXO Team comprised of the UXO Technician III and a UXO Technician II will inspect the location, condition, and net explosive weight of the MEC to be disposed.
- The UXO Technician III will ensure that permission to detonate explosives has been obtained from the SUXOS and coordinated with the USACE OE Safety Specialist.
- It is the responsibility of the SUXOS to schedule the detonations and to ensure that all project personnel are accounted for before disposal operations begin.
- The UXO Team will then prepare enough explosive charges and shock tube initiating systems materials to perform the planned detonations. The transportation vehicle will then be loaded with the explosives, shock tubing initiating systems, and other equipment required.
- Unless otherwise approved by the USACE OE Safety Specialist, all demolitions will be tamped, except 40 mm grenades. Initiators will always be transported in a separate container from the main-charge explosives.

- A MSD of 50 feet will be observed for initiators and main-charge explosives while at the disposal site.
- If several MEC items are located in close proximity to each other a mainline/branchline shot may be used to destroy these MEC simultaneously to increase the efficiency of the operation.
- The UXO Technician III will observe the UXO Technician II position the explosive charge against the MEC. The disposal shot may be tamped, except for 40 mm grenades, to minimize the effects of the detonation. However, the initiators (caps) will never be buried.
- The UXO Technician III will then inspect the disposal shot and return to the safe firing point.
- POMFD will sound a one minute siren blast five minutes prior and a 30 second blast one minute prior to detonation.
- Prior to initiation, the UXO Technician III will ensure that guards are stationed at the roadblocks, scan the EZ for personnel, and sound three distinct blasts on an air or vehicle horn. He will then scan the area again and initiate the demolition charge if all is clear.
- In the event of a misfire, there will be a 60-minute wait time for Shock Tube Initiating Systems and a 60-minute wait time for electric misfires. A Misfire Checklist (Appendix F, Form M-6) will be completed by the UXO Technician III and filed with the daily logs.

Post-Demolition Operations

After successful initiation of the explosive charge, the UXO Team will conduct an inspection of the shot to ensure complete destruction of the MEC. After verification that no more detonations will be required, an "all clear" notification will be sent out to all parties on the notification list.

The UXO Team will collect for disposal all sandbag fragments, large munition fragments, and other debris, and generally clean and restore the site.

Engineering Controls

Engineering controls may be required to mitigate the effects of an intentional detonation. The goals of using engineering controls are to improve personnel safety and/or to reduce the MSD. The most common engineering controls are either soil cover or sand bags. HNC-ED-CS-S-98-7, 1998 provides guidelines for use of sandbags to mitigate blast and fragmentation effects during intentional detonations. DDESB TP 15, 2004 authorizes use of this equipment during removal actions when appropriately used in accordance with established guidelines. HNC-ED-CS-S-96-8, 1997 provides guidelines for use of soil, water tamping or other forms of barricading during demolition operations to reduce fragmentation and/or blast range. DDESB TP 15, 2004

authorizes use of these forms of barricading when appropriately used in accordance with established guidelines.

Disposition of Material Potentially Presenting an Explosive Hazard

This section is intended to guide Shaw UXO Technicians in the safe and efficient handling and disposal of Material Potentially Presenting an Explosive Hazard (MPPEH) found at MRS-16. Figure 2-3 contains a logic diagram for the disposition MPPEH. Because the metal scrap recovered will ultimately be disposed off-site, it is imperative that procedures be established to preclude hazardous materials from becoming intermingled with other non-hazardous metal scrap. The establishment of a chain of custody and audit trail is mandatory.

The following paragraphs provide procedures and guidance for management, demilitarization, and preparation of MPPEH. Shaw will use an approved scrap metal dealer who will ensure the material is smelted.

2.4.4.13 Regulatory Guidance

The following references provide the regulatory framework for processing and disposal of MPPEH, including MD recovered from active or former military ranges.

- DoD 4140.62 Management and Disposition of MPPEH
- DoD 4160.21-M: Defense Materiel Disposition Manual
- DoD 4160.21-M-1: Defense Demilitarization and Trade Security Control Manual

2.4.4.14 Collection and Segregation Procedures

Shaw will use a systematic approach for collecting and inspecting MPPEH. The approach is designed to ensure that all such material is 100 percent independently inspected and then 100 percent reinspected as part of certification and verification process.

Small Arms ammunition will be transported to an approved, state and/or RCRA permitted offsite facility for treatment and/or recycling.

The process will include:

- Non-munitions related scrap such as pop cans, paint containers, barrels, etc will be removed to facilitate the geophysical survey.
- Collecting and inspecting MPPEH larger than 2 inches weighing and recording by grid number.
- MPPEH inspection, evaluation, demilitarization, and certification will be accomplished daily.

At the operating site, Shaw will position two scrap metal containers. One will be marked 5X scrap in yellow paint and will be used to collect non-hazardous scrap which has been visually inspected and determined to possess no hidden cavities or areas that could contain explosive. The other will be labeled 3X MPPEH and will be used to collect munitions related material which cannot be visually verified as free of explosives without undergoing additional procedures.

Collection procedures begin at the time MPPEH is discovered by a UXO Technician. In the event that MPPEH is encountered by someone other than a UXO Technician, such as a member of the DGM team, it will immediately be brought to the attention of the UXO Technician on site. At this point the UXO Technician makes a preliminary determination as to the classification of the item. If the item is identified range debris or general trash it will be collected for disposal as trash. If the item is identified as munitions related and all cavities and surfaces can be visually inspected, it will be placed in the 5X container. If the item is probably not explosive filled but will require additional procedures to visually inspect it will be placed in the 3X container. At the end of the day any of the cavities of 3X MPPEH will be vented using a jet perforator.

Buckets will be placed at each grid to facilitate transport of the smaller collected scrap and MPPEH to the 3X and 5X containers.

2.4.4.15 Venting of 3X MPPEH

3X Munition debris will be vented in order to provide access to all cavities for visual inspection. This will be accomplished using a jet perforator in an area sufficient to accommodate the Explosive Safety Quantity Distance arc for the item if it were HE filled. Once completed the UXO techs will confirm that all cavities are visually free of explosives and place the items in the 5X container.

2.4.4.16 Demilitarization

Once the material has been determined to be free of explosives a Shaw UXO technician will demilitarize the items to the point it cannot be construed as a munitions item. Generally, this will require cutting the item in half using a partner saw or band saw. This process must meet or exceed the demilitarization requirements of DoD 4160.21-M-1.

2.4.4.17 Certification/Verification/Disposal of Munitions Debris

Once the demilitarization process has been completed all 3X, 5X, and expended small arms material will be 100 percent reinspected and placed in containers with serialized seals. A DD Form 1348-1A will be affixed to the side of each container. The form will include the serial of the seal and the signatures of the SUXOS as the "certifier" and a qualified government official as the "verifier." The form will also contain the statement:

> *"This certifies that the material listed has been 100 percent properly inspected and to the best of our knowledge and belief, are free of explosives hazards, engine fluids, illuminating dials, and other visible liquid hazardous, toxic, and radioactive waste materials."*

At the completion of the removal action, the sealed containers will be shipped to an USACE approved facility for smelting. The facility will provide a letter stating that the material has been destroyed by smelting thus ensuring the proper chain of custody has been maintained.

Using these procedures, Shaw ensures that the collected scrap metal is properly inspected and classified. The method includes three distinct inspections, which are performed by persons of increasing levels of responsibility. A qualified UXO Technician performs the first inspection at the operating grid; the supervisor responsible for the operating grid performs the second; and the final inspection is performed by the SUXOS who is vested with overall responsibility.

2.4.5 Demobilization

Demobilization may occur for several reasons: (1) the project has been completed with all work accomplished; (2) the project may be incomplete, but the contractor has expended most of the contract funds; (3) weather conditions may lead to demobilization; or (4) conflicts with endangered species. Whatever the reason, the Government, through its Contracting Officer, must convey officially to the contractor its decision to demobilize from the project site.

2.4.5.1 Demobilization upon Project Completion

Full demobilization will occur when the project is completed with appropriate quality assurance (QA)/QC checks performed. During final demobilization, personnel will be retained only as long as necessary. All personnel no longer required will be demobilized. The following will occur prior to demobilization:

- Verification that all areas to be investigated/cleared are completed to the Government's satisfaction
- Identification of all areas that could not be investigated/cleared

- Verification that site restoration has been performed to an appropriate level
- Ultimate disposition of property used during the project has been performed according to Section 9.0, PMP.

2.4.5.2 Unscheduled Demobilizations

Due to the high cost of demobilizations and remobilizations, the PM will closely monitor the rate of expenditures versus the rate of progress to determine whether the work can be completed within the allocated funds, and if not, request additional funding to avoid unscheduled demobilizations.

If weather conditions threaten to force an unscheduled demobilization, the decision to demobilize will be based on an analysis of the cost to stay on the project until the weather clears versus cost to demobilize. If the number of predicted productive days during the poor weather conditions is sufficient enough to show a benefit by staying on-site, the work can continue.

2.4.6 Site Security

Subsequent to the removal of the 6-foot chain link fence surrounding the site, a roving security patrol will be in place during periods UXO crews are not working in the area. The security patrol will be responsible for preventing unauthorized access to the site.

Shaw personnel will comply with Fort Ord MRS Security Program guidance concerning personnel access rosters and identification for personnel and vehicles operating on controlled roadways and in restricted areas.

2.5 Erosion Protection

During and at the completion of the project, Shaw will provide appropriate erosion control. The EPP for this work is presented as Section 11.0 of this SSWP. Escort is required for this task.

2.6 Data Collection

A grid data packet will be created for each new grid. Each packet will contain a map showing the location of the grid and the following forms:

- Grid Summary Sheet (Appendix F, Form M-7) identifying grid summary information including:
  - Grid Name or Identification
  - Southwest Grid Corner Coordinates
  - Grid Dimensions and Acreage
  - UXO Team Personnel
  - Total Number of MEC Found

- Total Weight of MD Removed
- Hours Worked Each Day Performing Various Tasks
- Team Leader/SUXOS/UXOQCS/USACE Signature Blocks

2.7 Community Relations

The MEC project team will only perform community relations when requested by the Contracting Officer for a specific task/project. When approached by any person or entity requesting information about a project, site personnel will defer to the USACE on-site representative and/or installation representative as appropriate. Shaw will not make available or publicly disclose any data generated or reviewed under this contract or any subcontract unless specifically authorized by the Contracting Officer. Reports and data generated under this task order will become the property of the Government and distribution to any other source is prohibited unless authorized by the Contracting Officer.

During the implementation of actions under this contract, the Army will implement community relations activities based on the assessed level of community interest. These community relations activities include a direct notification program for individuals regarding the prescribed burn and a voluntary relocation program during the prescribed burn for Monterey County residents. For further details, please see Appendix M, Relocation/Notification Plan. As directed by the Contracting Officer, Shaw will assist with community notifications and public notices.

2.8 Final Report

At the completion of the removal activities, a site-specific report to document all operations and activities will be developed and submitted. The Site Specific After Action Report will consist of the following:

- Detailed accounting of all MEC materials located and destroyed
- GPS locations of all demolition shots
- Detailed information on the densities and distribution of MEC in the area
- A system of daily journals of all activities associated with this Statement of Work. A daily journal for the site will be opened upon first arrival for field operations and closed after demobilization from the project site
- A recapitulation of exposure data. This will include total number of man-hours worked on-site in MEC-related activities and any information from accident/incident reports.
- All QC documentation
- All scrap turn-in documentation

- Color digital pictures of sufficient quality to allow easy identification of the item being photographed. This will include pictures of all MEC located during the removal action, all demolition shots (before and after detonation), and any significant events during the course of the fieldwork. The digital pictures will include the anomaly number in the file name for each picture. The pictures will be imported into the text of the removal report.
- Identification of any areas where removal of MEC was not completed.
- Identification of any anomalies abandoned in place.
- Detailed maps, which provide accurate information of all MEC encountered and to what depths. The maps will be developed on the previously prepared survey. The maps will be sufficiently detailed so that they will serve as a permanent record of the extent of all MEC encountered.

The report and maps will be submitted in hard copy and electronic format as required by the scope of work. Field documents will be scanned into Adobe Acrobat portable document format (PDF).

3.0 Explosives Management Plan

This Explosives Management Plan provides details for management of explosives to be employed if necessary at MRS-16. This plan was developed in accordance with DID MR-005-03, Federal Acquisition Regulation 45.5, local and state laws and regulations, Alcohol, Tobacco, and Firearms P 5400.7, DoD 6055.9-STD, U.S. Department of Transportation regulations, and Army Regulation 190-11.

3.1 Acquisition

Shaw will acquire Government-owned explosives from the USACE OE Safety Specialist (Clinton Huckins). Shaw maintains a valid Bureau of Alcohol, Tobacco and Firearms (ATF) Explosive User permit. A copy of the ATF dealer license and the Shaw's Explosive User permit will be maintained at the project site, and upon request, will be made available to any local, state, or federal authority.

The SUXOS, Mr. Mathisen, is designated as the primary individual authorized to receive explosives. The UXOSO will be designated as the alternate in the event that Mr. Mathisen is not on site. In the event that both Mr. Mathisen and the UXOSO are absent, approval for an alternate must be obtained from the Contracting Officer.

Shaw personnel will transport explosives from the storage facility at the former Fort Ord Ammunition Supply Point, Barloy Canyon, to the work site. Types and estimated quantities of explosives and their intended use during this project are specified below. Typically, the following explosives will be used for disposal of MEC or venting of inert munitions:

- C-4 plastic explosives and/or perforators will be used to detonate MEC.
- Detonating cord will be used to construct mainline-branch line shots, to link multiple shots together, or to transmit the explosive train to the main charge explosive when the main charge is buried (tamped), underwater, or otherwise inaccessible.
- Non-electric (NONEL) initiators will be used to initiate the explosive train. NONEL tubing will be used to transmit the explosive train from the igniter to the demolition devices. Shock tube priming of explosives offer the instantaneous action of electric detonation without risk of accidental initiation of the blasting cap (and the charge) by radio transmitters in the area, or by static electricity discharge. The explosion of the shock tube is entirely contained within the plastic tubing.

3.2 Initial Receipt

Explosives will be transported to the project site on an as-required basis. An initial receipt inventory will be conducted before the explosives are transferred from Shaw.

The quantities received will be consumed on the day delivered or returned to the government storage facility. Explosive materials will not be stored on the project site. Copies of the receipt documentation will be filed at the on-site office and placed in the project's permanent archive file.

3.3 Storage

Since the Government has an existing explosive storage facility, Shaw is not required to establish a facility to store explosive materials.

3.4 Transportation

This section presents the vehicle requirements and on-site transportation procedures for explosives at the MRS-16 project area.

3.4.1 On-Site Transportation Procedures

Explosives will be receipted from the government and transported to the project site by Shaw personnel. Explosives will be transported in an appropriately placarded vehicle following the procedures stated in this section to the designated area when demolition activities are planned. Figure 3-1 shows the location of the government storage area relative to the work site.

Recovered MEC will not be moved unless safe to do so and only with the specific permission of the USACE OE Safety Specialist on site. Movement of MEC is the last consideration and will only be performed when a UXO Technician can make a positive identification that the munition is unfuzed and considered movable. Identification must be verified by at least one other UXO Technician prior to movement. The USACE OE Safety Specialist may require additional measures and inspection before movement and preparation for transportation.

On-site transportation procedures will include the following safeguards:

- The driver of any vehicle carrying explosives or MEC will ensure that the load is properly braced.
- Initiators will be carried separately from main charge explosives.
- The driver and any passengers transporting explosives or MEC will not carry any smoking products or flame producing devices. Smoking will be strictly forbidden among all personnel involved in the handling or transportation of explosives and MEC.
- If loose pyrotechnic, tracer, flare, or similar mixtures are to be transported, they will be placed in #10 mineral oil or equivalent to minimize fire and explosion hazards.
- If an unfired rocket motor must be transported, it shall be positioned in such a manner as to offer the maximum protection to personnel in the event of an accident.

- If base-ejection type projectiles must be transported to a disposal area or collection point, the base will be oriented to the rear of the vehicle and the projectile secured, in the event the ejection charge detonates in route.
- All MEC items will be positively identified, as to the type of munition, filler, and condition of the fusing prior to any movement.
- If MEC with exposed hazardous filler (HE, WP, etc), has to be moved to a disposal area, the item will be placed in an appropriate container with packing materials to prevent migration of the hazardous filler. Padding will also be added to protect the exposed filler from heat, shock, and friction.

3.4.2 Vehicle Requirements

Vehicles transporting explosives on the project site will comply with the following requirements:

- Vehicles transporting explosives will be placarded when carrying any Class 1 explosives.
- All vehicles transporting explosives will be equipped with reliable communications, a first aid kit, and two 10-pound BC fire extinguishers. One extinguisher will be located in the driver's compartment and the other located in the cargo compartment.
- Vehicles transporting explosives will be inspected daily when in use, and the inspections will be documented on an Explosives Transportation Vehicle Safety Checklist (Appendix F, Form M-10).
- The vehicle used to transport the explosives will have a non-sparking bed liner, and all explosive loads will be covered prior to departure.

3.5 Receipt Procedures

This section describes the procedures that Shaw will use to maintain records of explosives inventories and usage.

3.5.1 Inventory Control and Records Management

An accurate running inventory of all explosives received, used, and or returned back to the Government will be maintained. Copies of all paperwork pertaining to explosives received, used, and or returned, will be maintained by the SUXOS in the field office.

3.5.2 Authorized Individuals

The SUXOS will be responsible for the proper receipt and use of explosives for detonation purposes. He may authorize other specific individuals to perform the receipt and initial inventory of the explosives, but cannot delegate the responsibility for ensuring that the inventory, receipt, usage returns, and handling of the explosives is performed in accordance with the

requirements of this plan. Any individual authorized to receive explosives will be at least a UXO Technician III.

3.5.3 End User Certification

The SUXOS or UXO Technician III, as the end user of explosives, will certify in writing that the explosives were used for their intended purpose. This information is tracked on the Explosives Usage Record (Appendix F, Form M-11) and is included with daily reporting.

3.5.4 Reconciling Discrepancies

In the event that there is a discrepancy with any aspect of the management of explosives, the SUXOS will be immediately notified. The SUXOS, together with the UXOSO and UXOQCS, will review documentation to determine whether the discrepancy is a paperwork error or whether explosives have been lost or stolen. If it is concluded that explosives have been lost or stolen, the USACE OE Safety Specialist will be notified and the procedures specified in Section 3.7 will be implemented.

3.6 Inventory

Since no explosives will be stored on this project site, the inventory of explosives refers only the receipt and expenditure of the explosives ordered for a single day's activity.

3.7 Lost, Stolen, or Unauthorized Use of Explosives

If explosives are discovered to be lost, stolen, or used without authorization, the incident will be immediately reported to the SUXOS, who in turn, will inform the USACE OE Safety Specialist, Shaw PM, and Shaw Range Services and MR Center.

As the federal licensee, Shaw is required by law [27 Code of Federal Regulations (CFR) 55.30] to report the theft or loss of explosives to the ATF within 24 hours. In the event of such an occurrence, the following procedures will be followed:

- Shaw will make the appropriate notifications in accordance with 27 CFR 55.30. These include calling ATF (800-424-9555) and the local law enforcement authorities.
- Shaw will be responsible for completing and forwarding ATF Form 5400.5 (Appendix F, Form M-12). This form will be completed by the SUXOS, and a copy will be provided to the USACE OE Safety Specialist.

4.0 Explosives Siting Plan

This plan for siting explosives operations conforms to the requirements of DID MR-005-04. It is intended to ensure the safety and security of explosive operations during removal activities at MRS-16.

4.1 Exclusion Zones and Minimum Separation Distances

The MGFD for MRS-16 is the 2.36" rocket with a MSD of 809 feet. This distance was computed in accordance with DDESB TP 16, 2003. Engineering controls can be used to reduce the MSD when evacuation perimeters around the work site(s) do not permit establishment of the needed 360 degree EZ. Use of engineering controls can serve as an alternative to evacuation to the full MSD for the MGFD, but decreases work production rates, requires additional equipment and materials, and site approvals for use. Reducing the EZ zone with engineering controls is based on tests that follow the guidelines described in CEHNC memoranda identified below:

HNC-ED-CS-S-98-8, 1998 provides guidelines for use of the MOFB, (commonly referred to as the "Bud-Lite") for use during intrusive operations such as MEC investigation and anomaly excavations. This equipment authorized for use by DDESB TP 15, 2004 mitigates fragmentation range in 3 directions (sides and front) in the event of unintentional detonations, but offers no blast mitigation capability.

HNC-ED-CS-S-98-7, 1998 provides guidelines for use of sandbags to mitigate blast and fragmentation effects during intentional detonations. DDESB TP 15, 2004 authorizes use of this equipment during removal actions when appropriately used in accordance with established guidelines.

HNC-ED-CS-S-96-8, 1997 provides guidelines for use of soil, water tamping or other forms of barricading during demolition operations to reduce fragmentation and/or blast range. DDESB TP 15, 2004 authorizes use of these forms of barricading when appropriately used in accordance with established guidelines.

The MSD will be applied to various MR activities when operations are occurring in MRS-16 as follows:

- 809 feet for vegetation removal using mechanical methods
- 809 feet during the prescribed burn (a larger setback distance may be established by the POMFD)
- 809 feet during MEC investigation and anomaly excavation without engineering controls

- 200 feet to the sides and rear of a MOFB and 809 feet from the front of the MOFB during MEC investigation and anomaly excavation with appropriate engineering controls for unintentional detonations
- 200 feet between UXO and geophysics teams when no intrusive activities are occurring
- 200 feet during intentional detonations with appropriate engineering controls
- 809 feet for intentional detonations without appropriate engineering controls

Only personnel essential to the project will be permitted access into the EZ. Essential personnel are expected to include the SUXOS, UXOQCS, UXOSO and the personnel listed in Section 2.3.2.

Special consideration is required with regard to the BLM property adjacent to the south east corner of MRS-16. Work will be scheduled to reduce the inconvenience to BLM to the extent practicable.

If MEC larger than a 2.36" rocket is discovered, or if warranted by the quantity of MEC discovered, all work will be halted and a new EZ will be designated based on the item found. If demolition operations are to be performed, the SUXOS will compute a safety zone based on the type of MEC involved and the quantity of explosives required to destroy that type of MEC. The USACE OE Safety Specialist will approve this computation before demolition activities can be performed.

The EZ will be established based on the K328 value for the quantity of the explosives used obtained from DoD 6055.9-STD (Chapter C9).

4.2 Explosive Storage and Planned Demolition

Explosives will not be stored at the project site. All necessary coordinations will be made prior to the request for explosives. Explosives will be receipted from the government storage facility and transported by Shaw personnel as required.

Once the SUXOS has signed the receipt for the explosives, he will direct the demolition crew to commence the BIP operation as expeditiously as safety will permit in order to reduce any security concerns over explosives. If explosive operations are to be performed, an EZ will be established based on the amount of the explosive to be used during the demolition activities. This distance will be computed as the K328 distance for the maximum quantity of explosives to be used.

5.0 Geophysical Prove-Out Plan and Report

This document details the GPO Plan and Report for DGM at MRS-16. Data collected during the GPO at the 5 ODDS plots at Badger Flats will be used to demonstrate the performance of the equipment and personnel that will be used for performing the full-scale DGM investigation and removal actions. Government-furnished equipment [towed array system and Leica Real Time Kinematic (RTK) GPS systems] transferred from the previous contractor (Parsons) will be utilized. The GPO plan will be conducted in accordance with the U.S. Army Engineering Support Center, Huntsville (USAESCH) DID MR-005-05A and MR-005-05. Based on the results of the prove-out analysis, Shaw will verify to the USACE, Sacramento District, that the equipment and preferred instrument configurations, and survey techniques are optimal to be used for the DGM of MRS-16. The Contracting Officer Approval Letter for the GPO Plan (per DID MR-005-05A), will be included in Appendix P of the final SSWP.

5.1 Introduction

The site is a World War II era rocket range and is identified as a "bazooka practice" area. Records indicate the site was used as an anti-armor training area and that both practice and high explosive antitank rounds were used.

5.2 Geophysical Prove-Out Objectives

5.2.1 GPO Tasks

The following principal tasks will be performed in the GPO.

- The existing ODDS prove-out test grids (located at MRS-BLM) will be used and are expected be in an area with site, soil and geological conditions representative of MRS-16.
- The ODDS plots will be geophysically surveyed over the test grids to select the most appropriate geophysical sensors and sensor deployment using the Leica RTK GPS system for navigation.
- The sufficiency of the equipment, survey techniques, and data management, processing, and interpretation to meet the removal requirements will be evaluated.
- Anomaly relocation techniques will also be evaluated.
- Sufficiency of QC methods and techniques will be evaluated.
- A GPO letter report will be prepared and submitted to USACE for approval.

It is expected that the GPO will be conducted in close coordination with the USACE Geophysicist. Additional technical planning meetings will be held as necessary to plan and coordinate the GPO.

5.2.1.1 MEC Detection

The selection of the most appropriate technology is dependent on site conditions related to vegetation, topography, soil type, proximity to structures, degree and type of metallic debris, as well as type, distribution, and number of MEC. The performance capability of selected field equipment may vary within the site based on specific circumstances, such as the following:

- Item orientation
- Site background/noise levels
- Masking effects from adjacent metallic items
- Item shape
- Material composition of buried targets
- Weathering effects on the magnetic conductivity of item materials
- Soil properties
- Depth of burial

5.2.1.2 General Data Quality Objectives

The following DQOs are believed to provide sufficient metrics to quantify the quality of the data collected for the project. It is stressed that these DQOs are intended as objectives only, and will be used to monitor and evaluate the quality of data collected. Several of theses DQOs will be quantified based on site-specific factors in the GPO and from the experience of the previous contractor (Parsons).

- **Background Noise based on Leveled Survey Data Set**. A DQO for background noise will be established by the Project Geophysicist, in consultation with the USACE, based on site-specific and deployment-system-specific performance demonstrated during the GPO. Previous work by Parsons identified background levels of 3 millivolt (mV) in EM61 MK2 channel 3 data, and 3 nanoTeslas (nT) for the G858, with production levels below 2 mV for the EM data. The data will be clipped such that any measurements that are well above the background noise will not be included in these statistics. The clipping value(s) will be recorded.

- **Mean Speed:** Maintain mean speed < 3 miles per hour (mph). The speed will be evaluated based on sensor orientation and bounce in terms of the amount of noise introduced into the data and along line sample spacing. The speed will be tested for the proper data density along track. It is understood that Parsons was successful at maintaining a proper data density at a speed approximately 4 mph.

- **Along Track Sampling:** < 0.6 feet with cumulative gaps less than 2 percent of the line distance.

- **Across Track Sampling:** < 2.0 feet, excluding data gaps due to trees or other obstacles that preclude the survey platform from providing complete coverage. This metric is intended to control data gaps associated with inconsistent track plots that are not associated with trees or other obstructions. For the purposes of this project, minor occurrences (those not associated with physical obstructions) will not be accepted if they exceed 0.5 feet. As per the site DQO, deviations will not exceed 50 percent of the line spacing and the gaps will be less than 4 square feet.

- **Latency Correction:** No visible chevron effects in the data or pseudo-color plots. The use of appropriate color scaling will be maintained throughout the project.

- **Data:** Profile data will be representative with no systematic or sporadic system noise**.**

- **Data Leveling:** Consistent parameters and processing methods will be used for all channels within each dataset. Consistent processing routines will be used for all datasets throughout the project.

- **Anomaly Selection:** All anomaly selections for a given dataset will be reasonable and should identify all MEC or MEC-like items. This will be verified by the Project Geophysicist or their designee. Protocols will be tested and evaluated using GPO data and routines for the production survey finalized based on these results.

- **Positioning Errors:** Two positional errors are possible.

    1. Calibration Positional Check: The navigation (RTK GPS) will be used to reacquire location data at known fixed locations at the beginning and end of the day. The acceptable difference in location measurement is <0.5 feet.

    2. Dynamic Position Check: Cumulative navigation positioning errors are not to exceed 2.0 feet. A functionality test will be performed each morning and evening to quantify the accuracy of the positioning/navigation system.

- **Known Location QC Items:** Ground flush rebar hubs will be established at grid corner locations for use as known location items. All known QC locations must be detected to within 2 feet of their known locations.

- **Reacquisition:** Reacquisition of target anomalies must be successful to within 2.0 feet of their interpreted location. Additionally, 95 percent of all anomalies must lie within a one meter radius of their original surface location as marked on the dig sheet.

- **False Positives:** False positives will be kept to a minimum. This will be achieved by careful data collection activities (i.e. stable, fluid motion) and careful data processing techniques. Per DID MR-005-05, more than 15 percent false positives (anomalies reacquired which resulted in no detectable metallic material recovered in excavations calculated as a running average for the sector) will result in a reevaluation of the data, detection methods, and overall project QC.

In addition, the applicable MR DIDs shall also be adhered to.

5.3 Site Conditions

Site conditions are described in the following sections obtained from *Former Fort Ord, Monterey, California Ordnance and Explosives (OE) Cleanup, Ranges 43-48 Site Specific Work Plan, August 2003* (Parsons, 2003), and *Final Ordnance Detection & Discrimination Study (ODDS) Report, Volumes I – VI, January 2002* (Parsons 2002b).

5.3.1 Topography and Vegetation

Topographic conditions affect geophysical mapping in terms of sensor deployment and sensor positioning. The predominant topography of the former Fort Ord is typical of dune sand deposits that underlie the western and northern portions of the base. In these areas, the ground surface slopes gently west and northwest, draining toward Monterey Bay. Elevations at the former Fort Ord range from approximately 900 feet above mean sea level near Impossible Ridge, on the east side of the base, to sea level at the beach. The hummocky topography in the southeastern third of the base is notably different from the rest of the base. This area has relatively well-defined, eastward-flowing drainage channels within narrow, moderately to steeply sloping canyons. In general, all types of grade can be expected including relatively flat areas, shallow grades, moderate slopes, and steep slopes.

Central maritime chaparral is the most extensive natural community of vegetation at the former Fort Ord, occupying approximately 12,500 acres in the south-central portion of the base. Oak woodlands are widespread at the former Fort Ord and occupy the next largest area, about 5000 acres. Approximately 4,500 acres of grasslands cover the southeastern and northern portions of the base.

Other potential impacts on geophysical investigations due to vegetation include:

- Worker safety considerations due to poisonous or hazardous plants
- Site access limitation due to dense vegetation. Dense vegetation is expected to be removed by the prescribed burn operations at the site.
- Deployment obstructions due to immovable obstacles such as trees and hedges
- Access and productivity reduction due to encountering endangered/protected plant species.

5.3.2 Geologic, Soil and Hydrogeologic Conditions

The former Fort Ord lies within the Coast Ranges Geomorphic Province, and generally reflects the transitional condition characterized by the Coast Ranges; older, consolidated rock is exposed at the ground surface near the southern base boundary and becomes buried under a northward-thickening sequence of poorly consolidated deposits to the north. The former Fort Ord and the adjacent areas are underlain by one or more of the following units:

- Mesozoic granitic and metamorphic rocks
- Miocene marine sedimentary rocks of the Monterey Formation
- 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:
  - Plio-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
  - Recent alluvium

Geologic conditions affect DGM through influence of soil and rock constituents on the magnetic and/or electromagnetic response of UXO items. For example, minerals associated with mafic rocks (generally dark-colored igneous rock with significant amounts of one or more ferromagnetic minerals) or magmatic rocks (with significant amounts of iron and magnesium) significantly affect the magnetic properties of the soil and complicate the geophysical signatures of UXO in proximity to these soils. Similarly, soils with increased amounts of electrically conductive minerals can produce complex electromagnetic signatures that degrade the UXO detection and characterization process. Evaluation of site-specific geologic conditions is executed through; (a) review of geologic and soil maps that describe the subsurface mineralogical conditions, and (b) review of the site through a site walk-over whereby geologic and soil effects can be directly verified and evaluated. The soils map for the former Fort Ord is presented in Appendix B, Plate B2. The geologic map of the MRS-16 area is presented as Figure 5-1.

The most significant effects of the geologic conditions at the former Fort Ord are associated with the Santa Margarita Formation. This formation includes units containing significant amounts of iron matrix mineralization that manifest as magnetic concretions. These magnetic concretions are spherical, ranging from 1 to 3 centimeters (cm) in diameter, and are present throughout the former Fort Ord. The effect of the Santa Margarita Formation on the geophysical sensors is based on the local condition of the concretion-bearing units. At the former Fort Ord, depending on the specific site, the unit can be exposed at the surface, present beneath the surface, or eroded away leaving concentrations of magnetic concretions.

While poorly documented throughout the facility, the condition of the Santa Margarita Formation affects the geophysical mapping process in three ways:

1. When exposed on the surface, magnetic concretions cause anomalies in the geophysical data. EM methods will be less significantly affected as compared to magnetic methods.
2. When buried, the effects of concretions are anticipated to range from minor to severe, depending on the depth of burial (soil overburden thickness) and the concentration of items.
3. When the Santa Margarita Formation is eroded away, the effects of the concretions may be severe. As the concretions are resistant to erosion, the erosion of the formation can leave large accumulations of these items in the remaining soil that can result in large anomalies in the data.

At the former Fort Ord, the soil is sandy and prone to movement under the influences of water and wind causing MEC to either migrate off-site or to be buried deeper than would normally be expected for the MEC type. Post-range development may also have occurred in certain areas, potentially resulting in cuts and/or fills which would also alter the depth at which MEC is present. However, Parsons' ODDS results indicate that in MRS-16 area all the items including 2.36-inch rockets, rifle grenades and fragments found were within 24 inches of the surface.

Two types of soil conditions impact UXO detection and characterization. First, natural soil effects are directly associated with the geologic conditions of the site as discussed above. Second, migratory soil effects can be caused by earth moving/construction activity as well as natural erosion due to wind and water forces. Under this second category, complications to digital mapping methods include;

- Increased UXO depth due to soil emplaced on UXO contaminated sites
- UXO placed within berms
- UXO-contaminated soils used as fill material.

The presence of groundwater affects the performance capabilities of geophysical mapping methods with varying degrees, depending on geophysical sensor. For example, groundwater has minimal effect on magnetic and time-domain electromagnetic sensors. Groundwater is not expected to be an issue at MRS-16 or the ODDS plots with the exception of immediately following precipitation events. The Site Geophysicist is responsible for the assessment of groundwater conditions.

5.3.3 Geophysical Conditions

The earth's magnetic field, believed to originate in currents in the earth's liquid outer core, varies in intensity from approximately 25,000 nT near the equator, where it is parallel to the earth's surface, to approximately 70,000 nT near the poles, where it is perpendicular to the earth's surface. In the United States, the intensity of the earth's magnetic field varies from approximately 48,000 to 60,000 nT and has an associated inclination ranging from approximately 58 to 77 degrees. At the former Fort Ord the inclination is 61.5 degrees.

Previous DGM surveys at Fort Ord document background levels of 1-3 nT/foot for magnetometer/gradiometer and 1-3 mV for EM61 surveys.

5.3.4 Site Utilities and Man-Made Features

Many areas at the former Fort Ord that require investigation and/or MEC removal are remote former ranges with no development. However, the former use of many of these sites as testing and training facilities introduces the possibility that the sites have surface and subsurface utilities present. Site utilities and man-made structures will not affect the GPO surveys at the ODDS plots.

5.3.5 Site-Specific Dynamic Events Affecting Geophysical Investigations

Dynamic events (rain, lightning, solar flares, etc.) may temporarily impact geophysical data collection and/or data quality. For the purposes of the GPO, the data will be collected at the ODDS Plots during a "no rain" period.

5.3.6 Potential Worker Hazards

Other than the potential to encounter UXO, only the normal field-related hazards are expected. These include slip-trip-fall, poisonous and/or stinging flora and fauna, heat or cold stress, etc. All hazards are addressed in the site-specific health and safety plan and will be reviewed with the field team prior to the GPO operations at the ODDS Plots.

5.3.7 Site Access

Site conditions at the former Fort Ord pose no significant challenges in terms of site accessibility and system deployment impediments. Although, not necessarily an issue at the ODDS plot,

where the roads have been cleared and are passable with a 4-wheel drive vehicle, the following general site conditions and remedies are expected at most remote sites:

- **Remote access:** Many sites will be at distances from roadways and/or trails or across terrain that makes routine access difficult. In most of these cases, access difficulties can be anticipated well in advance via analysis of topographic maps and aerial photographs, and access routes established via 4-wheel drive, (4WD) off-road vehicles. Access to the ODDS test grids via 4WD vehicle is expected.
- **Poisonous plants:** Much of the former Fort Ord site has significant poison oak covering potential survey sites. To the maximum extent possible, these plants will be removed prior to surveying by brush cutting and/or burning.
- **Sensitive habitats:** In cases where surveying is coincident with the location of sensitive plant or animal habitats the Site Biologist, in conjunction with the Site Geophysicist, will be responsible for issuance of a memo of sensor deployment options. This memo will be submitted to the USACE Project Manager who will review the recommendations and discuss them at the next scheduled bi-weekly project status review meeting.
- **Steep slopes:** Unsurveyable, steep slopes are not expected at the ODDS site.
- **Thick vegetation:** Vegetation will not be an issue at the ODDS site.

5.4 GPO Prove-out Grid

The existing seeded ODDS grids at Badger Flats (MRS-BLM) will be used to test and demonstrate the most appropriate DGM system and procedures to meet the project objectives in the type of soils present. Two of the grids are "known" plots where types, depth and orientation of seeded items are known. The other three are "unknown" plots where the information is not publicized. Two of the unknown plots are level, open and grassy. The other "unknown" plot has a moderate slope and is slightly brushy.

5.4.1 Site Selection

Normally, locations for a GPO are chosen based on review of geology maps, soil maps, topography maps, access considerations, and site geologic reconnaissance over the site. However, in this case the existing ODDS plots at MRS-BLM will be used. The seeded test areas at MRS-BLM are presented as Figure 5-2. The ODDS test plots that pertain to MRS-16 are presented in detail in Figure 5-3.

5.4.2 Seed Items and Test Plot Design

Figure 5-3 illustrates the 5 ODDS plots design.

5.4.3 Prove-out Grid Construction

The ODDS grids are approximately 180'x100' (4 grids) and 90'x100' (1 grid) in size.

5.5 Geophysical Survey Equipment

The geophysical technology to be tested and evaluated on this site has three main components: sensors, navigation, and deployment system. The system will be positioned with a Leica RTK GPS system. Technical aspects of these components are discussed below.

5.5.1 Geophysical Sensors

Based on historical information on earlier DGM performed at Fort Ord, Shaw's experience at other MEC sites as well as the complicated geology and surface conditions at this site, focused GPOs will be conducted using the Geonics EM-61 MK2 time domain (TD) EM sensor and the Geometrics G858G magnetometer system. The EM61-MK2 sensor will likely be selected for production DGM. Previously at Fort Ord, it was found that the EM61-MK2 was more durable than the G858 and less likely to have equipment failure. Additionally, the EM61-MK2 was less affected by the magnetic concretion of the Santa Margarita Formation than the magnetometer. From Parsons' ODDS report we see that the EM techniques consistently out-performed the magnetometer in the field studies. The excavation results show that the targets are both ferrous and non-ferrous. Since the magnetometer detects ferrous materials and the EM61 is capable to detect both, the EM61 MK2 is the more suitable instrumentation. A Leica RTK GPS system will be the primary navigation system with a Leica 1200 Robotic Total Station (RTS) as the secondary system if unusual conditions are encountered.

5.5.1.1 Geonics EM-61 MK2

The Geonics EM-61 MK2 is a 4-channel high-sensitivity time-domain electromagnetic sensor designed to detect shallow ferrous and non-ferrous metallic objects with good spatial resolution and minimal interference from adjacent metallic features. TD EM sensors work by utilizing an EM transmitter which generates a pulsed primary magnetic field in the earth, which induces eddy currents in nearby metallic objects. The eddy current decay produces a secondary magnetic field measured by the receiver coil of the EM-61 MK2. Measurements are taken a relatively long time after the primary pulse at specified time gates which allows the current induced in the ground to have dissipated, leaving only the current in the metal to still produce a significant secondary field.

The EM-61 MK2 consists of two air-cored, 1-meter by 0.5-meter rectangular coils. This instrument has a higher sensitivity and resolution than the larger coiled (1 x 1 meter) EM-61. Secondary voltages induced in both coils are measured in mV. The coils are stacked 40 cm apart, with the source/receiver coil located below a second receiver coil.

Three modes of operation are available: (1) trailer mode, in which the coils are carried on a wheeled cart; (2) harness mode, in which the operator carries the coils on a shoulder harness, and (3) array mode whereby two or more coil systems are ganged into an array for high-productivity coverage. Towed array systems will be used at Fort Ord with possible single unit systems to in-fill the data.

The EM-61 MK2 records a voltage output from both coils, as well as a differential that is the calculated voltage difference between the two coils. The responses at four specified time gates are recorded and displayed by an integrated data logger. The EM-61 MK2 data will be collected at the maximum effective rate, which is anticipated to be minimally 10 hertz (Hz). All four time gates will be collected by the lower coil and used for evaluating decay curves for specific anomalies.

The use of EM technology as a primary detection, location and characterization device is dictated by several factors including terrain, vegetation, metallic composition of targets, surface clutter, soil conditions, and proximity to metal structures.

If the presence of non-ferrous metal targets is suspected or magnetic concretions in significant quantities are present, the use of the EM61 MK2 is applicable since it is capable of detecting non-ferrous metals and is not affected by magnetic geology. The EM61 may detect buried metal beyond 4 feet depending on the size of the target and the contrast between the native soils/geology and the target. Additionally, the EM61 MK2 response is focused directly beneath the coils so the response from nearby structures is minimal compared to other sensors such as the magnetometer.

In order of preference the system deployment includes towed arrays, push carts, and backpack/handheld configurations. The decision related to the most appropriate form factor follows the linear sequence of evaluation of the three options. First, towed arrays will be utilized if a site has appropriate vegetation and topographic conditions that allow deployment. This is expected to be the case at the former Fort Ord. Towed arrays will be deployed using the Parsons' trailer previously utilized at the former Fort Ord. If towed arrays are determined to be inappropriate in certain areas at MRS-16 the man-towed cart will be evaluated. Carts are appropriate if the topography and vegetation can be navigated with a wheeled device as discussed above. The cart will also be tested over the ODDS Plots before deployment. If vehicle-towed arrays and pushcarts are not applicable, then backpack/handheld configurations will be evaluated. If steep topography or thick vegetation is an impediment to primary sensor deployment, the EM61-HH may be used at the request of USACE. Should the EM61-HH be deployed, a partial GPO will be performed. Only in conditions where thick vegetation such as hedges and bushes are present will the backpack system be unusable.

5.5.1.2 Geometrics G858 Magnetometer/Gradiometer

Total field magnetic surveys will utilize Geometrics G858G total field magnetometers for survey data acquisition and a G858 magnetometer for base station measurements. The G858G, which is an optically pumped cesium vapor instrument, measures the intensity of the earth's magnetic field in nT. Magnetometer samples are typically collected at a rate of five samples per second per channel. For the survey the G858G will be operated in the vertical magnetic gradient mode, however, both the vertical magnetic gradient data and either the total magnetic field or a derivative (e.g. analytic signal) of the lower sensor will be evaluated.

The earth's magnetic field undergoes low-frequency diurnal variations associated with the earth's rotation, generally referred to as magnetic drift. A base station G858 proton precession magnetometer is used to monitor and record this drift so that it can be removed from the field data during processing.

The G-858G magnetometers can be deployed in a variety of configuration form factors (system configurations that include sensors, navigation components, and deployment apparatus). Magnetometers can be deployed as sensor pairs or as multiple-sensor arrays. They can be deployed via backpack where an operator carries a single G858G unit, via pushcarts where up to eight magnetometers collect data simultaneously, or via vehicles such as Surface Towed Ordnance Locator System or Multi-Sensor Towed Array Detector System tow arrays of sensors. These form factors provide a suite of options that allows for the overall objective to be met; to detect and locate all UXO that can be detected through application of available technology.

For magnetometer-based systems the definition of the best configuration depends on;

- Defined health and safety hazards
- Number, type, and distribution of suspected targets
- Existence of potential influencing cultural features (e.g., utilities, fences, structures, power lines, etc.)
- Most appropriate sensor configuration form-factor (backpack or cart-based)
- Most appropriate sensor navigation method.

If non-ferrous metal targets are suspected to be present, then EM sensors must be used as magnetometers measure anomalies in the earth’s magnetic field caused by ferromagnetic materials. If ferrous-rich geologic formations are present magnetometers are ineffective. Total field magnetometers are used when the removal is beyond 4 feet as they theoretically have a deeper depth of investigation. Magnetometer data also requires more geophysical insight and added steps during data processing activities.

Deployment configurations in order of preference include towed arrays, push carts, and backpack/handheld. The decision related to the most appropriate form factor follows the linear sequence of evaluation of the three options. First, towed arrays will be utilized if a site has appropriate vegetation and topographic conditions that allow deployment. Vehicle arrays can be utilized to deploy total field magnetometers. An additional consideration for a decision to use towed arrays is cost, as vehicle-based surveys have higher unit costs than pushcart surveys for small sites (less than approximately 25 acres). If towed arrays are determined to be inappropriate, man-powered pushcart systems will be evaluated. These carts can house total field magnetometers in both standard and gradiometric configurations. Carts are appropriate if the topography and vegetation can be navigated with a wheeled device as discussed above. If vehicle-towed arrays and pushcarts are not applicable, then backpack/handheld configurations will be evaluated. Only in conditions where thick vegetation such as hedges and bushes are present will the backpack system be unusable.

5.5.2 Geophysical Navigation

A Leica RTK GPS owned by the project will be utilized for the ODDS Plots. It is assumed that the RTK GPS will be the primary navigational system, however, should unusual conditions be present (e.g. canopy cover) a Leica TPS1100 RTS system will be deployed (minor areas possibly). Prior to changing the navigation technology for production mapping the ODDs plots will be partially surveyed with the new navigation-sensor deployment. The following paragraphs describe the selected navigation technologies.

The Leica TPS1100 RTS is a motorized RTS that uses automatic target recognition to track the location of the prism and has a highly accurate distance/azimuth measurement system to produce +/-5mm +2 parts per million (ppm) accuracy. The RTS system hardware consists of three integrated components; 1) the Leica TPS1100 dual laser RTS; and 2) the RTS rover remote link control panel; and 3) a survey prism which is tracked by the RTS base station. The navigation data is recorded and stored onto a Personal Computer Memory Card International Association (PCMCIA) data storage card on the RTS. The PCMCIA data storage card can then be used to transfer navigation data between the RTS and field computers. For DGM, RTS navigation data can also be output as a real-time data stream via a serial adapter from the remote link to the data tablet.

Real time kinematic GPS utilizes a base station that is set-up on a known position. Once the base station is set-up, it determines its location using satellites and then applies a correction based on the offset from the known coordinates at the location. This correction is then used by a rover that is in direct communication with the base station through a radio link. The rover must be within 6 to 10 miles of the base station and must have line of sight. RTK GPS is capable of taking survey-grade measurements in real time and providing immediate accuracy to within 1 to

4 cm. The RTK GPS will be the primary navigation system and the RTS will be the secondary system.

In addition to mapping geophysical data, the navigation system will be used for other location tasks including the following:

- **Feature Identification.** The navigation system will be used to augment geophysical data and improve geophysical mapping through capture of visual observations made during site walk-over. During this process, navigation system will be used for position-stamping debris piles, unidentified fences, soil changes, vegetation, burn areas, craters, etc.
- **Target Relocation.** The navigation system will be used for target relocation. The targets' coordinates from the GIS or American Standard Code for Information Interchange (ASCII) XY files will be loaded into the navigation system data logger. The "Waypoint-Mode" facilitates quick and reliable relocation.

5.5.3 Deployment Form Factor

Because of the conditions regarding vegetation and terrain, a vehicle-towed array sensor deployment system will be used for the ODDS site. Shaw will use the same array deployment cart used by previous contractors (Parsons) at Fort Ord. Man-portable and small cart form factors may be used in limited areas and will also be evaluated on the ODDS plots as the need arises during the project.

For towed arrays, the GPS antenna will be mounted above the sensors such that both sensor and navigation data can be simultaneously logged and time stamped using Geometrics MagLog software on a data tablet. Data will be transferred from the tablet using Universal Serial Bus Data sticks.

5.5.4 Data Processing System

The raw field data will be downloaded to field personal computers (PC) using Geonics DAT61 or Geometrics MagLog software, then imported (along with the navigation data) into Shaw's data merge software for pre-processing. This software provides a robust framework to spatially configure sensors relative to each other and with respect to the prism location, resulting in accurate spatial representation of all collected data. This software is used for merging the sensor and navigation data, making latency corrections, and generating accurate data file with Cartesian orthogonal coordinates (XYZ) data output files. Geosoft Oasis Montaj and UX-Detect software will be utilized for most data processing tasks and to perform review and QC checks on the DGM and QC data. Shaw has also developed Matlab based routines for specialized data processing and analysis techniques which may be utilized.

5.5.5 Sampling Frequency

For the GPO and full-scale DGM surveys, the sampling frequency will be no less than 1 Hz for the navigation data stream and 10 Hz or greater for the geophysical sensor data. As specified in the DQOs, along track sampling densities will be less than or equal to 0.6 feet and across track sampling densities will be less than or equal to 2 feet. The evaluation of the seeded targets' geophysical signatures will be used to determine final cross track intervals. Exception will be taken where physical obstructions (trees, wells, etc.) are encountered in the field.

5.5.6 Geophysical Survey Modes

Full coverage mode will be utilized for the GPO. Full coverage will be achieved through deployment of the sensor system through the collection of sub-parallel survey lines or swaths. All data traverses will be brought into the GIS for verification of area coverage.

Procedures for Full Coverage Survey Mode include the following:

- Define the bounds of the site that requires full coverage. This is accomplished by reviewing and identifying issues that may affect the selection of the most appropriate technology. For the GPO, the whole ODDS plot will be surveyed with RTK GPS. The coordinates of the ODDS Plots will be furnished by the USACE geophysicist.
- Systematically survey the site in the most effective pattern. The survey pattern will consist of consecutive multi-sensor passes with some overlap between passes. To ensure that full, overlapping coverage is obtained over the entire survey area, the vehicle will navigate through several methods, including 1) observing the tracks of previous lines and offsetting the new line to obtain overlapping coverage; or 2) the use of spray paint or portable markers to mark the position of lines and then offsetting the new lines.
- Review the site. The ODDS area requiring full coverage will be reviewed through a site walk-over during which the geophysical survey conditions will be reviewed by the site geophysicist.
- Set up the navigational system chosen by the Site Geophysicist at a convenient control point of known location. Confirm location control via checkshots to at least one other control point of known location.
- Place temporary location control QC items in the survey area using the navigation system as needed to document navigation precision. At least one location QC item (either temporary items or semi-permanent grid hubs) will be present in each data set. At least one location control item will be present in every five acres surveyed.
- Set up a replicate data line location and collect the pre- and post-survey data line. These data will be compared to insure repeatability of the data collection method.

- The sensors are towed, pulled or pushed at a mean speed less than 3 mph in the GPO (to be verified by analysis of the navigation data for each data set) to minimize sensor bounce and sway.
- Collect and maintain field logs to document the conditions of the data collections. The field logs will include information and observations of the data collection area, field conditions, data acquisition parameters, and QC performed.
- Field geophysical data and navigation data will be downloaded to a field PC. The electronic files will be organized on an office PC dedicated to geophysical investigation management. Data will be backed-up daily.
- Review all traverse data and overlay on the survey grid layout or planned traverse lines as QC and to identify any missed areas.

5.5.7 Location Control

Survey control for the ODDS Plots has been previously established by a California Licensed Professional Land Surveyor. These control points will be used for location control and providing known location set-up points. California State Plane, Zone 4, U.S. Survey feet Coordinates will be used.

The navigation system will be used for geophysical mapping, anomaly relocation, feature mapping and location, and establishment of interim location control points, utilizing these semi-permanent location control points.

5.6 Geophysical Data Processing

Shaw's standard data processing includes data leveling, statistical data assessment, grid generation, and non-customized data filtering to accentuate target signatures. Shaw will use software from the equipment manufacturers, in-house software, and Geosoft's Oasis Montaj and UX-Detect Software to complete all tasks.

Collected GPO field data will be downloaded in the field directly from the data-logger to a laptop computer for processing. Appropriate vendor software (e.g., Geonics DAT61, Geometrics MagLog) will be used to download the data. The vendor software will also be used for initial review and editing of the data as necessary, for generation of profile lines, and for conversion of the survey line data to (x,y) coordinates for contouring and analysis. The initial steps taken in the data processing flow will include the following:

5.6.1 Data Pre-Processing and Review of Data Sets

The data interpretation process begins by verifying the validity of the collected data sets. This will be accomplished by reviewing the QC data associated with the data, insuring that the sensor and navigation equipment is functioning properly, that the data are accurately positioned along

the predetermined survey lines, that they match the site dimensions, and properly fit within the predefined survey site. All validation results will be noted in the Data Processing Log.

5.6.1.1 Review of QC Data

Vendor-supplied software will be used to make initial review of the data. This step validates that the data collected fall within prescribed recording ranges, and that no data outliers or null-values are present. Data statistics will be developed to measure compliance with the DQOs. These QC and calibration data notes will be tracked with respect to collection and processing steps.

- **Review of Sensor QC Data.** Sensor QC test results (equipment warm-up, sensor position, static background and spike tests, cable shake test, personnel test) will be reviewed to ensure proper sensor function. Geonics/Geometrics and Geosoft software will be used to make initial review of the data. This step validates that the data collected fall within prescribed recording ranges, background noise and signal-to-noise-ratios fall within acceptable ranges, and that standard responses to known items are consistent with known values. Minimum, maximum, mean, and standard deviations of the pre- and post-survey Sensor QC tests will be calculated and reported into the Sensor QC Verification Log. Standard values and ranges will be determined, in consultation with USACE, based on GPO results.
- **Review of Navigation QC Data.** Vendor-supplied software will be used to make initial review of the navigation QC and to ensure that the navigation system is functioning properly. Geonics/Geometrics, Leica and Geosoft supplied software will be used to make initial review of the data. Navigation offset distances and latency factors will be calculated based on the test results and compared to the DQO objectives. The ODDS plots rebar marked corner locations will be reviewed. Cumulative positioning errors are not to exceed 2.0 feet. Navigation QC data parameters will be entered into the Navigation QC Verification Log.

5.6.1.2 Initial Data Review and Preprocessing

The Site Geophysicist will review sensor and navigation data for accuracy, completeness, and data fidelity. The geophysicist will also verify that the data are complete and fall within the prescribed survey area.

The operator will examine the quality of the data and define additional filtering or reprocessing of the data that may be necessary. Additionally, one-dimensional line data will be reviewed in Geosoft's Oasis Montaj UX Detect software that has a profile display mode. All observations related to data review will be fully documented in the Data Processing Log.

The vendor software will also be used for initial review and editing of the data as necessary, for generation of profile lines, and for conversion of the survey line data to (x,y) coordinates for contouring and analysis. Each sensor record has an associated time stamp. Preprocessing involves synchronization of the navigation data stream coordinates with the sensor output data

streams. All data will be converted into XYZ files in California State Plane, Zone 4, U.S. Survey Feet coordinates. All activities will be documented on the Data Processing Log. The initial steps taken in the data processing flow will include the following:

- **Initial Review of Collected Data.** Geometrics/Geonics supplied software will be used to make initial review of the data. This step validates that the data collected fall within prescribed recording ranges, and that no data outliers or null-values are present. During this step, all data collection and downloading parameters will be entered into the Data Processing Log.

- **Navigation Data Review.** Positional information collected via GPS/RTS is designed to provide real-time XYZ location solutions, concurrent with collection of the sensor data. However, circumstances can arise where the navigational data require post-processing to remove errors in coordinate locations. If positional errors are detected, they will be documented in the Data Processing Log.

- **Data Merge/Offset Calculation.** During this step, the sensor data will be integrated with navigation data to create sensor data files with coordinate positions using MagMap or Shaw's software. Form factor adjustments of each sensor location (offset) with respect to the GPS antenna are made. Latency corrections based on the navigation QC data are also performed. For the latency correction, the DQO specifies no visible chevron effects in the data or pseudo-color plots. The use of appropriate color scaling will be maintained throughout the project. This step creates ASCII XYZ data files containing Easting, Northing, and Sensor values in column format as described above. These files are similar to the USAESCH ASCII Data File, and conversion to the ASCII Data File format can be performed upon request.

- **Base Station Correction.** For data leveling, validated magnetometer data are corrected for diurnal fluctuations using Geometrics MagMap or MagMapper software. This software is designed to remove the ambient background from each sample collected by the G858G sensor. The resultant data set represents only the magnetic field changes that are caused by anomalous objects contained within the survey area. After the previously stated steps are executed and documented in the Data Processing Log, the data are adequately prepared for target detection and analysis.

- **Coverage Assessment.** To verify that coverage has been achieved during survey activities, all navigation traverses will be reviewed and documented during the data processing and analysis steps on the. The areas surveyed and areas missed will be calculated and documented on the Navigation QC Verification Log. If missed surveyable areas are present the ODDS plot will be resurveyed.

- **Deletion of Extra or Erroneous Data.** Extra or erroneous data such as instrument run-ons at the ends of lines, data collected in turnaround areas, data spike, nulls, etc. will be deleted.

- **Analysis of Data Sampling.** Data sampling statistics will be calculated in Geosoft and entered on the Navigation QC Verification Log. These statistics include: velocity, along-track and across-track data spacing, area surveyed, and area of data gaps. The

survey platform will maintain a mean speed < 3 mph or the maximum speed as determined during the ODDS survey. Along-track sampling error will be < 0.5 feet. Across-track sampling error will be < 2.0 feet excluding data gaps due to trees or other obstacles that preclude the survey platform from providing complete coverage. This metric is intended to control data gaps associated with inconsistent track plots that are not associated with trees or other obstructions. For the purposes of this project, minor occurrences will be accepted but will not be accepted if they exceed 0.5 feet.

- **Analysis of Replicate Data.** The pre-and post-survey replicate data lines will be reviewed for each data set. A stand will be constructed so that the EM61 wheels will be in the same place for both pre- and post survey standardization test conditions to be as similar as possible. Additionally, the instruments will be oriented in the same direction for both the data collection sessions. Data sampling statistics will be calculated in Geosoft and entered on the Navigation QC Verification Log. The amplitudes of the responses over the standard test item (trailer hitch ball lying on the ground) should be within 20 percent, the location accuracy should be within 2.0 feet, and the latency calculation should check with the Navigation Function Test results.

5.6.1.3 Data Processing

Geophysical data analysis will begin after execution of standard data pre-processing steps where field data are verified, cataloged, reviewed, and converted into XYZ files. All activities will be documented on the Data Processing Log.

The digital data will be an ASCII-delimited XYZ file suitable for input into the Geosoft programs. Successive data processing steps include:

- **Statistical Analysis.** All XYZ files will be processed to calculate statistics describing survey coordinates and sensor values. These statistics will be calculated to assist the site geophysicist in the assessment of data quality.

- **Data Leveling.** Based on the initial review of the data, the statistical assessment results, and the calibration data, data leveling will be applied to the data. Consistent parameters and processing methods will be used for all channels within each dataset. Consistent processing routines will be used for all datasets throughout the project.

- **Data Cataloging.** After leveling of the XYZ files is completed, all XYZs will be cataloged into an Access database. Information in the database will document the sensor types, deployment configurations, navigation methods, crew members, statistical analysis results, etc.

- **Data Gridding.** XYZ files will be interpolated onto right-rectangular, evenly spaced grids. Gridding will initially be performed using the Geosoft minimum curvature function with an initial grid cell size of no larger than 0.5 feet. Interpolated grids will be reviewed by the data processor to determine the completeness and accuracy of prior data manipulation steps. Gridding parameters will be adjusted based on the sampling intervals actually achieved in the data.

- **Data Filtering.** Initial assessment of the data will be performed on grids with no filtering applied to the data. However, a suite of simple data filters is available to enhance target signatures by reducing the effects of high frequency and/or low frequency noise sources. If filtering is needed, the filtering will be optimized to minimize the signal-to-noise-ratio on both weak and strong anomalies. Filter selections and all filtering parameters will be recorded.

5.6.2 Target Detection

Target detection activities evaluated at the ODDS plot will be used during the production surveys. General Shaw procedures for target detection are discussed in the following paragraphs.

Targets are detected in a two-step process: (1) initial automated detection, and (2) operator-aided detection by a qualified geophysicist. The first step is automated target detection based on threshold analyses. Geosoft's UX Detect will be used for simple threshold detection. Parameters controlling the selection of targets include proximity of adjacent targets, signal power density, collocation of targets on other channels of data, area size, and distribution of anomaly amplitudes.

The second step is manual detection of targets based on systematic visual search of raw and filtered data, on single or multiple channels. This will be accomplished within the Oasis Montaj/UX-Detect software system. At this stage, automatic target detections will be modified, deleted, and/or added by the operator. The automated and operator target detection steps will result in a target list and a set of target parameters, including X, Y, area, proximity to other targets, and signal strength statistics. The steps of the target detection process are documented in the Data Processing Log.

5.7 Quality Control

Instrument standardization procedures are implemented to ensure accuracy and repeatability of all collected field data. Requirements for instrument standardization, minimum test frequency, and acceptance criteria are outlined in Attachment B of USACE DID MR-005-05.

5.7.1 Equipment Function Verification

Equipment function verification will be performed at the ODDS site to ensure that the geophysical survey equipment is working according to manufacturer's specification and is appropriate for the intended survey activities (see Table 5-1). The Site Geophysicist or the QC Geophysicist will review and approve each Sensor QC Verification Log and Navigation QC Verification Log to document the proper equipment function. Additionally, the UXO QC Specialist will review the Equipment Verification Log forms as part of the QC program.

Quality Control test descriptions and frequency are as follows. Although these procedures will be used at the ODDS site during the day that data is obtained, the descriptions outline these functional tests as they will be used during the production surveys:

- **Equipment Warm-Up.** Most instruments require a few minutes to warm up before data collection begins to minimize sensor drift due to thermal stabilization effects. All instruments will be allowed to warm up for at least 5 minutes before data collection. This procedure will be followed each time the instrument is powered up (e.g. at the start of the day, after breaks, etc.).

- **Record Sensor Position.** At the beginning of the survey, and thereafter at any changes in form factor, or when a sensor is reattached to a pole or cart, the relative positions of the sensors and the sensor heights off the ground will be measured and recorded.

- **Static Background Test.** The Static Background Test and Spike Test monitors the instrument background readings, monitor for electronic drift, and identify potential interference. With the instrument held in static position, measurements are recorded for a period of at least 3 minutes. The test is performed twice daily, prior to collecting data and after completion of data collection. Static background readings for the EM-61 MK2 should remain within 2.0 mV of background. Static background readings for the G858G should remain within 1 nT of background. The results of the Static Background Test are documented on the Sensor QC Verification Form (Appendix F, Form G-1).

- **Static Spike Test.** The Static Spike Test monitors the impulse response and repeatability of measurements over a standard test item. The standard test item is a standard 2-inch diameter steel trailer hitch ball. For the EM-61 MK2, the standard test item is placed on the ground in a standardized form so that the location and orientation of the EM61 sensor or array of sensors can be repeated for all static spike tests. The resulting response shall not exceed 100 mV and will be preferably in the 30 to 40 mV range. For a G858G, the test item is placed on the ground centered below the sensor. At least one minute of data is recorded. Readings for the response of the standard test item should be within 20 percent after subtraction of the sensor baseline response. The test is performed twice daily, prior to collecting data and after completion of data collection. The results of the Static Spike Tests are documented on the Sensor QC Verification Form (Appendix F, Form G-1) so that the spike test responses can be quickly reviewed and long term trends (or changes) can be observed easily.

- **Personnel Test.** The Personnel Test is performed to check the influence of personnel carried metallic items (e.g. keys, boots, belt buckles, etc.) on the sensors. For a towed array system, the tow vehicle will be turned on during the test. With the instrument held in static position, the operator(s) walk around the sensors while measurements are being recorded for a period of at least 1 minute. In general, the EM-61-MK2 should remain within 2 mV of background. The test is performed twice daily, prior to collecting data and after completion of data collection. The Personnel Test will be included in the Static Background Test.

- **Cable Shake Test.** The cable shake test is performed for each sensor at the beginning and end of each day to document any cable or connection problems. With the instrument motionless and recording, each data cable is shaken and cable connector is wiggled to test for shorts or bad connections. Data collected during the Cable Shake Test should be free from spikes (greater than 2 mV) or variations. Cable problems generally require replacement. Connection problems are generally fixed either by cleaning or reconnection. The results of the Cable Shake Tests are documented on the Sensor QC Verification Form (Appendix F, Form G-1).

- **Azimuthal Test (magnetics only).** For the Azimuthal Test, an area free of geophysical noise is selected. A measurement point and the four cardinal directions are marked on the ground. A sensor head is fixed on the form factor to be deployed. Data is then recorded in a variety of sensor head orientations such that the orientation which minimizes drop outs can be selected. This test is performed once for each system deployment.

- **Octant Test (magnetics only).** For the Octant Test, a total of eight lines of magnetic data are collected, passing over the same central point. The arrangement of lines is North-South, Northeast-Southwest, East-West, and Northwest-Southeast arranged radically over a marked central point. The difference in the response over the central point documents heading effects. This is the recommended test for establishing heading correction parameters. Typically, this test is performed once over the project duration for each system deployment, however, small changes in heading errors from the same deployed system have been observed to over short periods of time. Therefore, in most instances, the actual heading corrections applied to any given set of data will need to be optimized during data processing. Should large heading changes be seen during data QC, the test will be re-run for further evaluation of both the equipment and data processing parameters.

- **Height Optimization (magnetics only).** A test line is established with at least one test object along its length. Data are collected with the instrument using a minimum of three different sensor heights. The goal is to optimize the target signal to noise ratio, and maintain adequate sensitivity.

- **Six Line Test.** A 50-foot test line is set up and well marked such that the same path can be repeatedly surveyed. Background conditions are evaluated on Lines 1 and 2. Heading effects, repeatability of response amplitude, positional accuracy and latency are evaluated in Lines 3-6. The test line is then surveyed as follows:

  - Lines 1 and 2: Survey up and back on the test line at a normal speed.
  - A standard 2-inch trailer hitch ball is placed at the center of the line for Lines 3-6. For multi-sensor form factors, a hitch ball is used for each sensor tack.
  - Lines 3 and 4: The line is surveyed up and back at a normal speed.
  - Line 5: The line is surveyed at a fast speed.
  - Line 6: Coming back, the line is surveyed at a slow speed.

- **Two Line Repeat Data.** The repeatability of geophysical mapping data is monitored by the collection of replicate data. Replicate data will be collected for each data set. Generally, a replicate data line is established about 10 feet outside of the area to be surveyed, 50- or 100-foot-long and oriented in the general direction of planned traverses. Start and endpoints of the line are marked with pin-flags and a measuring tape line. Two intersecting and perpendicular lines will be established. A standard test items (2inch trailer hitch ball) is placed at the intersection of the lines. For multi-sensor form factors an appropriate length of rebar may be substituted for the hitch ball. Two passes of both lines will be recorded, up and back at the start and again at the completion of each data set. The amplitudes of the standard test items should be within 20 percent. The on-line offset of the locations is used to calculate instrument latency.

- **Pull-away test.** Depending on the deployment form factor selected, documentation of non-effect of the deployment form factor infrastructure on the sensors will be documented via a "Pull-away" test. This test will be conducted once for each infrastructure item in the survey area. Additionally, it will be performed with any change in equipment.

5.8 Prove-out Report

Shaw will provide a GPO letter report to USACE describing the Prove-out and results. Shaw will first submit a draft GPO report and request a technical planning meeting with the USACE Geophysicist and other appropriate staff to review the findings, and as necessary reassess the procedures to be used in the production GPO.

The report will include the following:

- As-built drawing of the ODDS plot;
- Pictures of the seed items;
- Color maps of the geophysical data;
- Summary of the GPO results;
- Proposed geophysical equipment, techniques, and methodologies; and
- Sufficient supporting information (QC and data) to support the recommendations, including manufactures specifications for all recommended geophysical equipment, a definition of the expected target anomalies, and any other pertinent data used in decision making.

The geophysical data will be evaluated and scored so that the different geophysical approaches can be compared and ranked. Scoring criteria should include, for example, the following: percent of seeded items detected (by class or size, and overall); number of unknown targets; production rate; cost per unit area; equipment durability and safety.

The conclusions of the report will contain specific recommendations as to how production surveys are to be performed and how data are to be processed and targets picked.

A compact disc (CD) will be delivered with the GPO letter report containing the following files:

- GPO letter report (Microsoft Word format);
- All raw and processed geophysical data. All data, except raw sensor data, will be provided in x, y, v1, v2, v3, v4, ...t in comma or tab separated format where x and y are state plane coordinates, v is sensor values, and t is the time stamp. Raw sensor and navigation data will be provided in the manufacturer's standard file formats.
- All daily field logs, Data QC and Data Processing, Sensor QC Verification, Navigation QC Verification logs;
- Geophysical maps;
- Seed item location spreadsheet (Microsoft Excel format);
- Dig List spreadsheets including reacquisition data (Excel format); and
- Spreadsheet of all survey control point locations (Excel format).

5.9 GPO Schedule

Figure 5-4 shows a timeline for completion of the GPO. Time is shown in elapsed days; the actual completion date will depend on the date the GPO begins.

6.0 Geophysical Investigation Plan

This section details the GIP for DGM supporting the geophysical investigation required for MEC removal at MRS-16. This plan was developed in accordance with the CEHNC DID MR-005-05, *Geophysical Investigation Plan* (USACE, 2003).

6.1 Site Description

The site is a WWII era rocket range and is identified as a "bazooka practice" area. Records indicate the site was used as an anti-armor training area and that both practice and high explosive antitank rounds were used. A discussion of the history of MEC use at the MRS-16 is presented in Section 1.8.2.

6.1.1 Geophysical Data Quality Objectives

Data quality objectives and investigation program objectives will be identified for this project as required. GPO requirements identified in MR-005-05A (USACE, 2003) are discussed in Section 5.0. Specific DQOs for the geophysical investigation are discussed below.

6.1.1.1 Geophysical Investigation Program Objectives

Following MEC surface removal operations, DGM will be performed over MRS-16. These data will be used for a first round removal effort and to identify areas with dense anomalies. Iterative rounds of DGM may be conducted to complete the anomaly detection over parts of the site. Each DGM survey will be followed by a round of removal. The DGM and the removal of DGM-identified anomalies will be used to develop a clear, complete, and defensible record of the activities performed. The After Action Report shall contain all geophysical data (raw and processed), maps, reports, field sheets, databases, and all other ancillary data used to develop all geophysical results.

6.1.1.2 MEC Detection

The goals for MEC detection are based upon proper execution of the most appropriate geophysical technology as determined during the GPO. The performance objective is to locate all MEC and MEC-like targets equivalent to the diameter of a 37mm HE or larger and to a depth of 11 times the MEC item's diameter or the maximum depth of detection demonstrated in the ODDS plot surveys

The selection of the most appropriate technology is dependent on site conditions related to vegetation, topography, soil type, proximity to structures, degree and type of metallic debris, as well as type, distribution, and number of MEC. The performance capability of selected field

equipment are measured and documented through on-site prove-out verification (ODDS Plot) as described in the GPO Report.

Actual detection depths may vary within the survey area based on specific circumstances, such as the following:

- Item orientation;
- Site background/noise levels;
- Masking effects from adjacent metallic items;
- Item shape;
- Material composition of buried targets;
- Site geology and soil conditions;
- Weathering effects on the magnetic conductivity of item materials.

6.1.1.3 General Data Quality Objectives

The following DQOs are believed to provide sufficient metrics to quantify the quality of the data collected at MRS-16 site. It is stressed that these DQOs are intended as objectives only, and will be used to monitor and evaluate the quality of data collected.

- ***Background Noise based on Leveled Survey Data Set.*** A DQO for background noise will be established by the Project Geophysicist, in consultation with the USACE, based on site-specific and deployment-system-specific performance demonstrated during the GPO. Previous work by Parsons identified background levels of 3 mV in EM61 MK2 channel 3 data and 3 nT for the G858 with production levels below 2 mV for the EM data. The data will be clipped such that any measurements that are well above the background noise will not be included in these statistics. The clipping value(s) will be recorded.

- ***Mean Speed.*** Maintain mean speed less than 3 mph or the speed as determined during the GPO. The mean speed will be documented along with the standard deviation of the mean speed.

- ***Along Track Sampling.*** Less than 0.6 feet with cumulative gaps along line less than 2 percent of line distance.

- ***Across Track Sampling.*** Less than 2.0 feet, excluding data gaps due to trees or other obstacles that preclude the survey platform from providing complete coverage. This metric is intended to control data gaps associated with inconsistent track plots that are not associated with trees or other obstructions. For the purposes of this project, the deviation should not exceed 50 percent of the line spacing (1 foot) and no single gap will exceed 4 square feet excluding those caused by an obstruction.

- ***Latency Correction.*** No visible chevron effects in the data or pseudo-color plots. The use of appropriate color scaling will be maintained throughout the project.

- ***Data Leveling.*** Consistent parameters and processing methods will be used for all channels within each dataset. Consistent processing routines will be used for all datasets throughout the project.

- ***Systematic Noise.*** Data will be representative with no systematic or sporadic system noise related to environmental factors such as debris stuck to the sensors wheels or water in cable connections.

- ***Anomaly Selection.*** The anomaly selections will be accepted by the Project Geophysicist or his/her designated assistants. These individuals will verify that all anomaly selections for a given dataset are reasonable and should identify all MEC or MEC-like items in accordance with ODDS survey results.

- ***Positioning Errors.*** Cumulative navigation positioning errors are not to exceed 2.0 feet. A functionality test will be performed each morning and evening to quantify the accuracy of the positioning/navigation system. Single feature positional errors will be less than .5 feet.

- ***Known Location QC Items***. Ground flush rebar hubs will be established at grid corner locations for use as known location items. At least one known location item must be surveyed each day. Temporary "hubcap test" QC locations may also be established as needed to meet the frequency requirements. All known QC locations must be detected to within 2 feet of their known locations.

- ***Blind/Seed QC Items.*** All blind seed items must be detected to within 2.0 feet of their known locations. These items will be buried to the lesser of the depths that were reliably detected during the GPO, or to the top of weathered bedrock. Blind QC items will not be smaller or buried deeper than those emplaced at the ODDS plot.

- ***Reacquisition.*** Reacquisition of target anomalies must be successful to within 2.0 feet of their interpreted location. Additionally, 95 percent of all anomalies must lie within a 1-meter radius of their original surface location as marked on the dig sheet.

6.1.2 Past, Current, and Future Use

MRS-16 is a WWII era rocket range identified as a "bazooka practice" area on Fort Ord Training Facilities maps dating from 1945 and 1946. MRS-16 had been used for training and live fire exercises from approximately the 1940s until the time the base was officially closed in 1994. The site was used for a portion of the time as an anti-armor training area. Practice and HE rockets and rifle grenades were used in the 1940s and possibly the early 1950s. The site was later used for a portion of time as an anti-armor training area. Evidence from the site indicates that both practice and HEAT rounds were used. The area is in close proximity to a residential neighborhood (Fitch Park) on the former Fort Ord.

The land that includes MRS-16 will be transferred to the BLM (USACE, 1995a) and will be maintained as undeveloped habitat reserve under the HMP for Former Fort Ord. MRS-16 is located in Transfer Parcel F1.3, which the HMP identifies as a habitat reserve area that will be

maintained as open space and will not be developed. 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 potential adverse impacts to listed species. The BLM land immediately adjacent is open to the public for hiking, biking, jogging, and horseback riding.

6.1.3 Anticipated MEC Type, Composition, and Quantity

A discussion of the MEC previously located on MRS-16 is presented in Section 1.8.4. The performance objective is to locate all MEC and MEC-like targets equivalent to the diameter of a 37 mm HE or larger and to a depth of 11 times the MEC's diameter. Historical documents indicate mostly 2.36 inch rockets and MD with a low density of MEC items over a large area and a moderate density of inert and practice items with an unknown density of high explosive MEC should be anticipated.

6.1.4 Depth Anticipated

The performance objective is to locate all MEC and MEC-like targets equivalent to the diameter of 37 mm HE or larger and to a depth of 11 times the MEC item's diameter as per DIDs or to the maximum depth of detection as demonstrated during the ODDS plot surveys. Although anomaly investigation to depth has been specified, MEC excavations in the MRS-16 area have shown depths of targets less than 18 inches below ground surface. At Fort Ord, maximum burial depths in sand for the smallest item, the 37 mm projectile, have been approximately 3.9 feet and for the most likely item, the 2.36 inch rocket, 0.4 feet as noted in the Engineering Evaluation/Cost Analysis (USACE, 1998), 1998. Free-air tests (Parsons, 2002b) showed maximum detection of the 37 mm to a depth of 1.5 feet and 1.5 feet using an EM61 (1mx1m) and magnetometer, respectively, and for the 2.36 inch rocket the maximum depths were 2 feet for the EM61 and 3 feet for the magnetometer.

6.1.5 Topography and Vegetation

Topographic and vegetation conditions are discussed in detail in Section 5.3.1.

6.1.6 Geologic, Soil and Hydrogeologic Conditions

Geologic, Soil and Hydrologic conditions are discussed in detail in Section 5.3.2.

6.1.7 Geophysical Conditions

The earth's magnetic field, believed to originate in currents in the earth's liquid outer core, varies in intensity from approximately 25,000 nT near the equator, where it is parallel to the earth's surface, to approximately 70,000 nT near the poles, where it is perpendicular to the earth's surface. In the United States, the intensity of the earth's magnetic field varies from

approximately 48,000 to 60,000 nT and has an associated inclination ranging from approximately 58 to 77 degrees. At the former Fort Ord the inclination is 61.5 degrees.

Previous DGM surveys at Fort Ord document background levels of 1-3 nT/foot for magnetometers and 1-3 mV for EM61 surveys.

6.1.8 Site Utilities and Man-Made Features

Many areas at the former Fort Ord that require investigation and/or MEC removal are remote former ranges with no development. However, the former use of many of these sites as testing and training facilities introduces the possibility that the sites have surface and subsurface utilities present. These may include communication cables and electronically controlled pop-up targets. Cables and wire can introduce significant noise in most magnetic and electromagnetic data and should be removed to the maximum extent possible. If these items remain, they are highly evident in the data and may require re-surveying after their removal to mitigate their effects.

Man-made features existing within, or in close proximity to, survey areas negatively impact geophysical investigations. These features include, but are not limited to, utility corridors, buried pipes, cables, fences, playground equipment, trash dumpsters, benches, signs, buildings, and vehicles.

Munitions Response Site-16 is generally undeveloped with no building structures. However, several unknown bunker type structures and a man-made trench are located within MRS-16.

The effects of man-made structures and items will be mitigated through the execution of the following procedure:

- Review available documented feature locations via the site GIS
- Examination of the area during the site walk-over
- Removal of items to the extent practicable
- Evaluation of effects on geophysical mapping effectiveness
- Recommendation of appropriate field technologies
- Documentation of decisions in site-specific work plans

Generally, metallic items present in the investigation area cause severe complications in the analysis of geophysical data. Both magnetic and electromagnetic methods record the effects of man-made metallic structures and complicate the interpretation of data in varying degrees ranging from mild to extreme.

Other features potentially affecting geophysical investigation include energized electric lines, transformers, and certain communications equipment or lines. These features broadcast energy that may locally interfere with geophysical instruments or sensors. Static noise tests may need to

be performed to assess local noise conditions, including Parsons' reported GPS signal drop-outs at the GPS base station due to voice communication (from airport traffic).

6.1.9 Site-Specific Dynamic Events Affecting Geophysical Investigations

Dynamic events (rain, lightning, solar flares, etc.) may temporarily impact geophysical data collection and/or data quality. Procedures for these anticipated events are as follows:

- ***Rain.*** Depending on its intensity, rain can be a significant impediment to survey operations. The site geophysicist will assess the intensity of rainfall and its effects on survey instrumentation and safety (slip, trip, fall) considerations to determine when or how to proceed. General guidance for common conditions is as follows:
- ***Drizzle or Intermittent Light Rain.*** Tape plastic around instrument electronics and continue.
- ***Thunderstorm.*** Take cover and cease operation until the storm passes.
- ***Continuous Medium or Heavy Rain.*** Take cover and cease operations until conditions improve.
- ***Lightning***. Because most geophysical instruments contain sufficient metal and geometry to pose a preferred pathway for electrical discharge (lightning rod effect), observed lightning in the area will be deemed a safety hazard and will be cause for the cessation of survey activities until the lightning activity has ceased. Site personnel and equipment will shelter in a safe area. The UXOSO will make the determination that lightning is present and will log the times when site survey activities are shut down and resumed.
- ***Solar Flares***. Solar flares are sun-generated atmospheric phenomena, typically occurring in the afternoon, which may temporarily generate sufficient high magnitude magnetic noise so as to make magnetometers, often gradiometers, and occasionally EM sensors unusable for the duration of the event. Solar flares are typically readily observable by the instrument operators (throughout the area) as rapidly fluctuating signal readings with no apparent cultural or survey source. Field activity planning will include checking either the National Aeronautic and Space Administration (www.spaceweather.com) or National Oceanic and Atmospheric Administration (www.sec.noaa.gov) websites for possible solar flare activity to avoid the magnetic storms as much as possible. The site geophysicist will be alert to solar flares and temporarily cease data collection until static testing shows a cessation of the solar activity.

6.1.10 Overall Accessibility and Impediments

Site conditions at MRS-16 do not pose significant challenges in terms of site accessibility and system deployment impediments. The following general site conditions and remedies are expected:

- **Remote access:** Although the survey grids may be at distances from roadways and/or trails or across terrain that makes routine access difficult, 4WD vehicle access is anticipated to be easily available. MRS-16 is bound on the south by Eucalyptus Road, on the north by Parker Flats Road and on the east by Watkins Gate Road. Trails and dirt roads through MRS-16 are visible on aerial photographs of the area.
- **Poisonous plants:** Much of the former Fort Ord site has significant poison oak covering potential survey sites. To the maximum extent possible, these plants will be removed prior to surveying by brush cutting and/or burning.
- **Sensitive habitats:** In cases where surveying is coincident with the location of sensitive plant or animal habitats the Site Biologist, in conjunction with the Site Geophysicist, will be responsible for issuance of a memo of sensor deployment options. This memo will be submitted to the USACE Project Manager who will review the recommendations and discuss them at the next scheduled bi-weekly project status review meeting.
- **Steep slopes:** The issues associated with topography, as it affects geophysical surveying will be addressed by changing deployment from vehicle towed arrays to man-portable or if necessary, changing to an EM61 HH sensor. Hummocky terrain is anticipated rather than steep slopes.

6.1.11 Potential Worker Hazards

All site personnel will adhere to the practices, procedures, and training and monitoring requirements mandated by the APP. Because of the potential MEC hazard, qualified UXO personnel will perform a surface sweep of site roads and adjacent ditches and surface removal of the geophysical survey and support areas prior to initiation of geophysical survey activities at a site, such that instrument operators may proceed with survey activities without requiring active UXO escort in most areas.

6.2 Geophysical Investigation

A two-phased approach will be used at MRS-16. The first phase will be a 100 percent surface sweep using an analog magnetometer such as a Schondstedt, performed to clean surface metals to 1 or 2 inches below the surface.

The second phase will consist of iterative passes of DGM using a towed array or single EM61 units. The first DGM pass data will be used for a first round removal effort and to identify areas

with dense anomalies, large single anomalies and distinct and isolated anomalies. The isolated anomalies will be reacquired using the same navigation system (RTK-GPS) and geophysical instrumentation (EM61), excavated and QC will be performed. Areas of high concentration of anomalies and large single anomalies will be excavated either manually or mechanically. During excavation activities, analog instruments will be used to monitor the status of the dig. Given that there is potential for individual items to remain after excavations, these areas will be digitally resurveyed until only isolated targets remain. These remaining targets will be excavated.

Iterative rounds of DGM may not be required over the entire site. Each successive phase should represent a reduction in footprint relative to that which preceded it. It is intended that a second DGM pass will be performed over at least a portion of the site (up to 20 percent) including areas with all three anomaly signatures and the data compared to the first DGM pass to demonstrate the effectiveness of this phased approach. The DGM and the removal of DGM-identified anomalies will be used to develop a clear, complete, and defensible record of the activities performed. The After Action Report shall contain all geophysical data (raw and processed), maps, reports, field sheets, databases, and all other ancillary data used to develop all geophysical results.

The geophysical technology to be used on this site has three main components: sensors, navigation, and deployment system. Based on the results of the GPO (Section 5.2.1) and Shaw's experience at similar sites, it is anticipated both a Geonics EM61-MK2 TD EM single-sensor and the government vehicular-towed array system will be deployed. The system will be positioned primarily with a Leica RTK GPS and with a Leica RTS for unusual conditions. The towed-array deployment will survey the ODDS plot at the onset of the production survey to verify survey parameters and MEC detection. The array of EM61s will be used to map the open areas and the single-sensor man-portable EM61 or EM61 HH will be used to fill-in any data gaps in areas not accessible to the towed array such as steep slopes and near obstructions. Technical aspects of these components are discussed below.

6.2.1 Deployment Platform

The GPO test results will provide site-specific data to support the final deployment form factor to be used on the entire site in terms of sensor implementation and to achieve optimal results of the geophysical investigation. The deployment platform will be tested at the ODDS plot. The anticipated deployment platforms will consist of a vehicular-towed array of three sensors and a single unit man-portable sensor with a non-metallic RTK GPS antenna mounted above the sensor(s). Shaw will deploy the cart carrying an array of EM61 MK2s used by previous contractors at Fort Ord.

6.2.2 Geophysical Sensors

Based on historical information about Fort Ord, experience at other similar MEC sites and the GPO results the EM61-MK2 sensor will likely be selected for production DGM. Previously at Fort Ord, it was found that the EM61-MK2 was more durable than the G858 and less likely to have equipment failure. Additionally, EM61-MK2 was less affected by the magnetic concretion of the Santa Margarita Formation than the magnetometer. From the ODDS report (Parsons, 2002b) we see that the EM techniques consistently out-performed the magnetometer in the field studies. The excavation results show that the targets are both ferrous and non-ferrous. Since the magnetometer detects ferrous materials and the EM61 is capable to detect both, the EM61 MK2 is likely the more suitable instrumentation. Close monitoring of the geophysical data will be performed near high tension power lines. It has been seen that both magnetic and EM data may become noisy within 200 feet of power lines. (Parsons, 2006) If steep topography or thick vegetation is an impediment to primary sensor deployment, the EM61-HH may be used at the request of the USACE. Should the EM61-HH be deployed, a partial GPO will be performed. A Leica RTK GPS will be the primary navigation system with a Leica 1100 RTS as the secondary system used for spatial positioning. The DGM deployment form factor(s) will be selected based on the GPO results and the general site conditions.

6.3 Technical Methodology

This section outlines in further detail the technologies, deployment strategies, and data processing techniques that will be implemented during this project.

6.3.1 Instrumentation

6.3.1.1 EM61-MKII Time Domain Metal Detector

The instrumentation discussion of the EM-61-MKII Time Domain Metal Detector is included in Section 5.5.1.1.

6.3.1.2 Total Field Magnetometer

The instrumentation discussion of the Total Field Magnetometer is included in Section 5.5.1.

6.3.2 Data Processing System

The raw field data will be recorded in the field using Geometrics MagLog software for arrays of sensors. For single units standard dataloggers and their software will be used. The field sensor and navigation data will be downloaded to field PCs for processing. Shaw uses a combination of data processing software for data processing depending on the deployment system used:

- Geometrics MagMap/MagMapper software for data merging, sensor offset calculations and base-station corrections;

- Geosoft Oasis/Montaj and UX-Detect Software;
- Customized Leica software/firmware for the RTS may be utilized for surveying tasks and review of survey navigation data.

Geosoft Oasis Montaj and UX-Detect software will be utilized for most data processing tasks and to perform review and QC checks on the DGM and QC data. Shaw has also developed Matlab based routines for specialized data processing and analysis techniques which may be utilized.

6.3.3 Sampling Frequency

For the GPO and full-scale DGM surveys, the sampling frequency will be no less than 2 Hz for the navigation data stream and at least 10 Hz for the geophysical sensor data. As specified in the DQOs, along-track sampling densities will be less than or equal to 0.6 feet and across-track sampling densities will be less than or equal to 2 feet. Exception will be taken where physical obstructions (trees, wells, etc.) are encountered in the field.

6.3.4 Geophysical Survey Modes

Several survey modes can be used to collect geophysical data for the detection, location, and characterization of MEC. These modes include full surveys, grid surveys, transects, and meandering paths. Full coverage will be achieved at MRS-16 through deployment of the towed array sensor system and collection of sub-parallel survey lines or swaths. All data traverses will be brought into the GIS for verification of full coverage.

Procedures for Full Coverage Survey Mode include the following:

- Define the bounds of the site that requires full coverage. This is accomplished by reviewing the topographic, vegetative, or access conditions of the parcel via the GIS and identifying issues that may affect the selection of the most appropriate technology,
- Review the site. The area requiring full coverage will be reviewed through a site walk-over during which the geophysical survey conditions will be reviewed by the site geophysicist,
- Set up the navigational system at a convenient control point of known location. Confirm location control via checkshots to at least one other control point of known location,
- Place temporary location control QC items in the survey area using the navigational system as needed to document navigation precision. At least one location QC item (either temporary items or semi-permanent grid hubs) will be present in each data set. At least one location control item will be present in every five acres surveyed,

- Set up a replicate data line location and collect the pre-survey data line,
- Systematically survey the site in the most effective pattern. The survey pattern will consist of consecutive multi-sensor passes with some overlap between passes. To ensure that full, overlapping coverage is obtained over the entire survey area, the vehicle will navigate through several methods, including 1) observing the tracks of previous lines and offsetting the new line to obtain overlapping coverage; or 2) the use of spray paint or portable markers to mark the position of lines and then offsetting the new lines,
- The single-sensor or array is towed or pulled at a mean speed less than 3 mph or the maximum speed successfully demonstrated during the GPO (to be verified by analysis of the navigation data for each data set) to minimize sensor bounce and sway,
- Collect the post-survey replicate data line,
- Collect and maintain field logs to document the conditions of the data collections. The field logs will include information and observations of the data collection area, field conditions, data acquisition parameters, and QC performed,
- Field geophysical data and navigation data will be periodically downloaded throughout the data to a field PC. The electronic files will be organized on an office PC dedicated to geophysical investigation management,
- Review all traverse data and overlay on the survey grid layout as QC and to identify any missed areas. A Survey Rework Form (Appendix F, Form G-3) will be filled out whenever any survey has resulted in a significant missed area.

6.3.5 Instrument Standardization

Instrument standardization procedures are implemented to ensure accuracy and repeatability of all collected field data. Requirements for instrument standardization, minimum test frequency, and acceptance criteria are outlined in Attachment B of USACE DID MR-005-05 (USACE, 2003).

6.3.5.1 Equipment Function Verification

Equipment function verification will be performed at the site to ensure that the geophysical survey equipment is working according to manufacturer's specifications and is appropriate for the intended survey activities. The Site Geophysicist or the QC Geophysicist will review and approve each Sensor QC Verification Log (Appendix F, Form G-1) and Navigation QC Function Log (Appendix F, Form G-2) daily to document the proper equipment function. Additionally, the UXOQCS will review the Equipment Verification Log forms as part of the QC program.

6.3.5.2 Calibration Site Establishment

One or more calibration test areas will be established at convenient locations. Each calibration site will consist of the following marked, reference areas where calibration and QC tests may be performed.

A number of QC tests and will be performed as indicated in Table 6-1. Forms are located in Appendix F. QC test descriptions and frequency are as follows (some of these tests are not applicable to the towed array system which will be used):

- ***Equipment Warm-Up.*** Most instruments require a few minutes to warm up before data collection begins to minimize sensor drift due to thermal stabilization effects. All instruments will be allowed to warm up for at least 5 minutes before data collection. This procedure will be followed each time the instrument is powered up (e.g., at the start of the day, after breaks, etc.).
- ***Record Sensor Position***: At the beginning of the survey, and thereafter at any changes in form factor, or when a sensor is reattached to a pole or cart, the relative positions of the sensors and the sensor heights off the ground will be measured and recorded.
- ***Static Background Test***. The Static Background Test and Spike Test monitors the instrument background readings, monitor for electronic drift, and identify potential interference. With the instrument held in static position, measurements are recorded for a period of at least 3 minutes. The test is performed twice daily, prior to collecting data and after completion of data collection. Static background readings for the EM61 should remain within 2.0 mV of background. Static background readings for the G858G should remain within 1 nT of background. The results of the Static Background Test are documented on the Sensor QC Verification Form (Appendix F, Form G-1).
- ***Static Spike Test.*** The Static Spike Test monitors the impulse response and repeatability of measurements over a standard test item. The standard test item is a standard 2-inch diameter steel trailer hitch ball. For the EM-61 MK2, the standard test item is placed on the ground in a standardized form so that the location and orientation of the EM61 sensor or array of sensors can be repeated for all static spike tests. The resulting response shall not exceed 100mV and will be preferably in the 30 to 40 mV range. For a G858G, the test item is placed on the ground centered below the sensor. At least one minute of data is recorded. Readings for the response of the standard test item should be within 20 percent after subtraction of the sensor baseline response. The test is performed twice daily, prior to collecting data and after completion of data collection. The results of the Static Spike Tests are documented on the Sensor QC Verification Form (Appendix F, Form G-1) so that the spike test responses can be quickly reviewed and long term trends (or changes) can be observed easily.
- ***Personnel Test.*** The Personnel Test is performed to check the influence of personnel carried metallic items (e.g. keys, boots, belt buckles, etc.) on the sensors.

For a towed array system, the tow vehicle will be turned on during the test. With the instrument held in static position, the operator(s) walk around the sensors while measurements are being recorded for a period of at least 1 minute. In general, the EM61 should remain within 2 mV of background. The test is performed twice daily, prior to collecting data and after completion of data collection. The Personnel Test will be included in the Static Background Test.

- ***Cable Shake Test.*** The cable shake test is performed for each sensor at the beginning and end of each day to document any cable or connection problems. With the instrument motionless and recording, each data cable is shaken and cable connector is wiggled to test for shorts or bad connections. Data collected during the Cable Shake Test should be free from spikes greater than 2 mV or variations. Cable problems generally require replacement. Connection problems are generally fixed either by cleaning or reconnection. The results of the Cable Shake Tests are documented on the Sensor QC Verification Form (Appendix F, Form G-1).

- ***Six-Line Test.*** A 50-foot test line is set up and well marked such that the same path can be repeatedly surveyed. Background conditions are evaluated on Lines 1 and 2. Heading effects, repeatability of response amplitude, positional accuracy and latency are evaluated in Lines 3 through 6. The test line is then surveyed as follows:

  - Lines 1 and 2: survey up and back on the test line at a normal speed.
  - A standard 2-inch trailer hitch ball is placed at the center of the line for Lines 3 to 6. For multi-sensor form factors, a hitch ball is used for each sensor tack.
  - Lines 3 and 4: the line is surveyed up and back at a normal speed.
  - Line 5: the line is surveyed at a fast speed.
  - Line 6: coming back, the line is surveyed at a slow speed.

- ***Two Line Repeat Data.*** The repeatability of geophysical mapping data is monitored by the collection of replicate data. Replicate data will be collected for each data set. Generally, a replicate data line is established about 10 feet outside of the area to be surveyed, 50- or 100-foot-long and oriented in the general direction of planned traverses. Start and endpoints of the line are marked with pin-flags and a measuring tape line. Two intersecting and perpendicular lines will be established. A standard test items (2-inch trailer hitch ball) is placed at the intersection of the lines. For multi-sensor form factors an appropriate length of rebar may be substituted for the hitch ball. Two passes of both lines will be recorded, up and back at the start and again at the completion of each data set. The amplitudes of the standard test items should be within 20 percent. The on-line offset of the locations is used to calculate instrument latency.

- ***Pull-away test.*** Depending on the deployment form factor selected, documentation of non-effect of the deployment form factor infrastructure on the sensors will be documented via a "Pull-away" test. This test will be conducted once for each infrastructure item in the survey area. Additionally, it will be performed with any change in equipment.

- ***Azimuthal Test (magnetics only).*** For the Azimuthal Test, an area free of geophysical noise is selected. A measurement point and the four cardinal directions are marked on the ground. A sensor head is fixed on the form factor to be deployed. Data is then recorded in a variety of sensor head orientations such that the orientation which minimizes drop outs can be selected. This test is performed once for each system deployment.

- ***Octant Test (magnetics only).*** For the Octant Test, a total of eight lines of magnetic data are collected, passing over the same central point. The arrangement of lines is north-south, northeast-southwest, east-west, and northwest-southeast arranged radially over a marked central point. The difference in the response over the central point documents heading effects. This is the recommended test for establishing heading correction parameters. Typically, this test is performed once for each system deployment, however, small changes in heading errors from the same deployed system have been observed to over short periods of time. Therefore, in most instances, the actual heading corrections applied to any given set of data will need to be optimized during data processing. Should large heading changes be seen during data QC, the test will be re-run for further evaluation of both the equipment and data processing parameters.

- ***Height Optimization (magnetics only)***. A test line is established with at least one test object along its length. Data are collected with the instrument using a minimum of three different sensor heights. The goal is to optimize the target signal to noise ratio, and maintain adequate sensitivity.

6.3.6 Standardization Logs

Standardization for geophysical mapping is ensured through adherence to standard procedures and full documentation. The following logs are used to maximize standardization, repeatability, and control of mapping activities:

- ***Sensor QC Verification Log***. This log (Appendix F, Form G-1) will document the daily calibration of each field sensor. This form documents the results and analysis of the pre- and post-survey Static Test, Static Spike Tests, and Cable Shake Test.

- ***Navigation QC Function Log***. This log (Appendix F, Form G-2) will document daily calibration of the navigation system. Pre-and post-survey results of the Six-Line Test, latency calculation, and detection of location test points and blind seed items are documented.

- ***Survey Rework Log***. This log (Appendix F, Form G-3) will document any data recollection necessary and the reasons why.

- ***Dig Sheet***. Appendix F, Form G-4: Sample Dig Sheet.

- ***Data Processing Log***. All DGM data from the field will be run through a standard data-processing procedure. This procedure will be the same for all data and will be tracked with the Data Processing Log (Appendix F, Form G-5). This log documents all

coordinate transformations, visual data-quality checks, statistical data-quality checks, statistics, interpolation parameters, etc.

- ***Crew Deployment Log***. This log (Appendix F, Form G-8) will be used to identify the location of each geophysical survey crew on a daily basis. The log tracks crew members, equipment, and expected areas to be surveyed. Attached to this daily log will be maps of the areas to be surveyed containing the coordinates of benchmarks in the areas as well as the coordinates of each quadrant corner.
- ***Field Activity Log***. This log (Appendix F, Form G-6) will be filled out by each crew chief and will detail all activities of the survey. This is a daily log and contains observations about crew performance, sensor performance, site conditions, and weather changes.
- ***Anomaly Tracking Sheet***. This log (Appendix F, Form M-8) will document the relocation and intrusive verification of anomalies.
- ***False Negative Report Form***. This log (Appendix F, Form G-7) is utilized to document a false negative event (i.e., an MEC object was not detected during the DGM).

6.3.7 Personnel

All geophysical investigations will be managed by qualified personnel. The organizational structure of the site personnel is provided in Section 2.0.

6.3.7.1 Project Geophysicist

The Project Geophysicist has overall responsibility for design, implementation, and management of all geophysical investigations required for the work effort. This individual shall be the project geophysicist-of-record.

6.3.7.2 Quality Control Geophysicist

The QC Geophysicist is responsible for planning and executing QC oversight of geophysical activities and ensuring compliance with geophysical QC requirements. Specifically, the QC Geophysicist is responsible for the following:

- Reviewing and approving the qualifications of proposed geophysical staff and subcontractors;
- Assisting the UXOQCS in planning and ensuring the performance of preparatory, initial, follow-up, and completion inspections for the definable geophysical features of work;
- Planning and insuring the acceptable performance and completion of all geophysical QC activities as specified in this GIP;

- Reviewing the geophysical QC and DGM data, target lists, and dig results as specified in the GIP;
- Establishing QC location control and blind seed items for QC of geophysical activities;
- Identifying quality problems and verifying that appropriate corrective actions are implemented for geophysical activities;
- Ensuring that the requisite geophysical QC records, including submittals, are generated and retained as prescribed.

The QC Geophysicist will have daily access to all geophysical QC and DGM data, but may only be present on-site as needed with weekly visits anticipated after the completion of the initial inspections for geophysical activities. It is expected that the QC Geophysicist will provide detailed review at the onset of the project. Once the project performance levels are acceptable the level of effort of the QC may be reduced to weekly checks; however, should deficiencies in the program occur, the QC intensity will be increased until the performance level is back to acceptable levels and then once again reduced. The QC Geophysicist will report to the Project Geophysicist and be the liaison with the UXOQC.

6.3.7.3 Site Geophysicist

The Site Geophysicist has overall responsibility for design, implementation, and management of all geophysical investigations required for the work effort, and will be on-site full time. The Site Geophysicist will have a degree in geology, geological engineering, or a closely related field and a minimum of five years of directly related geophysical experience.

Additional supervising geophysicists may be required to oversee the day-to-day operations of the site geophysical investigations. The Supervisor shall have the same education requirements as the Site Geophysicist, except the five years minimum experience requirement is waived, if working under the general supervision of the Site Geophysicist. The Site Geophysicist will report to the Project Geophysicist.

6.3.8 Survey Control

As discussed in Section 7.0, Geospatial Information and Electronic Submittals, in order to establish location control for the assigned work sites, existing concrete monuments and semi-permanent survey pins and caps will be used.

The 100-foot by 100-foot grids of semi-permanent rebar pins with survey caps will be installed across removal areas based on the previously established grid system and nomenclature. These semi-permanent control points will be used to locate individual survey and removal grids, to

provide known location for RTS or GPS set-up points, and for use as QC anomalies for navigation location control.

A grid system, consisting of 100-by 100-foot grid squares, will be established across the DGM area for each site. All grid boundaries will be established electronically and will be used to reference the DGM data collected. Any changes made to the proposed grid sizes, locations, or orientations will be coordinated with the USACE. 1983 North American Datum (NAD83), California State Plane coordinates, Zone IV, feet, will be used.

6.4 Geophysical Survey

Several survey modes can be used to collect geophysical data for the detection, location, and characterization of MEC including full surveys, grid surveys, transects, and meandering paths. For the removal at MRS-16, a full survey will be executed to acquire accurate, high-fidelity EM and/or magnetic data. Full coverage will be achieved by deploying the vehicle-towed EM or magnetic sensor arrays to collect data in sub-parallel survey lines or swaths with fill-ins using man-portable sensors. Surveys will be performed either north-south or east-west as the survey area dictates with at least one cross-line for leveling. Procedures for full coverage survey mode are discussed in section 6.3.4. All data traverses will be brought into the GIS for verification of full coverage.

Portions of the MRS-16 site may be surveyed with DGM multiple times. The first DGM survey will be conducted after vegetation clearance and the surface removal. Additional DGM surveys may occur once the first data have been interpreted and the targets excavated, and will be used to verify the excavation results. Successive DGM surveys will be performed as described in Section 6.2.

6.5 Data Processing

Shaw's standard data processing includes data leveling, statistical data assessment, grid generation, and non-customized data filtering to accentuate target signatures. Shaw will use software from the equipment manufacturers, in-house software, and Geosoft's Oasis Montaj and UX-Detect software to complete all tasks. Subsequent to the processing and review of the data, all data grids and target detections will be loaded into the GIS.

Data will be downloaded in the field directly from the data-logger to a laptop computer for processing using the appropriate Geonics or Geometrics software. The vendor software will also be used for initial review and editing of the data as necessary, for generation of profile lines, and for conversion of the survey line data to XY coordinates for contouring and analysis. The initial data processing steps are described in the following sections.

6.5.1 Data Pre-Processing and Review of Data Sets

The data interpretation process begins by verifying the validity of the collected data sets. This will be accomplished by reviewing the associated QC data, insuring that the sensor and navigation equipment are functioning properly, that the data are accurately positioned along survey lines, that they match the site dimensions, and properly fit within the predefined survey site. All validation results will be noted in the Data Processing Log (Appendix F, Form G-5).

6.5.1.1 Review of QC Data

Vendor-supplied software will be used to make initial review of the data. This step validates that the data collected fall within prescribed recording ranges, and that no data outliers or null-values are present. Data statistics will be developed to measure compliance with the DQOs.

- ***Review of Sensor QC Data.*** Sensor QC test results (equipment warm-up, sensor position, static background and spike tests, cable shake test, personnel test) will be reviewed to ensure proper sensor function. Geonics, Geometrics and Geosoft software will be used to make initial review of the data. This step validates that the data collected fall within prescribed recording ranges, background noise and signal-to-noise-ratios fall within acceptable ranges, and that standard responses to known items are consistent with known values. Minimum, maximum, mean, and standard deviations of the pre- and post-survey Sensor QC tests will be calculated and reported into the Sensor QC Verification Log (Appendix F, Form G-1). Standard values and ranges will be determined, in consultation with USACE, based on the GPO results.
- ***Review of Navigation QC Data.*** Vendor-supplied software will be used to make initial review of the navigation QC and to ensure that the navigation system is functioning properly. Geonics/Geometrics, Leica and Geosoft supplied software will be used to make initial review of the data. Navigation offset distances and latency factors will be calculated based on the test results and compared to the DQO objectives. The QC location and blind seed item locations will be reviewed. Cumulative positioning errors are not to exceed 2.0 feet. Navigation QC data parameters will be entered into the Navigation QC Function Log (Appendix F, Form G-2).

6.5.1.2 Initial Data Review and Preprocessing

The Site Geophysicist will review sensor and navigation data for accuracy, completeness, and data fidelity. The geophysicist will also verify that the data are complete and fall within the prescribed survey area.

The operator will examine the quality of the data and define additional filtering or reprocessing of the data that may be necessary. Additionally, one-dimensional line data will be reviewed in Geosoft's Oasis Montaj UX-Detect software, which has a profile display mode. All observations related to data review will be fully documented in the Data Processing Log (Appendix F, Form G-5).

The vendor software will also be used for initial review and editing of the data as necessary, for generation of profile lines, and for conversion of the survey line data to XY coordinates for contouring and analysis. Each sensor record has an associated time stamp. Pre-processing involves synchronization of the navigation data stream coordinates with the sensor output data streams. All data will be converted into XYZ files in NAD83, California State Plane coordinates, Zone IV, feet. All activities will be documented on the Data Processing Log (Appendix F, Form G-5). The initial steps taken in the data processing flow will include the following:

- ***Initial Review of Collected Data.*** Geometrics and Geonics supplied software will be used to make initial review of the data. This step validates that the data collected fall within prescribed recording ranges, and that no data outliers or null-values are present. During this step, all data collection and downloading parameters will be entered into the Data Processing Log (Appendix F, Form G-5).

- ***Navigation Data Review.*** Positional information collected via RTS or GPS is designed to provide real-time XYZ location solutions at up to 2 to 4 times per second, concurrent with collection of the sensor data. However, circumstances can arise where the navigational data require post-processing to remove errors in coordinate locations. In the case of the RTS these errors can be caused by the loss of line-of-sight between the RTS and the prism due to intervening objects, or to inaccurate entry of coordinates for base station reference locations. If positional errors are detected, they will be documented in the Data Processing Log (Appendix F, Form G-5). Subsequently, these corrected position data will be used in the data-merging step to create XYZ files.

- ***Data Merge/Offset Calculation.*** During this step, the sensor array data will be integrated with navigation data to create sensor data files with coordinate positions using MagMap. Form factor adjustments of each sensor location (offset) with respect to the RTS prism or GPS antenna are made. Latency corrections based on the navigation QC data are also performed. For the latency correction, the DQO specifies no visible chevron effects in the data or pseudo-color plots. The use of appropriate color scaling will be maintained throughout the project. This step creates ASCII XYZ data files containing Easting, Northing, and Sensor values in column format as described above. These files are similar to the USAESCH ASCII Data File, and conversion to the ASCII Data File format can be performed upon request.

- ***Base Station Correction.*** For data leveling, validated magnetometer data are corrected for diurnal fluctuations using Geometrics MagMap or MagMapper software. This software is designed to remove the ambient background from each sample collected by the G858G sensor. The resultant data set represents only the magnetic field changes that are caused by anomalous objects contained within the survey area. After the previously stated steps are executed and documented in the Data Processing Log, the data are adequately prepared for target detection and analysis.

- ***Coverage Assessment.*** To verify that complete coverage has been achieved during survey activities, all navigation traverses will be reviewed and documented during the

data processing and analysis steps. With a line spacing of approximately 2 feet, traverse data overlap will not exceed 1 foot. The areas surveyed and areas missed will be calculated and documented on the Navigation QC Function Log (Appendix F, Form G-2). If missed surveyable areas are present, Survey Rework Form (Appendix F, Form G-3) will be completed and provided to the Site Geophysicist.

- ***Deletion of Extra or Erroneous Data.*** Extra or erroneous data such as instrument run-ons at the ends of lines, data collected in turnaround areas, data spike, nulls, etc. will be deleted.

- ***Site Feature Check.*** Additionally, the geophysicist will examine the data with respect to site cultural or natural features (wells, trees, utilities, etc.) observed on site or mapped in the GIS.

- ***Analysis of Data Sampling.*** Data sampling statistics will be calculated in Geosoft and entered on the Navigation QC Function Log (Appendix F, Form G-2). These statistics include: velocity, along-track and across-track data spacing, area surveyed, and area of data gaps. The survey platform will maintain a mean speed of less than 3 mph or the maximum speed as determined during the GPO. Along-track sampling error will be less than 0.5 feet. Across-track sampling error will be less than 1.0 feet and no single gap will be greater than 4 square feet excluding data gaps due to trees or other obstacles that preclude the survey platform from providing complete coverage. This metric is intended to control data gaps associated with inconsistent track plots that are not associated with trees or other obstructions.

- ***Analysis of Replicate Data.*** The pre-and post-survey replicate data lines will be reviewed for each data set. Data sampling statistics will be calculated in Geosoft and entered on the Navigation QC Function Log (Appendix F, Form G-2). The amplitudes of the responses over standard test items should be within 20 percent, the location accuracy should be within 2.0 feet, and the latency calculation should check with the Navigation Function Test results.

6.5.1.3 Data Processing

Geophysical data analysis will begin after execution of standard data pre-processing steps (discussed above in Section 6.5.1.2) where field data are verified, cataloged, reviewed, and converted into XYZ files in NAD83, California State Plane coordinates, Zone IV, feet. All activities will be documented on the Data Processing Log (Appendix F, Form G-5). The digital data will be an ASCII space or comma delimited XYZ file suitable for input into the Geosoft programs. Successive data processing steps include:

- ***Statistical Analysis.*** All XYZ files will be processed to calculate statistics describing survey coordinates and sensor values. These statistics will be calculated to assist the Site Geophysicist in the assessment of data quality.

- ***Data Leveling.*** Based on the initial review of the data, the statistical assessment results, and the calibration data, data leveling will be applied to the data. Consistent

parameters and processing methods will be used for all channels within each dataset. Consistent processing routines will be used for all datasets throughout the project.

- ***Data Cataloging.*** After leveling of the XYZ files is completed, all XYZ files will be cataloged into an Access database. Information in the database will document the sensor types, deployment configurations, navigation methods, crew members, statistical analysis results, etc.

- ***Data Gridding.*** XYZ files will be interpolated onto right-rectangular, evenly spaced grids. Gridding will initially be performed using the Geosoft minimum curvature function with an initial grid cell size of no larger than 0.5 feet. Interpolated grids will be reviewed by the data processor to determine the completeness and accuracy of prior data manipulation steps. Gridding parameters will be adjusted based on the sampling intervals actually achieved in the data.

- ***Data Filtering.*** Initial assessment of the data will be performed on grids with no filtering applied to the data. However, a suite of simple data filters is available to enhance target signatures by reducing the effects of high frequency and/or low frequency noise sources. If filtering is needed, it will be optimized to maximize the signal-to-noise-ratio on both weak and strong anomalies. Filter selections and all filtering parameters will be recorded.

The raw data, digital records, and field notes for each data set will be provided by the Project Geophysicist to the USACE for independent interpretation/evaluation. Draft data (i.e. corrected for sensor offset, diurnal variation, latency, heading error and drift) shall be submitted within 36 hours of data collection.

6.6 Target Detection

Targets are detected via a two-step process: (1) initial automated detection, and (2) operator-aided detection by a qualified geophysicist. The first step is automated target detection based on threshold analyses. Geosoft's UX-Detect will be used for simple threshold (Blakey) detection using gridded data. Parameters controlling the selection of targets include proximity of adjacent targets, collocation of targets on other channels of data, size, and distribution of anomaly amplitudes. Threshold values will be determined from the GPO results.

The manual detection of targets is based on systematic visual search of raw and filtered data, on single or multiple EM and magnetic channels. This will be accomplished using the Oasis Montaj/UX-Detect software system. At this stage, automatic target detections will be modified, deleted, and/or added by the operator based on the proximity to surface features, utilities or any known non-MEC object whose response is seen in the data. The automated and operator target detection steps will result in a target list and a set of target parameters, including X and Y coordinates, area, proximity to other targets, and signal strength statistics.

The steps of the target detection process are documented in the Data Processing Log (Appendix F, Form G-5) to facilitate replication of the target analysis results during QC.

6.6.1 Anomaly Selection and Decision Criteria

For each data set, the Site Geophysicist will assess each of the following factors prior to generating an anomaly list:

- The local background conditions of the geophysical response. The threshold values used for target detection will be based on the minimum signals recorded as part of the GPO;
- Data completeness and accuracy;
- Data quality;
- Field notes on site and survey conditions and observations;
- The boundary conditions, utilities and/or other cultural features present, and unsurveyable areas (beneath roads, trees, buildings, etc.);
- The shape and amplitude of the response of known targets buried in the ODDS test plot;
- The shape and amplitude of the response of relevant anomalies encountered in previous MEC removal grids;
- Local geology and soil conditions;
- The extent and boundaries of metal-rich fill areas, if any.

Target selection procedures and parameters will be based on the ODDS plot and Parsons' survey results. It is anticipated that EM data will be collected at MRS-16. Geosoft UX-Detect will be used to automate the initial anomaly selection process. Targets are anticipated to be picked using either time gate 3 or the sum of the 4 time gates for the EM61 data or analytic signal data for magnetic data.

A manual review of the anomalies and target lists will be performed to QC the anomalies and to optimally locate the target location on the anomaly as needed. Targets will be removed if caused by cultural anomalies (roads, fences, wells, etc.) or are due to obvious artifacts (drop outs, etc.) in the data. For EM data, a review of channel decay profiles will be performed at all suspect and/or low amplitude anomalies to remove anomalies not exhibiting the response characteristics of buried metallic objects.

6.7 Dig List Development

The target analysis results in the creation of dig lists which contain target location and the peak EM61-MKII Time Gate three amplitudes for reacquisition. These amplitude values are used to verify that the correct target is excavated. Following the identification of potential target anomalies from the geophysical data evaluation, the anomalies will be assigned to the appropriate grid for development of the grid dig lists.

6.7.1 Dig Sheet

The grid dig sheet will contain the following information:

- Facility;
- Responsible geophysicist;
- Geophysical data sets used;
- Grid identification;
- Southeast grid corner location in NAD83, California State Plane coordinates, Zone IV, feet;
- Grid background response levels;
- Unique anomaly identification numbers;
- Predicted anomaly easting and northing in both local grid (relative) coordinates and in NAD83, California State Plane coordinates, Zone IV, feet;
- QC target anomalies;
- Sensor peak values for each target anomaly.

The anomaly nomenclature will be consistent with existing protocol, that is, by grid then target number e.g. C2B4B4-0001.

6.7.2 Location QC Items

As part of the QC program, rebar hubs will be installed by the surveyor on grid corners within the removal areas at known locations to within ±0.5 foot. The frequency of the location QC items shall be at least one per data set or one per five acres of contiguously surveyed area. Two types of location QC items will be used: 1) semi-permanent location control rebar pins with survey caps; and 2) temporary items (hubcaps or trailer hitch balls) placed on the ground surface. A QC failure will result if the item is not detected or is not detected within 2 feet of its known location during the geophysical mapping and evaluation.

6.8 Target Location Reacquisition

Dig list (Appendix F, Form G-4) targets must be reacquired prior to excavation. Reacquisition consists of locating the position of the target based on the coordinates in the dig list and the refining of the location by finding the location of the peak response using the EM61-MKII. To locate the ground position of the anomaly coordinates the navigational system in Waypoint Location mode will be used. A white non-metallic pin flag, labeled with the unique anomaly number, will be placed in the ground at the indicated grid coordinates.

The same instrument/sensor used to detect the target, in this case, the EM61 MK2 will be used to identify the peak location of the anomaly (i.e., the precise location on the ground where the excavation should occur). The sensor will be moved back and forth (in at least 2 directions) over the general area of the anomaly coordinates until the peak value of the anomaly is located. If more than one peak is located, the peak with the highest amplitude will be selected. If no unique peak value is present (i.e., the same peak value is measured over an area), the center of the maximum area will be selected. If no peak value is located at the indicated location, the white anomaly location flag will be left in place, and the site geophysicist will be consulted. Similar to previous work by Parsons, 20 percent of these locations will be excavated for QC.

The reacquisition team will be provided an image plot of each target to assist in the localization of the center of the target. This will assist in areas where multiple anomalies are present or where the target is a compound anomaly comprised of multiple sub-anomalies.

The peak value measured over the anomaly will then be recorded and the dig location will be marked with a colored flag labeled with the anomaly number. The specified relocation process serves three purposes:

- It focuses the excavation over the actual anomaly peak, instead of an interpolated location between the survey measurement points.
- It reduces measurement errors.
- It provides a QC ground check for the dig locations.

Per DID MR-005-05 (USACE, 2003), 95 percent of all anomalies must lie within a 1-meter radius of their original surface location as marked on the dig sheet.

6.9 Feedback Process

The USACE QA will receive weekly updates on DGM and dig activities from the QC geophysicist. This will include but is not limited to outlining field operations, equipment or data

issues and resolutions. Statistics on grids/grid area coverage, data processed, anomalies picked and dug and false alarm rate will be provided. Additionally, data processing, calibration and navigation QC forms will be posted. As part of data management, tracking information will also be included.

The feedback of ground-truth excavation data via the Anomaly Tracking Sheet (Appendix F, Form M-8) and the Dig Sheets (Appendix F, Form G-4) is one of the most important ways to ensure effective geophysical mapping. Excavation data collected during each intrusive activity will be captured to document the item location, weight, shape, orientation, and depth. These data will be electronically entered into a ground-truth database, reviewed by the QC specialist, and incorporated within the MEC item database (see Section 7.0, Geospatial Information and Electronic Submittals). Excavation results for each MEC removal grid will be reported to USACE within three working days of grid completion. The Site Geophysicist or designee will review the excavation results with respect to the anomaly selection criteria, QC dig results, actual MEC encountered, and any DQO performance criteria failures and provide a weekly progress report with recommendations to the USACE.

6.10 Intrusive Target Verification

After anomaly locations have been reacquired, the following procedures will be used for the intrusive verification and reporting of the target anomalies. The Site Geophysicist will report the anomalies to the SUXOS as ready for excavation and identification. The SUXOS will assign a UXO team to excavate and identify the anomaly and record the required information in the Excavation Log Sheet per Attachment C of DID MR-005-05 (USACE, 2003).

An Anomaly Tracking Sheet will be used to record discrepancies between the dig sheet location and the actual reacquired location, and to note any anomalies that could not be reacquired. The reacquisition location will be measured and logged. The reacquisition coordinates will be used as the official dig location for location QC assessment.

After the UXO team has completed the excavation, the geophysical reacquisition team will return to the excavation location and record the post-excavation anomaly peak values to QC test that the source of the anomaly has been removed. Every excavation within a given grid will be QC tested. After the excavation is completed, the geophysical sensors will survey each excavation location. The same geophysical instrumentation used to obtain geophysical data and generate geophysical maps and target lists will be used for the geophysical QC testing (Geonics EM61-MK2). Data will be obtained in real-time and the sensor data will be noted and recorded on a QC form (hard copy or electronic). If the sensor data are determined to be within the background range, as determined by the Site Geophysicist, the QC test is completed and the

excavation can be backfilled. If the sensor data are determined to be above background range, the excavation will continue down to detection depths.

6.10.1 False Positives and Negatives

6.10.1.1 False Positives

False positives are reacquired anomalies that result in no detectable metallic material during excavations. These targets would be logged on the Dig Sheets (Appendix F, Form G-4) if reacquisition resulted in no evidence, either by instrumentation or excavation, of an MEC-related target. False positives result from effects in the data caused by topographic conditions, low amplitude signals associated with background noise, and subsurface soil conditions. False positives will be minimized to the extent possible through use of the best available geophysical practices executed by qualified staff. Additionally, false positives will be documented in the target database so that the 15 percent false positive metric can be monitored.

False positive excavations are different from "False Alarms," which result when an anomaly is detected at a given location and posted to a Dig Sheet, and the intrusive activity results in a target that is not an apparent MEC item (UXO or scrap). The objective at this site is to minimize false positives while achieving the MEC detection specifications.

Per DID MR-005-05, more than 15 percent false positives (anomalies reacquired which resulted in no detectable metallic material recovered in excavations calculated as a running average for the sector) will result in a reevaluation of the data, detection methods, and overall project QC. A written response explaining the reason for the excessive false positive rate, and a Corrective Action Plan (CAP), if appropriate, will be submitted within 10 days.

6.10.1.2 False Negatives

A false negative is defined as a target not detected or listed on the Dig Sheet. These "missed targets" are those that fall within the detection limits of the deployed geophysical sensor systems and, therefore, should be detected and included in the dig list. False negatives can be caused by operator error, instrument error, navigation inaccuracy, or procedural errors where data are lost, distorted, or made inaccurate through erroneous manipulation. False negatives will be assessed via the use of known location and blind QC targets. It is expected that the USACE QA will place seed items as an additional check for false negatives.

False negatives are difficult to identify, as they are undetected targets. These targets can be identified during reacquisition where new anomalous signatures are identified in the field. Additionally, false negatives can be identified during other site activities such as MEC removals

and other excavation activities. In any of these cases, the following procedures will be performed:

- A False Negative Report Form (Appendix F, Form G-7) will be completed by the Site Geophysicist and submitted to the QC Manager with copies provided to the Project Manager.
- The QC Manager will forward this information to the UXOQCS, who will investigate and provide a memo report describing the activities associated with the discovery. This report will also provide recommendations for further action. Technical information for this memo will be provided, upon request from the UXOQCS and Site Geophysicist.

6.10.2 Horizontal Accuracy

Cumulative positioning errors will not exceed 2.0 feet. A navigation functionality test will be performed each morning and evening to quantify the accuracy of the positioning system. All location and blind QC items will be detected within 2.0 feet of their known locations.

6.11 Quality Control

Geophysical mapping QC at the assigned work sites will ensure proper execution of all components of the work performed to detect, locate, and reacquire targets. The QC program is described in Section 10.0, QCP. The program will be administered by the UXOQCS, assisted by the QC Geophysicist.

6.12 Corrective Measures

The objectives of the geophysical investigations are to accurately locate and record the location of anomalies (potential MEC). In the event of a DQO failure, Shaw's Project Geophysicist and QC Geophysicist will perform a root-cause analysis to identify the reason for the failure, to identify how much data has been affected, and whether corrective actions can be taken to correct, mitigate, or eliminate the cause of the failure. This will include examining the ability to meet the metric for any DQO given the site conditions where the data was collected. The root-cause analysis will be submitted to the USACE Geophysicist.

In the event that a particular geophysical method, instrument, or procedure is not generating meaningful results or advancing the project goals, Shaw will convene a review team consisting of the Shaw's PM, Project Geophysicist, and QC Geophysicist and USACE's COR, Design Manager, and Geophysicist by the next working day to investigate the cause and recommend corrective action.

Specific corrective measures are dependent on the type of geophysical equipment used during an operation and will be developed on a site-specific basis. However, the following are the basic corrective measures Shaw will employ for DGM:

- Replace sensors if they fail to meet calibration requirements;
- Replace navigation equipment if daily check of location accuracy is not met;
- Re-survey grids when data quality specifications are not met;
- Reprocess all geophysical data collected during a survey day if 10 percent reprocessing procedures results in detection of additional valid targets;
- Re-excavate targets if Site Geophysicist determines that the excavated targets are not associated with the initial target anomaly.

Basic corrective measures will be implemented as part of day-to-day activities (i.e., replacing faulty equipment). USACE will receive written notification of all actions taken. If an instrument or process cannot be corrected to meet a DQO, Shaw will cease using that instrument or process and make recommendations to USACE. These recommendations may include modifications to this GIP. Shaw will implement the amended plan upon approval from USACE.

6.13 Geophysical Data Management

The geophysical records management plan includes four components: field survey records management, DGM (sensor and survey data) data management, GIS records management, and data processing/analysis records management.

Field Survey Records Management: All data files and field logs generated during the field operation will be managed by the Site Geophysicist and provided to the USACE on a monthly basis. Paper files will be organized in the office trailer and be filed by individual day. Photocopies of all paper documents will be made and filed at an off-site location. Paper documents with significant information not captured digitally will be scanned and archived. Electronic files will be organized on an office PC dedicated to geophysical investigation management. File directory structures will be organized by day of year, with subdirectories for specific field activities (navigational data, survey data, etc.). All directories will also have "README" files describing files contents and chain of custody history. All field data will be backed up onto CD read-only memory (CD-ROM) or tape on a daily basis as well as transferred to an offsite location.

Digital Geophysical Mapping Data Management: Field geophysical data and navigation data will be periodically downloaded throughout the data to a field laptop. The electronic files will be organized on an office computer dedicated to geophysical investigation management. Electronic

files include, but are not limited to, G-858G and/or EM61 data files, navigation files, sensor calibration files, and QC test data files. Standardized file naming conventions and directory names will be used. File directory structures for field data will be organized by day of year, with subdirectories for specific field activities (navigation data, survey data, etc.). All directories will also have "README" files describing directory contents and chain-of-custody history. All field data will be archived on CD-ROM on a daily basis. Backup data will be transferred to an off-site Shaw location twice per week.

GIS Records Management: All generated and developed GIS files will be managed by the GIS Manager and stored on an onsite PC dedicated for GIS management and analysis. The data will be stored within the standard GIS subdirectory structure with "README" files in each directory containing a description of the contained files. All GIS data will be backed up onto CD-ROM or tape on a regular basis as well as transferred to an offsite server location. Data on the off-site server will be backed-up onto tape as part of the data server archiving process.

Data Processing and Analysis Record Management: All data files and Data Processing Logs generated during the processing and analysis of geophysical field data will be managed by the Site Geophysicist. Paper files will be organized in the office trailer and be filed by individual day. Photocopies of all paper documents will be made and filed at an off-site location. Electronic files will be organized on an office PC dedicated to geophysical investigation management. File directory structures will be organized by day-of-year, with subdirectories for specific field activities (GPS data, survey data, etc.). All field data will be backed up onto CD-ROM on a daily basis as well as transferred to an offsite location.

All data, (field data, GIS data, geophysical processing and analysis data) will be backed up as a complete system on a weekly basis onto CD. Two copies of the CD will be created with one copy stored in the office trailer and one copy sent to an off-site server location. Data on the off-site server will be backed-up onto tape as part of the data server archiving process.

6.14 Interim Reporting and Submittals

Access to interim geophysical survey and navigation data will be provided so that raw and processed data will be posted no more than 3 and 5 working days (respectively) following collection. Updated field, QA/QC, data processing, anomaly tracking logs and data tracking forms will be available weekly. All digital data will be provided in formats compatible with the USACE computer systems. Interim data will include the following:

- Draft and final geophysical data for all data sets;

- All raw, interim, and processed XYZ and grids files, with associated "README" files documenting file header and channel information;
- Daily field logs, Data QC and Data Processing, Sensor QC Verification, Navigation QC Verification logs;
- Field sketches of each grid;;
- Grid data and QC reports for all MEC removal grids in Word format;
- Draft and final anomaly lists for all MEC removal grids in Excel format;
- Dig lists and relocation coordinates for all MEC removal grids in Excel format;
- Anomaly excavation reports for all MEC removal grids in Excel format;
- QA dig lists and excavation reports for all MEC removal grids in Excel format;
- Weekly summary of field operations including production rates, grid coverage, excavations and reacquisitions as well as any problems encountered and their solutions by the Project Geophysicist ;
- Summary of weekly events including data and general QC analysis by the QC Geophysicist.

Interim GIS data will be provided in formats compatible with the USACE computer systems on a monthly basis. Interim GIS data will include the following:

- Electronic base and topographic maps for all MEC removal grids, with grid control points, in Geosoft or ArcView format;
- Tracking grid status clearly showing work phase and submittal of each grid

The interim geophysical survey and GIS data will be posted to a project SharePoint site to facilitate data sharing between Shaw and USACE.

The USACE QA Geophysicist and Shaw QC Geophysicist will have regular weekly phone discussions as a means of providing updates and feedback as well as addressing more pressing issues.

6.14.1 Corrective Action Responses and Grid Failure

Shaw's quality management standard is based on root cause analysis and corrective action implementation. All non-conformances will be documented and the impact on the project reported. Included in the submission will be a CAP.

6.15 Final Reports and Maps

Finalized DGM data will be transmitted to USACE 14 days after completion of survey activities, along with a letter of transmittal conveying explanations and pertinent information, and will include maps, QC reports, summaries, and supporting data.

All sensor data will be preprocessed for sensor offsets, latency effects, etc., and correlated with navigation data. The geophysical mapping technology will digitally capture the instrument readings into a file coincident with in NAD83, California Coordinates, Zone IV, feet. This field data will be checked, corrected, and processed into ASCII files in the XYZ file format. Corrections (e.g., for navigation and instrument bias) will be applied, but there will be no filtering or normalization of the data. All corrections will be documented.

The data will be presented in delineated fields as X, Y, Z1, Z2, Z3…, where X and Y are State Plane, Zone 4, U.S. Survey Feet Coordinates in East and North and Z1, Z2, Z3… are the instrument readings. Each of the fields will be separated by a space (not a comma). Geophysical field data will consist of files in column format. Header information will be included in each file. Each grid of data will be logically and sequentially named so that the file name can be easily correlated with the grid name used by other project personnel.

Digital versions of daily field logs, Data QC and Data Processing, Sensor QC Verification, Navigation QC Verification logs will be provided.

A digital planimetric map of each geophysical survey grid will be prepared as part of the final deliverable. The map format will be consistent with DID MR-05-005, Attachment D. These maps will reflect the current site conditions after site preparation work (removal of vegetation, fencing, dumpsters, debris, etc.) has been completed. ArcView format GIS maps will be provided including the locations of all targets and excavation results. Geophysical image maps will be provided for each grid with the geophysical data displayed in color with overlaid target data. These maps will be in NAD83, California State Plane coordinates, Zone IV, feet, and will be coincident with the location of the geophysical survey data.

7.0 Geospatial Information and Electronic Submittals

This Location Surveys and Geographical Information Systems Plan describes the methods, resources, and accuracy necessary to successfully document the location of MEC and MEC components in project databases. This plan was developed in accordance with DID MR-005-07.

7.1 Objectives

Survey, mapping, and aerial photography tasks are key components of the MR to accurately identify the location of each MEC and MEC component in the field, for reporting the location of these components on maps, locating information in spatial queries conducted in the GIS, conducting statistical analyses, and for assisting with disposition of MEC and MEC components.

The existing Fort Ord GIS and associated databases will be used to track and manage the data generated during the course of MEC removal and the disposition of MD. Use of the existing system will provide consistency with previous and ongoing work by other contractors. This will provide an efficient mechanism for retrieving MEC related information for technical evaluation, removal efforts, reporting, and ultimately to assist in the efficient transfer and reuse of parcels at the former Fort Ord.

Shaw will use, if appropriate, a mapping grade GPS methods to document fieldwork and survey locations of MEC found. Data will be collected and stored in a database consistent with the existing GIS. Data will be provided in electronic deliverables compatible with the installation's existing software and hardware configurations. Positional information will be captured through the use of Trimble's highest mapping-grade real-time Differential GPS (GPS Pathfinder® Pro XR receiver with a TSCe data collector or better). Data will be referenced to the existing Master Grid System. Data to be collected and added to the GIS will include:

- Location/description of MEC;
- MEC scrap recorded by weight by grid;
- Inaccessible areas;
- Path walked (as documentation of area covered);
- Other/unusual features (targets, drums, small arms, etc);
- Usually more data collected than this. i.e depth, mV reading, orientation, type of MEC, etc.

7.2 MEC Safety Provision

Survey crews will be required to conduct fieldwork in areas containing potential MEC components. A UXO Technician II will accompany the survey crew during initial work

conducted in such areas and all subsequent work that may require intrusive field activities. Primary activities conducted by the UXO Technician II will consist of conducting a visual and magnetometer sweep at each location where intrusive activities will occur to ensure the site is anomaly free prior to the surveying crew setting monuments or driving stakes. Intrusive activities include driving stakes, placing monuments, setting control points, placing iron pins, or any other field activity that penetrates the soil surface. The UXO Technician II may not be required after an area has been cleared or if intrusive activities are not required. The UXO Technician II will not be assigned additional survey tasks that would interfere with the safety aspects of clearing the area to conduct these activities.

7.3 GPS Survey Methods

Global Positioning System methods will be used to document fieldwork and survey locations of UXO found. Data will be collected in a database consistent with the existing Fort Ord GIS and data will be provided in electronic deliverables compatible with the installation's existing software and hardware configurations. The GIS will be developed using the ArcView™ system and will utilize an Access database to control all developed site information. The ArcView™ GIS will be used on a regular basis as the project proceeds and be delivered to the Government at the completion of the operation.

Positional information will be captured through use of a Trimble survey-grade RTK–GPS or compatible systems. Data will be referenced to the existing Fort Ord Master Grid System (short version) which consists of medium and small grids (1,000 by 1,000 and 100 by 100 feet, respectively). Data to be collected and added to the GIS will include:

- Grid boundaries
- Location/description of MEC
- MD recorded by weight by grid
- Other/unusual features (targets, drums, small arms, etc.)

The grid boundaries will be located in the field using GPS to navigate to way-points obtained from the GIS.

Each MEC investigation team will include a dedicated GPS technician or a UXO Technician trained to use the GPS. Data will be collected in the GPS during each phase of the project, including geophysical surveys, anomaly reacquisition, excavation, and special case areas, where possible.

7.3.1 Control Points

Survey control will be established with permanent monuments. Plastic and wood hubs will be used to delineate the corners of the 100 by 100 foot investigation grids.

7.3.2 Accuracy

With GPS, the expected horizontal accuracy is subfoot. This is considered adequate for this work.

7.3.3 Plotting

All location survey control points (including monuments, aerial targets, and property corners) established on the site will be plotted at the corresponding coordinate point on a digital base map that can be reproduced at scales established for the project or at a scale appropriate for the parcel being described.

7.3.4 Mapping

Survey data will be stored digitally and will be reproducible for accurate plotting on planimetric or topographic maps at the scales specified in DID MR-005-07. Each control point will be identified on the digital map by its name and number and will include the final adjusted coordinates and elevation. Unless otherwise requested, each map will include a north arrow (grid, true and magnetic) with the differences between them in minutes and seconds posted. Grid lines or tic marks posted at systematic intervals with their corresponding grid values will be shown on the edges of the maps. The legend will include standard symbols used on the map and a map index showing the relationship of the map to the overall project or site boundary. NAD83, California State Plane, Zone IV, feet coordinates will be established for the corners of each grid area investigated. All status and report maps will be delivered in ArcGIS Mxd format with corresponding data set to relative path.

The horizontal location of each MEC item will be measured to 1 foot horizontal accuracy within the grid. Measurements will be made utilizing GPS technology to locate MEC components following site-specific protocols for recording, documenting, and integrating the location and MEC attributes with the MEC data management system. The location information for each MEC item that can be reproduced on a map from the GIS and associated database includes the Cartesian coordinates, California coordinates, depth, type, and disposition.

7.4 Geographic Information Systems

Significant amounts of data collected during the various investigations that have been conducted or are currently being conducted are already integrated into a GIS for the former Fort Ord. The GIS for MR projects conducted by Shaw will leverage existing systems already developed for the base so all data in the GIS can be efficiently integrated to meet the needs of MEC investigations and ultimately assist with making decisions regarding future reuse of parcels.

Under the direction of the Sacramento District USACE (CESPK), a comprehensive Microsoft Structured Query Language (SQL) Server database and Arc/INFO, Arcview GIS has been developed and maintained to manage, evaluate, and report site information. These systems consist primarily of environmental data (soil and groundwater chemistry), MEC data, geologic data (lithology, borehole and well construction details), hydrogeologic data (water levels), and infrastructure (roads and utilities). Attribute data are stored primarily in a Microsoft SQL Server relational database. Spatial data identifying elements such as buildings and reuse areas are managed in Arc/INFO and Arcview. The Arc/INFO and Arcview GIS are integrated with the Microsoft SQL Server database and are used for spatial analyses of the various attribute and spatial data. All existing data are referenced to the NAD83, California State Plane Coordinate System, Zone IV, Feet.

Data will be referenced to the existing grid system. Data to be collected and added to the GIS will include:

- Location/description of MEC;
- MEC scrap recorded by weight by grid;
- Inaccessible areas;
- Path walked (as documentation of area covered);
- Other/unusual features (targets, drums, small arms, etc)

The GIS will be developed using the ArcGIS™ software and will utilize an Access database to control all developed site information. Deliverables that will be provided during and at the completion of the project will be specified by the CESPK GIS Manager.

The GIS will be used to produce project reports and to document physical progress, shown visually on maps and by percent complete in tabular form.

7.5 GIS Staffing

Global Positioning System support will be provided for the duration of the project by one part time GIS Manager. GPS survey will be accomplished by a technician assigned full time to the field crew during surface and Schonstedt removal and during anomaly excavation.

The GIS Manager shall perform the following duties, assisted as appropriate by a technician:

- Primary interface with the CESPK GIS Manager
- Coordinate field data collection, accuracy, hardware/software, (GPS, field computers, etc.) and the data flow processes involved
- Provide training and oversight for GPS technicians

- Understand end user needs and objectives, optimize workflow, research and keep abreast of all available and applicable data, technology and standards, and integrate internal and external resources (staff, hardware/software, support services) necessary to meet project objectives
- Handle a highly sophisticated SQL server relational spatial database integrated into the GIS system
- Program in Microsoft and/or Environmental Systems Research Institute (ESRI) Software
- Respond to queries from team members; create and print maps, tabular data and reports from ArcGIS™

7.6 Computer Files

ArcGIS 8.0 or higher will be the primary GIS software used to manage the data. Microsoft SQL Server 2000 or newer version is the relational database to be used by contractor to store MMRP data. Arc/INFO v8 or higher will be utilized if ArcGIS 8.0 is not sufficient to handle specific tasks. AutoCAD Map v2000 will also be used for spatial editing. Microsoft Office 2000 or higher (Word, Excel, Access) will be the primary workstation application to manage text, spreadsheet and database information. Adobe PDF will be utilized to publish electronic deliverables on CDs and the web. The documents will have a linked table of contents, tables, photographs, graphs, figures and appendices. The shareware PDF viewer will be provided along with the PDF documents. The interrelationships between these applications, their associated data sources, and intended output will be documented in the site-specific GIS Users Manual.

Microsoft Access will be utilized to manage the project database. The data workflow and data management scheme will be developed in conjunction with the CESPK GIS Manager.

All location survey data, digital maps, GIS, associated database and computer-aided design (CAD) files, and digitized aerial photographs will be provided in common, transportable formats that can be copied to portable media for archiving or transfer to other team members. Submittals will be delivered on CD. As appropriate, sections of the database will also be available through file transfer protocol or project SharePoint sites for those that have appropriate permission.

As requested by CESPK, in progress maps, databases, survey information, maps, and documents will be provided to the CESPK GIS Manager.

Minimum hardware requirements to meet the basic computing needs of GIS and database analysts working on the project include a single 700 Megahertz Intel Pentium III processor, 20 gigabyte hard drive, 256 megabytes random access memory, read/write CD drive, high speed

graphic card, and 21-inch monitor. A workstation meeting these requirements is available at the site office. Local output devices will be available for producing quality 11 X 17 inch color output; D size (36 X 24 inches), and E size (34 X 44-inches) plots (such as a Hewlett Packard DesignJet 755CM or 1055CM), and 8-1/2 X 11 inch black and white laser jet quality text. A multiple page scanner is also recommended for archiving field data sheets.

Global Positioning System work will be conducted on a dedicated workstation at the Shaw Fort Ord field office. The on-site project team will have access via a Wide Area Network for additional support if needed using an existing Fort Ord broadband Internet connection. The Fort Ord local server is backed up on a daily basis. Data files that are stored on the workstation will be backed up either by placing them on the local server, or by CD-ROM on a weekly basis at a minimum.

7.7 Digital Data

This section presents a discussion on the general file requirements, plot size, GIS database, MR database, GIS Users Manual, and digital data compatibility.

7.7.1 General File Requirements

The primary digital data that will be managed as part of MEC removal actions include raw and processed geophysical data, location survey information, and MEC data. The data work flow and relationship between all primary components of the digital record will be documented to facilitate the use of these data by all interested parties. Close coordination will be required between the GIS manager, staff processing field data, and project task managers. Data will be differentiated between raw and final.

Raw and processed geophysical data will be provided in both text and database dBASE format. Specific text file structure will be based on-site and project specific standards but will generally have the following components. Data fields will be space delimited (not separated by a comma). A header will be included describing the type of data, when collected, where collected, collection interval, and line spacing. The z column(s) will be the instrument reading(s) and the number of columns present will be instrumentation dependent. All field names will be standardized and integrated with the project database. At a minimum, data fields will include the date, team (name, number and/or description), grid name, MR site and MEC items found, as appropriate. The naming conventions for items in each data field will be standardized as directed by USACE. Digital data will comply and be compatible with USACE GIS and graphics systems.

All location survey information, including control points, grid corner points, grid polygons, MR site polygons, inert and MEC points, will be provided in the project database and in a standardized GIS file format. All GIS applications will be delivered as complete as specified in the MEC QA SOP.

7.7.2 Plot Size

The default size for each sheet that is plotted will be standard 33.1 inches by 23.4 inches. Each sheet will have standard borders as dictated by the project and include a revision block; title block; complete index sheet layout; bar scale; legend; grid lines or grid tic layout in feet; and a True North, a Magnetic North and a grid North arrow with their differences shown in minutes and seconds; and the computer file path location where the digital map is stored. Plotting scales will be as outlined in DID MR-005-07 where parcels less than 10 acres will be plotted at 1:200 and parcels 10-100 acres should be plotted at 1:600.

7.7.3 Geographical Information System Database

Metadata will be created for each GIS layer in accordance with Federal Geographic Data Committee standards. This metadata will include information such as, the name of the GIS Analyst, when it was made, each and all updates, dates of updates, and what was changed. Spatial data shall conform to the Spatial Data Standards for Facilities Infrastructure and Environment and the requirements of the MEC QA SOP. This information will be tracked either in a Microsoft Access database or by utilizing the data management tools included with the latest version of ESRI's Arc/INFO and ArcGIS™ applications. These data will be included as part of quarterly GIS update submittals or upon request.

7.7.4 Munitions Response Database

All field data collected as part of the removal actions will be managed in and integrated with the site-wide relational database. The USACE will determine the frequency of the updates to the project database. The data fields in field forms and field data collection equipment will be formatted to be consistent with the data fields that are used in the database. Local data management utilities and programs used to process field data will correspond with the site-wide relational database. Standardized naming conventions will be used so all field observations and measurements are consistent. Attributes specific to the MEC investigation will be stored and managed in tables separate from other database tables (such as environmental or endangered species related data.) Several types of information that will be used to join tables include:

- Site name - Common name used to identify the study area
- MR Parcel – Site number assigned to each study area
- Grid number - Unique number of sampling grid where MEC was observed
- Identification number - Unique identification number assigned by the field team to each observation, MEC component, or explosion pit

MEC spatial data will be entered into the database as point data, identified by a unique northing and easting coordinate pair. In the event that multiple MEC items encountered in the field, they

will be recorded in the database as accurately as possible. This can be performed by entering the quantity of items into the "quantity" field, or, if different nomenclature of type (e.g., UXO, MD, Discarded Military Munitions) are required, a separate record will be completed. All MEC data, both items encountered and operational data, will be submitted in the existing MMRP SQL Server database format.

Attribute data includes both qualitative and quantitative sample information such as ordnance type, quantity, and status.

The general workflow for transferring the field data to the database is summarized below. The exact field data collection and transfer procedures will be determined on a project-by-project basis by the CESPK District.

- Field observations are recorded either on pre-printed filed forms (hardcopy) or electronically (laptop/palmtop system, or data logger). Electronic data collection systems will have pre-defined data dictionaries with drop down boxes to simplify and standardize recording of field data.
- At the end of the field day, data on field forms are verified for completeness and accuracy (i.e., number of observations made match the number of observations recorded). Copies of the field forms are made and hard copies of the electronic forms are printed for the field office.
- Data from field forms are entered on-site into MR database loading tables, or field forms are faxed to off-site location (i.e., local office) for entry into the loading tables. These tables are then loaded into the MR GIS and database. (If data are entered off-site, loading tables are electronically transmitted to the field office for loading into the MR database). Electronic forms are processed on-site and loaded directly into the MR database.
- QA/QC of the data will be maintained following the guidance of the MEC QA SOP. One key element of this process is the monitoring of data by comparing hard copy field forms with the electronic data. Also, built-in QC mechanisms will verify that the data are entered correctly. For example, ordnance type information cannot be entered unless an ordnance sampling location has been properly defined.
- After data tables are loaded, the database is ready for use at the site for data analysis and reporting, uploading to the on-site GIS, generation of field maps, or transfer and uploading to the former Fort Ord site-wide database.
- The database will be backed up on a daily basis. Daily backups will be systematically numbered to facilitate tracking and restoration of the data in the event of a database or system error.

To facilitate data entry, minimize errors, and allow tracking of the data, data entry fields on the paper and electronic forms will match the field names in the MR database. This will allow the

project team to track the flow of MEC information from data collection through processing, analysis, storage, and archiving.

The MR database will also be used to store and track inventory information related to field disposal. For example, the type, quantity, and weight of charges, fusing, and other items delivered and used on-site will be maintained in a database table. If MEC is moved and detonated on-site, this information will also be included in the GIS.

If chemical and other environmental data is collected during the course of the removal action, such additional chemical data can be accommodated in the database by adding separate tables as necessary; these data tables will be related to the MEC data tables, as appropriate. The data structure for chemical data has already been established in the existing site-wide database. This structure and data flow would be strictly followed to allow for easy uploading and integration into the site-wide database and GIS.

Additional data will be incorporated as necessary into the on-site GIS as coverages. These coverages consist of pre-existing data, or other non-MEC data collected during the MEC investigation. Sources for such data include existing CAD files, published data, and output from other software applications (such as Geosoft or computer gridding or contouring programs). Examples of these coverages include existing anomaly data, spatial and attribute data collected and mapped by previous investigators, if available.

The GIS will not be used to store all raw data generated during the MEC investigations. For example, data points collected by geophysical instruments, gridded data used by modeling programs to generate contour maps, and similar types of backup data will likely be archived as separate tables in the database or as independent databases. An attribute field will be added to the GIS coverage that identifies a file location or similar reference to document these data. However, the interpreted results of analysis (such as interpreted geophysical results) will be included in the GIS.

7.7.5 Geographical Information System Users Manual

The project will use the site-specific users manual prepared by USACE to document SOPs, the overall work flow (graphical) depicting how the GIS fits into the data management cycle of the project, computer file structure, back up procedures, technical tips and fixes, symbology standards, scaling guides, examples, pointers to other reference materials.

7.7.6 Digital Data Compatibility

All digital data files and application will be developed and delivered in a format compatible with systems actively in use by USACE. No proprietary software will be used to prepare these applications. This ensures that data will be readily accessible by all members of the project team

authorized to use these data. This also ensures that the data is portable should it be necessary to transfer each project GIS and associated databases to other servers and workstations. Deviations or changes to project standards will be done only at the request of USACE.

7.8 Items and Data

Each of the following deliverable items and data will be submitted to USACE.

7.8.1 Field Survey

Copies will be provided of field books, layout sheets, computation sheets, and computer printouts will be suitably bound, marked, and packaged for delivery. These documents will be made available in either hard copy or digital format (scanned).

7.8.2 Control Points

Tabulated lists will be provided for all surveyed control points showing the adjusted coordinates and elevations that were established for the specific MR project. These data will be part of each project database and will be submitted in tabular format.

7.8.3 Aerial Photographs

New aerial photographs are not expected to be required.

7.8.4 MEC Items

Tabular lists will be prepared for all MEC and MEC components with associated location, anomalies, and descriptions. All survey coordinates and MEC-related digital information will be stored as part of the site-wide relational database and reported in digital and hard copy format.

7.8.5 Description Card Report

Provide required information for each permanent monument as required, including identification number, coordinates elevations, description, site sketch, and directions for locating the monument in digital format.

7.8.6 Maps and Geographical Information System Projects

Paper and digital maps will be provided at the scale and size required by the project and as requested by the CESPK. The GIS applications will be delivered as complete, and documented in the format specified by the MEC QA SOP or in a format specified by the CESPK GIS Manager.

8.0 Work, Data, and Cost Management Plan

This Work, Data, and Cost Management Plan describes procedures for the management and control of work and costs for the MR. This plan was developed in accordance with DID MR-005-08, Work Data, and Cost Management Plan, and Engineer Pamphlet 1110-1-18 (USACE, 2000).

8.1 Approach

The key UXO personnel will be supported by the existing on site TERC management team including the PM, Project Controls Manager, procurement specialist, project business administrator and administrative assistant. Weekly management team project review meetings will be conducted to ensure that the removal action is being performed efficiently and safely. The overall project organization and reporting structure is presented in Section 2.0, TMP. An organizational chart for the Shaw project team is presented as Figure 2-1.

The Shaw Range Services and MR Center is responsible for ensuring that the correct technical procedures are in place during the planning phase of operations and that they are carried out in the field to ensure the safety of field personnel and the public and the efficiency of activities.

The PM will be responsible for overall performance of the MEC tasks including ensuring that the work is being performed efficiently and that approved procedures are being followed. The PM will oversee and track project tasks both from a schedule and cost perspective. The PM will track the progress of field operations on a daily, weekly, and monthly basis to ensure operations are running as planned. If activities are running behind or ahead of schedule, the PM will be responsible for reporting schedule variances to the USACE as they become apparent. During field operations, the PM will communicate daily or as needed with the SUXOS, UXOSO, and UXOQCS to ensure that operations are being performed in an efficient manner and, if efficiency becomes a concern, the PM will be the primary driver for corrective measures.

The SUXOS will be in charge of all UXO personnel on-site. The SUXOS will efficiently manage the UXO teams to optimize production while maintaining a safe work environment for team members as well as the public. On those occasions where there is a HTRW Superintendent and SUXOS on-site, the SUXOS will have full authority and responsibility for MEC field operations. However, the SUXOS and HTRW Superintendent will coordinate daily to ensure the optimum use of project resources. The SUXOS will report to the PM on progress of activities and will maintain open communications with the Range Services and MR Center to discuss any technical issues. The SUXOS will ensure that all MEC operations in the field are being conducted in accordance with the work plan.

The UXOSO will be in charge of the Shaw safety program for MEC activities. The UXOSO will ensure that safety requirements are being conducted in accordance with Appendix D, APP. The UXOSO will have the authority to stop operations on-site if a safety concern arises. The UXOSO will communicate with the PM on the status of safety as the project is performed, and will coordinate his/her activities with the SSHO.

The UXOQCS will ensure that all work is being performed in accordance with the procedures established in this SSWP. The UXOQCS will communicate with the PM on the status of quality of operations as the project is performed. The UXOQCS will write daily QC reports on the progress of operations as well as any QC issues that arise. The UXOQCS will be responsible for overseeing any corrective actions that take place during the project. He/she will also coordinate his/her activities with the site Contractor Quality Control System Manager (CQCSM).

8.2 Schedule

The project schedule is included in Appendix I.

The schedule identifies the task components in the different phases of work in the appropriate chronology including deliverables and important project milestones. For both planning and reporting documents, review periods are included.

Task/project progress will be tracked monthly on the schedule to show actual project status compared to the initial project schedule to show variance and impact on project duration. The project costs will also be loaded into the Primavera schedule monthly and graphically shown in the form of histogram or curvilinear plot with the schedule plot.

8.3 Cost Control and Tracking

The PM, SUXOS, and Project Controls Manager will track costs weekly. Daily labor, equipment, supplies, etc. utilized in the field will be tracked by the SUXOS and submitted to the Project Controls Manager who will convert the resources into costs. The Project Controls Manager will submit this information to the PM who will use the information to make project adjustments as necessary to optimize project. Monthly reporting to the USACE will be consistent with TERC contract management procedures, and will include cost tables showing monthly expenditures, expenditures to date, committed costs, estimate to complete, budget, and variance information. Also, as stated above, the project costs will be loaded into the schedule monthly and graphically shown in the form of histogram or curvilinear plot with the schedule. The details concerning any positive variance (i.e., cost growth) in the cost tables will be discussed in the monthly report. These cost control methods will be used to project additional budget needs necessary for the successful completion of the project.

In addition to the monthly reports Shaw will submit weekly progress reports to show actual versus estimated production rates on a grid-by-grid basis, MEC scrap recovered/disposed, and the type and amount of MEC identified, removed or detonated. The project team shall use this report to evaluate field operations and make recommendations for changes, if any, to the installation. These reports will be provided by e-mail to the COR and others as requested.

8.4 Recurring Deliverables

Over the course of the project, three deliverables will be submitted regularly to the USACE that discusses the project performance and/or cost management. These deliverables include the daily QC report (when the project has field related activities on going), weekly physical progress report and monthly Cost and Performance Report (CPR).

8.4.1 Daily Quality Control Report

As stated above, the UXOQCS will prepare daily QC reports for each day that work is performed on-site. Details of the report are discussed in Section 10.0, QCP. The daily QC Report will be submitted to the on-site USACE Safety Specialist the morning of the day after the reporting date.

8.4.2 Weekly Progress Report

Shaw will submit a weekly progress report showing physical progress. This will include tabular and/or graphical representations of grids completed, and percent complete versus planned progress.

8.4.3 Monthly Cost and Performance Report

This report will discuss the activities conducted in the month past and report the project costs for the month and costs to date. Specifically, the CPR will include the following topics:

- Accomplishments for the period
- Deliverables completed during the period
- QC issues
- Health and safety issues
- Variance analysis
- Project schedule

The monthly CPR will be distributed by the 20th day of the following month to the USACE personnel identified in the contract management procedures.

8.5 Records Management

Shaw will maintain records of all survey data and related files. Field data, including data, lists, removal results, photographs, and maps, will be organized by MEC removal grid. All reports and memos will additionally have a unique Shaw document control number.

The master repository of the electronic files documenting the MEC-removal will be maintained on an on-site GIS database. This data will be backed up on a daily basis. Electronic files of final MEC removal grid data, maps, QA/QC data, anomaly lists, dig lists, and removal areas will be archived to CD-ROM. Reports and submittals will be provided to the USACE Sacramento District.

8.6 Subcontractors

If necessary, detailed subcontracts, which designate the services to be provided, will be used to procure and manage subcontractors. Shaw will monitor performance, with respect to the scope of work, to ensure that these services are provided in a safe, efficient and cost effective manner. In addition, Shaw will review all billing documents to ensure that they accurately reflect the services provided. In the event of a disagreement between Shaw and a subcontractor concerning the services provided or the cost of these services, Shaw will resolve these difference/discrepancies prior to submitting either the subcontractor's work or billings to USACE.

Subcontractors will work under the direction and oversight of the SUXOS or other appropriate Shaw Task Manager and will be monitored by the UXOSO and UXOQCS. Throughout their operations, subcontractors will coordinate their MEC operational schedules with the SUXOS and strictly adhere to the controlling documents, including this SSWP.

8.7 Manpower Requirements

Personnel needs to meet the operational requirements have been evaluated. Emphasis will be made on the use of local staff and local hires to minimize associated costs (i.e., travel and per-diem), and provide an effective blend of technical talents and skills for executing the work associated with the scope of work.

All new key personnel need prior approval as described in Section 2.2.1. All key and core labor categories described in Huntsville MCX DID OE-025.01, Personnel/Work Standards will have the qualifications verified and approved by the Contracting Officer prior to being deployed to the site.

9.0 Property Management Plan

Property used on the project will be managed in accordance with DID MR-005-09 and Engineering Pamphlet 1110-1-18 (USACE, 2000). In addition to this plan, all projects implemented under the TERC II will manage government property in a manner consistent with the approved Government Property Control Plan (IT, 2000).

The following equipment and facilities will be required for the project:

- 2 Crew Cab 4x4 Pickups
- 2 Standard 4x4 Pickups
- Portable Toilets, 1 male and 1 female
- 3 Leica RTK GPS systems
- 4 EM61 MK 2 Systems
- Towed Array
- 10 Schonstedt GA-52CXs
- Radios for UXO and DGM crews
- Water Coolers

10.0 Quality Control Plan

This QCP details the approach, methods, and operational procedures to be employed to perform QC during all phases of the MR covered under this SSWP. This plan was developed in accordance with DID MR-005-11, QCP, and where applicable, ER 1180-1-6, *Construction Quality Management* (USACE, 1995b), ER 1110-1-12: *Engineering and Design - Quality Management* (USACE, 1993); and ER 415-1-10: *Contractor Submittal Procedures* (USACE, 1997b), and *TERC II Program Contractor QCP (*PCQCP) (ICF Kaiser, 1998).

10.1 Standard Quality Control Procedures

The project will be conducted following standard procedures established in the PCQCP (ICF Kaiser, 1998) that for brevity are only outlined in this SSWP. These include:

- Any revisions or changes to the accepted QCP must be approved by the COR prior to being implemented.
- Development of submittals will follow the guidelines and procedures stated in ER 415-1-10 (USACE 1997b) and TERC II PCQCP (ICF Kaiser, 1998).
- Submittals are to be listed and tracked using USACE Engineering Form (ENG) 4288, Submittal Register.
- The UXOQCS is to establish and maintain an on-site project file in accordance with contract requirements and Shaw policies for document control.
- During the preparatory phase for a definable feature of work, the UXOQCS or his designee is responsible for reviewing the specifications and requesting clarification from USACE, where necessary.
- Prior to client delivery or use, project submittals are to be reviewed and approved by Shaw. Certification and signature of the UXOQCS are required on each submittal. Prior to submittal to the UXOQCS for certification, technical documents (e.g., reports, plans, and engineering drawings) are to be reviewed by qualified staff. For each project document that is submitted for technical review, a Shaw Document Review and Release Form (Appendix F, Form QC-2) is to be initiated by the author, submitted with the document to be reviewed, and used to document and track the review process.
- Submittals to the client are to be accompanied by a completed ENG 4025.
- The UXOQCS is responsible for verifying compliance with this QCP through implementation of the three-phase control process.
- The UXOQCS or designee will perform a preparatory phase inspection prior to beginning each definable feature of work. The purposes of this inspection are to review applicable specifications and verify that the necessary resources, conditions, and

controls are in place and compliant before the start of work activities. To conduct and document the inspection, the UXOQCS is to generate the Preparatory Phase Inspection Checklist (Appendix F, Form QC-3).

- The UXOQCS is to perform an initial phase inspection the first time a definable feature of work is performed. To conduct and document the inspection, the UXOQCS is to generate the Initial Phase Inspection Checklist (Appendix F, Form QC-4).
- The UXOQCS or designee will perform a follow-up phase inspection each day a definable feature of work is performed. The purpose is to ensure continuous compliance and an acceptable level of workmanship. To conduct and document these inspections, the UXOQCS is to generate the Follow-up Phase Inspection Checklist (Appendix F, Form QC-5).
- The final acceptance inspection is performed, upon conclusion of the feature of work and prior to closeout, to verify that project requirements relevant to the particular feature of work are satisfied. Outstanding and nonconforming items are to be identified and documented on the Final Inspection Checklist (Appendix F, Form QC-6) included at the end of this section.
- The UXOQCS is also responsible for QC and surveillance on project activities performed by subcontractors.
- Records of these calibration/maintenance activities are to be generated by the individual performing the activity with copies provided to the UXOQCS for retention in the project QC file.
- Project staff at all levels are to be encouraged to provide recommendations for improvements in established work processes and techniques.
- Any member of the project staff, including Shaw and subcontractor employees, can issue a Corrective Action Request (CAR) (Appendix F, Form QC-8).
- The UXOQCS will determine whether a written CAP (Appendix F, Form QC-9) is necessary, based on whether or not any of the following are met: the CAR priority is high; deficiency requires a rigorous corrective action planning process to identify similar work product or activities affected by the deficiency; or deficiency requires extensive resources and planning to correct the deficiency and to prevent recurrence.
- The UXOQCS is responsible for preparing and submitting the Daily QC Report to the COR, USACE OE Safety Specialist, the CQCSM for the project file, and providing concurrent courtesy copies to the MR PM.

QC forms are included in Appendix F.

10.2 Quality Control Personnel Organization and Responsibilities

The overall project organization and reporting structure is presented in Section 2.0, TMP. QC personnel, organization, qualifications, and responsibilities are addressed in more detail in this section.

10.2.1 Unexploded Ordnance Quality Control Specialist

The designated UXOQCS will be determined later and qualifications will be submitted to the Contracting Officer for approval. Replacement of this function can only be made with the prior written consent of the USACE COR. The UXOQCS will communicate with the HTRW CQCSM and the SUXOS, and will report to the TERC PQCSM. The UXOQCS has authority to enforce the procedures defined in this QCP. In alignment with this authority, the UXOQCS has the authority to stop work in order to ensure that project activities comply with specifications of this QCP, the contract, and the task order. This authority applies equally to all project activities, whether performed by Shaw or its subcontractors and suppliers.

The UXOQCS is responsible for planning and executing QC oversight of project operations, and ensuring compliance with specified QC requirements. Specifically, the UXOQCS is responsible for:

- Developing, assessing the effectiveness of, and maintaining this QCP and related procedures
- Reviewing and approving the qualifications of proposed technical staff and subcontractors
- Ensuring QC of no less than 10 percent of all grids cleared.
- Ensuring QC checks of 100 percent of all intrusive investigations
- Planning and ensuring the performance of preparatory, initial, follow-up, and completion inspections for each definable feature of work
- Identifying quality problems and verifying that appropriate corrective actions are implemented
- Ensuring that the requisite QC records including submittals are generated and retained as prescribed in this QCP
- Issuing the Daily QC Report
- Notifying USACE's OE Safety Specialist 48 hours prior to beginning any required action of the preparatory and initial phases. At a minimum, the UXOQCS will use Daily QC Reports for the purposes of this notification.

The UXOQCS is to be physically on-site whenever project-related fieldwork is in progress. If the UXOQCS is to be absent from the site, with COR approval, a qualified alternative UXOQCS will be designated and will be given equivalent responsibilities and authority. .

A technical specialist to be assigned to provide QC specifically for GIS applications will support the UXOQCS.

10.2.2 Letters of Authority

A letter of authority will be signed by Shaw's TERC PQCSM and included in the project file. This letter will describe the responsibilities of, and delegate authority to the UXOQCS, including the authority to stop work that is not in compliance with project requirements.

10.2.3 Personnel Qualifications and Training

Project staff will be qualified to perform their assigned jobs in accordance with terms outlined by the TERC II PCQCP (ICF Kaiser, 1998) and CESPK DID OT-FTO-025.

10.2.4 Documentation of Qualification and Training

The review and verification of personnel qualifications are to be documented on the Personnel Qualification Verification Form (Appendix F, Form QC-1). Verified personnel qualification verification forms will be included in the project files. The UXOQCS will maintain records documenting the required qualifications and training for each site worker. The UXOQCS will monitor expiration dates to provide advance warning to the PM of when employees will require refresher training or other requirements. The UXOQCS will maintain records of site-specific and routine training for personnel and visitors, as required by this work plan. These records will be maintained on-site for audit purposes.

10.2.5 Unexploded Ordnance Qualified Personnel

Unexploded Ordnance personnel will meet the minimum qualifications outlined in DDESB TP 18, Minimum Qualifications for UXO Technicians and Personnel, 20 December 2004. UXO personnel, assigned to positions UXO Technician I, UXO Technician II, UXO Technician III, UXOSO, UXOQCS, and SUXOS, will be graduates of one of the following schools or courses:

- U.S. Army Bomb Disposal School, Aberdeen Proving Ground, Maryland
- U.S. Naval EOD School, Indian Head, Maryland
- EOD Assistants Course, Redstone Arsenal, Alabama
- EOD Assistants Course, Eglin Air Force Base, Florida
- DoD certified equivalent course

Explosives ordnance disposal experience in National Guard or Reserve Units will be based on the actual documented time spent on active duty, not on the total time of service.

10.2.6 Unexploded Ordnance Team Composition and Roles

Unexploded Ordnance Team Composition and Roles are described in Section 2.0.

10.2.7 Health and Safety Training

Health and Safety training requirements for on-site project personnel have been established in accordance with Occupational Safety and Health Administration requirements for hazardous site workers (29 CFR 1910.120) and Shaw policies and procedures. These training requirements are specified in Appendix D, APP, and are to be met before project personnel can begin site work.

10.3 Quality Control Testing

Geophysical QC testing will be performed to ensure proper execution of all components of the work performed to detect, locate, and reacquire targets according to the performance standards as defined in Section 6.0, GIP. The following four-phase process will be executed to ensure quality work:

- Phase 1: QC of initial MEC detection, location and mapping
- Phase 2a: Analog safety QC surveys to validate safe removal of all MEC
- Phase 2b: Digital QC surveys to validate safe removal of all MEC
- Phase 3a: Field Analog QC Surveys after completion of initial analog survey
- Phase 3b: Field Digital QC Surveys after completion of initial digital survey
- Phase 4: USACE QA operations

Variation for this procedure can be implemented based upon concurrence of the COR. If changes to this procedure occur, the changes will be documented in a Field Work Variance and copies of the Field Work Variance will be provided to the MR BCT.

10.3.1 Quality Control of Subsurface MEC Detection, Location, and Mapping

This phase is intended to monitor all significant procedures leading to the initial target dig sheets and reacquisition location.

10.3.1.1 Digital Geophysical Mapping Quality Control

The following DGM QC elements will be performed and documented by each geophysical team on a daily basis (unless otherwise noted), and reviewed by the UXOQCS:

- Daily Calibration/maintenance of geophysical instruments, radios/cell phones, vehicles/machinery, and other project equipment will be performed per manufacture's specifications with damaged or malfunctioning gear identified and fixed or replaced
- Daily pre- and post-operation sensor instrument verification to ensure readings within manufacturer's specifications

- Daily pre- and post-operation navigation equipment testing to insure navigational precision within manufacturer's specifications
- Check personnel to ensure that they are "magnetically clean"
- Target reacquisition accuracy testing via repetitive acquisition of anomalies
- Daily review of sensor and navigation QC data and completion of the Geophysical QC forms in the GIP (Section 6.0) by the Site Geophysicist to document acceptability of the DGM data. Included are reviewing data for instrument functionality, instrument noise, missing survey lines, data "gaps" along survey lines, number of data spikes, navigation control, and equipment calibration. The Project Geophysicist will review and approve all QC prior to submission.

10.3.1.2 Geophysical Data Processing, Interpretation, and Anomaly Selection

This includes review of data manipulation and evaluation by the Project Geophysicist after the data collection is completed. The processed data and resulting dig lists will be reviewed by a second qualified geophysicist. The processed data will be reviewed for leveling, completeness, processing procedures, data presentation and overall data quality. The dig list review may include the additional selection of targets above and below the cut line, the rejection of select targets, correct grid information and additional notes.

10.3.1.3 UXOQCS QC

The following QC elements of Phase 1 will be performed and documented by the UXOQCS:

- Independent reviews of anomalies and the resulting dig sheets prior to intrusive activity
- Audit of field and records management procedures. Corrective actions will be performed according to TERC procedures
- Review excavation results
- Feedback from excavation results will be communicated at daily project status meetings

10.3.2 Phase 2a: Analog Safety Quality Control Surveys to Validate Identification of MEC

Phase 2a Analog Safety QC surveys will be conducted in areas where Schonstedt GA-52Cx magnetometer assisted removal work is conducted. These areas include any areas requiring mag and dig operations because of high anomaly density during DGM survey. This phase is intended to verify that no MEC remain within the detection capabilities of an analog Schonstedt GA-52Cx magnetometer after anomaly excavation. After anomaly excavation, the hole will be checked with a Schonstedt GA-52Cx to ensure no additional anomalies remain.

10.3.3 Phase 2b: Digital QC surveys to validate safe removal of all MEC

Phase 2a Digital Safety QC surveys will be conducted in areas where digital geophysical assisted removal work is conducted. These areas include any areas where dig sheets are developed during DGM survey. This phase is intended to verify that no MEC remain within the detection capabilities of the digital geophysical equipment after anomaly excavation. After anomaly excavation, the hole will be checked with the digital instrument used during the DGM survey to ensure no additional anomalies remain.

10.3.4 Phase 3a: Field Analog QC Surveys after completion of initial analog survey

Phase 3a QC surveys will be performed by the UXOQCS using "Mag & Dig" surveys with Schonstedt GA-52Cx magnetometers in areas requiring "Mag and Dig" operations. Under this phase of QC, a minimum of 10 percent of each of the grids will be resurveyed. If any MEC, MEC-like targets, or metallic items exceeding 2-inches maximum dimension are found, then the grid will be failed and the entire grid will be resurveyed. Failure of QC will result in a meeting with the UXO personnel and USACE representative(s) to discuss the problem and provide recommendations for resolution. Depending on the cause of the failure it is possible that additional resurvey of other grids will be required.

10.3.5 Phase 3b: DGM Quality Control Surveys

Some percentage of the site will have a DGM QC survey conducted. The determination of the percentage of the site requiring DGM QC depends on a number of site specific factors and has not been determined. The determination regarding percentage of the site requiring a DGM QC survey will be developed in consultation with USACE.

10.4 Quality Assurance Operations

Quality Assurance will be provided by the USACE to assure that the Shaw's QC system is functioning as stated. Areas of QA include:

- Monitor subcontractor field practices including announced and extemporaneous, unobtrusive observations.
- Review and observe field ground control and GPS procedures. This is meant to avoid geo-referencing incompatibilities between Shaw and the USACE.
- Independently examine data files and anomaly maps. QA will check the database against Team Leader grid sheets to ensure all anomalies flagged were excavated.
- Independently conduct surveys with Schonstedt GA-52Cx magnetometers over a minimum of 10 percent of each of the grids.
- Independently conduct DGM QA to include 3 to 5 percent digital resurvey. May also include QA seeding and/or QA digs.

10.5 Definable Features of Work

The following basic definable features of work are anticipated for this removal action.

10.5.1 Work Plan

This definable feature of work includes development of this SSWP.

10.5.2 Geophysical Survey

This definable feature of work includes all phases of the DGM described in Section 6.0. QC procedures for the DGM are presented in Section 10.3.

10.5.3 MEC Removal

This definable feature of work includes all activities relating to the identification and removal of MEC. The QC inspector will verify and document through the QC procedures identified in this QCP, that the MEC removal requirements specified in Section 2.0, TMP are met. This QC process will specifically include:

- Completion of the Personnel Qualification Verification Form (Appendix F, Form QC-1)
- Completion of the Preparatory Inspection Checklist (Appendix F, Form QC-3) which will include amending or updating the Personnel Qualification Verification Form if necessary
- Completion of the Initial Phase Inspection Checklist (Appendix F, Form QC-4) on the first day of removal activities
- Completion of the Follow-up Phase Inspection Checklist (Appendix F, Form QC-5) on each successive day of removal activities
- Completion of the Final Inspection Checklist (Appendix F, Form QC-6) at the completion of removal activities
- Correcting deficiencies and providing lessons learned to the USACE through CAPs
- Verify that field activities are in compliance with the HMP as discussed in Section 11.0.

10.5.4 MEC Detonation

This definable feature of work includes all required activities associated with disposing of MEC or explosively venting items.

This definable feature of work includes an important safety component regarding the procedures for safe and proper handling of explosives and MEC. The UXOQCS will verify and document through the QC procedures identified in this QCP that the MEC detonation procedures and

requirements specified in Section 2.0, TMP; Section 3.0, Explosives Management Plan; and Section 4.0, Explosives Siting Plan; are met. This QC process will specifically include:

- Completion of the Personnel Qualification Verification Form (Appendix F, Form QC-1)
- Weekly audit of explosives stored on-site
- Completion of the Preparatory Phase Inspection Checklist (Appendix F, Form QC-3) which will include amending or updating the Personnel Qualification Verification Form if necessary
- Completion of the Initial Phase Inspection Checklist (Appendix F, Form QC-4) on the first day of MEC detonation activities
- Completion of the Follow-up Phase Inspection Checklist (Appendix F, Form QC-5) on each successive day of MEC detonation activities
- Completion of the Final Inspection Checklist (Appendix F, Form QC-6) at the completion of MEC detonation activities
- Correcting deficiencies and providing lessons learned to the USACE through CAPs.

10.5.5 Final Report

This definable feature of work includes development of a final report describing the removal activity. This QC process will specifically include:

- Verification of the qualifications of suitable technical reviewers
- QC checking of the draft document
- Verification of appropriate response to USACE comments.
-

11.0 Environmental Protection Plan

This EPP describes the approach, methods, and procedures to be employed to protect the natural environment during performance of the removal action. Specifically, this EPP describes the procedures and methods that will be implemented during site activities to minimize pollution, protect and conserve natural resources, restore disturbed areas, and control noise and dust within reasonable limits. This plan was developed in accordance with DID MR-005-12.

This EPP is intended to address the protection of special-status biological resources and implement mitigation measures identified in Chapter 3 of the HMP (USACE, 1997a) and the Biological Opinion (USFWS, 2005). The HMP was developed to meet the requirements of the federal ESA for the Army actions during disposal and reuse of the former Fort Ord. The HMP was prepared in response to a biological conference opinion issued by U.S. Fish and Wildlife Service (USFWS) during consultation with the Army under ESA. This includes Army pre-disposal activities, such as cleanup of remediation sites. Implementation of the HMP mitigation measures will be in compliance with ESA and the substantive requirements of the California ESA. Mitigation measures for special-status species and HMP sensitive resources identified in the HMP include conducting baseline surveys, pre-construction surveys, implementing minimization and avoidance measures, restoration, and follow-up monitoring.

The HMP outlines resource conservation management requirements for reuse parcel owners. These management requirements are dependent upon parcel designation. The MRS-16 site is located on Parcel F1.3 of the HMP. The HMP identifies specific habitat management requirements that serve to preserve and protect natural habitats.

11.1 Description of Site and Natural Resources

Munitions Response Site-16 is located just north of the Impact Area. The site is mostly covered by maritime chaparral with patches of annual grassland habitats along the site's western and southern boundaries. The natural resources of concern include several HMP listed species that are associated with maritime chaparral and are considered endangered, threatened, or rare by the federal government or the state of California. These HMP-listed plant species include sandmat manzanita, Monterey Ceanothus, and Monterey spineflower. The HMP-listed wildlife includes the California black legless lizard, and the California Tiger Salamander (CTS). Wetland or vernal pond areas are not present in the site, however there are vernal pools located northeast and adjacent to the site.

11.2 Protection of Natural Resources

The majority of the MRS-16 is designated in the HMP for habitat reserve. Therefore, measures to reduce impacts to natural resources will be implemented in accordance with HMP, and Biological Opinion (USFWS, 2005) guidelines. In addition, all guidelines that minimize activities that could degrade lands through soil erosion or invasive weed problems will be followed. These considerations will be addressed in this section.

The Shaw field biologist will conduct a preliminary environmental survey (habitat checklist) of the sites to identify locations of sensitive species. Shaw will assume a policy of minimizing and avoiding disturbances to areas with sensitive species as much as possible without unreasonably disrupting removal activities. The Shaw field biologist will be regularly present on work sites to ensure that these environmental directives are being followed and document and address any unforeseen environmental concerns, as they may occur. Shaw will coordinate with BRAC on any environmental issues that are not addressed in the HMP and on any environmental issues that may unreasonably disrupt removal activities. It should be noted that this EPP only addresses the measures to be taken under normal circumstances and does not consider special-case areas, which will be reevaluated to determine if additional habitat protection or restoration requirements are required.

11.2.1 Employee Environmental Training

The Shaw field biologist will conduct site-specific environmental training for all field personnel prior to the beginning of project work. Topics covered in the training will include a description of HMP plant and wildlife species that could be encountered in the project area, environmental laws related to the conservation of these species, guidelines that personnel must follow to reduce or avoid impacts to HMP species, and the appropriate points of contact to report unforeseen impacts on HMP species.

11.2.2 Fire Retardants and Foams

Fire retardants and foams that may potentially be used on the site will not contain sodium ferrocyanide, and their application shall not be closer than 300 feet from the vernal pool (located just outside the site to the northeast) unless there is a breach or risk of breach and it is required to assist in preventing a break out in order to reduce the likelihood that they will contaminate wetlands. Appendix N presents the procedures that will be implemented for sampling, analysis, and monitoring of the vernal pool before and after the prescribed burn.

11.2.3 Vegetation Clearance

To facilitate the surface and subsurface MEC removal, a prescribed burn will be performed in MRS-16. One of the goals of the prescribed burn is to clear as much vegetation as possible in order to reduce the need to cut maritime chaparral; however, there may be some unburned brush

and leftover standing burnt stems and branches from the maritime chaparral that will need to be cleared so geophysical instrument operators can access the ground.

The extent of the unburned maritime chaparral cutting will be limited to 50 acres—the maximum amount of chaparral cutting per each site under the current agreement with the USFWS. However, if there are more than 50 acres of unburned chaparral, BRAC will get an approval from the USFWS to clear the remaining unburned chaparral. The leftover dead wood from the burned shrubs may need to be cut using mechanical equipment (e.g., TAZ® [or equivalent]) and/or manual equipment (e.g., chainsaws, loppers, and weed whackers), as necessary. Environmental impacts and the safety of personnel will be considered for selecting the feasible cutting method(s) for clearing the unburned maritime chaparral and leftover deadwood in a given area. Depending on the amount of unburned brush in an area, Shaw may seek guidance from BRAC to determine the appropriate cutting method for that area.

11.2.4 MEC Removal

During land excavations, the top 3 to 4 inches of soil will be replaced at the surface after backfilling holes, where feasible, to preserve the seedbank of rare annual plants. The feasibility of replacing soil will be determined by the type of soil and whether rare plant species are present. All MEC removal activities will be monitored to minimize impacts to HMP-listed species to the greatest extent feasible.

11.2.5 Vehicle Access

Vehicle access will be restricted to the existing roads and fuel breaks as much as possible, except during mechanical brush removals.

11.2.6 Avoiding Impacts to Black Legless Lizards

If a black legless lizard is encountered during excavations or other site activities, the established protocol as stated in the HMP, for avoiding impacts will be followed.

11.2.7 Avoiding Impacts to California Tiger Salamanders

If a CTS is encountered during excavations or other site activities, the established protocol, as stated in the HMP and Biological Opinion (USFWS, 2005), for avoiding impacts will be followed. Only authorized personnel per the Biological Opinion (USFWS, 2005) can handle CTSs. Procedures will be in place prior to site activities to have an authorized biologist available should an encounter and subsequent handling (to remove from harms way) be required. If a dead or injured CTS is found, it must be recorded and reported as described in the Biological Opinion (USFWS, 2005).

11.2.8 Site Restoration and Monitoring for Invasive Weeds

The Shaw field biologist will assess the need for any site restoration and will coordinate the work. Site restoration will likely be limited to basic erosion control measures (e.g., straw application and straw crimping). The field biologist will also perform informal follow-up monitoring of the site for erosion or invasive weed problems throughout the surface and subsurface MEC removal.

12.0 Investigation Derived Waste Plan

This IDWP describes the handling of materials during MEC removal activities. Two general types of materials are anticipated to be generated during MEC removal activities, MEC and non-MEC-related materials. This IDWP was developed in accordance with DID MR-005-13.

12.1 Non-MEC Related Debris Disposal

The following procedures apply to non-MEC-related scrap or debris removed from the site:

- Economically recyclable debris, such as scrap metal, concrete, and asphalt, will be collected and stockpiled or delivered to an appropriate facility. Disposition of recyclable waste will be coordinated with the Army.
- Non-recyclable, and other debris, such as tires, plastic, wood, personal protective equipment, and metal that is not considered recyclable, will be collected and stockpiled or delivered to an appropriate facility. Disposition of non-recyclable waste will be coordinated with the Army.

Based on preliminary site inspections, large amounts of non-MEC debris are not anticipated.

12.2 MEC Related Materials Disposal

It is not anticipated that there will be any movement or transportation off site of any MEC found on this site.

12.3 Clearing and Grubbing

Cut vegetation will be left on site.

12.4 Hazardous Waste

Hazardous wastes are not anticipated during MEC removal activities. If hazardous wastes are encountered during MEC removal activities, disposition will be in accordance with applicable and relevant requirements of Title 22 California Code of Regulations, Division 4.5, Environmental Health Standards for the Management of Hazardous Waste.

Should any nonstandard event occur (e.g., discovery of leaking drums or paint cans, soil with abnormal consistency and discoloration, or unknown and unidentified materials), fieldwork will be stopped at this location and the COR will be notified along with the PM and SSHO. The SSHO will identify potential concerns and implement requirements before MEC removal activities continue in accordance with the Basewide SSHP (Shaw, 2003).

12.5 Transportation

Transport of encountered MEC-related material, including MEC, will be in accordance with Section 2.0, TMP. Transportation of significant quantities of non MEC related materials is not anticipated.

13.0 Interim Holding Facility Siting Plan for RCWM Projects

It is not expected that RCWM will be encountered on this project. A CWM Risk Assessment has been completed for the former Fort Ord. The results indicated that the probability of encountering CWM munitions is "unlikely" while the probability of encountering CWM Chemical Identification Sets is "seldom" (Appendix D, Attachment 1).

14.0 Physical Security Plan for RCWM Project Sites

It is not expected that RCWM will be encountered on this project. A CWM Risk Assessment has been completed for the former Fort Ord. The results indicated that the probability of encountering CWM munitions is "unlikely" while the probability of encountering CWM Chemical Identification Sets is "seldom" (Appendix D, Attachment A).

15.0 References

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