FINAL

Site Inspection Report
Sahuarita Air Force Range
Pima County, Arizona

U.S. Army Corps of Engineers
Southwest IMA Region

FUDS Project No. J09AZ057601
Contract No. W912DY-04-D-0005
Task Order 0009

Prepared for

U.S. Army Corps of Engineers, Los Angeles District
915 Wilshire Blvd., Suite15018
Los Angeles, CA 90017-3401
and
U.S. Army Corps of Engineers
South Pacific Division Range Support Center

Prepared by

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September 2007

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September 17, 2007

U.S. Army Corps of Engineers, Los Angeles District (CESPL)
ATTN: CESPL-PM-M (Mr. Lloyd Godard)
915 Wilshire Blvd., Suite 15018
Los Angeles, CA 90017-3401
213-452-4014

Subject: Contract W912DY-04-D-0005, Delivery Order 0009
MMRP SI for SW Region – Final Site Inspection Report
Sahuarita Air Force Range, Pima County, AZ

Dear Mr. Godard:

Parsons has prepared this Final Site Inspection (SI) Report in accordance with the Performance Work Statement (PWS) to include the completed Munitions Response Site Prioritization Protocol (MRSPP). The MRSPP notification announcement was prepared with coordination with USACE, Los Angeles District (CESPL) Public Affairs Office (PAO) and Project Manager (PM) and appeared in the agreed newspaper prior to the second (closeout) TPP Meeting held in the Tucson Clarion Hotel on August 16, 2007. The comments received from ADEQ and the City of Tucson following the second TPP meeting have been incorporated into the Final as discussed at the meeting.

Two copies have been provided for your internal files. Three additional copies are provided for your distribution to the regulators and other key project stakeholders. We have simultaneously forwarded a copy to Jeff Waugh, Monique Ostermann, HTRW CX and MM CX. Electronic copies have also been provided.

If you have any questions or comments, please contact me at (678) 969-2384 or (404) 606-0346 (cell) or the Deputy Program Manager (Ms. Laura Kelley) at (678) 969-2437.

Sincerely,

Parsons

Don Silkebakken, P.E.
MMRP SI Program Manager

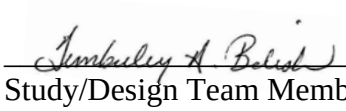
cc: HQUSACE Jeff Waugh – 1 CD
SPD Monique Ostermann – 1 copy/CD
MM CX Betina Johnson /Deborah Walker – 1 copy/CD
HTRW CX Heidi Novotny – 1 CD
Laura Kelley (Parsons PM - Project File 744653.05000)

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Parsons has completed the Final Site Inspection Report for the former Sahuarita Air Force Range, New Mexico. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan. The independent technical review verified compliance with established policy principles and procedures, using justified and valid assumptions. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

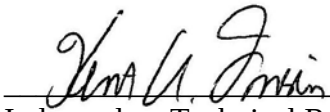
Study/Design Team Leader — September 17, 2007 Date

Study/Design Team Members — September 17, 2007 Date



Study/Design Team Members — September 17, 2007 Date

Review Team — September 17, 2007 Date

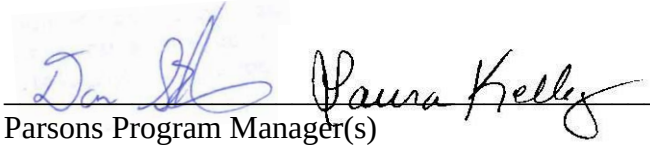


Independent Technical Review Team Leader — September 17, 2007 Date

Significant concerns and the explanation of the resolution are as follows:

None

As noted above, all concerns resulting from independent technical review of the project have been considered.



Parsons Program Manager(s) — September 17, 2007 Date

U.S. Army Corps of Engineers
Southwest IMA Region

FINAL

Site Inspection Report
Sahuarita Air Force Range
Pima County, Arizona

FUDS Project No. J09AZ057601

September 2007

In Support of
FUDS MMRP Site Inspections Project

Prepared by

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5390 Triangle Parkway, Suite 100
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Contract No. W912DY-04-D-0005
Task Order 0009
Project No. 744653

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ACRONYMS AND ABBREVIATIONS

°F	degree Fahrenheit
µg/kg	microgram per kilogram
AAF	Army Air Field
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AFR	Air Force Range
amsl	above mean sea level
ASR	archives search report
AZHD	Arizona Historic Districts
AZ SHPO	Arizona Historic Preservation Office
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CRREL	Cold Regions Research and Engineering Laboratory
CSEM	conceptual site exposure model
CSM	conceptual site model
CZMP	Coastal Zone Management Program
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DQO	data quality objective
USEPA	Unites States Environmental Protection Agency
ER	Engineer Regulation
ERA	ecological risk assessment
ESV	ecological screening value
FUDS	Formerly Used Defense Site
GIS	geographic information system
GPS	Global Positioning System
HDMS	Heritage Data Management System
HE	high explosive
HEI	high explosive incendiary
HQ	hazard quotient
HRS	Hazard Ranking System
HTW	hazardous and toxic waste
INPR	inventory project report
JATO	jet-assisted take-off
MC	munitions constituent
MEC	munitions and explosives of concern
mg/kg	milligram per kilogram
mm	millimeter
MMRP	Military Munitions Response Program
MRS	munition response site
MRSPP	Munitions Response Site Prioritization Protocol

MSSL	medium-specific screening level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDAI	no Department of Defense action indicated
NHA	National Heritage Area
NHL	National Historic Landmark
NHP	(Arizona) Natural Heritage Program
No.	Number
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRHD	National Register Historic District
NRHP	National Register of Historic Places
NRIS	National Register Information System
NWI	National Wetlands Inventory
NWRS	National Wildlife Refuge System
OB/OD	open burn / open detonation
OQ	unpiloted (O) radio-controlled (Q) flying target
Parsons	Parsons Corporation
PRG	preliminary remediation goal
PSAP	programmatic sampling and analysis plan
PWP	programmatic work plan
QA	quality assurance
QC	quality control
QR	qualitative reconnaissance
RAC	risk assessment code
RI/FS	remedial investigation and feasibility study
ROE	right of entry
SI	site inspection
SLERA	screening-level ecological risk assessment
SLRA	screening-level risk assessment
SRL	soil remediation level
SSL	soil screening level
SS-WP	site-specific work plan
STL	Severn Trent Laboratories
TCRA	time-critical removal action
T&E	threatened and endangered
TESS	Threatened and Endangered Species System
TPP	technical project planning
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

GLOSSARY OF TERMS

magnetometer	An instrument for measuring the strength of a magnetic field; used to detect buried iron and other metal objects.
military munitions	All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the 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.
munitions and explosives of concern (MEC)	Military munitions that may pose unique explosives safety risks, including UXO, discarded military munitions, or munitions constituents present in high enough concentrations to pose an explosive or other health hazard.
munitions constituents (MC)	Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.
munitions debris	Remnants of munitions (for example, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.
munitions response	Response actions, including investigation, removal actions, and remedial actions, to address the explosive safety, human health, or environmental risks presented by unexploded ordnance, discarded military munitions, or munitions constituents, or to support a determination that no removal or remedial action is required.
munitions response area (MRA)	Any area on a defense site that is known or suspected to contain unexploded ordnance, discarded military munitions, or munitions constituents. Examples are former ranges and munitions burial areas. An MRA comprises one or more munitions response sites.

munitions response site (MRS)	A discrete location within an MRA that is known to require a munitions response.
projectile	Object projected by an applied force and continuing in motion by its own inertia. This includes bullets, bombs, shells, grenades, guided missiles, and rockets.
unexploded ordnance (UXO)	Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; that have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material; and that remain unexploded whether by malfunction, design, or any other cause.

EXECUTIVE SUMMARY

ES.1 PROJECT OBJECTIVES

ES.1.1 The objective of this site inspection (SI) is to determine whether the former Sahuarita Air Force Range (AFR) site in Pima County, Arizona, warrants further investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The former Sahuarita AFR was used as a training facility between 1942 and 1958. The SI at the former Sahuarita AFR was performed to confirm munitions response site (MRS) locations and to evaluate the evidence for the presence of munitions and explosives of concern (MEC) and munitions debris at the site. To accomplish this objective, qualitative reconnaissance (QR) and munitions constituent (MC) sampling were conducted at the following three MRSs:

- Range Complex Number (No.) 1
- Range Complex No. 2
- Range Complex No. 3

ES.1.2 Outcomes at the three MRSs could include MEC response action or no Department of Defense action indicated (NDAI), among others. If NDAI status is recommended and approved after evaluation of the SI data, the process to close out the site will be initiated. If an imminent threat is identified to the public or the environment, a time-critical removal action (TCRA) may be performed as an interim action, or a remedial investigation and feasibility study (RI/FS) will be initiated to evaluate feasible MEC response actions.

ES.1.3 The technical project planning (TPP) process determined that the collection of 10 soil samples and three groundwater samples would be sufficient to meet the SI project objectives. Eight soil samples would be collected within the MRS boundaries, as these represent the most likely places for MC contamination. Two soil samples would be collected from land buffer areas to provide ambient data.

ES.2 SUMMARY OF RESULTS

ES.2.1 The SI evaluation included 44 miles of walked QR and the collection of 10 surface soil samples and three groundwater samples. As planned, eight of these samples were collected from within the MRSs, and two samples were collected from adjacent land buffers to provide ambient data. Groundwater samples were moved from their planned location because right of entry was not obtained for the planned sample locations GW 2 and GW 3, which were therefore collected from one well at Range Complex No. 1 and two locations at Range Complex No. 2 (Figure ES. 1).

ES.2.2 Severn Trent Laboratories in Arvada, Colorado analyzed the soil and groundwater samples for explosives and selected metals and, additionally, analyzed groundwater samples for perchlorate. The analytical results were then compared to the following three criteria to determine the need to perform a screening-level risk assessment (SLRA) and a screening-level ecological risk assessment (SLERA) for each particular analyte.

- Was the analyte detected above background screening levels?
- Is the analyte a potential constituent of munitions known or suspected of being used on site?
- Is the analyte considered a hazardous substance listed in 40 CFR Part 302, Table 302.4 of CERCLA?

ES.2.3 Of the eight biased soil sample and three groundwater sample locations, explosive compounds were detected in only one soil sample at one MRS, metals were detected in all soil samples, and metals and perchlorate were detected in all groundwater samples. For each analyte that met the criteria, a SLRA and SLERA was performed. The SLRA compared MC detections in soil to the most stringent of the Environmental Protection Agency (USEPA) Region 6 residential soil screening levels (SSLs), the State of Arizona residential soil remediation levels (SRLs), and USEPA Region 9 residential soil preliminary remediation goals (PRGs). Groundwater analytical results were evaluated using the more stringent of USEPA Region 9 and Region 6 tap water human health screening values. All detected metals and explosives retained for consideration in a SLRA were found to be below screening levels. The SLERA compared MC detections in soil to the USEPA Region 4 ecological screening values (ESVs), or USEPA Region 5 ESVs if a Region 4 ESV for an analyte was not available. Based on this screening evaluation, ecological risk due to chromium at Range Complex No. 1 and Range Complex No. 2 cannot be ruled out.

TABLE ES.1
SUMMARY OF RESULTS
SAHUARITA AFR, ARIZONA

MRS	Area (acres)	Surface MEC Found	Munitions Debris Found	MC Contamination
Range Complex No. 1	1,394.3	No[1]	Yes	Yes
Range Complex No. 2	7,921.9	No	Yes	Yes
Range Complex No. 3	940.6[2]	No	Yes	Yes[3]

[1] Does not reflect observations of unfired small arms. Unfired .50-caliber cartridges were found at Bombing Targets No. 1 and No. 4.

[2] Reflects the acreage documented in the ASR Supplement not the acreage shown on the figures (See Section 2.4.1).

[3] MC risk from contamination was not observed in samples collected at this MRS; however, likely contaminated soil was observed at a possible OB/OD area.

ES.3 CONCLUSIONS REGARDING POTENTIAL MUNITIONS AND EXPLOSIVES OF CONCERN

No MEC were identified during the SI visit; however, numerous pieces of munitions debris were noted at each MRS. The potential for a completed pathway for MEC exposure at the former Sahuarita AFR is moderately significant.

ES.4 CONCLUSIONS REGARDING POTENTIAL EXPOSURE PATHWAYS

ES.4.1 An exposure pathway is not considered to be completed unless all four of the following elements are present (USEPA, 1989):

- A source and mechanism for chemical release;
- An environmental transport/exposure medium;
- A receptor exposure point; and
- A receptor and a likely route of exposure at the exposure point.

ES.4.2 Based on the evidence from the SI, no indications of unacceptable human health risk due to MC have been identified at any of the samples collected in the MRSs at the former Sahuarita AFR; however, visual evidence of contaminated soil was present at MRS 03. In conclusion, risk to human heath is not expected from MC at Range Complex Nos. 1 and 2, but risk due to MC at Range Complex No. 3 is possible. Ecological risk due to chromium at Range Complex No. 1 and Range Complex No. 2 cannot be ruled out, and ecological risk due to MC at Range Complex No. 3 is possible based on visual observations at the possible OB/OD area.

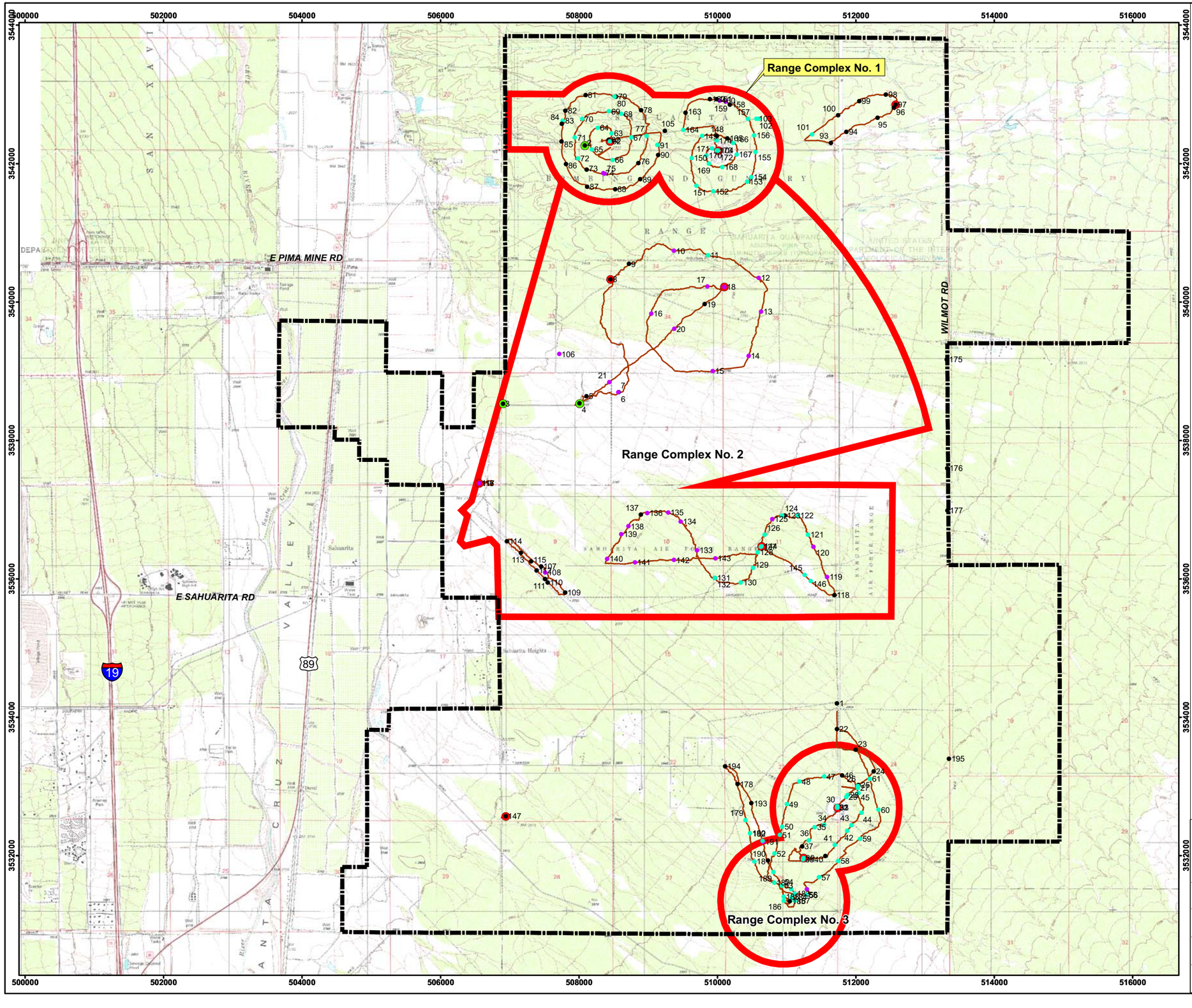
ES. 5 RECOMMENDATIONS

Due to the munitions debris observed at this site during the SI, it is recommended that each MRS at the former Sahuarita AFR proceed to RI/FS. It is recommended that the RI/FS focus on both MEC and MC at each of the three range complexes. No MEC was found during the SI site visit, and an imminent threat was not identified; therefore, a removal action is not warranted at this time.

Figure ES.1

General Site Overview
Former Used Defense Site
Sahuarita AFR
FUDS Project No. J09AZ057601

Sahuarita, Arizona



Legend

- Munitions Debris Field Observation Location (Small Arms)
- Munitions Debris Field Observation Location (Excluding Small Arms)
- Other Field Observation Location
- Ground Water Sample Location
- Soil Sample Location
- Range Complex Boundary
- Installation Boundary
- Qualitative Reconnaissance Track

Site Location in Arizona

N

Image Source: USGS 7.5' Topo Quadrangles, 1981 - 1992
Projection: UTM Zone 12 NAD83, Map Units in Meters

4,500 2,250 0 4,500 Feet

PARSONS	U.S. ARMY SOUTH PACIFIC DIVISION RANGE SUPPORT CENTER

DESIGNED BY: BT	General Site Overview		
DRAWN BY: BT	SCALE: As Shown	PROJECT NUMBER: 744653.05000	
CHECKED BY: NH	DATE: June 2007	PAGE NUMBER: ES-4	
SUBMITTED BY: DS	FILE: X:\GIS\Site_inspections_sw\Maps\sahuarita_az\ FigES_1.mxd		

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

1.1.1 Parsons Corporation (Parsons) received Contract Number W912DY-04-D-0005, Task Order Number 0009, from the United States (U.S.) Army Corps of Engineers (USACE), Engineering and Support Center, Huntsville to perform a site inspection (SI) of the former Sahuarita Air Force Range (AFR) Formerly Used Defense Site (FUDS) (Project Number J09AZ057601). The site is in Pima County, southeastern Arizona, just south of Tucson, Arizona. The former Sahuarita AFR is located at approximately latitude 31° 57′ 49" N, longitude 110° 53′ 55" W. The site location is shown on Figure 1.1.

1.1.2 The Department of Defense (DoD) established the Military Munitions Response Program (MMRP) to address DoD sites suspected of containing munitions and explosives of concern (MEC) or munitions constituents (MC). Under the MMRP, the USACE is conducting environmental response activities at FUDS for the Army, the DoD's executive agent for the FUDS program.

1.1.3 Pursuant to the USACE's Engineer Regulation (ER) 200-3-1 (USACE, 2004b) and the *Management Guidance for the Defense Environmental Restoration Program* (DERP) (Office of the Deputy Under Secretary of Defense [Installations and Environment], 2001), USACE is conducting FUDS response activities. All work is performed in accordance with the following:

- The DERP statute (10 U.S. Code [USC] 2701 *et seq.*);
- The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 USC §9601 *et seq.*);
- Executive Orders 12580 and 13016; and
- The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] Part 300).

USACE is conducting SIs, as set forth in the NCP, to evaluate hazardous substance releases or threatened releases from eligible FUDS.

1.1.4 While not all MEC/MC constitute CERCLA hazardous substances, pollutants, or contaminants, the DERP statute provides the DoD with the authority to respond to

releases of MEC/MC. DoD policy states that such responses shall be conducted in accordance with CERCLA and the NCP.

1.1.5 This report summarizes the work performed during the SI and presents an accounting of any MEC and MC contamination identified on the site. The SI is limited exclusively to MEC and MC contamination issues and does not consider other unrelated hazardous and toxic waste (HTW) concerns that the site may pose. Per ER 200-3-1 guidance for conducting an SI, "The SI is not intended as a full-scale study of the nature and extent of contamination or explosive hazards"; it requires the collection of a sufficient and appropriate amount of information.

1.2 PROJECT OBJECTIVES

1.2.1 The primary objective of the MMRP SI is to determine whether a FUDS project warrants further response action under CERCLA. The SI collects sufficient and appropriate information necessary to make this determination, as well as it:

(i) Determines the potential need for a removal action;

(ii) Collects or develops additional data, as appropriate, for Hazard Ranking System (HRS) scoring by the U.S. Environmental Protection Agency (USEPA); and

(iii) Collects data, as appropriate, to characterize the release for effective and rapid initiation of the remedial investigation and feasibility study (RI/FS).

1.2.2 An additional objective of the MMRP SI is to collect the additional data necessary to complete the Munitions Response Site Prioritization Protocol (MRSPP).

1.3 PROJECT SCOPE

1.3.1 The primary project planning documents used to perform the SI include the Site-Specific Work Plan (SS-WP) Addendum for the former Sahuarita AFR (Parsons, 2006b), the South Pacific Division Range Support Center Programmatic Work Plan (PWP) (Parsons, 2005), the Programmatic Sampling and Analysis Plan (PSAP) (USACE, 2005), and the PSAP Addendum (Parsons, 2006a). The performance work statement for this project is in Appendix A.

1.3.2 The USACE Los Angeles District facilitated a technical project planning (TPP) meeting on September 8, 2005, that included representatives of USACE, Parsons, the USEPA, the Arizona Department of Environmental Quality (ADEQ), the Arizona State Land Department, and the Town of Sahuarita. The TPP Team unanimously concurred with the technical approach presented in the Final TPP Memorandum (Parsons, 2006c), including the locations of the 10 soil samples, sampling methods, and laboratory analyses for explosives and metals constituents as well as perchlorate.

1.3.3 The TPP Team concurred during review of the SS-WP that comparison criteria for soil sample results would be the more conservative of the State of Arizona residential

soil remediation levels (SRLs), USEPA Region 9 residential soil preliminary remediation goals (PRGs), and USEPA Region 6 residential soil screening levels (SSLs) included in its medium-specific screening levels (MSSLs) for 2007. The TPP Team agreed that a soil sample depth of 0 inches to 2 inches below ground surface (bgs) was appropriate for this site. During review of the SS-WP, the TPP Team also agreed that groundwater would be compared to the most conservative of USEPA Region 9 and Region 6 tap water human health screening values.

1.3.4 Ecological screening values (ESVs) include USEPA Region 4 ESVs. If Region 4 does not publish a screening value for a particular analyte, the USEPA Region 5 ESV is used.

Figure 1.1

Site Location
Former Used Defense Site
Sahuarita AFR
FUDS Project No. J09AZ057601

Sahuarita, Arizona

Legend

Installation Boundary

Site Location in Arizona

N

Image Source: USGS Topos
Projection: UTM Zone 12 NAD83, Map Units in Meters

0 2.5 5 10 Miles

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DESIGNED BY: BT	Site Location		
DRAWN BY: BT		SCALE: As Shown	PROJECT NUMBER: 744653.05000
CHECKED BY: DS		DATE: June 2007	PAGE NUMBER: 1 – 4
SUBMITTED BY: DS		FILE: X:\GIS\Site_inspections_sw\Maps\sahuarita_az\Fig1_1.mxd	

CHAPTER 2

PROPERTY DESCRIPTION AND HISTORY

2.1 SITE DESCRIPTION

The former Sahuarita AFR is in Pima County just south of Tucson, Arizona (Figure 1.1). Figure 2.1 shows the site setting and sub-ranges associated with the former Sahuarita AFR. The munitions response sites (MRSs) at this site are made up of range complex containing two or more sub-ranges. Figure 2.2 shows the MRSs investigated during the SI at the former Sahuarita AFR. The former facility consisted of approximately 27,000 acres.

2.2 SITE LOCATION AND SETTING

2.2.1 Topography and Vegetation

2.2.1.1 The former Sahuarita AFR is on the Sahuarita and Corona de Tucson 7.5′ U.S. Geological Survey (USGS) quadrangles within Pima County. Elevations across the site range from 2,640 feet to 3,140 feet above mean sea level (amsl). The property is flat with a slight increase in elevation from the northwest to the southeast. The Santa Rita Mountains are south-southeast of the site, with the nearest peak (Mount Fagan, elevation 6,189 feet amsl) approximately 8 miles east-southeast of the site.

2.2.1.2 The vegetation at the former Sahuarita AFR consists of mostly low water plants and succulents of the Sonora desert scrub. At the time of the SI field work in January 2007, vegetation included a wide variety of scrub brush and cactus. Photographs in Appendix E of this report show the vegetation at the site.

2.2.2 Soil

The site soil is deep, sandy, and silty. The soils developed as alluvial and terrace deposits and are well drained to excessively drained. Soil erosion due to wind is high, forming a desert pavement in many areas. Groundwater present in the alluvial deposits is mostly connected, forming a single aquifer system. Depth to groundwater varies from near surface at perennial streams to depth of more than 500 feet. Vertical permeability is high.

2.2.3 Climate

Temperatures near the former Sahuarita Air Force Range are typical of the desert southwest. The hot season includes April to October, with average temperatures above 90 degrees Fahrenheit (°F) from May to September and the hottest days around June and July, with temperatures frequently over 100°F. The humidity is very low during the hot season, and the temperature range averages 30°F or more per day. Precipitation occurs in two seasons. July through September brings heavy showers supplying more than 50% of the annual rainfall. These showers are scattered and heavy, often filling previously dry washes and resulting in destructive flash flooding. Over 20% of the annual precipitation occurs from December through March; groundwater recharge occurs predominately during these months as a result of more lengthened storms allowing for greater infiltration into the subsurface. Surface water at the site flows west to the Santa Cruz River (Parsons, 2006b).

2.2.4 Significant Structures

The former Sahuarita AFR is just east of the Town of Sahuarita, approximately 17 miles south of downtown Tucson. A portions of the site on the northern end is within the city limits of Tucson. The area is accessible from Interstate I-19 and U.S. Highway 89. Notable structures include residential areas, Sahuarita Park (including playgrounds and several ball fields), and Edge Charter School (9^{th} through 12^{th} grades with 40 to 45 students).

2.2.5 Demographics

The former Sahuarita AFR lies in the southeast corner of Arizona in Pima County. Residential areas are located within and along the western and eastern property boundaries. The site is 40 miles north of the Mexico border and 12 miles south of Tucson International Airport. As of the 2000 census (Table 2.1), the population density of Pima County is 91.8 people per square mile, however more than 24,000 individuals live within a 4-mile buffer of the former Sahuarita AFR. The 2006 U.S Census Bureau American Community Survey listed the population density of the Town of Sahuarita, located directly west of the site, as 434 people per square mile. The population density of the City of Tucson is 2,500 people per square mile. Though the city center is located several miles north of the site, the city boundary reaches the northern border of the former Sahuarita AFR near Range Complex No. 1. The SI field team observed residents within the FUD site boundary; however, no residents where observed within any of the MRSs. Figure 2.2 depicts the 2000 Census Bureau data by blocks in the vicinity of the site.

2.2.6 Current and Future Land Use

Most of the former Sahuarita AFR is now owned by the state of Arizona and is leased for cattle grazing. Pima County uses part of the site as a public park, and other portions of the site are privately-owned residential areas. A small charter high school is located near Pima County's Sahuarita Park at the northwest end of the former runway. The site

is projected to continue to be used for similar purposes, with residential development continuing within the site.

TABLE 2.1
POPULATION WITHIN 4-MILE BUFFER
SAHUARITA AFR, ARIZONA

Range	On Site	0 to 1/4 Mile	1/4 to 1/2 Mile	1/2 to 1 Mile	1 to 2 Miles	2 to 3 Miles	3 to 4 Miles	Total
Range Complex No. 1	0	4	196	93	1,244	4,709	3,279	9,525
Range Complex No. 2	258	688	726	1,003	863	1,782	7,102	12,422
Range Complex No. 3	216	0	5	372	760	2,037	292	3,682
Entire Site	1,808	980	316	403	2,863	12,469	5,892	24,731

Source: U.S. Census 2000 data. Note that the population of 258 and 216 people within the Range Complex Nos. 2 and 3, respectively, results from the conservative approach that was used to calculate the population of an area by including the total number of people for a partial census section that intersects the site boundary or MRS boundary. No residents were observed within any MRS by the SI field team.

2.3 SITE OWNERSHIP AND HISTORY

2.3.1 In April 1942, the Army Air Corps at Davis-Monthan Field announced the establishment of the Sahuarita Air Force Range. The site consisted of 27,046 acres resulting from leases from the City of Tucson, transfers from the Department of the Interior, and acquisitions of easement acres. Improvements included 12 buildings, observations towers, a 5,540-foot runway, miscellaneous structures, utilities, an OQ range, four bombing targets, and two air-to-ground targets. Airmen from Davis-Monthan Field conducted most of the training on the Sahuarita Air Force Range, but other stations occasionally used the range. The flying group from March Field, California, made first use of the Sahuarita Bombing Range. By January 1943, airmen began conducting high-altitude and night bombing training at the Sahuarita Air Force Range. In October 1950, crews from Carswell Air Force Base, Texas, conducted many of the bombing missions flown on Sahuarita Air Force Range.

2.3.2 In 1943, the Commanding Officer at Davis-Monthan Field requested closing the Air-to-Ground Gunnery Range at Sahuarita, due to its dangerous proximity to the bombing targets and the flight strip. In 1944, Headquarters at Davis-Monthan Field assigned Bomb Range Control, at the Sahuarita Range Camp, to control operations on Bombing Pattern Number One and the Air-to-Ground Gunnery Range. However, the Air-to-Ground Gunnery Range was not closed and is believed to have remained open and in use until as late as November 1958. The Davis-Monthan Bombing Pattern Number One consisted of two targets with wooden pyramids 24 feet wide on each side. The Munitions Branch at Davis-Monthan Field issued 250-pound practice bombs and 20-millimeter (mm) rounds to the training wings, although it is unknown whether the airmen dropped these practice bombs at Sahuarita Air Force Range.

2.3.3 The flight strip at Sahuarita Air Force Range was wholly within the boundaries of the Air-to-Ground Gunnery Range Number (No.) 2, but was retained for emergency use on the range. The OQ Range was constructed in April 1945 just south of the northern end of the airstrip, and was used to train airmen in ground-to-air firing of .50-caliber

machine guns at pilotless, radio-controlled airplanes. In 1950, the Engineering Section completed a Rotary Launcher Site for the OQ Range, and in 1953 the OQ Range was recommended for rehabilitation in lieu of construction of a new range at Davis-Monthan Air Force Base.

2.3.4 On 18 August 1948, 2,063 acres were transferred back to the Department of the Interior. Portions of the leases totaling 1,680 acres were terminated in 1948, with an additional 3,797 in 1949. The 2,438 acres acquired through easements and additional portions of the leases totaling 14,469 acres were terminated in 1971 and 1972. The final 2,550 acres of leases were terminated 31 March 1978.

2.4 SITE OPERATIONS AND WASTE CHARACTERISTICS

2.4.1 Munitions Response Site-Specific Descriptions/Operations

The SI visit in January 2007 focused on the three MRSs (Figure 2.1) at the former Sahuarita AFR, as defined in the 2004 Archives Search Report (ASR) Supplement and discussed below:

Range Complex No. 1

- **Bombing Target No. 1:** Bombing Target No. 1 is on the north end of the former Sahuarita AFR, overlapping the east side of Bombing Target No. 4 and the east end of Air-to-Ground Range No. 1. This target was used as a practice bombing range, and the concentric circles marking the target center are still visible from the ground surface and in aerial photography.

- **Bombing Target No. 4:** Bombing Target No. 4 is listed in the ASR as an X-shaped bombing target west of Bombing Target No. 1 on the north end of the former Sahuarita AFR. The target was used for practice bombing with 100- and 250-pound practice bombs. No visual indications of the target remain at the site; however, practice bomb debris was seen throughout the MRS during the ASR site visit.

- **Air-to-Ground Range No. 1:** Air-to-Ground Range No. 1 is a gunnery range on the north end of the site overlapping Bombing Targets No. 1 and No. 4. This area was used for strafing and other air-to-ground firing with .50-caliber small arms. Debris from .50-caliber munitions has previously been found in the area.

Range Complex No. 2

- **Air-to-Ground Range No. 2:** Air-to-Ground Range No. 2 is a strafing range located in the center of the site just east of the airstrip. Munitions used on this MRS include .50-caliber small arms and various 20mm projectiles.

- **OQ Range:** The OQ Range is a large ground-to-air gunnery range encompassing a large portion of the north half of the former Sahuarita AFR.

Remote controlled drone aircraft were launched from a large rotary launcher located just southwest of the runway, and were fired on from the ground with 20mm and .50-caliber munitions. The rotary launcher and firing line are visible in aerial photographs, and small arms and 20mm munitions debris has previously been found on site.

Range Complex No. 3

- **Bombing Target No. 2:** Bombing Target No. 2 is in the southeastern corner of the Sahuarita AFR just northeast of Bombing Target No. 3. The concentric circles at this target center are still visible from the ground and in aerial photography. This target was used for demolition bombing using 100-pound high explosive (HE) bombs as well as practice bombs.

- **Bombing Target No. 3:** Bombing Target No. 3 is in the southeastern corner of the Sahuarita AFR just southwest of Bombing Target No. 2. This target was used for demolition bombing using 100-pound HE bombs as well as practice bombs. The target is not visible at the location shown in the ASR Supplement; however, the concentric circles marking this target are still visible on the ground and faintly on aerial photos in the location marked by the ASR as the target center, approximately ½ mile farther south than shown in the ASR Supplement. Figure 2.1 shows both the ASR Supplement location for Bombing Target No. 3 and the location shown in the ASR and confirmed during the SI visit. All other figures throughout this SI report will show only the correct target location confirmed during the site visit.

2.4.2 Regulatory Compliance

The USACE is conducting the SI at the former Sahuarita AFR as part of FUDS response activities pursuant to and in accordance with the guidance, regulations, and legislation listed in Section 1.1.

2.5 PREVIOUS INVESTIGATIONS

2.5.1 Parsons performed a document review for the former Sahuarita AFR, including the Inventory Project Report (INPR; USACE, 1994), the ASR (USACE, 1996), and the ASR Supplement (USACE, 2004a).

2.5.2 Previous investigations have determined that the former Sahuarita AFR was used from 1942 to 1958. The INPR identified the site as a FUDS. The ASR included interviews, record reviews, and a site visit, and identified the types of munitions potentially used at this site.

2.5.1 Inventory Project Report

The INPR was completed by the USACE Los Angeles District and signed in 1994. This document established the Sahuarita AFR as a FUDS, established a site boundary,

and assigned Project No. J09AZ057600. The INPR states that 27,046 acres were acquired by transfer from the Department of the Interior, by lease from the city of Tucson, and in fee beginning in 1942. Improvements included 12 buildings, four observation towers, a 5,540-foot runway, and other miscellaneous structures and utilities. According to the original Risk Assessment Code (RAC) completed as part of the INPR, a site survey was conduced as part of the final land transfer in 1978. The survey team found 71 jet-assisted take-off (JATO) bottles in the runway area and one 750-pound practice bomb. The RAC score also noted that the sergeant at Davis-Monthan EOD recalled two 500-pound practice bombs being found on the Sahuarita site "several years ago." No information was available indicating the location or the condition of the items found.

2.5.2 Archives Search Report

The ASR was completed by the USACE St. Louis District in September 1996 after reviewing available records, photographs, and reports that documented the history of the site. It is the source of most of the historical information pertaining to site operations and identifies the key areas of focus for the SI. As part of the ASR, a site visit was conducted in 1996. The site visit team identified practice bombs and .50-caliber ammunition at several locations. The team found evidence of 20mm projectiles on the OQ Range and on Air-to-Ground Gunnery Range No. 2, and identified HE bomb fragments between Bombing Targets No. 2 and No. 3.

2.5.3 Archives Search Report Supplement

2.5.3.1 The ASR Supplement was completed in 2004 by the USACE Rock Island District as an addition to the 1996 ASR. This document applied standard range configurations to the site, yielding specific range boundaries for each target area. The ASR Supplement also developed a list of MEC that may be found within each range area. No site visit was conducted in support of the ASR Supplement. RAC scores in the ASR Supplement assigned each MRS a score from 1 to 5 indicating the highest and lowest hazard potentials, respectively. This document identified seven sub-ranges at the former Sahuarita AFR, assigned their RAC scores, and listed the types of munitions potentially used at each. The following specific information comes from the ASR Supplement:

Range Complex No. 1 – 1,394.3 Acres

- **Bombing Target No. 1:** RAC 4. 649 acres. Expected munitions: 100-pound practice bombs (M38A2), 250-pound practice bombs (Mk86), and spotting charges (M1A1).

- **Bombing Target No. 4:** RAC 4. 649 acres. Expected munitions: 100-pound practice bombs (M38A2), 250-pound practice bombs (Mk86), and spotting charges (M1A1).

- **Air-to-Ground Range No. 1:** RAC 5. 640 acres. Expected munitions: general small arms and .50-caliber projectiles.

Range Complex No. 2 – 7,921.9 Acres

- **Air-to-Ground Range No. 2:** RAC 3. 2,727.8 acres. Expected munitions: general small arms, .50-caliber projectiles, 20mm high explosive incendiary (HEI) projectiles (MKI), and 20mm ball projectiles (M55A1 and Mk1).

- **OQ Range:** RAC 3. 5,515.7 acres. Expected munitions: general small arms, .50-caliber projectiles, 20mm HEI projectiles (MKI), and 20mm ball projectiles (M55A1 and Mk1).

Range Complex No. 3 – 940.6 Acres (Acreage as reported in ASR Supplement)

- **Bombing Target No. 2:** RAC 3. 649 acres. Expected munitions: general small arms, .50 caliber projectiles, 100-pound practice bombs (M38A2), 100-pound general purpose bombs (AN-M30), old-style general purpose bombs, and spotting charges (M1A1).

- **Bombing Target No. 3:** RAC 3. 649 acres. Expected munitions: general small arms, .50 caliber projectiles, 100-pound practice bombs (M38A2), 100-pound general purpose bombs (AN-M30), old style general purpose bombs, and spotting charges (M1A1). (As discussed in Section 2.4.1 and shown in Figure 2.1, Bombing Target No. 3 was determined during the SI visit to have been located incorrectly in the ASR Supplement. The 940.6 acres listed in the ASR Supplement is not the acreage of the MRS shown on the figures in this SI Report.)

2.5.3.2 Table 2.2 shows the munitions potentially present at these locations.

2.5.4 Defense Environmental Programs Annual Report to Congress

The Defense Environmental Programs Annual Report to Congress for fiscal year 2005 includes the former Sahuarita AFR in the MMRP Inventory (DoD, 2006).

TABLE 2.2
SUSPECTED OR KNOWN MUNITIONS
SAHUARITA AFR, ARIZONA

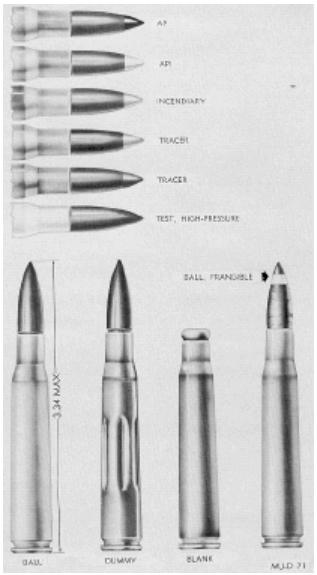
Munitions	Photograph/Diagram
Small Arms Ammunition, .30-Caliber	
Small Arms Ammunition, .50-Caliber Carbine	
Bomb, Practice, 100 pound with Spotting Charge M38A2	

TABLE 2.2 (CONTINUED)
SUSPECTED OR KNOWN MUNITIONS
SAHUARITA AFR, ARIZONA

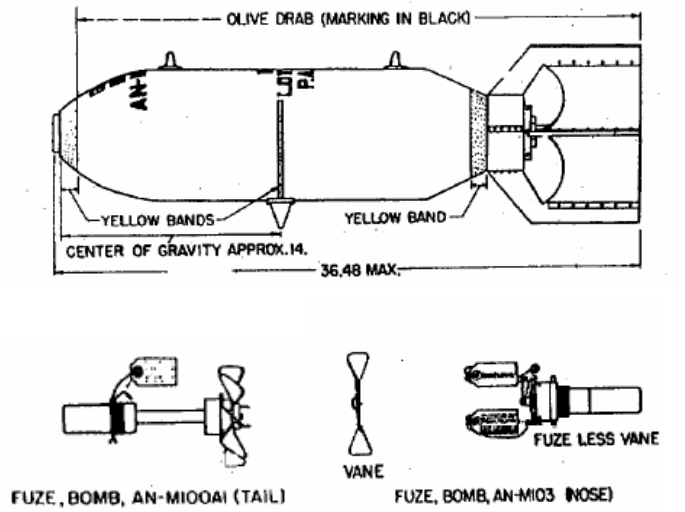
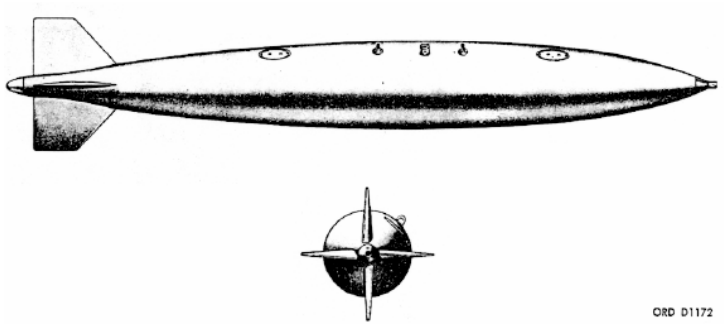
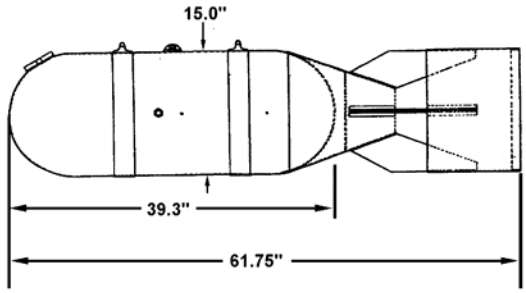
Munitions	Photograph/Diagram
Bomb, General Purpose, 100 Pound, AN-M30*	
Bomb, Practice, 250 Pound, Mk86	
Bomb, Practice, 500 pound*	

TABLE 2.2 (CONTINUED)
SUSPECTED OR KNOWN MUNITIONS
SAHUARITA AFR, ARIZONA

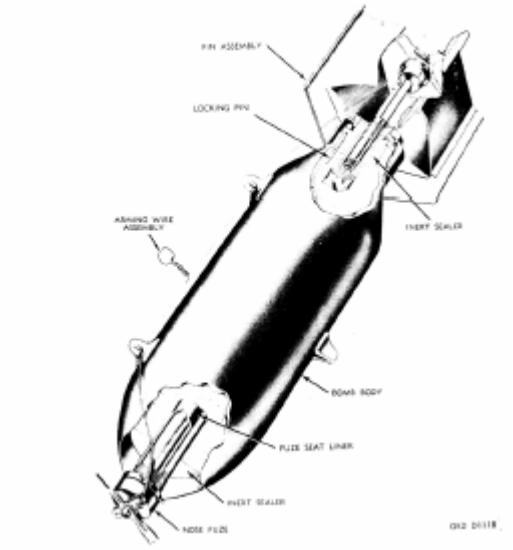
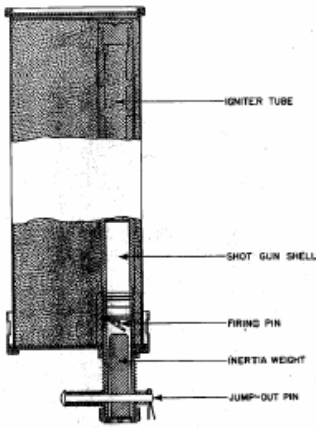
Munitions	Photograph/Diagram
Bomb, Practice, 750 Pound*	
Bomb, General Purpose, Old Style* 100 Pound to 2,000 Pound	
Spotting Charge, M1A1	

TABLE 2.2 (CONTINUED)
SUSPECTED OR KNOWN MUNITIONS
SAHUARITA AFR, ARIZONA

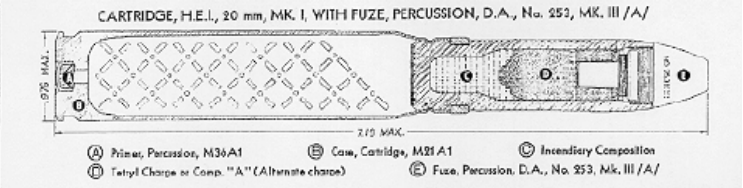
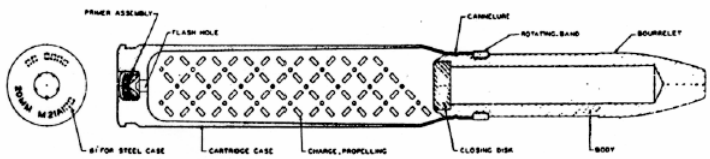
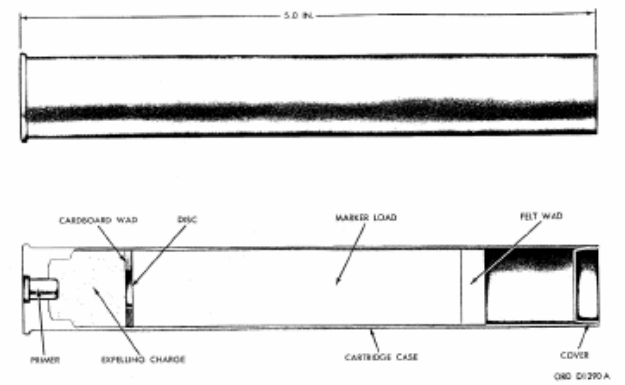
Munitions	Photograph/Diagram
Shell, 20mm, High Explosive Incendiary, MK I	
Cartridge, 20mm, Ball, MK I*	
Cartridge, 20mm, Ball, M55A1*	

TABLE 2.2 (CONTINUED)
SUSPECTED OR KNOWN MUNITIONS
SAHUARITA AFR, ARIZONA

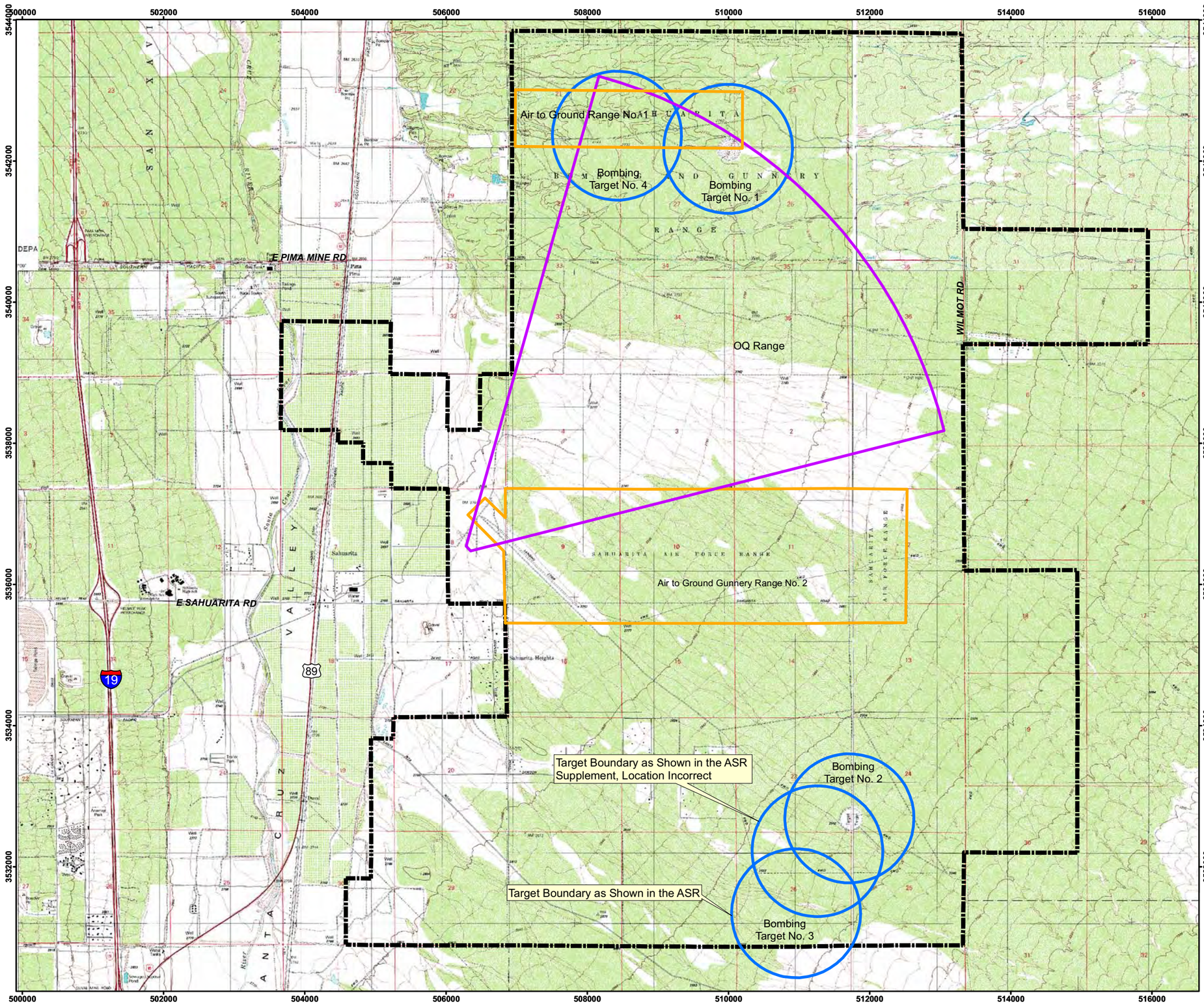
Munitions	Photograph/Diagram
Signal, Practice Bomb, MK 4 Mod 3 and 4	
Jet assisted take-off bottles (JATO)*	 

* - Munitions debris observed at site by eyewitnesses, referenced generally without Munitions ID.

Figure 2.1

Site Setting
Former Used Defense Site
Sahuarita AFR
FUDS Project No. J09AZ057601

Sahuarita, Arizona



Legend

- Air-to-Ground Range Boundary
- Bombing Range Boundary
- Small Arms Range Boundary
- Installation Boundary

Site Location in Arizona

N

Image Source: USGS 7.5' Topo Quadrangles, 1981 - 1992
Projection: UTM Zone 12 NAD83, Map Units in Meters

4,500 2,250 0 4,500 Feet

PARSONS

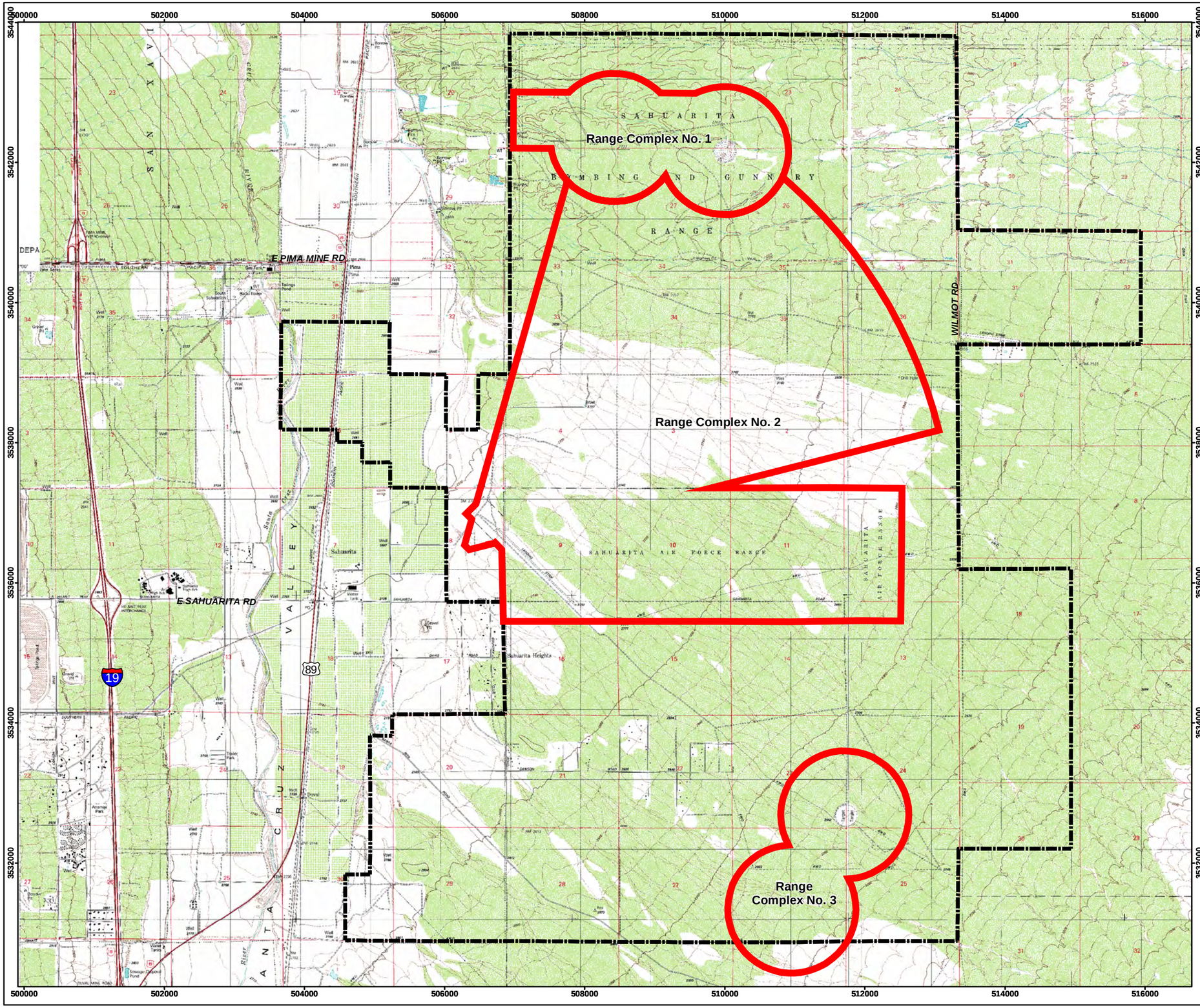
U.S. ARMY SOUTH PACIFIC DIVISION RANGE SUPPORT CENTER

DESIGNED BY: BT	**Site Setting**
DRAWN BY: BT	
CHECKED BY: NH	SCALE: As Shown — PROJECT NUMBER: 744653.05000
SUBMITTED BY: DS	DATE: June 2007 — PAGE NUMBER: 2-13
	FILE: X:\GIS\Site_inspections_sw\Maps\sahuarita_az\ Fig2_1.mxd

Figure 2.2

MRS Locations
Former Used Defense Site
Sahuarita AFR
FUDS Project No. J09AZ057601

Sahuarita, Arizona



Legend

- Range Complex Boundary
- Installation Boundary

Site Location in Arizona

N

Image Source: USGS 7.5' Topo Quadrangles, 1981 - 1992
Projection: UTM Zone 12 NAD83, Map Units in Meters

4,500 2,250 0 4,500 Feet

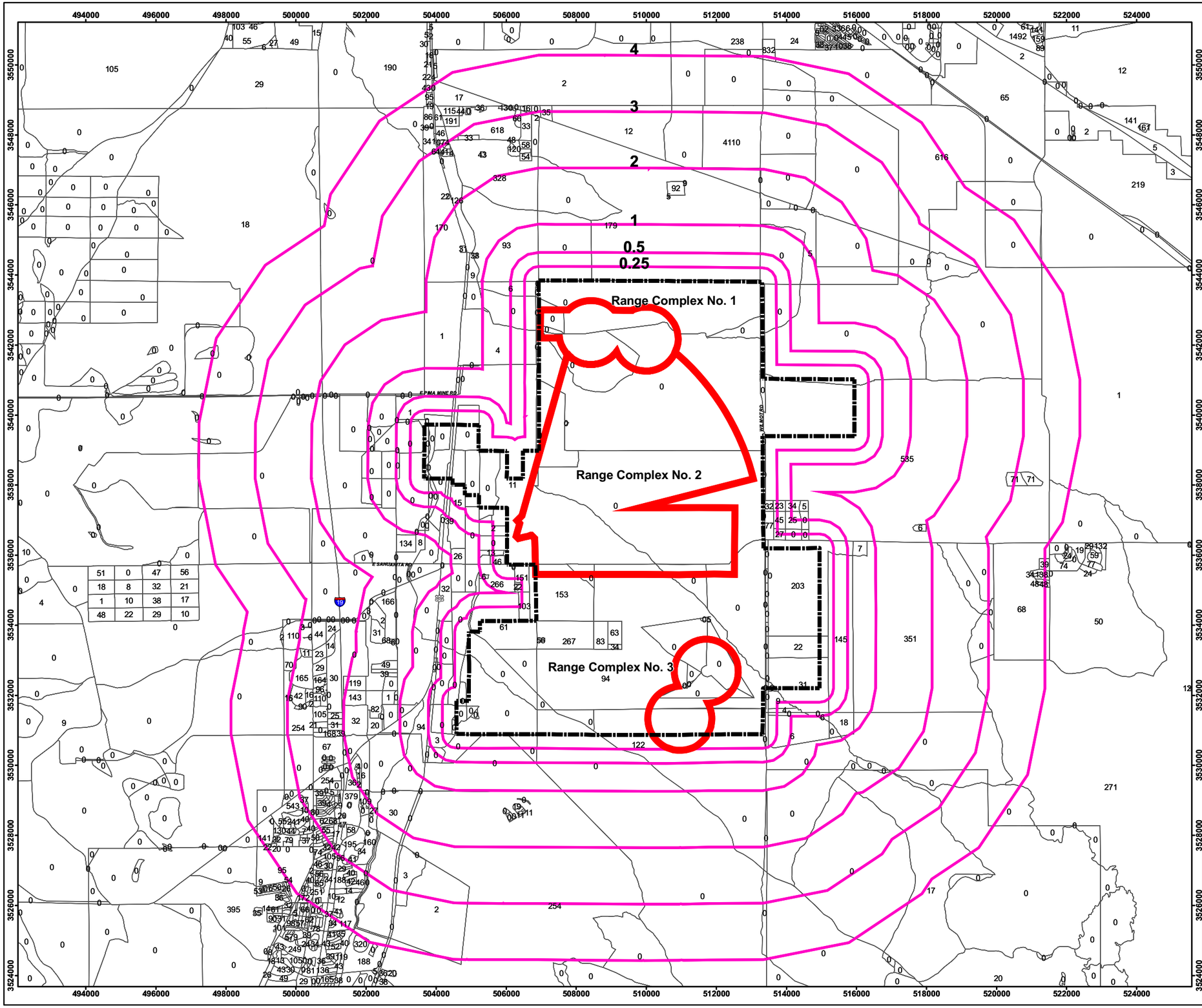
PARSONS	U.S. ARMY SOUTH PACIFIC DIVISION RANGE SUPPORT CENTER

DESIGNED BY: BT	MRS Locations		
DRAWN BY: BT			
CHECKED BY: NH	SCALE: As Shown	PROJECT NUMBER: 744653.05000	
SUBMITTED BY: DS	DATE: June 2007	PAGE NUMBER: 2-14	
	FILE: X:\GIS\Site_inspections_sw\Maps\sahuarita_az\Fig2_2.mxd		

Figure 2.3

2000 Census Data
Former Used Defense Site
Sahuarita AFR
FUDS Project No. J09AZ057601

Sahuarita, Arizona



Legend

- 76 — 2000 Census Block Boundary with Total Population
- Range Complex Boundary
- Installation Boundary
- Buffer (Mile)

Site Location in Arizona

N

Projection: UTM Zone 12 NAD83, Map Units in Meters

0 1 2 4 Miles

PARSONS

U.S. ARMY SOUTH
PACIFIC DIVISION
RANGE SUPPORT CENTER

DESIGNED BY:	BT
DRAWN BY:	BT
CHECKED BY:	NH
SUBMITTED BY:	DS

2000 Census Data

SCALE: As Shown

PROJECT NUMBER: 744653.05000

DATE: June 2007

PAGE NUMBER: 2-15

FILE: X:\GIS\Site_inspections_sw\Maps\sahuarita_az\Fig2_3.mxd

CHAPTER 3

SITE INSPECTION TASKS

3.1 HISTORICAL RECORD REVIEW

As discussed in Section 2.5, Parsons performed a document review for the former Sahuarita AFR, including the 1994 INPR, the 1996 ASR, and the 2004 ASR Supplement.

3.2 TECHNICAL PROJECT PLANNING

The former Sahuarita AFR falls under the purview of the USACE Los Angeles District, which facilitated a TPP meeting on September 8, 2006, that included representatives of the USACE, Parsons, the ADEQ, the Arizona State Land Department, and the Town of Sahuarita. The TPP Team reached unanimous concurrence with the technical approach presented in the Final TPP Memorandum (Parsons, 2006c; reprinted in Appendix B). Key TPP findings and decisions are summarized below:

- The TPP Team concurred with the technical approach, including number, type, and location of samples as well as sampling methods and laboratory analyses. The team authorized collection of eight soil samples and three groundwater samples from biased locations as well as two ambient conditions samples. All soil samples were to be analyzed for explosives and metals, and groundwater for explosives, metals, and perchlorate.

- The TPP Team determined that comparison criteria for soil sample results would be the more conservative of the State of Arizona residential SRLs, USEPA Region 6 SSLs, and USEPA Region 9 residential soil PRGs. Groundwater results would be compared to USEPA Region 9 and 6 tap water human health screening values.

- The USACE Los Angeles District agreed to obtain official rights of entry (ROEs) from the owners and lessees at the site.

- Endangered species are potentially present within Pima County, but no specific occurrences or critical habitats within the former Sahuarita AFR are known.

3.3 NON-MEASUREMENT DATA COLLECTION

3.3.1 ADEQ provided hydrogeological consultation, including information about wells on and near the site. Kate Rao of the USEPA Region 9 Source Water Protection Program was contacted to provide information about potential tribal drinking water

supplies, as was Lowell Carty of the ADEQ to provide information regarding wellhead protection and surface water intakes for drinking water systems on other lands. Tribal lands are present within a four mile buffer of the FUDS site. Information regarding wellhead protection areas is not available; however, drinking water and municipal drinking water supply wells are present on site. Because of the presence of municipal supply wells, it is assumed that wellhead protection areas are present within the FUDS boundary.

3.3.2 The following printed and electronic information sources were consulted as part of the former Sahuarita AFR SI:

- USGS – Topographic maps
- USGS – Groundwater Atlas of the United States, http://capp.water.usgs.gov/gwa/ch_c/C-text3.html
- U.S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI) – Wetlands Online Mapper, http://wetlandsfws.er.usgs.gov/wtlnds/launch.html
- USFWS, Endangered Species Program – Threatened and Endangered (T&E) Species System (TESS), http://ecos.fws.gov/tess_public/StateListing.do?state=all
- USFWS, National Wildlife Refuge System (NWRS), http://www.fws.gov/refuges /profiles/bystate.cfm
- National Oceanic and Atmospheric Administration (NOAA), Coastal Zone Management Program (CZMP)
- National Geochemical Survey, http://tin.er.usgs.gov/geochem/doc/averages/as/southwestern.html
- U.S. Department of Agriculture Forest Service, http://www.fs.fed.us
- National Park Service (NPS), http://www.nps.gov/applications/parksearch /geosearch.cfm
- National Register Information System (NRIS) – National Register of Historic Places (NRHP), http://www.nr.nps.gov/nr.research.nris.htm
- NRIS – National Register Historic Districts (NRHD), http://www.historicdistricts .com/nm/districts.html and http://www.historicdistricts.com/nm/luna/districts.html
- National Historic Landmarks Program (Arizona) – List of National Historic Landmarks (NHLs), http://www.cr.nps.gov/nhl/designations/Lists/AZ01.pdf
- National Heritage Areas Program – List of National Heritage Areas (NHAs), http://www.cr.nps.gov/heritageareas/VST/#list

- Arizona Historic Districts (AZHD), Pima County
- Arizona Historic Preservation Office (AZ SHPO), Archeology Department
- Arizona Natural Heritage Program (NHP) – Heritage Data Management System (HDMS)
- Arizona Department of Water Resources (ADWR)
- City of Tucson, Department of Urban Planning and Design

3.3.3 According to the NRIS, AZHD, NHL, and NHP HDMS, there are no cultural resources within the boundary of the former Sahuarita AFR. According to the AZ SHPO, there are no known archeological resources within the boundary of the site. (Parsons, 2006b)

3.4 SITE-SPECIFIC WORK PLAN

3.4.1 The SS-WP (Parsons, 2006b) augments the PWP and PSAP to present pertinent site-specific information and procedural adjustments that could not be readily captured in the programmatic documents or that resulted from TPP Team agreements that required modifying the preliminary SI technical approach. The ADEQ concurred with the technical approach and field procedures in the SS-WP.

3.4.2 The PWP and PSAP are umbrella documents that set overall programmatic objectives and approaches, whereas the SS-WP provides site-specific details and action plans. The PWP, PSAP, and SS-WP accompanied the SI field team during SI field activities.

3.4.3 The SS-WP includes the project description, the field investigation plan, the sampling and analysis plan, the environmental protection plan, and the health and safety plan specific to the former Sahuarita AFR. The field investigation plan developed a technical approach to guide sample collection and analysis for MEC and MC to ensure that the results were sufficient to determine whether additional investigations or implementation of a remedy are necessary for the site. Key elements of the technical approach include the conceptual site model (CSM; included in Appendix J) to help determine types of samples and their locations, data quality objectives (DQOs) to ensure that the data acquired is sufficient to characterize MEC and MC at the site, and qualitative reconnaissance (QR) to confirm known target locations and to evaluate the presence or absence of MEC/MC in remote portions of the site.

3.4.4 The sampling and analysis plan discusses procedures for soil sample acquisition from locations biased toward the highest potential for MEC or MC contamination; quality control (QC) and quality assurance (QA) for the sampling process; sample shipment to an approved, independent laboratory; and analysis of the samples by the laboratory. The environmental protection plan presents procedures for avoiding, minimizing, and mitigating potential impacts to environmental and cultural resources during site field

activities. The health and safety plan supplements the programmatic accident prevention plan with site-specific emergency contact information and directions to the nearest hospital.

3.5 DEPARTURES FROM PLANNING DOCUMENTS

As shown in the SS-WP, two groundwater samples were planned at locations west of the former runway area. ROE was refused for these planned well locations (SAH-RL-GW-02 and SAH-RL-GW-03); therefore, two alternative sample locations were selected at wells for which ROE had been granted. Groundwater samples are discussed further in Sections 5.2.5, 5.3.2, and 5.4.1. Additionally, the SS-WP specified that the most conservative of EPA Region 6 SSLs, EPA Region 9 residential soil PRGs and the of State of Arizona non-residential SRLs would be used for comparison to soil sample analytical results. After visual observations of residential areas surrounding the sites it was determined that the State of Arizona residential SRLs would be more appropriate. Therefore, the list of comparison criteria included the State of Arizona residential SRLs.

CHAPTER 4

MUNITIONS AND EXPLOSIVES OF CONCERN FINDINGS

4.1 GENERAL INFORMATION

4.1.1 Qualitative Reconnaissance

4.1.1.1 As stated previously, the primary task of the SI was to assess the potential presence of MEC, munitions debris, and MC. To assess the potential presence of MEC, the field team conducted QR by walking approximately 44 miles over the site from January 22 through 26, 2007.

4.1.1.2 Site QR consisted of visual reconnaissance of the site surface to provide qualitative data on potential subsurface anomalies, and the identification of visual indicators of suspect areas, including earthen berms, distressed vegetation, stained soil, ground scars or craters, target remnants, and visible metallic debris. QR activities focused on the known MRSs at the site considered to potentially contain MEC contamination from training activities during the site's history, and in the remaining lands to verify the absence of MEC.

4.1.1.3 QR was primarily conducted along the route prescribed in the SS-WP (Parsons, 2006b) and generally progressed from sample to sample. The team recorded a field observation if debris or unique site features were observed or if a sample was collected. Figure 4.1 shows the QR route and observation locations. As discussed in the SS-WP, the QR route essentially followed the proposed path, but the field team was given the flexibility to redirect the route based on visual observations and site features. Table 4.1 presents the MEC potentially present at the site based on the ASR and ASR Supplement. The MEC CSM is included in Appendix J.

4.1.1.4 As shown in Appendix E (Photograph Documentation), the SI team noted 195 discrete field observations throughout the course of the SI, such as topography, soil color, drainage, and the presence of any barriers. Table 4.2 summarizes pertinent field observations. Appendix D includes related field forms.

4.1.2 Data Quality Objectives

4.1.2.1 Introduction

4.1.2.1 DQOs are qualitative and quantitative statements that clarify study objectives and specify the type and quality of the data necessary to support decisions. The

TABLE 4.1
CHEMICAL COMPOSITION OF MUNITIONS AND EXPLOSIVES OF CONCERN AND POTENTIAL MUNITIONS CONSTITUENTS
SAHUARITA AFR, ARIZONA

General Munition Type	Type/Model	Case Composition	Filler	Potential Constituent
Small Arms Ammunition, .30 Caliber with Gliding Metal Jacket	M2 Ball M1 Tracer M2 Armor Piercing (AP) Primer, Percussion	Brass, steel, aluminum	Lead antimony Tracer Composition, Tungsten Chrome Steel Single- or double-base powder Primer Composition	Lead, antimony, copper, zinc, molybdenum, iron, tungsten, chromium, aluminum, calcium, strontium, magnesium
Carbine Ammunition, .30 Caliber with Gliding Metal Jacket	M1 Ball M16 Tracer Propellant Primer, Percussion	Brass, steel, aluminum	Lead antimony Tracer Composition Single- or double-base powder Primer Composition	Lead, antimony, iron, copper, zinc, molybdenum, aluminum, calcium, strontium, magnesium,
Small Arms Ammunition, .50 Caliber with Gliding Metal Jacket	M2 Ball M1 Tracer M10 Tracer M17 Tracer M21 Tracer M2 AP Propellant Primer, Percussion	Brass, steel, aluminum	Soft steel Tracer Composition Tracer Composition Tracer Composition Tracer Composition Tungsten Chrome Steel Single- or double-base powder Primer Composition	Calcium, iron, strontium, lead, magnesium, molybdenum, tungsten, chromium, aluminum, nitroglycerin, nitrocellulose*, antimony, PETN, potassium, trinitrotoluene (TNT), perchlorate
Practice Bomb, 100 Pound, w/Spotting Charge	M38A2 M1A1	Metal, black powder	Sand, wet sand, or water; spotting charge contains black powder	Iron, potassium
Bomb, Practice, 250-Pound, w/Signal Charge	MK-86 Signal- MK4 Mod 3	Metal, black powder	Sand, wet sand, or water; spotting charge contains black powder	Iron, potassium

TABLE 4.1 (CONTINUED)
CHEMICAL COMPOSITION OF MUNITIONS AND EXPLOSIVES OF CONCERN AND POTENTIAL MUNITIONS CONSTITUENTS
SAHUARITA AFR, ARIZONA

General Munition Type	Type/Model	Case Composition	Filler	Potential Constituent
Bomb, Practice, 500-Pound, w/Signal Charge		Metal, black powder	Sand, wet sand, or water; spotting charge contains black powder	Iron, potassium
Bomb, Practice, 750-Pound, w/Signal Charge		Metal, black powder	Sand, wet sand, or water; spotting charge contains black powder	Iron, potassium
Bomb, General Purpose, 100-Pound	AN-M30 Fuze Nose AN-M103, M103, M118 Fuze Tail AN-M103, M112, M100, M106, AN-M100A1	Steel	TNT Amatol (ammonium nitrate, TNT) Tritonal (aluminum, TNT)	TNT, aluminum
Bomb, General Purpose, Old Style	AN-M30A1 100 pound	Steel	Amatol (ammonium nitrate, TNT), tritonal (aluminum, TNT), TNT;	TNT, aluminum
Bomb, General Purpose, Old Style	AN-M57A1 250 pound	Steel	Amatol, tritonal, TNT	TNT, aluminum
Bomb, General Purpose, Old Style	AN-M64A1 500 pound	Steel	Amatol, TNT, Composition B (RDX, TNT), tritonal	TNT, RDX, aluminum
Bomb, General Purpose, Old Style	AN-M65A1 1,000 pound	Steel	Amatol, TNT, Composition B, tritonal	TNT, RDX, aluminum
Bomb, General Purpose, Old Style	AN-M166A2 2,000 pound	Steel	Amatol, TNT, Composition B, tritonal	TNT, RDX, aluminum
Signal	MK4 mod 3	Cast iron, zinc alloy, aluminum	Zinc oxide, black powder, titanium tetrachloride	Iron, zinc, potassium, titanium, aluminum

TABLE 4.1 (CONTINUED)
CHEMICAL COMPOSITION OF MUNITIONS AND EXPLOSIVES OF CONCERN AND POTENTIAL MUNITIONS CONSTITUENTS
SAHUARITA AFR, ARIZONA

General Munition Type	Type/Model	Case Composition	Filler	Potential Constituent
Signal, Illumination, Ground Parachute	Model unknown, (for MC purposes we used the M127A1, M126A1, and M8A1 only reporting constituents greater than 0.5% weight of the item)	Aluminum,	Aluminum, calcium carbonate, charcoal, chromium, iron, potassium nitrate, potassium perchlorate, laminac/lupersol, magnesium, sodium nitrate, nickel, sulfur, lamic #4116, polyvinyl chloride, sulfur, strontium nitrate, barium nitrate, copper, lead, sodium oxalate, silicon, tin, zinc, linseed oil, castor oil.	Aluminum, calcium, chromium, iron, potassium, perchlorate, magnesium, sodium, nickel, strontium, barium, copper, lead, tin, zinc
Spotting Charges	M1A1 M5 M3		Black powder Dark smoke filling FS smoke mixture	Potassium
Shell, High Explosive Incendiary 20mm,	MK 1 Fuze- MK.III Primer- M36A1 Cartridge M21A11	Steel	IMR powder Tetryl, incendiary mixture Composition A – ammonium nitrate Tetryl	Ammonium, aluminum, magnesium, tetryl
Cartridge, 20mm, Ball, MK I	MK 1 Cartridge- M21	Steel, brass	Double base propellant, no filler	Nitroglycerin
Cartridge, 20mm, Ball, M55A1	M55A1 Case-M103 Primer- electric M52A3B1	Steel, aluminum	Double base propellant, no filler	Aluminum, nitroglycerin
Jet Assisted Take-Off (JATO) Bottles		Steel	Solid rocket fuel (ammonium perchlorate, aluminum powder)	Perchlorate, ammonium, aluminum

* Nitrocellulose is a potential constituent of munitions used on site; however, there is no reliable analytical method for nitrocellulose, and the toxicity of nitrocellulose is very low. Therefore, laboratory analysis for nitrocellulose was not conducted.

TABLE 4.2
SUMMARY OF QUALITATIVE RECONNAISSANCE OBSERVATIONS
SAHUARITA AFR, ARIZONA

MRS	Sub-Range	MEC	Munitions Debris	Munitions-Related Features
Range Complex No. 1	**Bombing Target No. 1**	One unfired .50 caliber ball ammunition	Pieces of 100-pound practice bombs; .50-caliber (ball, links, and cartridge)	Visible target center covered in .50-caliber links
	Bombing Target No. 4	One unfired .50 caliber ball ammunition	Pieces of 100-pound practice bombs; .50-caliber (ball and cartridge); expended illumination signal (2)	None
	Air-to-Ground Range No. 1	None	Overlapped by Bombing Targets No. 1 and No. 4	None
Range Complex No. 2	**Air-to-Ground Range No. 2**	None	Pieces of one 100-pound practice bomb; .50-caliber (ball, tracer, cartridges, and links); .30-caliber (cartridge and ball); 20mm ball and tracer; small metal fragments from an unknown HE munition	None
	OQ Range (Ground-to-Air Gunnery Range)	None	Pieces of one 100-pound practice bomb; .50-caliber (ball and links)	None
Range Complex No. 3	**Bombing Target No. 2**	None	Pieces of 100- and 500-pound practice bombs; .50-caliber links; unknown projectile; metal fragments from an unknown HE munition	Visible target center covered in .50-caliber links; possible crater; unknown aluminum item, possible airplane munitions mount
	Bombing Target No. 3	None	Pieces of 100- and 500-pound practice bombs; .50-caliber (ball and links); unknown MD at suspect OB/OD area; fragments from an unknown HE munition	Possible OB/OD of very large item, target debris; craters. Visible bombing target was not identified at MRS center but at the southern edge of the MRS boundary; range boundary identified incorrectly in ASR Supplement

development of DQOs for a specific site takes into account factors that determine whether the quality and quantity of data are adequate for project needs, such as data collection, uses, types, and needs. While developing these DQOs in accordance with the process presented in Chapter 3, paragraph 3.1.2 of the PWP, Parsons followed the *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001 (USEPA, 2006b).

4.1.2.2 The goal of the TPP process is to achieve stakeholder, USACE, and applicable state and federal regulatory concurrence with the DQOs for a given site. The TPP Team approved the former Sahuarita AFR DQOs at the TPP meeting in September 2005. Appendix B of this SI Report presents the TPP documentation, including the DQO worksheets.

4.1.2.3 As stated in Section 1.2 of this SI Report, sufficient data must be collected to perform the following: 1) determine whether a removal action is necessary; 2) enable HRS scoring by the USEPA; 3) characterize the release for initiation of an RI/FS; and 4) complete the MRSPP.

4.1.2.4 DQOs cover four project objectives that SI data must satisfy: 1) evaluate potential presence of MEC; 2) evaluate potential presence of MC; 3) collect data needed to complete MRSPP scoring sheets; and 4) collect information for HRS scoring.

4.1.2.2 Munitions and Explosives of Concern Data Quality Objective

The MEC DQO was achieved by evaluating the potential presence of MEC at each of the known MRSs and remaining lands at the former Sahuarita AFR by performing QR according to the procedures in the SS-WP and PWP. Except for two unfired .50-caliber cartridges at Range Complex No. 1, no MEC were identified at the site; however, munitions debris was observed in all of the MRSs (Table 4.2).

4.1.2.3 Munitions Constituents Data Quality Objective

The MC DQO was achieved by evaluating the potential presence of MC at the MRSs at the former Sahuarita AFR through MC sampling and visual observations. The TPP Team agreed on the list of compounds/analytes for sample analysis based on the munitions potentially used at the site, as listed in Section 2.5.3. Table 4.1 summarizes the MC known to occur in the MEC documented or suspected at the former Sahuarita AFR. Section 4.4.2 discusses visual observations made during the SI visit. Chapter 5 presents the MC results from the soil samples collected during the SI at the former Sahuarita AFR.

4.1.2.4 Munitions Response Site Prioritization Protocol Data Quality Objective

The MRSPP DQO was achieved by obtaining sufficient information to complete the MRSPP scoring sheets. Specific input data were collected, and the three modules for the MRSPP were populated as part of the SI. The scoring sheets for the MRSPP are included in Appendix K.

4.1.2.5 Hazard Ranking System Data Quality Objective

The HRS DQO was achieved by including information in the SI report necessary for the USEPA to populate the HRS score sheets. Source documents for the HRS information include the INPR, ASR, and ASR Supplement; the MC sampling results reported in Chapter 5; and information from local and state agencies regarding population, groundwater well users, and drinking water well use.

4.2 RANGE COMPLEX NO. 1

4.2.1 Historical Munitions and Explosives of Concern

Aerial photographic analysis conducted as part of the ASR identified target centers for each of the sub-ranges: Bombing Target No. 1, Bombing Target No. 4, and Air-to-Ground Range No. 1. The site visit conducted in 1996 in support of the ASR reported 100-pound practice bomb debris, wood debris from targets, .50-caliber links, and a possible crater near the target center at Bombing Target No. 1, but found no MEC. The ASR Supplement assigned a RAC score of 4 to this MRS, with 5 indicating the least risk and 1 the highest risk.

4.2.2 Inspection Activities

To assess the presence of MEC contamination at Range Complex No. 1, the field team conducted QR in a spiral pattern from each of the bombing target centers out to the periphery of the two sub-ranges (Figure 4.1). Debris from 100-pound practice bombs was observed at many locations within the MRS, as were target debris; .50-caliber balls, cartridges, and links; and two illumination signals. Two unfired .50-caliber rounds were also noted in this MRS (Table 4.2). It is assumed that the small arms ammunition identified at both bombing targets is due to historical Air-to-Ground Gunnery Range No. 1 activity.

4.3 RANGE COMPLEX NO. 2

4.3.1 Historical Munitions and Explosives of Concern

This MRS includes two sub-ranges: the Air-to-Ground Range No. 2, and the OQ Range. The site visit conducted in 1996 in support of the ASR reported evidence of 20mm and .50-caliber ammunition in the form of links and ammunition cans at Range Complex No. 2; however, the site visit team found no MEC. The ASR Supplement assigned a RAC score of 3 to this MRS.

4.3.2 Inspection Activities

To assess the presence of MEC contamination at Bombing Target No. 4, the field team conducted QR in a spiral pattern from the center of the range out to the periphery of the range at the OQ Range and in a snaking pattern through the center of Air-to-Ground Gunnery Range No. 2 (Figure 4.1). At the OQ Range, one observation of munitions debris from a 100-pound practice bombs was noted on the north-central portion of the range just south of Bombing Target No. 1, and .50-caliber ball munition debris were seen throughout the range. The field team noted .50-caliber munitions debris throughout the Air-to-Ground Gunnery Range No. 2 as well as two observations of .30-caliber munition debris. Several 20mm ball and tracer projectiles that were identified were generally clustered near the central to east-central portion of Air-to-Ground Gunnery Range No. 2, and two small HE fragments were observed. No MEC were observed at Range Complex No. 2.

4.4 RANGE COMPLEX NO. 3

4.4.1 Historical Munitions and Explosives of Concern

The 1996 site visit reported HE bomb fragments, spent fuzes, practice bomb debris, .50-caliber debris, and target debris at Bombing Target No. 2; and practice bomb debris, .50-caliber debris, and target debris at Bombing Target No. 3. Additionally, a small parachute was found that may have come from an M8A1 parachute aircraft flare. No MEC was observed during the 1996 site visit. The ASR Supplement assigned a RAC score of 3 to this MRS. The location of Bombing Target No. 3 is inconsistent between the ASR and ASR Supplement. The ASR stated that a third bomb target is present one mile southwest of the South Bombing Target (known as Bombing Target No. 2 in this SI Report and the ASR Supplement). The ASR Supplement indicated Bombing Target No. 3 at a location approximately ½ mile southwest of Bombing Target No. 2.

4.4.2 Inspection Activities

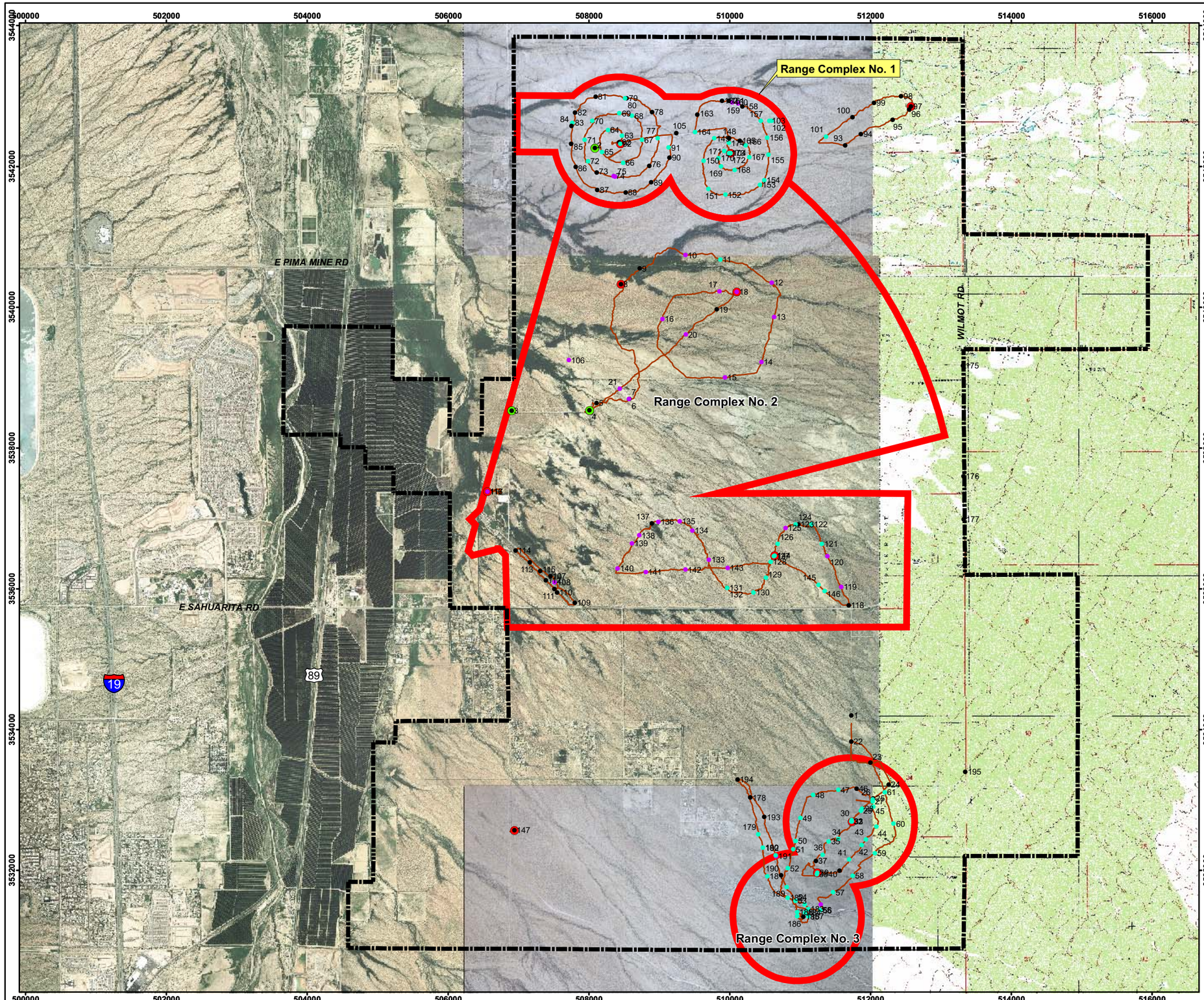
4.4.2.1 To assess the presence of MEC contamination at Range Complex No. 3, the field team completed QR in an oblong spiral pattern around both Bombing Target No. 2 and No. 3 (Figure 4.1). No MEC were observed; however, many occurrences of munitions debris as well as craters were noted in this MRS. While conducting QR, the field team noted HE fragments, debris from 100- and 500-pound practice bombs, debris from one unknown projectile, and a large piece of aluminum debris with a placard attached that read "Arming Instructions," with the fourth step listed as "4. Load BLU-1C/B on Avlon" (see record number 34 in Appendix E). In the bottom of a crater southwest of this unknown aluminum debris, the site visit team found a large metal plate with a shallow bowl shape approximately 1 inch thick and 4.5 feet in diameter. The field team noted white and yellow crystalline material surrounding the crater (approximately 8 feet wide by 3.5 feet deep; see record number 35 in Appendix E). These observations may indicate an open burn / open detonation (OB/OD) site. This possible OB/OD site is believed to be a source of MC in soil. This is supported by the observed crystalline material and stained soil surrounding the crater.

4.4.2.2 While conducting QR in the vicinity of the ARS Supplement's location for Bombing Target No. 3, the field team did not note any evidence of a target center. After consultation with the USACE Los Angeles District Project Manager Lloyd Godard, as well as careful visual inspection of aerial photos, the field team made a second attempt to identify the target center for Bombing Target No. 3. They then proceeded further south of the location indicated in the ASR Supplement to an area near the border of the Sahuarita AFR property, where very faint rings and cross hairs could be seen on the aerial photograph. At this location, the field team found piles of stone and debris forming concentric rings and cross hairs, identified as the target center. This location contained numerous .50-caliber links (as similarly observed on Bombing Targets No. 2 and No. 1), as well as target debris. Practice bomb debris was noted throughout the area.

Figure 4.1

Qualitative Reconnaissance and Field Observation Locations
Former Used Defense Site
Sahuarita AFR
FUDS Project No. J09AZ057601

Sahuarita, Arizona



Legend

- Munitions Debris Field Observation Location (Small Arms)
- Munitions Debris Field Observation Location (Excluding Small Arms)
- Other Field Observation Location
- Ground Water Sample Location
- Soil Sample Location
- Range Complex Boundary
- Installation Boundary
- Qualitative Reconnaissance Track

Site Location in Arizona

N

Image Source: Orthophoto, 2006
Projection: UTM Zone 12 NAD83, Map Units in Meters

Feet
4,500 2,250 0 4,500

PARSONS

U.S. ARMY SOUTH
PACIFIC DIVISION
RANGE SUPPORT CENTER

DESIGNED BY: BT	Qualitative Reconnaissance and Field Observation Locations
DRAWN BY: BT	
CHECKED BY: NH	SCALE: As Shown
SUBMITTED BY: DS	DATE: June 2007
	FILE: X:\GIS\Site_inspections_sw\Maps\sahuarita_az\ Fig4_1.mxd
	PROJECT NUMBER: 744653.05000
	PAGE NUMBER: 4 - 9

CHAPTER 5

MIGRATION/EXPOSURE PATHWAYS AND TARGETS

5.1 POTENTIAL FOR ADVERSE IMPACT

5.1.1 Chapter 5 evaluates the potential for adverse impact on human health and the environment based on site-specific conditions, providing the information used in Chapter 6 to evaluate risks posed to potential receptors under current and future land use scenarios. This chapter evaluates exposure pathways for groundwater, surface water, soil, and air. The conceptual site exposure model (CSEM) for the former Sahuarita AFR (Appendix J) summarizes which potential receptor exposure pathways are (or may be) complete and which are (and are likely to remain) incomplete. An exposure pathway is not considered to be completed unless all four of the following elements are present (USEPA, 1989):

- *A source and mechanism for contaminant release*: e.g., a site has known MEC from which MC have leached and contaminated surface soil.
- *An environmental transport and/or exposure medium*: e.g., the MC in soil is mobile and can contaminate groundwater.
- *A point of exposure at which the contaminant can interact with a receptor*: e.g., a drinking water well at the site draws from the contaminated aquifer.
- *A receptor and a likely route of exposure at the exposure point:* e.g., the resident lives onsite and drinks water from the well.

5.1.2 In the hypothetical resident example, all four factors are true; therefore, the groundwater exposure pathway is complete. If any single factor were absent (for example, the MC was immobile in soil, or the resident gets drinking water from another source), the pathway would not be complete. An assessment of the potential significance of completed pathways (that is, whether there is an unacceptable risk) is reserved for Chapter 6.

5.2 GENERAL INFORMATION

General information regarding the geology, hydrogeology, and hydrology of the former Sahuarita AFR is presented below, followed by a discussion of MRS-specific characteristics and sampling results for the MRSs investigated as part of the SI.

5.2.1 Regional Geological and Hydrogeological Setting

5.2.1.1 The former Sahuarita AFR is within the Upper Santa Cruz River Basin of the Basin and Range Physiographic Province. The Basin and Range Province is dominated by features characteristic of the significant structural extension that has taken place in this area. This extension has nearly doubled the width of some locations in the region and, as a result, normal faults are prevalent in the Basin and Range. Normal faulting led to the creation of the basins in the province as sections of land between faults dropped relative to the land around them; the ranges are generally the land in between the down-dropped basins. The extension has been primarily east-west; therefore, the faults trend north-south, as do the mountain ranges created by this process (USGS, 2007).

5.2.1.2 The geology in the immediate area of the site is consistent with the general geology associated with most valleys in the Basin and Range Province. The geology of the site consists of undifferentiated alluvial deposits discontinuously underlain by gravel and clayey silts of the Fort Lowell Formation (Early Pleistocene). Below the Fort Lowell Formation are the Miocene and Pliocene aged Tinaja beds, defined by gravel to gypsiferous clayey silt and mudstone including basaltic andesite flows and dacite tuff underlain by the Oligocene Pantano Formation of gravel, sandstone, mudstone, and gypsiferous mudstone with tuff beds and interbedded volcanic flows (Davidson, 1973). Groundwater is generally found in interconnected, unconfined aquifers of the Fort Lowell Formation, Tinaja beds, and Pantano Formation with a range of vertical interconnection between aquifer lenses and some locally confined conditions (USACE, 1996).

5.2.1.3 Recharge to the basin-fill aquifers is primarily from precipitation adjacent to the mountains and along major streams or through underflow from adjacent basins (USACE, 1996). Most of the precipitation falling on the valleys themselves is lost to evapotranspiration before it reaches the aquifers. Groundwater levels reported in wells on site between 1998 and 2006 range from 140 feet bgs to 460 feet bgs (ADWR, 2006).

5.2.2 Regional Groundwater Use

5.2.2.1 ADEQ provided hydrogeological consultation, including information about wells on and near the site. Kate Rao of the USEPA Region 9 Source Water Protection Program was contacted to provide information about potential tribal drinking water supplies, as was Lowell Carty of the ADEQ to provide information regarding wellhead protection and surface water intakes for drinking water systems on other lands. Tribal lands are present within a four mile buffer of the FUDS site. Information regarding wellhead protection areas is not available; however, drinking water and municipal drinking water supply wells are present on site. Because of the presence of municipal supply wells, it is assumed that wellhead protection areas are present within the FUDS boundary.

5.2.2.2 A total of 947 water wells are known to exist within a 4-mile buffer zone from the site, as shown on Figure 5.1 and listed in Table 5.1. Of these, 579 are listed as drinking water wells, 155 of which are within the boundaries of the former Sahuarita

AFR site. Several of the groundwater wells present on the former Sahuarita AFR are municipal production wells; therefore, the number of individuals using drinking water from the municipal wells can not be accurately estimated. It is assumed that at least the 1,808 people living in rural areas on site (Table 2.1) are using groundwater wells on site; however, the number of people using groundwater from the site is likely much larger due to the municipal wells.

TABLE 5.1
GROUNDWATER WELLS WITHIN 4-MILE BUFFER OF THE SITE
SAHUARITA AFR, ARIZONA

Distance from Site	Public/ Domestic	Commercial/ Industrial	Stock/ Irrigation	Observation/ Environmental	Other[a]	Total
On Site	155	2	16	1	6	180
0 to ¼ Mile	72	1	13	None	3	89
¼ to ½ Mile	59	6	17	5	11	98
½ to 1 Mile	39	3	23	3	11	79
1 to 2 Miles	101	19	42	16	32	210
2 to 3 Miles	96	11	19	22	22	170
3 to 4 Miles	57	10	13	21	20	121
Site to 4 Miles	579	52	143	68	105	947

a – *Other Wells* include unknown use wells.

5.2.3 Regional Hydrologic Setting

5.2.3.1 As noted in Section 5.2.1, the former Sahuarita AFR is located within the Upper Santa Cruz River Basin. The topographic map shows several streams near the former Sahuarita AFR. The QR path followed by the field team crossed many indicated streams, and no water was observed at any crossing point. The field team noted deep washes and washed out bridges on the west-central site of the OQ Range. It is assumed that the ephemeral streams only flow during and immediately after significant rain or during snowmelt. It is unlikely that runoff from the range is a primary source of water in these streams, but instead, they are fed by rain and/or snowmelt in the nearby mountains. The ephemeral streams on the south side of the site do not reach the Santa Cruz River and end on the west side of the site at agricultural fields. Only the northernmost channel near Range Complex No. 1 exits the site, following a channel that stretches to the Santa Cruz river (Arizona Department of Transportation [ADOT], 2007). After exiting the site, the channel leads around fields and under roads for almost 6 miles northward before joining with the Santa Cruz River. Again, even in this northern channel that reaches the Santa Cruz River, surface water is only present during flash flooding, when surface water drains from the nearby mountains.

5.2.3.2 Due to the presence of municipal water supply wells on site, it is assumed that wellhead protection areas are present within the FUDS boundary at the former Sahuarita AFR.

5.2.4 Historical Munitions Constituents Information

No historical MC-related groundwater, surface water, soil, or air investigations have been conducted at the former Sahuarita AFR. No MC-related sampling has been documented at the former Sahuarita AFR.

5.2.5 Groundwater Sample Locations/Methods

5.2.5.1 Groundwater samples were collected from three discrete locations (with one location including a field duplicate sample) within the former Sahuarita AFR (Figure 5.2). The groundwater sampling locations were originally selected to represent the areas with the highest likelihood for MC contamination due to migration from MC contaminated soil, but ROE was not granted for the wells near the airstrip to analyze for potential perchlorate contamination due the JATO bottles that have been previously identified in the area. Instead, substitute wells were selected based on ROE and their location downgradient from Bombing Targets No. 1 and No. 4 and the OQ Range.

5.2.5.2 Groundwater samples were collected in accordance with the PWP and SS-WP (Parsons, 2005, Parsons, 2006) except as indicated in Section 3.5 of this SI Report. Severn Trent Laboratories (STL) in Arvada, Colorado, analyzed groundwater samples for explosives (Method SW8321A), select metals (USEPA SW-846 Methods 6010B and 6020, and for mercury, Methods 7470A and 7471A), and perchlorate (STL Method SOP No. DEN-LC-0024). Global Positioning System (GPS) coordinates for each sample location were recorded and updated in the Geographic Information System (GIS) database.

5.2.5.3 For a particular analyte to require a screening-level risk assessment (SLRA) for groundwater, it must meet the following three criteria:

- The analyte must be detected on site,
- The analyte must be a potential constituent of munitions known or suspected of being used on site, and
- The analyte must be considered a hazardous substance listed in 40 CFR Part 302, Table 302.4 of CERCLA.

5.2.5.4 The need to perform a SLRA for each groundwater analyte will be assessed further in Sections 5.3 and 5.4.

5.2.6 Surface Water Sample Locations/Methods

Surface water was not sampled at the former Sahuarita AFR.

5.2.7 Soil Sample Locations/Methods

5.2.7.1 Soil samples were collected from 10 discrete locations within the former Sahuarita AFR (Figure 5.2). Eight of these samples were collected within MRS boundaries and were selected to represent areas with the highest likelihood for the presence of MEC or MC contamination, per the SS-WP (Parsons, 2006b). Two soil samples were collected outside the MRS boundaries at locations selected to be least likely to contain MC contamination to provide ambient data for background metals comparison. These two ambient samples were also analyzed for explosives as an additional confirmation that these two areas were not used for munitions training.

5.2.7.2 Sample locations were guided by the preliminary sample locations identified before the SI field team arrived on site and were approved by the UXO technician prior to final location selection and sample collection. For safety reasons, the UXO technician used a Minelab magnetometer prior to final location selection and collection of the 10 samples. Per the PWP, the Minelab underwent QC and battery checks each day of use to confirm that it was working properly. In accordance with the PWP, the Cold Regions Research and Engineering Laboratory (CRREL) seven-point wheel composite sampling technique was employed. Samples were collected from 0 to 2 inches bgs, and GPS coordinates for the center point of each sample location were recorded and updated in the GIS database.

5.2.7.3 STL in Arvada, Colorado, analyzed soil samples for explosives (Method SW8321A) and select metals (USEPA SW-846 Methods 6010B or 6020 and Method 7471A for mercury). The detected concentrations of metals were compared to selected background screening levels that were determined by using the USGS background concentration for metals in Pima County when available (USGS, 2007) or the maximum detected concentration from the ambient samples collected on site. For this report, the USGS background concentrations selected consist of the mean concentration plus two times the standard deviation, and are intended to approximate the 95% upper confidence limit of the mean, assuming a normal distribution. If a background concentration was not available from the USGS, then the maximum ambient concentration was used. Table 5.2 shows the determination of the selected background concentration.

5.2.7.4 Sections 5.3 through 5.5 provide analytical data for soil samples collected at each MRS. For a particular analyte to require a SLRA for soil, the following three criteria must be met:

- The analyte must be detected on site above the background screening level,
- The analyte must be a potential constituent of munitions known or suspected of being used on site, and
- The analyte must be considered a hazardous substance listed in 40 CFR Part 302, Table 302.4 of CERCLA.

5.2.7.5 Sections 5.3 through 5.5 further assess the need to perform a SLRA for each particular analyte.

TABLE 5.2
SOIL BACKGROUND CONCENTRATIONS
SAHUARITA AFR, ARIZONA

Analyte	Units	Pima County USGS Background Concentration[a]	Maximum Site-Specific Ambient Concentration	Selected Background Concentration[b]
Metals				
Aluminum	mg/kg	82320	10000	82320
Antimony	mg/kg	NA	<0.28 [c]	<0.28
Arsenic	mg/kg	69.394	4.5	69.39
Barium	mg/kg	NA	58	58
Beryllium	mg/kg	NA	0.52	0.52
Cadmium	mg/kg	NA	0.093	0.093
Calcium	mg/kg	52970	9900	52970
Chromium	mg/kg	NA	6.9	6.9
Cobalt	mg/kg	NA	3.6	3.6
Copper	mg/kg	381.528	14	381.528
Iron	mg/kg	55210	12000	55210
Lead	mg/kg	99.72	10	99.72
Magnesium	mg/kg	12560	2900	12560
Manganese	mg/kg	1256.906	230	1256.9
Mercury	mg/kg	0.04	<0.036 [c]	0.04
Molybdenum	mg/kg	NA	0.3	0.3
Nickel	mg/kg	NA	6	6
Potassium	mg/kg	NA	2000	2000
Selenium	mg/kg	0.292	0.25	0.29
Silver	mg/kg	NA	0.062	0.062
Sodium	mg/kg	23660	<630 [c]	23660
Strontium	mg/kg	NA	41	41
Thallium	mg/kg	NA	0.11	0.11
Titanium	mg/kg	5060	240	5060
Vanadium	mg/kg	NA	15	15
Zinc	mg/kg	113.432	29	113.43

a - USGS derived background concentration for Pima County. Value equals the mean + 2xSD (http://tin.er.usgs.gov/geochem/county.php?place=f04019&el=As&rf=southwestern).
b - The screening values are selected from those available in the column order shown (that is, the USGS value is used if there is one; if there is no USGS value, then the maximum ambient concentration is used).
c - If an analyte was not detected above the adjusted practical quantitation limit (PQL), the concentration is listed as less than the PQL.
NA Background concentration not available.

5.2.8 Air Sample Locations/Methods

Air samples were not collected at the former Sahuarita AFR.

5.3 RANGE COMPLEX NO. 1

5.3.1 Historical Munitions Constituents Information

Range Complex No. 1 is in the northwestern portion of the former Sahuarita AFR (Figure 5.2). No historical MC-related groundwater, surface water, soil, or air sampling has been documented at this MRS or within the former Sahuarita AFR site.

5.3.2 Groundwater Migration Pathway

Groundwater can potentially serve as a contaminant transport mechanism that may impact surface water bodies, drinking water supplies, vegetation, and sensitive environments such as wetlands. The likelihood of exposure is influenced by such factors as the volume and concentration of contaminated soil at the ground surface that can be transported to the groundwater, site-specific geology, climate, and the expected future land use.

5.3.2.1 Geologic and Hydrogeologic Setting

There are no known differences between the geologic and hydrogeologic setting at Range Complex No. 1 and the setting described for the overall site in Section 5.2.

5.3.2.2 Releases and Potential Releases to Groundwater

There are no known releases of MC to groundwater at the former Sahuarita AFR, including at Range Complex No. 1.

5.3.2.3 Groundwater Migration Pathway Targets

Three hundred fifty-seven wells are known to exist within a 4-mile buffer of the Range Complex No. 1 boundary. Table 5.3 summarizes the number and types of wells as well as their distances from the MRS. As shown, 225 drinking water wells are within 4 miles of the site. Several groundwater wells within 4-miles of Range Complex No. 1 are municipal production wells; therefore, the number of individuals using drinking water from the municipal wells cannot be accurately estimated.

5.3.2.4 Groundwater Sample Locations/Methods

One groundwater sample, SAH-BT-GW-01, was collected in Range Complex No. 1 (Figure 5.2). There are no differences between the sample methods employed at Range Complex No. 1 and the methods described for the overall site in Section 5.2.5.

TABLE 5.3
GROUNDWATER WELLS IN THE VICINITY OF RANGE COMPLEX NO. 1
SAHUARITA AFR, ARIZONA

Distance from Site	Public/ Domestic	Commercial/ Industrial	Stock/ Irrigation	Observation/ Environmental	Other	Total
On Site	3	None	None	None	None	3
0 to ¼ Mile	2	None	None	None	None	2
¼ to ½ Mile	3	None	2	None	1	6
½ to 1 Mile	6	1	6	None	1	14
1 to 2 Miles	45	4	25	3	10	87
2 to 3 Miles	63	4	15	7	13	102
3 to 4 Miles	103	15	14	3	8	143
Site to 4 Miles	225	24	63	13	33	357

Detailed well information is included in Appendix L.

5.3.2.5 Groundwater Migration Pathway Analytical Results

As shown in Table 5.4, laboratory analysis of the samples did not detect explosives but did detect several metals and perchlorate in sample SAH-BT-GW-01. Background concentrations of metals in groundwater were not obtained and no ambient groundwater samples were collected on site; therefore, the analytical results were not compared to background concentrations of metals. Table 5.5 compares the analytical results for explosives, perchlorate, and metals analysis to the three criteria discussed in paragraph 5.2.5.3 to determine which analytes should be retained for consideration in a SLRA.

5.3.2.6 Groundwater Migration Pathway Conclusions

As shown in Table 5.5, eight of the detected groundwater analytes (antimony, barium, chromium, copper, lead, nickel, zinc, and perchlorate) were retained for consideration in a SLRA in Chapter 6. The SLRA for these analytes at Range Complex No. 1 is included in Section 6.2.5.1.

5.3.3 Surface Water Migration Pathway

Surface water can potentially serve as a contaminant transport mechanism that may impact surface water bodies, sediment, drinking water supplies, vegetation, and sensitive environments such as wetlands.

5.3.3.1 Hydrologic Setting

As discussed in Section 5.2.3, the USGS topographic map covering the Sahuarita AFR indicates several intermittent streams passing through the range boundary or near the range. QR in this area noted dry washes and arroyos, and no standing water was seen on site. It is assumed that the streams only flow during and immediately after significant rain or during snowmelt; therefore, it is unlikely that runoff from the range is a primary source of water in these streams.

Table 5.4
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR SAHUARITA AIR FORCE RANGE WATER SAMPLES COLLECTED IN JANUARY 2007

SAMPLE ID:		SAH-BT-GW-01		SAH-RL-GW-02		SAH-RL-GW-05*		SAH-RL-GW-03	
DATE SAMPLED:		01/22/07		01/22/07		01/22/07		01/22/07	
LAB SAMPLE ID:		D7A240272001		D7A240272002		D7A240272004		D7A240272003	
	Units	Range Complex No. 1		Range Complex No. 2					
Explosives - SW8321A									
1,3,5-Trinitrobenzene	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
1,3-Dinitrobenzene	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
2,4,6-Trinitrotoluene (TNT)	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
2,4-Dinitrotoluene	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
2,6-Dinitrotoluene	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
2-Amino-4, 6-dinitrotoluene	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
2-Nitrotoluene	ug/L	0.2	U	0.2	U	0.2	U	0.2	U
3-Nitrotoluene	ug/L	0.2	U	0.2	U	0.2	U	0.2	U
4-Amino-2,6-Dinitrotoluene	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
4-Nitrotoluene	ug/L	0.2	U	0.2	U	0.2	U	0.2	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	ug/L	0.12	U	0.12	UJ	0.12	U	0.12	U
Nitrobenzene	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
Nitroglycerin	ug/L	0.15	U	0.15	U	0.15	U	0.15	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
Pentaerythritol Tetranitrate (PETN)	ug/L	0.12	U	0.12	U	0.12	U	0.12	U
Total Metals - SW6010B/6020/7470A									
Aluminum	ug/L	300	U	300	U	300	U	**26**	J
Antimony	ug/L	**0.096**	J	6.0	U	6.0	U	**0.084**	J
Arsenic	ug/L	**5.3**		**3.2**	J	**3.4**	J	**2.0**	J
Barium	ug/L	**66**		**110**	J	**110**		**86**	
Beryllium	ug/L	1.0	U	1.0	U	1.0	U	1.0	U
Cadmium	ug/L	1.0	U	1.0	U	1.0	U	1.0	U
Calcium	ug/L	**39000**		**130000**		**130000**		**76000**	
Chromium	ug/L	**3.5**	J	10	U	10	U	**1.1**	J
Cobalt	ug/L	**0.11**	J	**0.33**	J	**0.30**	J	**0.17**	J
Copper	ug/L	**3.6**		**4.4**		**3.5**		**38**	
Iron	ug/L	100	U	100	U	100	U	**840**	J
Lead	ug/L	**0.26**	J	**0.52**	J	**0.48**	J	**3.5**	
Magnesium	ug/L	**3600**		**19000**		**18000**		**12000**	
Manganese	ug/L	**0.47**	J	**0.47**	J	**0.42**	J	**5.5**	
Mercury	ug/L	0.20	U	0.20	U	0.20	U	0.20	U
Molybdenum	ug/L	**2.6**	J	**2.9**	J	**3.0**	J	**2.6**	
Nickel	ug/L	**0.57**	J	**0.48**	J	**0.42**	J	3.0	U
Potassium	ug/L	**3000**		**4000**		**3900**		**2500**	J
Selenium	ug/L	5.0	U	**1.3**	J	**1.1**	J	**0.90**	J
Silver	ug/L	5.0	U	5.0	U	5.0	U	5.0	U
Sodium	ug/L	**50000**		**50000**		**47000**		**32000**	
Strontium	ug/L	**480**		**940**		**890**		**590**	
Thallium	ug/L	1.0	U	1.0	U	1.0	U	1.0	U
Titanium	ug/L	10	U	10	U	10	U	10	UJ
Vanadium	ug/L	**8.3**		**5.0**	J	**5.1**	J	**5.1**	J
Zinc	ug/L	**12**	J	**12**	J	**12**	J	**23**	
Perchlorate - STL SOP DEN-LC-0024									
Perchlorate	ug/L	**0.44**		**0.90**		**0.95**		**0.59**	
QA NOTES AND DATA QUALIFIERS:									

(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).
UJ - Analyte not detected, reported PRL may be inaccurate or imprecise.
J - Analyte detected, estimated concentration.
* - Field duplicate of sample on left.
Detections are bolded.

Table 5.5
Range Complex No. 1
Groundwater Source Evaluation
SAHUARITA AFR, ARIZONA

Analyte	Units	Maximum Detected Site Concentration [a]	Potential MC? [b]	CERCLA Hazardous? [c]	SLRA Required?	Primary reason for exclusion from SLRA
Total Metals - SW6010B/6020/7470A						
Aluminum	µg/L	26	**Yes**	No	No	Not CERCLA hazardous
Antimony	µg/L	0.084	**Yes**	**Yes**	**Yes**	--
Arsenic	µg/L	3.4	No	**Yes**	No	Not a potential MC
Barium	µg/L	110	**Yes**	**Yes**	**Yes**	--
Beryllium	µg/L	< 1	No	**Yes**	No	Not detected at MRS
Cadmium	µg/L	< 1	No	**Yes**	No	Not detected at MRS
Calcium	µg/L	130000	**Yes**	No	No	Not CERCLA hazardous
Chromium	µg/L	1.1	**Yes**	**Yes**	**Yes**	--
Cobalt	µg/L	0.33	No	**Yes**	No	Not a potential MC
Copper	µg/L	38	**Yes**	**Yes**	**Yes**	--
Iron	µg/L	840	**Yes**	No	No	Not CERCLA hazardous
Lead	µg/L	3.5	**Yes**	**Yes**	**Yes**	--
Magnesium	µg/L	19000	**Yes**	No	No	Not CERCLA hazardous
Manganese	µg/L	5.5	No	No	No	Not a potential MC
Mercury	µg/L	< 0.2	No	**Yes**	No	Not detected at MRS
Molybdenum	µg/L	3	**Yes**	No	No	Not CERCLA hazardous
Nickel	µg/L	0.48	**Yes**	**Yes**	**Yes**	--
Potassium	µg/L	4000	**Yes**	No	No	Not CERCLA hazardous
Selenium	µg/L	1.3	No	**Yes**	No	Not a potential MC
Silver	µg/L	< 5	No	**Yes**	No	Not detected at MRS
Sodium	µg/L	50000	**Yes**	No	No	Not CERCLA hazardous
Strontium	µg/L	940	**Yes**	No	No	Not CERCLA hazardous
Thallium	µg/L	< 1	No	**Yes**	No	Not detected at MRS
Titanium	µg/L	< 10	**Yes**	No	No	Not detected at MRS
Vanadium	µg/L	5.1	No	No	No	Not a potential MC
Zinc	µg/L	23	**Yes**	**Yes**	**Yes**	--
Explosives - SW8321A						
1,3,5-Trinitrobenzene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
1,3-Dinitrobenzene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2,4,6-Trinitrotoluene (TNT)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2,4-Dinitrotoluene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2,6-Dinitrotoluene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2-Amino-4, 6-dinitrotoluene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2-Nitrotoluene	µg/L	< 0.2	**Yes**	**Yes**	No	Not detected at MRS
3-Nitrotoluene	µg/L	< 0.2	**Yes**	**Yes**	No	Not detected at MRS
4-Amino-2,6-Dinitrotoluene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
4-Nitrotoluene	µg/L	< 0.2	**Yes**	**Yes**	No	Not detected at MRS
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Nitrobenzene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Nitroglycerin	µg/L	< 0.15	**Yes**	**Yes**	No	Not detected at MRS
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Pentaerythritol Tetranitrate (PETN)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Perchlorate - STL SOP DEN-LC-0024						
Perchlorate	µg/L	0.44	**Yes**	No	**Yes**[d]	--

a - If an analyte was not detected above the adjusted practical quantitation limit (PQL), the concentration is listed as less than the PQL.

b - Potential MCs as listed in Table 4.1

c - Source: 40 CFR Part 302, Table 302.4--List of Hazardous Substances

d - Perchlorate is not CERCLA hazardous; however, perchlorate has been evaluated at the request of USACE and will be retained for consideration in the SLRA.

5.3.3.2 Releases and Potential Releases to Surface Water

There are no known releases of MC to surface water at the former Sahuarita AFR, including Range Complex No. 1.

5.3.3.3 Surface Water Migration Pathway Analytical Targets

Surface water sampling was not performed during the SI at Range Complex No. 1 or elsewhere on the former Sahuarita AFR. As discussed in Section 5.2.3, surface water is rarely present at the former Sahuarita AFR.

5.3.3.4 Sample Locations/Methods

Surface water sampling was not performed during the SI at Range Complex No. 1 or elsewhere on the former Sahuarita AFR.

5.3.3.5 Surface Water Migration Pathway Analytical Results

Surface water sampling was not performed during the SI at Range Complex No. 1 or elsewhere on the former Sahuarita AFR.

5.3.3.6 Surface Water Migration Pathway Conclusions

As discussed in Section 5.2.3, surface water is rarely present at the former Sahuarita AFR and when present is derived from off site. Therefore, based on the assumption that surface water must be present on site or derived from runoff from the MRS, the surface water migration pathway is incomplete. Since the surface water migration pathway is incomplete, a SLRA for surface water is not required. Risk from MC is not expected through a surface water migration pathway at Range Complex No. 1.

5.3.4 Soil Exposure Pathway

Potential soil exposure pathways include incidental ingestion, dermal contact, and inhalation of re-suspended particulates by human and ecological receptors, as well as leaching to groundwater. The likelihood of exposure is influenced by such factors as the volume and concentration of contaminated soil exposed at the ground surface, site-specific geology, climate, and the expected future land use.

5.3.4.1 Physical Source Access Conditions

Barbed wire fences are present at Range Complex No. 1 as well as most of the Sahuarita AFR; however, gates are not locked and unimproved roads run throughout the area for access to groundwater wells and ranching areas. These barbed wire fences are not considered to restrict access to Range Complex No. 1 or to the other MRSs at the former Sahuarita AFR.

5.3.4.2 Actual or Potential Contamination Areas

There are no known MC contamination areas within Range Complex No. 1.

5.3.4.3 Soil Exposure Targets

There are no residences within the Range Complex No. 1. No residences, work areas, schools, or day care centers are present within 200 feet of the MRS, although there are residences within the 1- to 2-mile buffer of the site. Using conservative estimates, the U.S. census data for 2000 indicate that 9,525 people live within 4 miles of the MRS, which is assumed to be the total population within the 0- to 4-mile buffer (Table 2.1).

5.3.4.4 Sample Locations/Methods

5.3.4.4.1 As specified in the SS-WP (Parsons, 2006b), the soil sample locations were screened for potential subsurface anomalies and approved by the UXO technician using a Minelab magnetometer prior to final location selection and sample collection. In accordance with the PWP, the CRREL seven-point wheel composite sampling technique was employed. The GPS coordinates for each sample location were recorded and updated in the GIS database.

5.3.4.4.2 The field team that performed the QR at Range Complex No. 1 recorded observations of 100-pound practice bomb remnants as well as two unfired .50-caliber ammunition rounds and numerous links, cartridges, ball projectiles, and debris from two illumination signals. Within Range Complex No. 1, two soil samples (SAH-BT-SS-02-09 and SAH-BT-SS-02-08) were collected at the target center of Bombing Target No. 1 and No. 4, respectively. Figure 5.2 shows the sample locations.

5.3.4.5 Soil Migration Pathway Analytical Results

Soil samples SAH-BT-SS-02-09 and SAH-BT-SS-02-08 were collected in Range Complex No. 1 (Figure 5.2) and analyzed for explosives and metals as agreed to by the TPP team. Table 5.6 shows the soil sample analytical results for the former Sahuarita AFR. Explosive compounds were not detected in these samples, but 24 of the 26 metals were detected. Table 5.7 shows the maximum detected concentrations for each analyte from soil samples SAH-BT-SS-02-09 and SAH-BT-SS-02-08, and compares each analyte to the three criteria described in paragraph 5.2.7.4 to determine which analytes should be retained for consideration in a SLRA.

5.3.4.6 Soil Exposure Conclusions

As shown in Table 5.7, three detected soil analytes (barium, chromium, and nickel) were retained for consideration in a SLRA in Chapter 6. The SLRA for these analytes at Range Complex No. 1 is included in Section 6.2.4.1.

Table 5.6
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR SAHUARITA AIR FORCE RANGE SOIL SAMPLES COLLECTED IN JANUARY 2007

SAMPLE ID:		SAH-RL-SS-02-01		SAH-RL-SS-02-10		SAH-BT-SS-02-08		SAH-BT-SS-02-09		SAH-RL-SS-02-04		SAH-AG-SS-02-05		SAH-OQ-SS-02-06		SAH-OQ-SS-02-07		SAH-BT-SS-02-02		SAH-BT-SS-02-03		SAH-BT-SS-02-15*	
DATE SAMPLED:		**01/25/07**		**01/24/07**		**01/24/07**		**01/24/07**		**01/25/07**		**01/25/07**		**01/22/07**		**01/22/07**		**01/23/07**		**01/23/07**		**01/23/07**	
LAB SAMPLE ID:		**D7A270154009**		**D7A270154005**		**D7A270154004**		**D7A270154006**		**D7A270154007**		**D7A270154008**		**D7A240272006**		**D7A240272005**		**D7A270154002**		**D7A270154001**		**D7A270154003**	
	Units	Ambient Samples				Range Complex No. 1				Range Complex No. 2								Range Complex No. 3					
Explosives - SW8321A																							
1,3,5-Trinitrobenzene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
1,3-Dinitrobenzene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2,4,6-Trinitrotoluene (TNT)	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2,4-Dinitrotoluene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2,6-Dinitrotoluene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2-Amino-4, 6-dinitrotoluene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2-Nitrotoluene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
3-Nitrotoluene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
4-Amino-2,6-Dinitrotoluene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
4-Nitrotoluene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ug/kg	180	U	180	U	180	U	180	U	180	U	180	U	180	U	180	U	180	U	180	U	180	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	ug/kg	300	U	300	U	300	U	300	U	300	U	300	U	300	U	300	U	300	U	300	U	300	U
Nitrobenzene	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
Nitroglycerin	ug/kg	500	U	500	U	500	U	500	U	500	U	500	U	500	U	500	U	500	U	**63**	J	**43**	J
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	ug/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
Pentaerythritol Tetranitrate (PETN)	ug/kg	500	U	500	U	500	U	500	U	500	U	500	U	500	U	500	U	500	U	500	U	500	U
Total Metals - SW6010B/6020/7471A																							
Aluminum	mg/kg	**4900**		**10000**		**18000**		**16000**		**15000**		**15000**		**26000**		**12000**		**6800**		**6900**	J	**7700**	
Antimony	mg/kg	0.26	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.30	U	0.28	UJ	0.27	U	0.27	UJ	0.27	U
Arsenic	mg/kg	**1.3**		**4.5**		**4.6**		**6.8**		**3.0**		**5.5**		**8.9**		**3.8**		**1.5**		**2.1**		**1.7**	
Barium	mg/kg	**34**		**58**		**100**		**88**		**71**		**83**		**78**		**49**	J	**31**		**38**	J	**44**	
Beryllium	mg/kg	**0.35**		**0.52**		**0.90**		**0.71**		**0.73**		**0.76**		**1.1**		**0.58**		**0.48**		**0.40**		**0.42**	
Cadmium	mg/kg	**0.065**	J	**0.093**	J	**0.15**		**0.42**		**0.18**		**0.20**		**0.11**	J	**0.11**		**0.13**		**0.15**		**0.16**	
Calcium	mg/kg	**850**		**9900**		**6100**		**18000**		**3900**		**20000**		**2800**		**1900**		**7400**		**14000**	J	**18000**	
Chromium	mg/kg	**4.7**		**6.9**		**13**		**9.8**		**11**		**11**		**15**		**8.7**		**5.4**		**5.9**		**5.9**	
Cobalt	mg/kg	**2.9**		**3.6**		**6.2**		**5.4**		**5.4**		**5.6**		**5.1**		**3.9**		**2.9**		**2.6**	J	**5.9**	J
Copper	mg/kg	**13**		**14**		**25**		**24**		**110**		**100**		**29**		**22**		**180**		**120**	J	**130**	
Iron	mg/kg	**8800**		**12000**		**15000**		**17000**		**15000**		**14000**		**21000**		**14000**		**11000**		**8700**	J	**9200**	
Lead	mg/kg	**5.7**		**10**		**15**		**18**		**14**		**13**		**15**		**11**		**7.8**		**7.8**		**8.4**	
Magnesium	mg/kg	**830**		**2900**		**5100**		**4300**		**4000**		**4800**		**5700**		**2800**		**2900**		**2200**		**2500**	
Manganese	mg/kg	**180**		**230**		**370**		**360**		**440**		**430**		**260**		**250**	J	**300**		**200**	J	**280**	
Mercury	mg/kg	0.035	U	0.036	U	**0.0053**	J	**0.0097**	J	**0.0036**	J	0.037	U	**0.021**	J	**0.0087**	J	0.035	U	0.035	U	0.035	U
Molybdenum	mg/kg	**0.30**		**0.25**		**0.35**		**0.51**		**2.0**		**1.1**		**0.57**		**0.92**	J	**2.9**		**2.4**	J	**5.5**	J
Nickel	mg/kg	**3.3**		**6.0**		**11**		**8.4**		**9.3**		**9.6**		**11**		**6.4**		**4.1**		**4.4**		**4.5**	
Potassium	mg/kg	**1100**		**2000**		**4200**		**4200**		**4500**		**3500**		**6400**		**3100**		**1900**		**1500**		**1700**	
Selenium	mg/kg	**0.25**	J	**0.19**	J	**0.37**	J	**0.32**	J	**0.34**	J	**0.45**	J	**0.41**	J	**0.28**	J	**0.32**	J	**0.24**	J	**0.31**	J
Silver	mg/kg	**0.036**	J	**0.062**	J	**0.11**		**0.11**		**0.17**		**0.16**		**0.12**		**0.065**	J	**0.11**		**0.087**	J	**0.11**	
Sodium	mg/kg	600	U	630	U	640	U	650	U	630	U	640	U	**220**	J	640	U	610	U	610	U	610	U
Strontium	mg/kg	**12**		**41**		**44**		**51**		**32**		**42**		**42**		**19**		**15**		**23**		**25**	
Thallium	mg/kg	**0.092**	J	**0.11**		**0.22**		**0.16**		**0.18**		**0.17**		**0.25**		**0.15**		**0.13**		**0.092**	J	**0.099**	J
Titanium	mg/kg	**230**		**240**		**340**		**270**		**380**		**370**		**310**		**290**		**310**		**220**	J	**260**	
Vanadium	mg/kg	**10**		**15**		**20**		**20**		**19**		**19**		**30**		**17**	J	**11**		**11**	J	**11**	
Zinc	mg/kg	**17**		**29**		**48**		**50**		**51**		**52**		**43**		**30**		**43**		**32**	J	**30**	

QA NOTES AND DATA QUALIFIERS:

(NO CODE) - Confirmed identification.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

UJ - Analyte not detected, reported PRL may be inaccurate or imprecise.

J - Analyte detected, estimated concentration.

* - Field duplicate of sample on left.

Detections are bolded.

Table 5.7
Range Complex No. 1
Soil Source Evaluation
SAHUARITA AFR, ARIZONA

Analyte	Units	Maximum Detected Site Concentration [a]	Background Concentration [b]	Exceeds Background Concentration?	Potential MC? [c]	CERCLA Hazardous? [d]	SLRA Required?	Primary reason for exclusion from SLRA
Total Metals - SW6010B/6020/7471A								
Aluminum	mg/kg	18000	82320	No	**Yes**	No	No	Not detected above background
Antimony	mg/kg	< 0.28	<0.28	No	**Yes**	**Yes**	No	Not detected at MRS
Arsenic	mg/kg	6.8	69.39	No	No	**Yes**	No	Not detected above background
Barium	mg/kg	100	58	**Yes**	**Yes**	**Yes**	**Yes**	--
Beryllium	mg/kg	0.9	0.52	**Yes**	No	**Yes**	No	Not a potential MC
Cadmium	mg/kg	0.42	0.093	**Yes**	No	**Yes**	No	Not a potential MC
Calcium	mg/kg	18000	52970	No	**Yes**	No	No	Not detected above background
Chromium	mg/kg	13	6.9	**Yes**	**Yes**	**Yes**	**Yes**	--
Cobalt	mg/kg	6.2	3.6	**Yes**	No	**Yes**	No	Not a potential MC
Copper	mg/kg	25	381.528	No	**Yes**	**Yes**	No	Not detected above background
Iron	mg/kg	17000	55210	No	**Yes**	No	No	Not detected above background
Lead	mg/kg	18	99.72	No	**Yes**	**Yes**	No	Not detected above background
Magnesium	mg/kg	5100	12560	No	**Yes**	No	No	Not detected above background
Manganese	mg/kg	370	1256.9	No	No	No	No	Not detected above background
Mercury	mg/kg	0.0097	0.04	No	No	**Yes**	No	Not detected above background
Molybdenum	mg/kg	0.51	0.3	**Yes**	**Yes**	No	No	Not CERCLA hazardous
Nickel	mg/kg	11	6	**Yes**	**Yes**	**Yes**	**Yes**	--
Potassium	mg/kg	4200	2000	**Yes**	**Yes**	No	No	Not CERCLA hazardous
Selenium	mg/kg	0.37	0.29	**Yes**	No	**Yes**	No	Not a potential MC
Silver	mg/kg	0.11	0.062	**Yes**	No	**Yes**	No	Not a potential MC
Sodium	mg/kg	< 650	23660	No	**Yes**	No	No	Not detected at MRS
Strontium	mg/kg	51	41	**Yes**	**Yes**	No	No	Not CERCLA hazardous
Thallium	mg/kg	0.22	0.11	**Yes**	No	**Yes**	No	Not a potential MC
Titanium	mg/kg	340	5060	No	**Yes**	No	No	Not detected above background
Vanadium	mg/kg	20	15	**Yes**	No	No	No	Not a potential MC
Zinc	mg/kg	50	113.43	No	**Yes**	**Yes**	No	Not detected above background
Explosives - SW8321A								
1,3,5-Trinitrobenzene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
1,3-Dinitrobenzene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2,4,6-Trinitrotoluene (TNT)	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2,4-Dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2,6-Dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2-Amino-4, 6-dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2-Nitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
3-Nitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
4-Amino-2,6-Dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
4-Nitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/kg	< 180	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Methyl-2,4,6-trinitrophenylnitramine (Tetryl	µg/kg	< 300	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Nitrobenzene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Nitroglycerin	µg/kg	< 500	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Pentaerythritol Tetranitrate (PETN)	µg/kg	< 500	NA	No	**Yes**	**Yes**	No	Not detected at MRS

a - If an analyte was not detected above the adjusted practical quantitation limit (PQL), the concentration is listed as less than the PQL.

b - Background Concentration as established in Table 5.2

c - Potential MCs as listed in Table 4.1

d - Source: 40 CFR Part 302, Table 302.4--List of Hazardous Substances

NA - Background concentration not available.

5.3.5 Air Migration Pathway

The air migration pathway accounts for hazardous substance migration in gaseous or particulate form through the air. Airborne deposition of contaminants can be a potential threat to people and sensitive environments.

5.3.5.1 Climate

Section 2.2.3 discusses climate.

5.3.5.2 Releases and Potential Releases to Air

There are no known releases to air at Range Complex No. 1 or elsewhere at the former Sahuarita AFR.

5.3.5.3 Air Migration Pathway Targets

Target populations potentially impacted by the air pathway consist of people who reside, work, or go to school within the target distance limit of 4 miles around the site. According to the 2000 census, approximately 9,525 persons live within the 4-mile buffer around the Range Complex No. 1 MRS (Table 2.1). The census data show that fewer than 300 reside within the 2-mile buffer of Range Complex No. 1.

5.3.5.4 Sample/Monitoring Locations/Methods

There is no historical record of air sampling at the former Sahuarita AFR. Air sampling was not conducted as part of the SI at Range Complex No. 1 or elsewhere on the former AFR.

5.3.5.5 Air Migration Pathway Analytical Results

There is no historical record of air sampling at the former Sahuarita AFR. Air sampling was not conducted as part of the SI at Range Complex No. 1 or elsewhere on the former AFR.

5.3.5.6 Air Migration Pathway Conclusions

An exposure pathway for air is potentially complete at the MRS based on the presence of barium, chromium, and nickel in the soil (see Section 5.3.4.6) and the potential for fugitive dust. This exposure pathway is evaluated further in the SLRA because the screening values for soil incorporate the inhalation pathway for human health.

5.4 RANGE COMPLEX NO. 2

Sections 5.2 and 5.3 summarize information on the regional setting, migration/exposure pathways, exposure targets, and historical MC information for the former Sahuarita AFR. This section provides additional details specific to Range Complex No. 2.

5.4.1 Groundwater Migration Pathway

5.4.1.1 Seven hundred twenty-two wells are known to exist within a 4-mile buffer of the Range Complex No. 2 boundary. Table 5.8 summarizes the number and types of wells as well as their distances from the Range Complex No. 2 MRS. Several municipal drinking water wells are present within the 4-mile buffer area of Range Complex No. 2; therefore, the number of individuals using drinking water from the municipal wells cannot be accurately estimated.

TABLE 5.8
GROUNDWATER WELLS IN THE VICINITY OF RANGE COMPLEX NO. 2
SAHUARITA AFR, ARIZONA

Distance from Site	Public/ Domestic	Commercial/ Industrial	Stock/ Irrigation	Observation/ Environmental	Unknown Type	Total
On Site	9	None	None	1	None	10
0 to ¼ Mile	10	None	2	None	1	13
¼ to ½ Mile	26	1	5	None	None	32
½ to 1 Mile	69	1	11	None	1	82
1 to 2 Miles	196	4	28	1	11	240
2 to 3 Miles	107	8	42	11	26	194
3 to 4 Miles	82	22	19	16	12	151
Site to 4 Miles	499	36	107	29	51	722

Detailed well information is included in Appendix L.

5.4.1.2 Two groundwater samples, SAH-RL-GW-02 and SAH-RL-GW-03, were collected in the Range Complex No. 2 MRS. As shown in Table 5.4, laboratory analysis of the samples did not detect explosives but detected several metals and perchlorate. Background concentrations of metals in groundwater were not obtained, and no ambient groundwater samples were collected on site; therefore, the analytical results were not compared to background concentrations of metals. Table 5.9 compares the analytical results from explosives, perchlorate, and metals analysis to the three criteria listed in paragraph 5.2.5.3 for conducting a SLRA. Eight groundwater analytes were retained for consideration in the SLRA (antimony, barium, chromium, copper, lead, nickel, zinc, and perchlorate), as presented in Section 6.2.5.2.

5.4.2 Surface Water Migration Pathway

As discussed in Section 5.2.3, an exposure pathway for surface water is not complete due to the absence of surface water at the former Sahuarita AFR as well as at Range Complex No. 2. Because this pathway is incomplete, a SLRA is not required.

Table 5.9
Range Complex No. 2
Groundwater Source Evaluation
SAHUARITA AFR, ARIZONA

Analyte	Units	Detected Site Concentration [a]	Potential MC? [b]	CERCLA Hazardous? [c]	SLRA Required?	Primary reason for exclusion from SLRA
Total Metals - SW6010B/6020/7470A						
Aluminum	µg/L	< 300	**Yes**	No	No	Not detected at MRS
Antimony	µg/L	0.096	**Yes**	**Yes**	**Yes**	--
Arsenic	µg/L	5.3	No	**Yes**	No	Not a potential MC
Barium	µg/L	66	**Yes**	**Yes**	**Yes**	--
Beryllium	µg/L	< 1	No	**Yes**	No	Not detected at MRS
Cadmium	µg/L	< 1	No	**Yes**	No	Not detected at MRS
Calcium	µg/L	39000	**Yes**	No	No	Not CERCLA hazardous
Chromium	µg/L	3.5	**Yes**	**Yes**	**Yes**	--
Cobalt	µg/L	0.11	No	**Yes**	No	Not a potential MC
Copper	µg/L	3.6	**Yes**	**Yes**	**Yes**	--
Iron	µg/L	< 100	**Yes**	No	No	Not detected at MRS
Lead	µg/L	0.26	**Yes**	**Yes**	**Yes**	--
Magnesium	µg/L	3600	**Yes**	No	No	Not CERCLA hazardous
Manganese	µg/L	0.47	No	No	No	Not a potential MC
Mercury	µg/L	< 0.2	No	**Yes**	No	Not detected at MRS
Molybdenum	µg/L	2.6	**Yes**	No	No	Not CERCLA hazardous
Nickel	µg/L	0.57	**Yes**	**Yes**	**Yes**	--
Potassium	µg/L	3000	**Yes**	No	No	Not CERCLA hazardous
Selenium	µg/L	< 5	No	**Yes**	No	Not detected at MRS
Silver	µg/L	< 5	No	**Yes**	No	Not detected at MRS
Sodium	µg/L	50000	**Yes**	No	No	Not CERCLA hazardous
Strontium	µg/L	480	**Yes**	No	No	Not CERCLA hazardous
Thallium	µg/L	< 1	No	**Yes**	No	Not detected at MRS
Titanium	µg/L	< 10	**Yes**	No	No	Not detected at MRS
Vanadium	µg/L	8.3	No	No	No	Not a potential MC
Zinc	µg/L	12	**Yes**	**Yes**	**Yes**	--
Explosives - SW8321A						
1,3,5-Trinitrobenzene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
1,3-Dinitrobenzene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2,4,6-Trinitrotoluene (TNT)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2,4-Dinitrotoluene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2,6-Dinitrotoluene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2-Amino-4, 6-dinitrotoluene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
2-Nitrotoluene	µg/L	< 0.2	**Yes**	**Yes**	No	Not detected at MRS
3-Nitrotoluene	µg/L	< 0.2	**Yes**	**Yes**	No	Not detected at MRS
4-Amino-2,6-Dinitrotoluene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
4-Nitrotoluene	µg/L	< 0.2	**Yes**	**Yes**	No	Not detected at MRS
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Nitrobenzene	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Nitroglycerin	µg/L	< 0.15	**Yes**	**Yes**	No	Not detected at MRS
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Pentaerythritol Tetranitrate (PETN)	µg/L	< 0.12	**Yes**	**Yes**	No	Not detected at MRS
Perchlorate - STL SOP DEN-LC-0024						
Perchlorate	µg/L	0.95	**Yes**	No[d]	**Yes**	--

a - If an analyte was not detected above the adjusted practical quantitation limit (PQL), the concentration is listed as less than the PQL

b - Potential MCs as listed in Table 4.1

c - Source: 40 CFR Part 302, Table 302.4--List of Hazardous Substances

d - Perchlorate is not CERCLA hazardous; however, perchlorate has been evaluated at the request of USACE and will be retained for consideration in the SLRA.

5.4.3 Soil Exposure Pathway

5.4.3.1 Four soil samples (SAH-RL-SS-02-04, SAH-AG-SS-02-05, SAH-OQ-SS-02-06, and SAH-OQ-SS-02-07) were collected at the Range Complex No. 2 MRS. The SI field team did not find any evidence of a visible target during the QR, so samples SAH-OQ-SS-02-06 and SAH-OQ-SS-02-07 were collected near the proposed location in an area with debris present. SAH-RL-SS-02-05 was proposed to be collected near the end of the runway; however, it was moved from the proposed location due to lack of ROE and was relocated as near as possible to the proposed location. SAH-BT-SS-02-05 was collected near the center of the range in an area were debris from several 20mm projectiles were noted.

5.4.3.2 As shown in Table 5.6, laboratory analysis of the samples did not detect explosives but detected several metals. Table 5.10 compares maximum detected concentrations of each analyte to the three SLRA criteria, as discussed in paragraph 5.2.7.4. As shown in Table 5.10, three detected soil analytes (barium, chromium, and nickel) were retained for consideration in a SLRA in Chapter 6. The SLRA for these analytes at Range Complex No. 2 is included in Section 6.2.4.2.

5.4.4 Air Migration Pathway

An exposure pathway for air is potentially complete at the MRS based on the presence of barium, chromium, and nickel in the soil (see Section 5.4.3) and the potential for fugitive dust. This exposure pathway is evaluated further in the SLRA because the screening values for soil incorporate the inhalation pathway for human health.

5.5 RANGE COMPLEX NO. 3

Sections 5.2 and 5.3 summarize information on the regional setting, migration/exposure pathways, exposure targets, and historical MC information for the former Sahuarita AFR. This section provides additional details specific to Range Complex No. 3.

5.5.1 Groundwater Migration Pathway

5.5.1.1 Three hundred forty-five wells are known to exist within a 4-mile buffer of the Range Complex No. 3 boundary. Table 5.11 summarizes the number and types of wells as well as their distances from the MRS boundary. Municipal drinking water wells are present within the 4-mile buffer area of Range Complex No. 3; therefore, the number of individuals using drinking water from the municipal wells cannot be accurately estimated. However, at Range Complex No. 3, there are generally only domestic wells within 2 miles of the site boundary. As shown, 142 drinking water wells are within 2 miles of the site. A population of 1,353 people within the 0- to 2-mile buffer (same range as the location of the drinking water wells) was assumed using conservative estimates for the distances shown in Table 2.1, based on U.S. census data for 2000. Given the distance to the site from any sort of public infrastructure, it is reasonable to assume that the 1,353

residents within the 2-mile buffer drink water provided by domestic wells within that 2-mile buffer area.

5.5.1.2 No groundwater samples were collected within Range Complex No. 3; therefore, a SLRA for groundwater was not performed. However, Section 6.2.5.3 discusses potential risk due to possible MC migration from soil to groundwater.

5.5.2 Surface Water Migration Pathway

As discussed in Section 5.2.3, an exposure pathway for surface water is not complete due to the absence of surface water at the former Sahuarita AFR, including Range Complex No. 3. Because this pathway is incomplete, a SLRA is not required.

Table 5.10
Range Complex No. 2
Soil Source Evaluation
SAHUARITA AFR, ARIZONA

Analyte	Units	Maximum Detected Site Concentration [a]	Background Concentration [b]	Exceeds Background Concentration?	Potential MC? [c]	CERCLA Hazardous? [d]	SLRA Required?	Primary reason for exclusion from SLRA
Total Metals - SW6010B/6020/7470A								
Aluminum	mg/kg	26000	82320	No	**Yes**	No	No	Not detected above background
Antimony	mg/kg	< 0.3	<0.28	No	**Yes**	**Yes**	No	Not detected at MRS
Arsenic	mg/kg	8.9	69.39	No	No	**Yes**	No	Not detected above background
Barium	mg/kg	83	58	**Yes**	**Yes**	**Yes**	**Yes**	--
Beryllium	mg/kg	1.1	0.52	**Yes**	No	**Yes**	No	Not a potential MC
Cadmium	mg/kg	0.2	0.093	**Yes**	No	**Yes**	No	Not a potential MC
Calcium	mg/kg	20000	52970	No	**Yes**	No	No	Not detected above background
Chromium	mg/kg	15	6.9	**Yes**	**Yes**	**Yes**	**Yes**	--
Cobalt	mg/kg	5.6	3.6	**Yes**	No	**Yes**	No	Not a potential MC
Copper	mg/kg	100	381.528	No	**Yes**	**Yes**	No	Not detected above background
Iron	mg/kg	21000	55210	No	**Yes**	No	No	Not detected above background
Lead	mg/kg	15	99.72	No	**Yes**	**Yes**	No	Not detected above background
Magnesium	mg/kg	5700	12560	No	**Yes**	No	No	Not detected above background
Manganese	mg/kg	430	1256.9	No	No	No	No	Not detected above background
Mercury	mg/kg	0.037	0.04	No	No	**Yes**	No	Not detected above background
Molybdenum	mg/kg	1.1	0.3	**Yes**	**Yes**	No	No	Not CERCLA hazardous
Nickel	mg/kg	11	6	**Yes**	**Yes**	**Yes**	**Yes**	--
Potassium	mg/kg	6400	2000	**Yes**	**Yes**	No	No	Not CERCLA hazardous
Selenium	mg/kg	0.45	0.29	**Yes**	No	**Yes**	No	Not a potential MC
Silver	mg/kg	0.16	0.062	**Yes**	No	**Yes**	No	Not a potential MC
Sodium	mg/kg	640	23660	No	**Yes**	No	No	Not detected above background
Strontium	mg/kg	42	41	**Yes**	**Yes**	No	No	Not CERCLA hazardous
Thallium	mg/kg	0.25	0.11	**Yes**	No	**Yes**	No	Not a potential MC
Titanium	mg/kg	370	5060	No	**Yes**	No	No	Not detected above background
Vanadium	mg/kg	30	15	**Yes**	No	No	No	Not a potential MC
Zinc	mg/kg	52	113.43	No	**Yes**	**Yes**	No	Not detected above background
Explosives - SW8321A								
1,3,5-Trinitrobenzene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
1,3-Dinitrobenzene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2,4,6-Trinitrotoluene (TNT)	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2,4-Dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2,6-Dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2-Amino-4, 6-dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2-Nitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
3-Nitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
4-Amino-2,6-Dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
4-Nitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/kg	< 180	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Methyl-2,4,6-trinitrophenylnitramine (Tetryl	µg/kg	< 300	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Nitrobenzene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Nitroglycerin	µg/kg	< 500	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Pentaerythritol Tetranitrate (PETN)	µg/kg	< 500	NA	No	**Yes**	**Yes**	No	Not detected at MRS

a - If an analyte was not detected above the adjusted practical quantitation limit (PQL), the concentration is listed as less than the PQL.
b - Background Screening Level as established in Table 5.2
c - Potential MCs as listed in Table 4.1
d - Source: 40 CFR Part 302, Table 302.4--List of Hazardous Substances
NA - Background concentration not available.

TABLE 5.11
GROUNDWATER WELLS IN THE VICINITY OF RANGE COMPLEX NO. 3
SAHUARITA AFR, ARIZONA

Distance from Site	Public/ Domestic	Commercial/ Industrial	Stock/ Irrigation	Observation/ Environmental	Other	Total
On Site	None	None	None	None	None	None
0 to ¼ Mile	2	None	None	None	None	2
¼ to ½ Mile	14	None	None	None	None	14
½ to 1 Mile	46	1	3	None	None	50
1 to 2 Miles	80	None	3	1	3	87
2 to 3 Miles	110	None	3	None	3	116
3 to 4 Miles	51	2	21	1	1	76
Site to 4 Miles	303	3	30	2	7	345

Detailed well information is included in Appendix L.

5.5.3 Soil Exposure Pathway

5.5.3.1 The soil samples collected in the Range Complex No. 3 (SAH-BT-SS-02-03, and SAH-BT-SS-02-02) were collected from the target centers as identified in the ASR Supplement. SAH-BT-SS-02-02, was collected at the Bombing Target No. 3 sub-range. SAH-BT-SS-02-02 was collected at the range target center in an area where, as noted in the ASR Supplement, several pieces of practice bomb debris were noted. The SI team did not find any evidence of a visible target center during the QR prior to collecting the soil sample, so they collected the sample near the proposed location in an area where practice bomb munitions debris was present. After the collection of sample SAH-BT-SS-02-02, additional QR revealed that the target center has been placed inaccurately and was located approximately ½ mile south of the location shown in the ASR Supplement.

5.5.3.2 As shown in Table 5.6, laboratory analysis of the samples detected nitroglycerin and several metals. The maximum detected concentration of each metal was compared to selected background concentrations, the MC list in Table 4.1, and the CERCLA hazardous substance list. Table 5.12 compares maximum detected concentrations of each analyte to these three SLRA requirements, as stated in Section 5.2.7 paragraph 5.2.7.4. As seen in Table 5.12, only nitroglycerin was retained for consideration in the SLRA that was conducted to further evaluate the soil migration pathway of nitroglycerin at the Range Complex No. 3 MRS, as presented in paragraphs 6.2.4.3 and 6.3.5.3. These paragraphs also discuss the potential for MC-contaminated soil at the suspected OB/OD area discussed in Section 4.4.2.

5.5.4 Air Migration Pathway

As shown in Table 2.1, several residents live within the 4-mile buffer around the Range Complex No. 3 MRS. An exposure pathway for air is potentially complete at the MRS based on the presence of explosive constituents in the soil (see Section 5.5.3) and the potential for fugitive dust. This exposure pathway is evaluated further in the SLRA because the screening values for soil incorporate the inhalation pathway for human health.

Table 5.12
Range Complex No. 3
Soil Source Evaluation
SAHUARITA AFR, ARIZONA

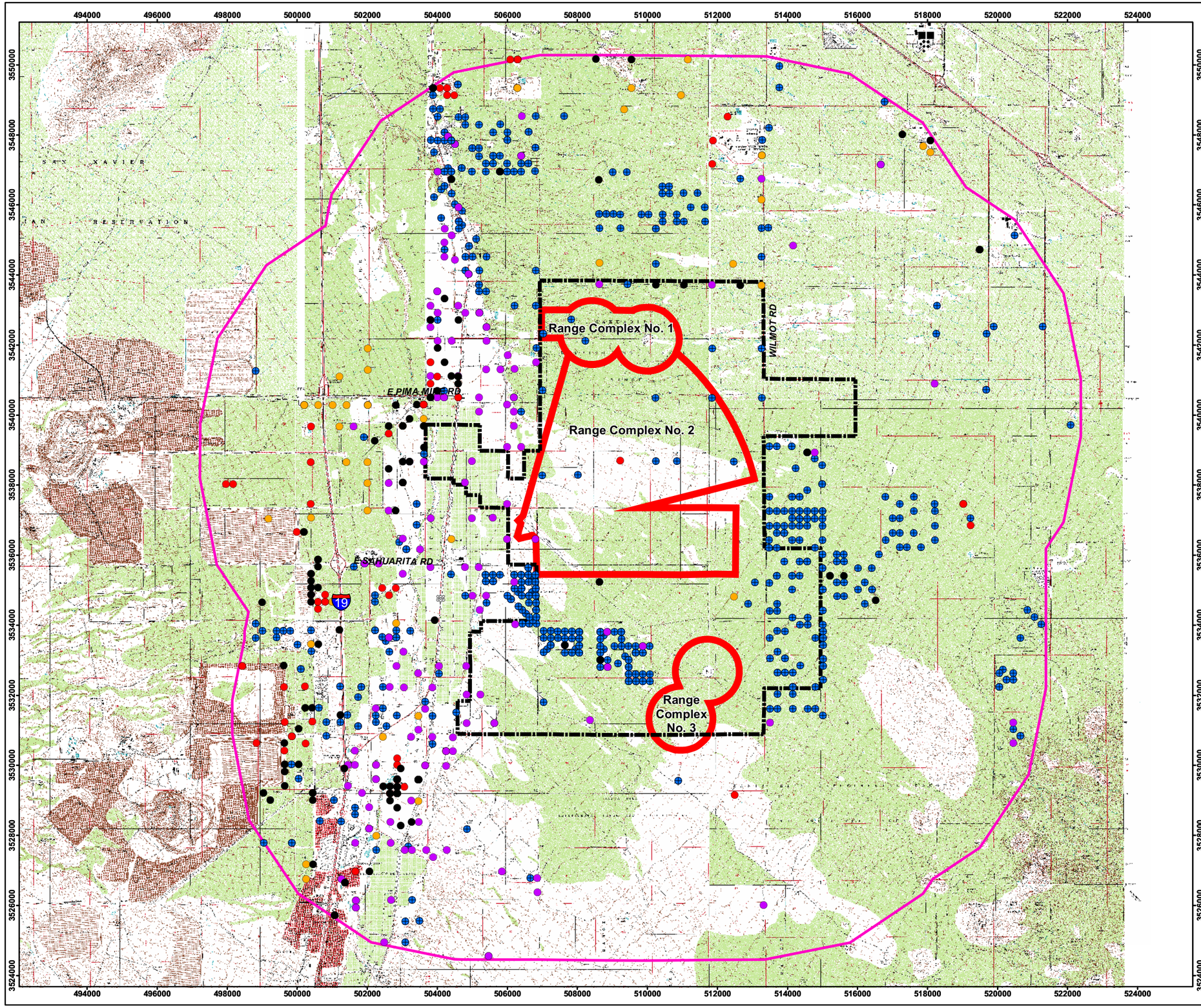
Analyte	Units	Maximum Detected Site Concentration [a]	Background Concentration [b]	Exceeds Background Concentration?	Potential MC? [c]	CERCLA Hazardous? [d]	SLRA Required?	Primary reason for exclusion from SLRA
Total Metals - SW6010B/6020/7471A								
Aluminum	mg/kg	6900	82320	No	**Yes**	No	No	Not detected above background
Antimony	mg/kg	< 0.27	<0.28	No	**Yes**	**Yes**	No	Not detected at MRS
Arsenic	mg/kg	2.1	69.39	No	No	**Yes**	No	Not detected above background
Barium	mg/kg	38	58	No	**Yes**	**Yes**	No	Not detected above background
Beryllium	mg/kg	0.48	0.52	No	No	**Yes**	No	Not detected above background
Cadmium	mg/kg	0.15	0.093	**Yes**	No	**Yes**	No	Not a potential MC
Calcium	mg/kg	14000	52970	No	**Yes**	No	No	Not detected above background
Chromium	mg/kg	5.9	6.9	No	**Yes**	**Yes**	No	Not detected above background
Cobalt	mg/kg	2.9	3.6	No	No	**Yes**	No	Not detected above background
Copper	mg/kg	180	381.528	No	**Yes**	**Yes**	No	Not detected above background
Iron	mg/kg	11000	55210	No	**Yes**	No	No	Not detected above background
Lead	mg/kg	7.8	99.72	No	**Yes**	**Yes**	No	Not detected above background
Magnesium	mg/kg	2900	12560	No	**Yes**	No	No	Not detected above background
Manganese	mg/kg	300	1256.9	No	No	No	No	Not detected above background
Mercury	mg/kg	< 0.035	0.04	No	No	**Yes**	No	Not detected at MRS
Molybdenum	mg/kg	2.9	0.3	**Yes**	**Yes**	No	No	Not CERCLA hazardous
Nickel	mg/kg	4.4	6	No	**Yes**	**Yes**	No	Not detected above background
Potassium	mg/kg	1900	2000	No	**Yes**	No	No	Not detected above background
Selenium	mg/kg	0.32	0.29	**Yes**	No	**Yes**	No	Not a potential MC
Silver	mg/kg	0.11	0.062	**Yes**	No	**Yes**	No	Not a potential MC
Sodium	mg/kg	< 610	23660	No	**Yes**	No	No	Not detected at MRS
Strontium	mg/kg	23	41	No	**Yes**	No	No	Not detected above background
Thallium	mg/kg	0.13	0.11	**Yes**	No	**Yes**	No	Not a potential MC
Titanium	mg/kg	310	5060	No	**Yes**	No	No	Not detected above background
Vanadium	mg/kg	11	15	No	No	No	No	Not detected above background
Zinc	mg/kg	43	113.43	No	**Yes**	**Yes**	No	Not detected above background
Explosives - SW8321A								
1,3,5-Trinitrobenzene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
1,3-Dinitrobenzene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2,4,6-Trinitrotoluene (TNT)	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2,4-Dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2,6-Dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2-Amino-4, 6-dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
2-Nitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
3-Nitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
4-Amino-2,6-Dinitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
4-Nitrotoluene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/kg	< 180	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Methyl-2,4,6-trinitrophenylnitramine (Tetryl	µg/kg	< 300	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Nitrobenzene	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Nitroglycerin	µg/kg	63	NA	**Yes**	**Yes**	**Yes**	**Yes**	--
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/kg	< 120	NA	No	**Yes**	**Yes**	No	Not detected at MRS
Pentaerythritol Tetranitrate (PETN)	µg/kg	< 500	NA	No	**Yes**	**Yes**	No	Not detected at MRS

a - If an analyte was not detected above the adjusted practical quantitation limit (PQL), the concentration is listed as less than the PQL.
b - Background Screening Level as established in Table 5.2
c - Potential MCs as listed in Table 4.1
d - Source: 40 CFR Part 302, Table 302.4--List of Hazardous Substances
NA - Background concentration not available.

Figure 5.1

Water Wells within 4-Mile Buffer
Former Used Defense Site
Sahuarita AFR
FUDS Project No. J09AZ057601

Sahuarita, Arizona



Legend

- Commercial/Industrial Well
- Observation/Environmental Well
- Public/Domestic Well
- Stock/Irrigation Well
- Other Well
- Range Complex Boundary
- Installation Boundary
- 4-Mile Buffer

Site Location in Arizona

N

Image Source: USGS 7.5' Topo Quadrangles, 1981 - 1992
Projection: UTM Zone 12 NAD83, Map Units in Meters

0 1 2 4 Miles

PARSONS

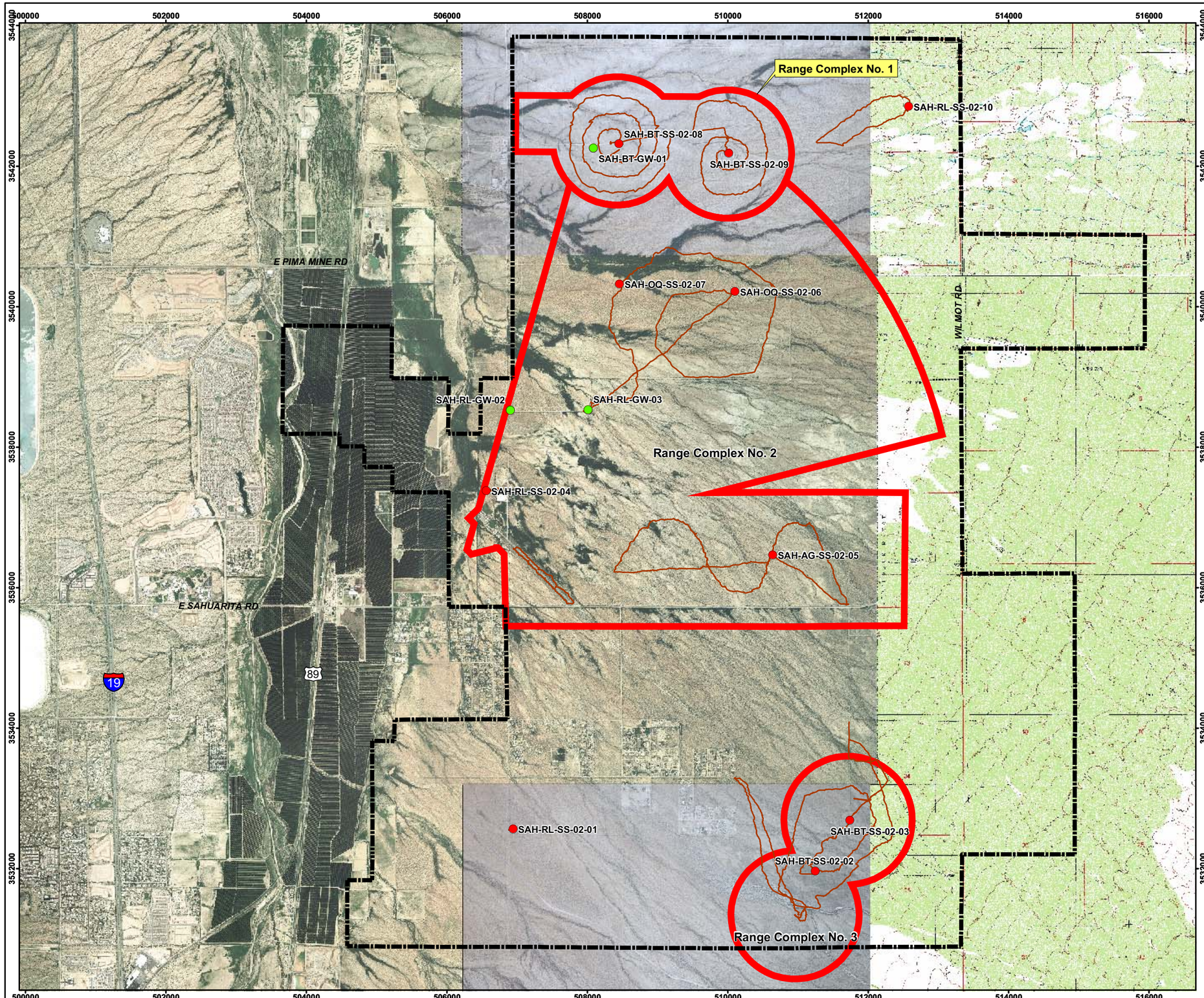
U.S. ARMY SOUTH
PACIFIC DIVISION
RANGE SUPPORT CENTER

DESIGNED BY: BT	Water Wells within 4-Mile Buffer
DRAWN BY: BT	
CHECKED BY: NH	SCALE: As Shown; PROJECT NUMBER: 744653.05000
SUBMITTED BY: DS	DATE: June 2007; PAGE NUMBER: 5-23
	FILE: X:\GIS\Site_inspections_sw\Maps\sahuarita_az\ Fig5_1.mxd

Figure 5.2

Sample Locations
Former Used Defense Site
Sahuarita AFR
FUDS Project No. J09AZ057601

Sahuarita, Arizona



Legend

- Ground Water Sample Location
- Soil Sample Location
- Range Complex Boundary
- Installation Boundary
- Qualitative Reconnaissance Track

Site Location in Arizona

N

Image Source: Orthophoto, 2006
Projection: UTM Zone 12 NAD83, Map Units in Meters

4,500 2,250 0 4,500 Feet

PARSONS	U.S. ARMY SOUTH PACIFIC DIVISION RANGE SUPPORT CENTER

DESIGNED BY: BT	Sample Locations		
DRAWN BY: BT			
CHECKED BY: NH	SCALE: As Shown		PROJECT NUMBER: 744653.05000
SUBMITTED BY: DS	DATE: June 2007		PAGE NUMBER: 5-24
	FILE: X:\GIS\Site_inspections_sw\Maps\sahuarita_az\Fig5_2.mxd		

CHAPTER 6

SCREENING-LEVEL RISK ASSESSMENT

6.1 MUNITIONS AND EXPLOSIVES OF CONCERN SCREENING-LEVEL RISK ASSESSMENT

6.1.1 A qualitative risk evaluation was conducted to assess potential explosive safety risk to the public at the former Sahuarita AFR and to qualitatively communicate the magnitude of the risk at the site and the primary causes of that risk. The risk evaluation presented below was developed using the interim guidance for ordnance and explosive risk impact assessment (USACE, 2001) and is based on the historical information presented in prior studies noted in Chapter 2 and on the QR observations for the MRSs.

6.1.2 An explosive safety risk is the possibility for MEC to detonate as a result of human activities and potentially cause harm. An explosive safety risk exists if a person can come near or into contact with MEC and act on that item to cause a detonation. The potential for an explosive safety risk depends on the presence of three critical elements: a source (presence of MEC), a receptor or person, and interaction between the source and receptor (such as picking up the item or disturbing the item). There is no risk if any one element is missing. Each of the three elements provides a basis for implementing effective risk-management response actions.

6.1.3 The exposure route for MEC receptors is primarily direct contact as a result of some human activity. Agricultural or construction activities involving subsurface intrusion are examples of human activities that will increase the likelihood for direct contact with buried MEC. MEC will tend to remain in place unless disturbed by human or natural forces, such as erosion. Movement of MEC may increase the possibility for direct human contact but will not necessarily result in direct contact or exposure.

6.1.1 Munitions and Explosives of Concern Conceptual Site Model

CSMs can help identify risks to human health and the environment by identifying complete exposure pathways between physical media affected by site-related contamination (for example, soil, water, air) and potential human or ecological receptors. Appendix J includes the MEC CSM at the former Sahuarita AFR.

6.1.2 Definition of Risk Evaluation Factors, Categories, and Subcategories

The potential risk posed by MEC was characterized qualitatively by evaluating three primary risk factors: 1) presence and nature of MEC sources, 2) site characteristics that affect the accessibility or pathway between sources and human receptors, and 3) human factors that define the receptors and types of activities that may result in direct contact between receptors and MEC sources. By performing a qualitative assessment of these three factors, an overall assessment of the safety risk posed by MEC may be evaluated. The following sections describe the components of each primary risk factor.

6.1.2.1 Presence of Munitions and Explosives of Concern

6.1.2.1.1 Four categories can be used to evaluate the risk from the presence of MEC: MEC type, MEC sensitivity, MEC density, and MEC depth distribution. At the SI stage, MEC density and MEC depth are generally unknown; they are evaluated during the RI/FS stage.

6.1.2.1.2 **MEC type** affects the likelihood of injury and the severity of exposure. If multiple MEC types are identified in an area, the type posing the greatest risk to public health is selected for risk evaluation. Table 6.1 shows the four subcategories of MEC type, presented in order of severity from highest to lowest risk.

TABLE 6.1
MUNITIONS AND EXPLOSIVES OF CONCERN TYPE SUBCATEGORIES
SAHUARITA AFR, ARIZONA

Subcategory	MEC Type Description
Most severe	MEC that may be lethal if detonated by an individual's activities
Moderately severe	MEC that may cause major injury to an individual if detonated by an individual's activities
Least severe	MEC that may cause minor injury to an individual if detonated by an individual's activities
No injury	Munitions debris (inert) that will cause no injury

6.1.2.1.3 **MEC sensitivity** affects the likelihood of detonation and the severity of exposure. Factors considered in evaluating sensitivity include fuzing and environmental factors such as weathering. The category of sensitivity is based on the results of the SI field QR as well as the results of archival studies. When multiple subcategories of MEC types are discovered in an area, the highest risk subcategory is used in the risk evaluation. Table 6.2 defines the four subcategories of sensitivity, presented in order from highest to lowest.

TABLE 6.2
MUNITIONS AND EXPLOSIVES OF CONCERN
SENSITIVITY SUBCATEGORIES
SAHUARITA AFR, ARIZONA

Subcategory	MEC Sensitivity
Very sensitive	MEC that is very sensitive, that is, electronic fuzing, land mines, booby traps
Less sensitive	MEC that has standard fuzing
Insensitive	MEC that may have functioned correctly or is unfuzed but has a residual risk
Inert	Munitions debris (inert) that will cause no injury

6.1.2.1.4 **MEC density** directly affects the likelihood that an individual will be exposed to and negatively impacted by MEC. The more ordnance per acre, the greater the likelihood of exposure to MEC and thereby opportunity to create an incident. Given the absence of reliable and confirmed subsurface data at the SI stage, MEC density is not evaluated during the SI.

6.1.2.1.5 **MEC depth distribution** refers to the vertical location of MEC in the subsurface. There exists an inverse relationship between the depth of MEC and the likelihood of exposure to the MEC: the greater the depth of the MEC, the lower the risk of exposure. The two subcategories within the MEC depth distribution category are surface and subsurface MEC. The surface subcategory includes those items recovered on the ground surface, protruding from the ground surface, or beneath the leaf litter. Given the absence of reliable and confirmed subsurface data at the SI stage, the MEC depth distribution category is not evaluated during the SI.

6.1.2.2 Site Characteristics

6.1.2.2.1 The two categories evaluated in the site characteristics risk factor are site accessibility and site stability.

6.1.2.2.2 **Site accessibility** affects the likelihood of encountering MEC. Natural or physical barriers can limit the accessibility. Natural barriers can include the terrain or topography of the site as well as the vegetation. Physical barriers can include walls and fences that control, limit, or prevent access to the site. Both the physical and natural barriers found at a sector are considered when evaluating this category. Site accessibility has three subcategories, presented in Table 6.3.

TABLE 6.3
SITE ACCESSIBILITY SUBCATEGORIES
SAHUARITA AFR, ARIZONA

Subcategory	Accessibility Description
No restriction to site access	No man-made barriers, gently sloping terrain, no vegetation that restricts access, no water that restricts access
Limited restriction to access	Man-made barriers, vegetation, water, snow or ice cover, and/or terrain restrict access
Complete restriction to access	All points of entry are controlled

6.1.2.2.3 **Site stability** relates to the probability of exposure to MEC by natural processes, including recurring natural events (for example, erosion and frost heave) or extreme natural events (for example, severe wind and flash floods). The local soil type, topography, climate, and vegetation affect stability of the site. The soil type and climate primarily affect the depth of penetration of the MEC. Over time, the soil type and climate will also affect the degree of erosion that takes place at a site. Topography and vegetation in the area will also affect the rate of erosion that takes place in an area. Site stability has three subcategories, described in Table 6.4.

TABLE 6.4
SITE STABILITY SUBCATEGORIES
SAHUARITA AFR, ARIZONA

Subcategory	Accessibility Description
Stable site	MEC should not be exposed by natural events
Moderately stable site	MEC may be exposed by natural events
Unstable site	MEC most likely will be exposed by natural events

6.1.2.3 Human Factors

6.1.2.3.1 The human risk factor evaluates site activities and population.

6.1.2.3.2 **Types of activities** conducted at a site affect the likelihood of encountering MEC. Activities may be generally classified as recreational and occupational. This category examines whether the impact from an activity on MEC is significant, moderate, or low. To assign such a score, the general guidelines presented in Table 6.5 are considered. First, the type of activity is identified. Second, the depth of the activity is considered. For example, at a site where MEC is at the surface, all activities that can impact MEC at the surface are considered activities that have significant impact or contact level. Conversely, if all MEC is located at depths greater than 1 foot and only surface impact activities are being performed, then the activities are considered as moderate or low impact. Third, a score of significant, moderate, or low may be assigned.

Given the absence of reliable and confirmed subsurface data at the SI stage, the subsurface category cannot be evaluated during the SI.

TABLE 6.5
MUNITIONS AND EXPLOSIVES OF CONCERN
CONTACT PROBABILITY LEVELS
SAHUARITA AFR, ARIZONA

Examples of Activities	Depth of MEC	Contact Level
Child play, picnic, short cuts, hunting, hiking, jogging, surveying, off-road driving	Surface Below surface to 12 inches >12 inches	Significant Low Low
Camping, campfires, metal detecting	Surface Below surface to 12 inches >12 inches	Significant Moderate Low
Intrusive work	Surface Below surface to 12 inches >12 inches	Significant Significant Moderate

6.1.2.3.3 **Population** refers to the number of people that potentially access the MRS on a daily basis. A direct relationship exists between the number of people and the risk of exposure. An estimate of the number of people accessing the MEC on a daily basis was made using best professional judgment based on knowledge of the type of site, land use, and site accessibility.

6.1.3 Application of Risk Evaluation Factors, Categories, and Subcategories

An evaluation of MEC risk was performed for each identified MRS at the former Sahuarita AFR.

6.1.3.1 Presence of Munitions and Explosives of Concern

6.1.3.1.1 The munitions debris identified during the QR at the former Sahuarita AFR ranged from small arms casings to fragments created by HE detonation. Based on Table 6.1 and the munitions debris observed during the SI, an MEC type subcategory was assigned to all MRSs at the former Sahuarita AFR. The MEC type given to each MRS is detailed in Table 6.6.

6.1.3.1.2 In accordance with Table 6.2, the MEC sensitivity subcategory of "less sensitive" was assigned to all of the MRSs at which non-small arms munitions debris were observed, based on the assumed use of standard fuzing. Table 6.6 indicates the MEC sensitivity assigned to each MRS.

6.1.3.1.3 Given the absence of reliable and confirmed subsurface data at the SI stage, the MEC density and depth subcategories are not evaluated during the SI.

TABLE 6.6
SITE INSPECTION MUNITIONS AND EXPLOSIVES OF CONCERN RISK EVALUATION
SAHUARITA AFR, ARIZONA

MRS	Presence of MEC Factors					Site Characteristics Factors		Human Factors	
	Type		Sensitivity	MEC Density	MEC Depth Distribution	Accessibility	Stability	Contact Level / Activities	Population (Daily)
Range Complex No. 1	100- and 250-pound practice bomb and fuzes, small arms	Moderately severe	Less sensitive	Not evaluated in SI	Not evaluated in SI	No restriction to site access	Moderately stable	Significant	<5
Range Complex No. 2	Small arms and 20mm HEI projectiles	Most severe	Less sensitive	Not evaluated in SI	Not evaluated in SI	No restriction to site access	Moderately stable	Significant	>100
Range Complex No. 3	100-pound practice and HE bombs and fuzes	Most severe	Less sensitive	Not evaluated in SI	Not evaluated in SI	No restriction to site access	Moderately stable	Significant	<5

6.1.3.2 Site Characteristics

6.1.3.2.1 The majority of the former Sahuarita AFR site is used for cattle ranching, and therefore barbed wire fences run throughout the area. Though fences are present, dirt roads and all-terrain vehicle trails run throughout the site and gates are generally not locked. Additionally, residential areas are present within the FUDS boundary but not within any of the MRSs. Per Table 6.3, each of the former Sahuarita AFR MRSs received a site accessibility subcategory of "No restriction to site access."

6.1.3.2.2 Vegetation is sparse across the former Sahuarita AFR due to the extremely arid climate, and it is assumed that the wind can erode significant amounts of soil in this type of environment. Despite the dry climate, washes are prevalent throughout the site, and erosion around these washes was evident during the field work. Flash flooding occurs in the area, which could potentially erode soil in areas outside the washes. Due to the relative warmth of the area, frost heaving is not expected to be of concern. Therefore, per Table 6.4, all three MRSs were assigned a site stability subcategory of "moderately stable" with regard to the potential for MEC to be exposed by erosion.

6.1.3.3 Human Factors

6.1.3.3.1 Given the current and future use of the site as ranch land with residential development, the MRSs were assigned a site activity subcategory based on the munitions debris observed during the SI. All MRSs containing munitions debris other than small arms remnants were given a contact probability of "significant" based on the fact that the munitions debris observed during the SI were on the ground surface.

6.1.3.3.2 Based on the current uses of the former Sahuarita AFR, the number of people potentially exposed to MEC at the MRSs on a daily basis is estimated to be less than five. Only at Air-to-Ground Gunnery Range No. 2 is access more frequent, with more than 100 visitors per day, due to use of the airstrip area for jogging and walking and the location of a park and school within the MRS boundary. Potential access is limited due to the factors outlined in Section 6.1.3.2.

6.1.4 Hazards Assessment

Each of the primary risk factors identified above was evaluated using the data collected during the SI field investigation and the historical data available from other studies. Table 6.6 summarizes the MEC risk evaluation for the former Sahuarita AFR.

6.1.5 Munitions and Explosives of Concern Risk Summary

6.1.5.1 The risk to public safety associated with the presence of MEC was evaluated for the former Sahuarita AFR. The MEC safety risk is due to a combination of the primary risk factors presented above.

6.1.5.2 No MEC were observed during the SI field work in January 2007 or during any prior field visit except for intact small arms ammunition. However, various types of munitions debris ranging from small arms casings to metal fragments created by HE munitions were observed during the SI visit. Only a small percentage of the area covered by each range was traversed during the SI; therefore, it is possible that MEC are present in ranges containing munitions debris and were beyond the observation range of the SI field team. Based on observations of munitions debris during the SI visit and previous site visits, MEC may exist and the MEC exposure pathway is complete at each of the MRSs at the former Sahuarita AFR.

6.2 MUNITIONS CONSTITUENTS SCREENING-LEVEL HUMAN HEALTH RISK ASSESSMENT

6.2.1 Conceptual Site Model

Potential human receptors for the former Sahuarita AFR include current and future site workers and visitors. The site consists of 27,046 acres of land primarily owned by the State of Arizona and leased for cattle grazing. Barbed wire fences partially restrict public access. The Air-to-Ground Gunnery Range No. 2 is accessed frequently, with greater than 100 visitors per day, due to use of the air strip area for jogging and walking. In addition, a park and school are located within the MRS boundary. The MC CSEM identifies impacted media, transport mechanism, exposure routes, and potential receptors. A CSEM has been developed for each MRS and is included in Appendix J.

6.2.2 Affected Media

Direct release of MC from munitions activities at the site would have been to surface soil. Migration of MC to groundwater is possible. Based on decisions made at the TPP meeting, 10 soil samples (including two ambient samples) and three groundwater samples were collected during the SI at Sahuarita AFR. Surface soil is expected to act as an indicator of potential contamination. Since activities at the site would be expected to release MC directly to surface soil and result in the highest concentrations in the surface soil, the potential absence of MC in surface soil would indicate an absence of contamination in other media.

6.2.3 Screening Values

6.2.3.1 The soil screening values consist of the most conservative value between residential SSLs from the USEPA Region 6 MSSLs, USEPA Region 9 residential soil PRGs, and State of Arizona residential SRLs. The groundwater screening levels were the more conservative of USEPA Region 6 tap water MSSLs and USEPA Region 9 tap water PRGs.

6.2.3.2 Laboratory reporting limits were confirmed to have met the requirement of the approved Final SS-WP.

6.2.4 Risk Characterization for Soil

To complete the risk characterization for this site, the maximum detected concentration of each analyte retained for consideration in the SLRA in Chapter 5 was compared to the screening levels selected during the TPP process (that is, USEPA Region 9 PRGs, USEPA Region 6 MSSLs, and State of Arizona residential SRLs).

6.2.4.1 Range Complex No. 1

Two soil samples were collected from Range Complex No. 1. As described in Section 5.3.4.6, three analytes (barium, chromium, and nickel) were retained for risk characterization. Table 6.7 presents the SLRA results for these analytes and indicates that the maximum detected concentrations are less than the respective risk-based screening values. Based on these results, no unacceptable human health risk from MC is expected through exposure to soil at Range Complex No. 1.

TABLE 6.7
SOIL SCREENING-LEVEL HUMAN HEALTH RISK ASSESSMENT: RANGE COMPLEX NO. 1
SAHUARITA AFR, ARIZONA

Analyte	Units	Maximum Detected Site Concentration	Human Health Screening Values [a]	Exceeds Screening Level?
Metals				
Barium	mg/kg	100	5,300	No
Chromium	mg/kg	13	211	No
Nickel	mg/kg	11	1,500	No

a - Lowest value of either USEPA Region 9 residential soil PRG (December 28, 2004), State of Arizona residential SRLs or USEPA Region 6 MSSL (February 6, 2007).

6.2.4.2 Range Complex No. 2

Four soil samples were collected from Range Complex No. 2. As described in Section 5.4.3, three analytes (barium, chromium, and nickel) were retained for risk characterization. Table 6.8 presents the SLRA results for these analytes and indicates that the maximum detected concentrations are less than the respective risk-based screening values. Based on these results, no unacceptable human health risk from MC is expected through exposure to soil at Range Complex No. 2.

TABLE 6.8
SOIL SCREENING-LEVEL HUMAN HEALTH RISK ASSESSMENT: RANGE COMPLEX NO. 2
SAHUARITA AFR, ARIZONA

Analyte	Units	Maximum Detected Site Concentration	Human Health Screening Values [a]	Exceeds Screening Level?
Metals				
Barium	mg/kg	83	5,300	No
Chromium	mg/kg	15	211	No
Nickel	mg/kg	11	1,500	No

a - Lowest value of either USEPA Region 9 residential soil PRG (December 28, 2004) , State of Arizona residential SRLs or USEPA Region 6 MSSL (February 6, 2007).

6.2.4.3 Range Complex No. 3

Two soil samples were collected from Range Complex No. 3. As described in Section 5.5.3, one analyte (nitroglycerin) was retained for risk characterization. The maximum detected nitroglycerine concentration (63 micrograms per kilogram [µg/kg]) did not exceed the soil screening value of 35,000 µg/kg. Because visible indicators of MC were present at Range Complex No. 3; human health risk from MC through exposure to soil cannot be ruled out.

6.2.5 Risk Characterization for Groundwater

To complete the risk characterization for this site, the maximum detected concentration of each groundwater analyte retained for consideration in the SLRA in Chapter 5 was compared to the screening levels selected during the TPP process (that is, the lowest value from either USEPA Region 6 tap water MSSLs or USEPA Region 9 tap water PRGs).

6.2.5.1 Range Complex No. 1

One groundwater sample was collected at Range Complex No. 1. As described in Section 5.3.2.6, eight analytes were carried forward for risk characterization: antimony, barium, chromium, copper, lead, nickel, zinc, and perchlorate. Table 6.9 presents the SLRA results for these analytes and indicates that the maximum detected concentration is less than the risk-based screening value. Based on these results, no unacceptable human health risk from MC is expected through direct exposure to groundwater at Range Complex No. 1.

TABLE 6.9
GROUNDWATER SCREENING-LEVEL HUMAN HEALTH RISK ASSESSMENT: RANGE COMPLEX NO. 1
SAHUARITA AFR, ARIZONA

Analyte	Units	Maximum Detected Site Concentration	Human Health Screening Values Tap Water	Exceeds Screening Level?
Metals				
Antimony	µg/L	0.084	15[a]	No
Barium	µg/L	110	2,550 [a]	No
Chromium	µg/L	1.1	110 [a]	No
Copper	µg/L	38	1,400[a]	No
Lead	µg/L	3.5	15[a]	No
Nickel	µg/L	0.48	730 [a]	No
Zinc	µg/L	23	11,000[a]	No
Perchlorate				
Perchlorate	µg/L	0.44	24[b]	No

a - Lowest value of either USEPA Region 9 tap water PRG (December 28, 2004) or USEPA Region 6 tap water MSSL (February 6, 2007).
b - The site-specific screening value of 24 ug/L is based on the Policy on DoD Required Actions Related to Perchlorate Memorandum (January 26, 2006).

6.2.5.2 Range Complex No. 2

Two groundwater samples were collected at Range Complex No. 2. As described in section 5.4.1, eight analytes were carried forward for risk characterization: antimony, barium, chromium, copper, lead, nickel, zinc, and perchlorate. Table 6.10 presents the SLRA results for these analytes and indicates that the maximum detected concentration is less than the risk-based screening value. As discussed in Section 5.2.4, groundwater samples at Range Complex No. 2 were not collected at optimal locations for detecting possible perchlorate contamination associated with JATO bottles near the runway. However, the two samples do represent optimal conditions for detecting explosive or metals associated with Range Complex No. 2. Based on these results, no unacceptable human health risk from explosives and metals MC is expected through ingestion of groundwater at Range Complex No. 2. Risk due to perchlorate could not be fully evaluated.

6.2.5.3 Range Complex No. 3

As discussed in Section 5.5.1, the groundwater pathway for human receptors is potentially complete due to possible migration of MC from soil to groundwater. Because of visual indicators of MC in the soil at the suspect OB/OD area identified during the SI visit (Section 5.4.1.2), risk from MC in groundwater cannot be eliminated.

TABLE 6.10
GROUNDWATER HUMAN HEALTH SCREENING-LEVEL RISK ASSESSMENT: RANGE COMPLEX NO. 2
SAHUARITA AFR, ARIZONA

Analyte	Units	Maximum Detected Site Concentration	Human Health Screening Values Tap Water	Exceeds Screening Level?
Metals				
Antimony	µg/L	0.096	15[a]	No
Barium	µg/L	66	2550 [a]	No
Chromium	µg/L	3.5	110 [a]	No
Copper	µg/L	3.6	1400[a]	No
Lead	µg/L	0.26	15[a]	No
Nickel	µg/L	0.57	730 [a]	No
Zinc	µg/L	12	11000[a]	No
Perchlorate				
Perchlorate	µg/L	0.95	24[b]	No

[a] Lowest value of either USEPA Region 9 tap water PRG)(December 28, 2004) or USEPA Region 6 tap water MSSL (February 6, 2007).
[b] The site-specific screening value of 24 ug/L is based on the Policy on DoD Required Actions Related to Perchlorate Memorandum (January 26, 2006).

6.2.6 Discussion

6.2.6.1 In summary, none of the analytes retained for the SLRA exceeded the risk-based screening levels. Although MC was not detected at levels exceeding screening criteria in soil, visual observation of possible MC-contaminated soil at Range Complex No. 3 indicates that MC may be present in the soil at this MRS. Therefore, no unacceptable human health risk through release of MC to soil is expected at Range Complex No. 1 and No. 2; however, risk due to MC at Range Complex No. 3 cannot be ruled out.

6.2.6.2 Five analytes (antimony, copper, lead, zinc, and perchlorate) in groundwater within Range Complex No. 1 and Range Complex No. 2 were retained for consideration in the SLRA. The maximum detected concentrations of these analytes in either Range Complex did not exceed their respective risk-based screening levels. Therefore, no unacceptable human health risk through release of MC to groundwater is expected. However, risk due to perchlorate in groundwater at Range Complex No. 2 could not be determined because ROE could not be secured for the wells located west of the airstrip.

6.3 MUNITIONS CONSTITUENTS SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT

6.3.1.1 The 27,000-acre former Sahuarita AFR site is within the southern Arizona region, which the ADOT identifies (including most of Pima County) as a biologically important location (ADOT, 2007). According to the USFWS, there is potential for several federal- and state-listed threatened and endangered species to occur within Pima County; therefore, these species may also occur on the Sahuarita site (although none have been specifically documented at the site). No permanent surface water is present at Sahuarita AFR, and according to the USFWS, no wetlands are at the site, which limits habitat for some T&E species. Because protected species and habitats are likely present, the site is considered an important ecological place (ADOT, 2007), and therefore a screening-level ecological risk assessment (SLERA) is required.

6.3.1 Conceptual Site Model

Based on the potential to occur within Pima County, nine federal- and state-listed animal species and three federal-listed plant species may occur in the Sahuarita AFR. Therefore, potential ecological receptors were considered for the site. One species, the Chiricahua leopard frog, is unlikely to be present at the site due to lack of water resources and therefore will not be considered further in this SLERA. The plant species were not evaluated separately in the SLERA and will not be considered further in the SLERA. Exposure of wildlife to MC could occur through direct exposure to contaminated soil, surface water, and sediment, as well as through ingestion of deeply rooted plants. The MC CSEM identified impacted media, transport mechanisms, exposure routes, and potential ecological receptors. Appendix J includes the CSEM for each of the three Range Complexes.

6.3.2 Management Goals

6.3.2.1 Management goals are defined as general statements about the desired condition of ecological values of concern. The goals vary based on the objectives of the property owner, current and reasonable future land use, regulatory requirements, the ecosystem, and the environmental needs of the community or other stakeholders (USACE, 2006). The Army has an over-arching management goal for ecological risk assessments (ERAs):

> *Protect valuable biological resources from unreasonable adverse effects due to the release of hazardous substances associated with Army operations, including*

past Department of Defense operations for FUDS (Department of the Army, 2005).

All site-specific management goals should be consistent with this over-arching goal.

6.3.2.2 As discussed above, protected species and habitats may be present within the former Sahuarita AFR. Therefore, for this SLERA, the entire site is considered an ecologically important place. Various valuable ecological resources are present or expected to be present within the site, potentially including eight federal-listed animal species. Based on these ecological resources, the primary ERA management goal is to protect any listed species that occur at the site.

6.3.3 Affected Media

Direct release of MC from munitions activities at the site would have been to soil. Migration of MC to groundwater through leaching is also possible. Based on decisions made at the TPP meeting, soil and groundwater were the only media sampled during the SI at the Sahuarita AFR. Surface soil is expected to act as an indicator of potential contamination. Since activities at the site would be expected to release MC directly to surface soil and result in the highest concentrations in the surface soil, the potential absence of MC in surface soil would indicate the absence of contamination in other media. In general, groundwater is not directly accessible to most organisms except for deeply rooted plants, and exposure for wildlife would be limited to secondary ingestion via ingestion of deeply rooted plants. Therefore, groundwater is not included in the SLERA.

6.3.4 Screening Values

6.3.4.1 The criteria used for screening-level comparison to soil are the USEPA Region 4 ESVs; if a Region 4 ESV for an analyte is not available, then the USEPA Region 5 ESV was used. If Region 4 or Region 5 did not provide a screening value (as for most explosive compounds), the ESV presented in Table 1-A, Appendix D of the Final Sampling and Analysis Plan Addendum was used. These values were used to determine the validity of non-detect concentrations of explosive compounds. An ESV for nitroglycerin in soil (54,990 µg/kg) was determined using the wildlife toxicity assessment for nitroglycerin, prepared by the Health Effects Research Program and the Environmental Health Risk Assessment Program. The calculations and the list of assumptions used to determine this ESV are in Appendix L of this SI report.

6.3.4.2 Laboratory reporting limits meet the requirement of the approved Final SS-WP.

6.3.5 Ecological Risk Characterization for Soil

6.3.5.1 Section 5.2.7 describes how the soil data for each of the MRSs were screened to determine whether analytes were both MC and present above ambient levels. Only those soil analytes that exceeded background concentrations, are potential MC, and are CERCLA hazardous substances were retained for risk characterization in this chapter.

6.3.5.2 To complete the ecological risk characterization for this site, the maximum detected concentration of each selected analyte was evaluated against the screening values (Section 6.3.4). This comparison resulted in the calculation of hazard quotients (HQs) for each analyte. The HQ was calculated by determining the ratio of the maximum detected site concentration to the screening value (in this case, the lowest value of either the USEPA Region 4 or USEPA Region 5 ESVs). If the HQ was equal to or less than one, the potential for ecological risk for that receptor group was considered to be negligible. If the HQ was greater than one, then unacceptable ecological risks cannot be ruled out based on the screening comparison alone.

6.3.5.1 Range Complex No. 1

Two soil samples were collected from Range Complex No. 1. As described in Section 5.3.4.6, three analytes (barium, chromium, and nickel) were retained for risk characterization. The maximum detected chromium concentration (13 mg/kg) exceeded the USEPA Region 4 ESV of 0.4 mg/kg, resulting in a hazard quotient of 32.5. Barium and nickel concentrations (100 mg/kg and 11 mg/kg) did not exceed the ESVs of 165 mg/kg and 30 mg/kg, respectively. Therefore, there is potential for ecological risk due to chromium in soil at Range Complex No. 1.

6.3.5.2 Range Complex No. 2

Four soil samples were collected at Range Complex No. 2. As described in Section 5.4.3, three analytes (barium, chromium, and nickel) were retained for risk characterization. The maximum detected chromium concentration (15 mg/kg) exceeded the USEPA Region 4 ESV of 0.4 mg/kg, resulting in a hazard quotient of 37.5. Barium and nickel concentrations (83 mg/kg and 11 mg/kg) did not exceed the ESVs of 165 mg/kg and 30 mg/kg, respectively. Therefore, there is potential for ecological risk due to chromium in soil at Range Complex No. 2.

6.3.5.3 Range Complex No. 3

Two soil samples were collected at Range Complex No. 3. As described in Section 5.5.3, one explosive (nitroglycerin) was detected above background; it is a potential MC from munitions used on site and is a CERCLA hazardous substance. The maximum detected nitroglycerin concentration (63 µg/kg) did not exceed the ESV of 54,990 µg/kg (see Section 6.3.4). Ecological risk due to nitroglycerin is not expected at Range Complex No. 3. However, MC may be present in the soil at the suspected OB/OD area identified during the site visit; therefore, ecological risk due to MC in soil cannot be ruled out.

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.1 SUMMARY

7.1.1 The SI performed on the former Sahuarita AFR in Pima County, Arizona, evaluated site-specific conditions to assess the potential for completed exposure pathways to human and ecological receptors at the site. The project was planned and performed with the goal of satisfying the DQOs set for the project: 1) evaluate potential presence of MEC; 2) evaluate potential presence of MC; 3) collect data needed to complete MRSPP scoring sheets; and 4) collect information for HRS scoring. Successful completion of the DQOs allowed determination of whether this FUDS project warrants further response action under CERCLA.

7.1.2 The SI evaluation included more than 44 miles of QR and the collection of 10 surface soil samples (plus one associated field duplicate) and three groundwater samples (plus one associated field duplicate). Eight of these samples were collected from biased locations representing areas with the highest likelihood for the presence of MEC or MC contamination. Two samples were collected from adjacent land buffers to provide ambient data.

7.1.3 STL in Arvada, Colorado, analyzed for explosives and metals in the soil and groundwater samples as well as for perchlorate in the groundwater samples. The detected analytes from the soil sampling were evaluated using the most conservative of the State of Arizona residential SRLs, USEPA Region 6 residential SSLs, or the USEPA Region 9 residential soil PRGs, as well as, USEPA Region 4 ESVs. The detected groundwater analytes that were MC-related and CERCLA hazardous substances (select metals and perchlorate) were compared to the more conservative value of USEPA Region 6 tap water screening levels and Region 9 tap water PRGs; all of these constituents were below screening levels.

7.1.4 Summaries for each MRS at the former Sahuarita AFR follow.

7.2 CONCLUSIONS REGARDING POTENTIAL MUNITIONS AND EXPLOSIVES OF CONCERN EXPOSURE PATHWAYS

7.2.1 Range Complex No. 1

No MEC other than unfired .50-caliber small arms rounds were observed during the QR in this MRS. Munitions debris (from practice bombs, illumination signals, and small

arms) was identified during the SI, and there is potential for MEC at the site; however, a removal action is not warranted at Range Complex No. 1 at this time.

7.2.2 Range Complex No. 2

No MEC were observed during the QR in this MRS. Munitions debris (from practice bombs, 20mm, and small arms) was identified during the SI, and there is potential for MEC at the site; however, a removal action is not warranted at Range Complex No. 2 at this time.

7.2.3 Range Complex No. 3

No MEC were observed during the QR in this MRS. However, there was evidence that HE bombs had been used at the site. The center of the target area was saturated with practice bomb debris, metal fragments created by the detonation of HE bombs were identified, and craters were observed. Munitions debris is present, and there is potential for MEC at the site; however, a removal action is not warranted at Range Complex No. 3 at this time.

7.3 CONCLUSIONS REGARDING POTENTIAL MUNITIONS CONSTITUENT EXPOSURE PATHWAYS

An exposure pathway is not considered to be completed unless all four of the following elements are present (USEPA, 1989):

- A source and mechanism for chemical release;
- An environmental transport/exposure medium;
- A receptor exposure point; and
- A receptor and a likely route of exposure at the exposure point.

Eight soil samples were collected from within the three MRSs at the former Sahuarita AFR. Concentrations were compared to three criteria to determine the need for a SLRA. For an analyte to be retained for the SLRA, it must exceed the background concentration, be a constituent of munitions potentially used on site, and it must be listed as a CERCLA hazardous substance. Three groundwater samples were collected within the MRSs. No background data was obtained and no ambient background samples were collected at the site; therefore, analytes detected in groundwater were retained for the SLRA if they were constituents of munitions potentially used on site and were listed as CERCLA hazardous substances.

7.3.1 Range Complex No. 1

Two soil samples were collected from Range Complex No. 1 and analyzed for explosive compounds and metals. No explosives were detected in the samples. Three analytes (barium, chromium, and nickel) were retained for the SLRA; however, the

concentrations were below the selected human health screening levels and only chromium exceeded the ESVs. One groundwater sample was collected and analyzed for explosive compounds, perchlorate, and metals. No explosives were detected in the sample, and detected MC-related metals and perchlorate concentrations were below screening levels. Based on these results, no human health risk is expected due to MC in soil or groundwater at Range Complex No. 1; however, ecological risk due to chromium in soil cannot be ruled out.

7.3.2 Range Complex No. 2

Four soil samples were collected and analyzed for explosive compounds and metals. No explosives were detected in the samples. Three analytes (barium, chromium, and nickel) were retained for the SLRA; however, the concentrations were below the selected human health screening levels, and only chromium exceeded the ESVs. Two groundwater samples were collected and analyzed for explosive compounds, perchlorate, and metals. No explosives were detected in the samples, and detected MC-related metals and perchlorate concentrations were below screening levels. Based on these results, no unacceptable human health risk is expected due to MC in soil at Range Complex No. 2; however, ecological risk due to chromium in soil cannot be ruled out. Unacceptable human health risk is not expected due to MC in groundwater at Range Complex No. 2; however, perchlorate results are inconclusive because samples could not be collected at an optimal location.

7.3.3 Range Complex No. 3

Two soil samples were collected and analyzed for explosive compounds and metals. One explosive compound was detected in one of the two samples, and metals were detected in both samples. The detected metals concentrations did not meet the requirements for a SLRA. The explosive compound was retained for the SLRA, but the detected concentration was below both human health and ESVs. Although risk due to MC was not identified through MC sampling, the SI field team observed a suspected OB/OD area with discolored soil within the boundary of Range Complex No. 3; therefore, MC may be present in the soil surrounding this suspected OB/OD area at concentrations that pose a human health or ecological risk. Human health and ecological risk due to MC at Range Complex No. 3 cannot be ruled out; therefore, further evaluation of MC in both soil and groundwater may be appropriate during the recommended RI/FS.

CHAPTER 8

RECOMMENDATIONS

All of the MRSs at the former Sahuarita AFR are recommended to proceed to RI/FS status, based on the following (see Table 8.1):

- Although no MEC have been observed or reported at the former Sahuarita AFR, historical documentation indicates that HE, practice munitions, and small arms ammunition were used during DoD use of the site from 1942 through 1978.

- During the SI visit, munitions debris from practice and/or explosive munitions was observed at each of the MRSs.

- As noted in Section 2.4.1, one of the range boundaries was inaccurately placed in the ASR supplement. The actual center of Bombing Target No. 3 is approximately ½ mile further south at a location shown on the ASR plates and confirmed during the SI visit. The acreage listed in this report matches that of the ASR Supplement and the report to Congress. However, the figures show the range boundaries as they are believed to be present and as shown in the ASR. The proposed new location for Bombing Target No. 3 would change the acreage of Range Complex No. 3 and should be evaluated further during the RI/FS.

- One munitions constituent (chromium) was detected at concentrations that exceeded ESVs at Range Complexes No. 1 and No. 2. Therefore, further evaluation of MC contamination may be warranted during the RI/FS.

- Suspected munitions constituents were visually identified during QR at a suspected OB/OD area. Therefore, further evaluation of MC in soil and groundwater at Range Complex No. 3 is recommended.

- As noted in Sections 3.5 and 5.2.4, access was not granted to two wells selected for biased sampling of possible perchlorate associated with JATO bottles identified during previous investigations near the runway. Perchlorate results at Range Complex No. 2 are therefore inconclusive, and further groundwater MC sampling should be considered during the RI/FS.

TABLE 8.1
RECOMMENDATIONS
SAHUARITA AFR, ARIZONA

MRS	Recommendation	Justification
Range Complex No. 1	RI/FS	Practice bomb debris, small arms munitions debris, other munitions debris, and unfired small arms munitions identified during SI. Possible ecological risk due to MC in soil.
Range Complex No. 2	RI/FS	Practice bomb debris, small arms munitions debris, 20mm munitions debris, and HE fragments identified during SI. Possible ecological risk due to MC in soil. Risk from perchlorate in groundwater is inconclusive because samples could not be collected at an optimal location.
Range Complex No. 3	RI/FS	Practice bomb debris, small arms munitions debris, unknown munitions debris, craters, and HE fragments identified during SI. The MRS boundary should be reevaluated to include the new location of Bombing Target No. 3. Possible ecological and human health risk due to MC in soil and possible migration to groundwater.

CHAPTER 9

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