Final
Engineering Evaluation/Cost Analysis

174th ATTACK WING
NEW YORK AIR NATIONAL GUARD
HANCOCK FIELD AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

Military Munitions Response Program

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LIST OF ACRONYMS/ABBREVIATIONS

ANG	Air National Guard
ANGB	Air National Guard Base
ARAR	Applicable or Relevant and Appropriate Requirements
AR/IR	administrative record/information repository
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
CSE	Comprehensive Site Evaluation
CSM	Conceptual Site Model
CY	cubic yard
°F	degrees Fahrenheit
DER	Division of Environmental Remediation
DERP	Defense Environmental Restoration Program
DMM	discarded military munitions
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
ft	foot or feet
Hancock Field	Hancock Field Air National Guard Base
HEAT	high explosive anti-tank
HHRA	Human Health Risk Assessment
IRP	Installation Restoration Program
ITRC	Interstate Technology Regulatory Council
ITSI	Innovative Technical Solutions, Inc.
LUC	land use control
MAJCOM	major command
MEC	munitions and explosives of concern
MC	munitions constituent
MD	munitions debris
mg/kg	milligrams per kilogram
mm	millimeter
MMRP	Military Munitions Response Program
MRA	Munitions Response Area
MRS	Munitions Response Site
msl	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NTCRA	Non-Time Critical Removal Action
NYANG	New York Air National Guard
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
RAO	Removal Action Objective
RCRA	Resource Conservation and Recovery Act
RMIS	Restoration Management Information System
RSL	Regional Screening Levels

SARA	Superfund Amendments and Reauthorization Act
SCO	Soil Cleanup Objective
SLERA	Screening Level Ecological Risk Assessment
SLHHRA	Screening Level Human Health Risk Assessment
TBC	to be considered
TCLP	Toxicity Characteristic Leaching Procedure
USACE	United States Army Corps of Engineers
USAF	United States Air Force
U.S.C.	United States Code
USEPA	United States Environmental Protection Agency
UUUE	unlimited use/unrestricted exposure
UXO	unexploded ordnance
WWII	World War II
XRF	x-ray fluorescence

EXECUTIVE SUMMARY

This Engineering Evaluation/Cost Analysis (EE/CA) is being performed in support of the Military Munitions Response Program (MMRP) at the Hancock Field Air National Guard Base (Hancock Field) located in Syracuse, New York. The purpose of the EE/CA is to identify the objectives of the removal action; evaluate the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives; and identify the recommended action for each Munitions Response Site (MRS). Two MRSs were previously identified at the facility warranting further munitions response actions:

MRS SR001, Smalls Arms Range and Shooting-In Buttress – This MRS was used for training by Hancock Field personnel, the New York Air National Guard, local reserve units, and local police. Ammunition used at the range reportedly included 7.62-millimeter (mm), .38-caliber, .45-caliber, and .50-caliber munitions as well as 5.56-mm and 9-mm ball munitions. Additionally, the access path to the small arms range may have been used for M-203 training with 40-mm practice grenades. The use of the small arms range was discontinued in 2002.

MRS SR002, Firing-In Buttress – This MRS was used as a backstop and safety berm for jammed ammunition rounds. It was also used by F-86 aircraft for test firing and boresight alignment (Sky Research, Inc., 2011). Ammunition used at the MRS reportedly included small arms ammunition of various calibers up to 0.50-caliber. According to an interview conducted during the Comprehensive Site Evaluation (CSE) Phase I, the area has been inactive since at least 1976.

Based on the CSE Phase I/II for the MRSs, it was determined that lead-impacted soils are present on the range floor and impact berm (SR001) and within the Firing-In Buttress (SR002). A future response action is necessary to mitigate potential hazards to human health and the environment based upon the CSE Phase II sampling results. Using criteria established by the United States Environmental Protection Agency (USEPA), three response action alternatives were evaluated and are listed below.

- Alternative One: No Action;
- Alternative Two: Institutional Controls; and,
- Alternative Three: Excavation and Offsite Disposal.

A brief summary of the evaluation criteria and comparative analyses detailed in this EE/CA is presented in Table E-1.

Table E-1. Summary of Alternatives Evaluation

Criteria	Alternative 1: No Action	Alternative 2: Institutional Controls	Alternative 3: Excavation & Offsite Disposal
1. Protects human health and the environment	No	No	Yes
2. Compliance with Appropriate, Relevant and Applicable Requirements	Yes	Yes	Yes
3. Effective long-term and permanent	No	No	Yes
4. Reduces toxicity, mobility, and/or volume	No	No	No
5. Effective short-term	No	No	Yes
6. Implementable	Yes	Yes	Yes
7. Cost (Net Present Value)	$0	$153,000	$808,000
8. State/Support Agency Acceptance	No	No	Probable
9. Community Acceptance	No	No	Probable

In summary, Alternative Three, Excavation and Offsite Disposal, meets evaluation criteria, removes lead-impacted soil from each MRS, is relatively easy to implement, is effective in both the short- and long-term, and will most likely be acceptable by regulatory agencies and the community. Public comments and responses to public comments on the selection of the preferred alternative will be incorporated into the Action Memorandum.

1.0 INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) was prepared to support a Non-Time Critical Removal Action (NTCRA) for the Small Arms Range and Shooting-In Buttress (SR001) and the Firing-In Buttress (SR002) Munitions Response Sites (MRSs) located at the Hancock Field Air National Guard Base (Hancock Field) in Syracuse, New York. MRSs SR001 and SR002 were delineated following investigation activities that identified soil impacts.

This EE/CA was performed to support the Military Munitions Response Program (MMRP) and prepared in accordance with the Air National Guard (ANG) Investigation Guidance (ANG, 2009), the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300.415, 2005), the Comprehensive Environmental Response Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA), and provisions set forth by the United States Environmental Protection Agency (USEPA) and the New York State Department of Environmental Conservation (NYSDEC).

1.1 PURPOSE AND SCOPE

This EE/CA presents an evaluation of removal action alternatives for two MRSs at Hancock Field based on results from the Comprehensive Site Evaluation (CSE) Phase I/II (Innovative Technical Solutions, Inc. [ITSI] and Shaw Environmental, Inc. [Shaw], 2009 and Sky Research, Inc. [Sky], 2011). The purpose of the EE/CA is to identify the objectives of the removal action; evaluate the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives; and identify the recommended action for each MRS. The EE/CA will be used to assist decision-makers in selecting an appropriate response action for each MRS. The primary objectives of the EE/CA are to:

- Summarize collective results from the CSE Phase I/II;
- Identify the removal action objective(s) (RAOs) for the removal action;
- Evaluate removal action alternatives and associated costs; and,
- Recommend a preferred removal action alternative.

1.2 STATUTORY AUTHORITY

In 1980, Congress passed CERCLA, also known as Superfund, which requires the identification, investigation, and cleanup of sites contaminated by past releases of hazardous substances. In 1986, Congress amended CERCLA to create the Defense Environmental Restoration Program (DERP) and its corresponding funding component, the Defense Environmental Restoration Account. This program is managed by the Office of the Deputy Under Secretary of Defense (Installations and Environment) within the Department of Defense (DoD).

Within the DERP, DoD has created two program categories to address sites and reduce risks to human health and the environment: (1) Installation Restoration Program (IRP) and (2) MMRP. In its earlier years, the DERP focused heavily on the identification, investigation, and cleanup of land impacted by historical defense operations and training activities under the IRP. In 2001, Congress enacted Title 10 of the United States Code (U.S.C.) §2710 which directed the DoD to develop an inventory of all defense sites within the United States known or suspected to contain munitions and explosives of concern (MEC) or munitions constituents (MCs). MEC includes unexploded ordnance (UXO), discarded military munitions (DMM), and MCs that may pose an explosive hazard. MCs are defined as those materials that originate from UXO, DMM, or other military munitions, including explosive and non-explosive materials and emission, degradation, or breakdown elements of such ordnance or munitions (10 U.S.C. 2710[e][4]). In addition, DoD developed, in consultation with representatives of the States and Indian tribes, a protocol for assigning a relative priority to all MRSs and establishing precedence for completing response actions. Therefore, the MMRP was established in 2001 to reflect the statutory program goals established for the DERP, to enhance the understanding of the nature of MRSs, and to manage response activities more effectively. MRSs identified as eligible for placement into the MMRP are based on two criteria:

- The facility or site qualifies as a defense site, defined as a site that is or was owned by, leased to, or otherwise possessed by the United States and under the jurisdiction of the Secretary of Defense. Defense sites do not include operational ranges, operating storage or manufacturing facilities, or facilities used for or previously permitted for the treatment or disposal of military munitions.
- A non-defense site, provided that contamination attributable to DoD has migrated from a defense site (e.g., by groundwater) or military munitions have come to be located on the site from a defense site (e.g., munitions landing off an operational range that were not promptly retrieved."

In response to the requirements outlined in Title 10 U.S.C. §2710 in October 2005, the DoD published the finalized MRS Prioritization Protocol for consistently assigning a relative priority for munitions response actions at MRSs.

1.3 STAKEHOLDERS

Project stakeholders include agencies/parties that provide oversight of removal response actions and review of project documents to ensure that removal response actions satisfy the RAOs, are cost effective, and are protective of human health and the environment. Stakeholders for this project include:

- ANG;
- USEPA;
- NYSDEC; and,
- The City of Syracuse.

2.0 SITE CHARACTERIZATION

The information contained in the following sections was collected from previous investigation reports, soil survey reports, and a site visit.

2.1 DESCRIPTION AND HISTORY

2.1.1 Installation

Hancock Field, as shown in Figure 2-1, is located at the Syracuse Hancock International Airport, approximately 5 miles north of the City of Syracuse in Onondaga County, New York. It encompasses approximately 357 acres and consists of several buildings and operational facilities. The installation is divided into two tracts of land: Tract II and Tract III. Tract II encompasses approximately 87 acres and includes MRA SR001 and Tract III encompasses approximately 270 acres and includes MRA SR002. Both tracts are owned by the United States Air Force (fee-owned) with a license to New York State for ANG use. The City of Syracuse owns the land bordering Tract II and the land north of Tract III.

In 1942, Hancock Field, formerly Mattydale Bomber Base, was constructed along with three 5,500-foot (ft) runways. The facility was built to serve as a staging and storage area for repairing and re-outfitting B-17 and B-24 aircraft used in World War II (WWII). The base was also used by the First Concentration Command, later known as the Air Service Command, to assemble and test B-24 aircraft. In 1946, the City of Syracuse took control of the Mattydale Bomber Base, and in 1948, the base was dedicated as a commercial airfield. The Clarence E. Hancock Airport opened in September 1949, attaining international airport status in 1970. Over the last few decades, both the mission and physical size of the Hancock Field (military) installation have been reduced from the initial WWII capacity. Much of the airbase, including the runways, was converted to civilian use as the Syracuse Hancock International Airport (ITSI/Shaw, 2009 and Sky, 2012).

Currently, Hancock Field is home to the 174th Attack Wing of the New York ANG (NYANG). The 174th began as the 138th Fighter Squadron on October 28, 1947. In 1962, the 138th was officially renamed the 147th Tactical Fighter Group. In 1979, there was a status change from Tactical Fighter Group to Tactical Fighter Wing. In 1992, the Tactical Fighter Wing was re-designated the 174th Fighter Wing. In 2012, the 174th Fighter Wing was renamed to the 174th Attack Wing. Aircraft historically utilized by the unit include the P-47D Thunderbolt, F-84B Thunderjet, F-86H Sabre, A-10A Thunderbolt II, and F-16A Fighting Falcon (Sky, 2012). The installation's mission is to maintain well-trained, well-equipped units available for prompt mobilization during war and provide assistance during national emergencies (such as natural disasters or civil disturbances). During peacetime, the combat-ready units and support units are

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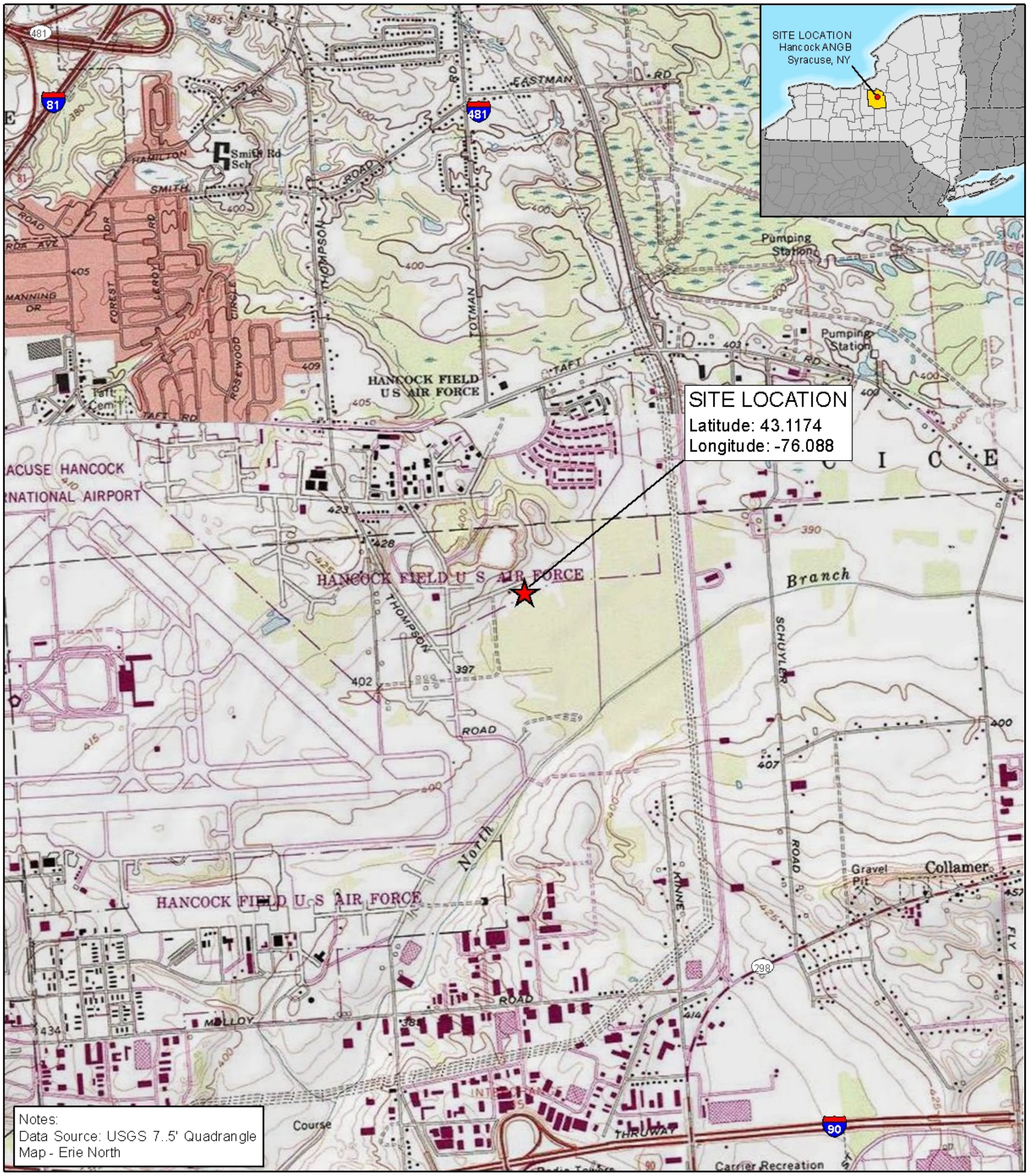


New York Air National Guard Syracuse, New York		N	**FIGURE 2-1** **Installation Location Map** Engineering Evaluation/Cost Analysis 174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

Scale	Date	File
0 0.5 1 2 Kilometers	03/09/2012	File: ANG_Hancock_Installation_Loc_EECA.mxd
0 0.25 0.5 1 1.5 Miles	PROJ: 912810001	Drawn: JBO

assigned to most United States Air Force (USAF) major commands (MAJCOMs) to carry out missions compatible with training, mobilization readiness, and humanitarian and contingency operations. Mission-related activities include vehicle, aircraft, and runway maintenance, fueling operations, and military training operations.

2.1.2 MRS SR001, Small Arms Range and Shooting-In Buttress

MRS SR001 encompasses approximately 1.9 acres of land located within Munitions Response Area (MRA) SR001, Small Arms Range and Shooting-In Buttress (Figure 2-2). The area defined as MRS SR001 (Figure 2-3) was delineated during the 2011 CSE Phase II and consists of approximately 0.63 acres located within the former small arms range and approximately 1.27 acres of land historically used as a practice grenade range. A description of the MRA SR001 is presented below and a summary of the results of the CSE Phase II is presented in Section 2.1.4.2.

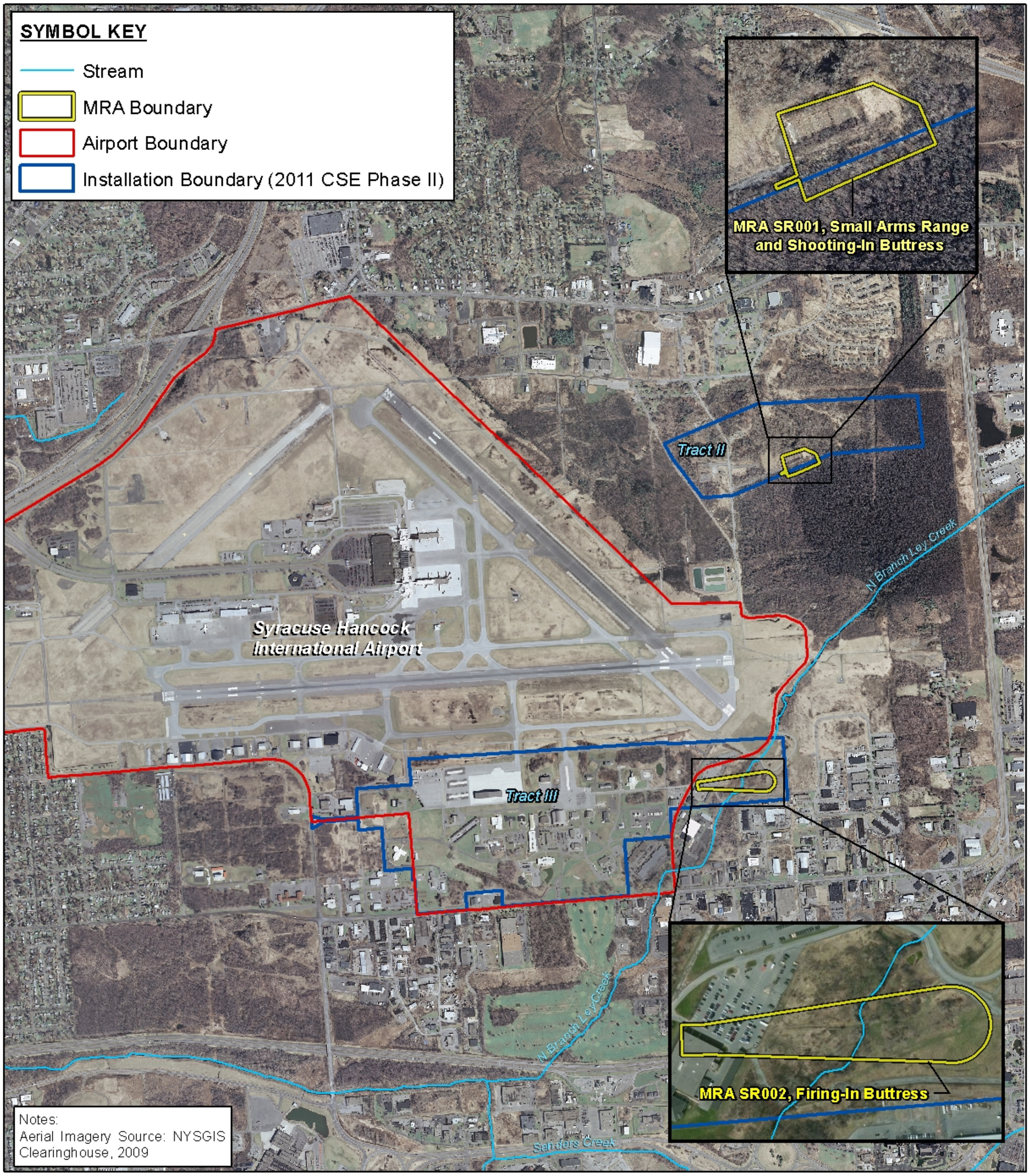
The Shooting-In Buttress was constructed during the WWII era. Historical documents do not indicate the types of munitions used, the frequency of use, or when activities ended (ITSI/Shaw, 2009).

The small arms range was constructed in the 1960s and used for training by Hancock Field personnel, the NYANG, local reserve units, and local police. The Shooting-In Buttress may have been removed during construction of the small arms range. According to historical documents, the berm may have been used to construct a portion of the small arms range berm. Ammunition potentially used prior to 1986 at the range included 7.62-millimeter (mm), .38-caliber, .45-caliber, and .50-caliber munitions. Small arms use after 1986 consisted of 5.56-mm and 9-mm ball munitions. The use of the small arms range was discontinued in 2002 (ITSI/Shaw, 2009).

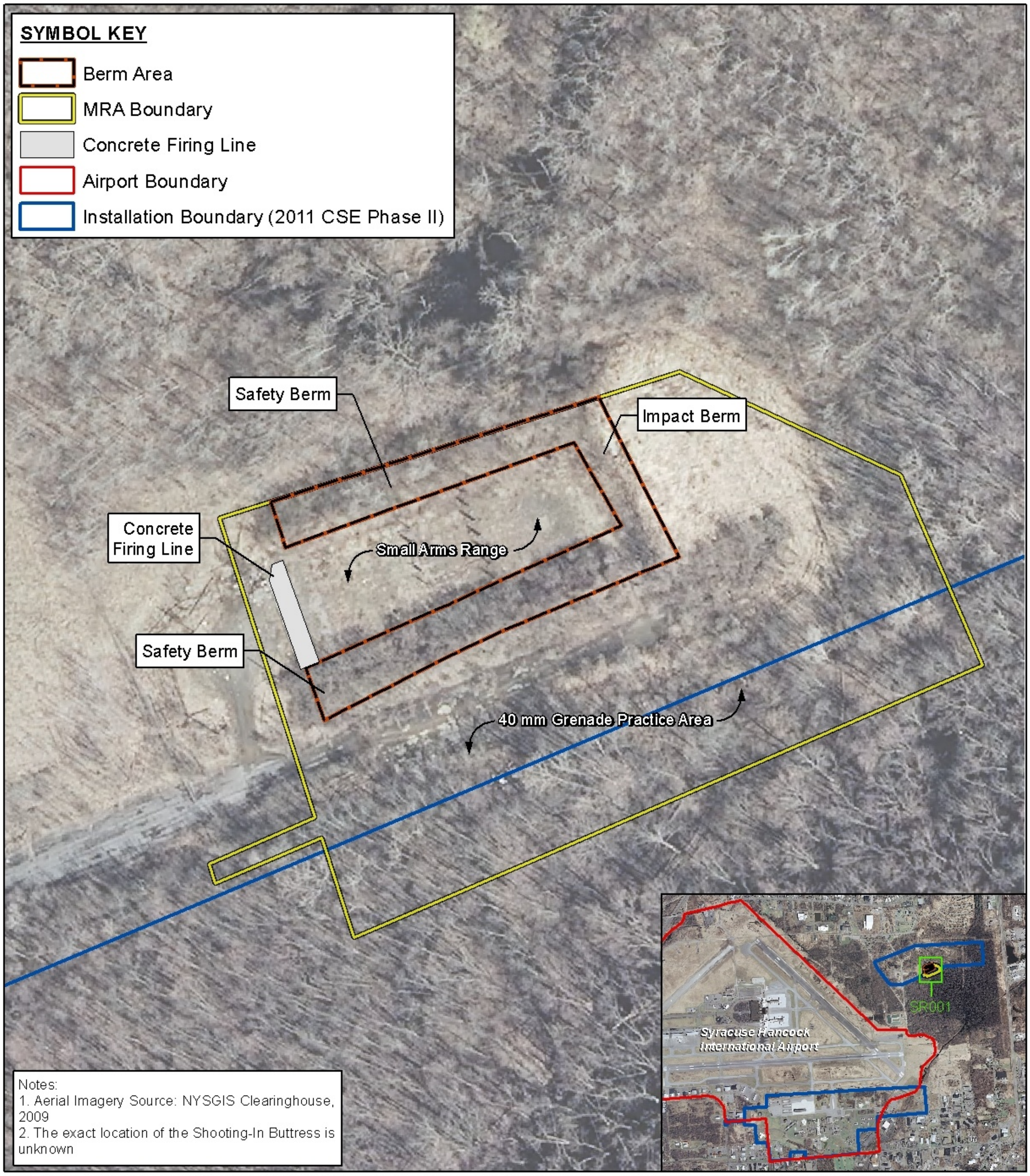
Currently, MRS SR001 consists of vacant land with remnants of berms and small arms facilities. On-site berms consist of safety berms located on the north and south and an impact berm to the east of the site. The berms range in height from 12 to 15 ft and are densely vegetated. A concrete firing pad remains on the western extent of the range. Remnants of large target frames made of wooden utility poles are located throughout the range. Many target structures remain upright and have small arms projectiles imbedded in the front sides (ITSI/Shaw, 2009).

2.1.3 MRS SR002, Firing-In Buttress

MRS SR002 encompasses approximately 0.03 acres of land located within the Firing-In Buttress. The area defined as MRS SR002 was delineated during the 2011 CSE Phase II and consists of the Firing-In Buttress, a wood and concrete structure and the soil within the structure. A description of the MRA SR002 is presented below and a summary of the results of the CSE Phase II is presented in Section 2.1.4.2.



New York Air National Guard Syracuse, New York		N	FIGURE 2-2 Site Location Map Engineering Evaluation/Cost Analysis 174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY	
0 0.5 1 2 Kilometers 0 0.25 0.5 1 1.5 Miles			03/12/2012	File: ANG_Hancock_Site_Loc_Map_MRS_EECA.mxd
			PROJ: 912810001	Drawn: JBO



New York Air National Guard
Syracuse, New York

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FIGURE 2-3
MRA SR001 - Site Map
Engineering Evaluation/Cost Analysis
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 50 100 200 300 400 Feet
0 25 50 100 Meters

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The MRS consists of the Firing-In Buttress, constructed of wooden railroad ties, concrete, and sod. According to the CSE Phase I, the top of the structure is comprised of eight rows of wooden railroad ties with a concrete slab over the wooden ties and sod covering the concrete. The side supports consists of 13 rows of wooden railroad ties. The opening of the structure is approximately 15 ft high and 80 ft wide. The inside of the wooden structure contains the soil impact berm. It is not known when activities began at the site; however, it is thought that the Firing-In Buttress (Figure 2-4) was used on rare occasions. The intended use of the site was as a backstop and safety berm for jammed rounds (ITSI/Shaw, 2009). It was also used by F-86 aircraft test firing and boresight alignment of up to .50-caliber ammunition (Sky, 2012). According to an interview conducted during the CSE Phase I, the area has been inactive since at least 1976 (ITSI/Shaw, 2009).

Currently, MRS SR002 is vacant and contains dense vegetation consisting of shrubs and trees. The wooden portion of the Firing-In Buttress structure is still present and largely intact.

2.1.4 Previous Investigations

Investigations conducted prior to this EE/CA at SR001 and SR002 include:

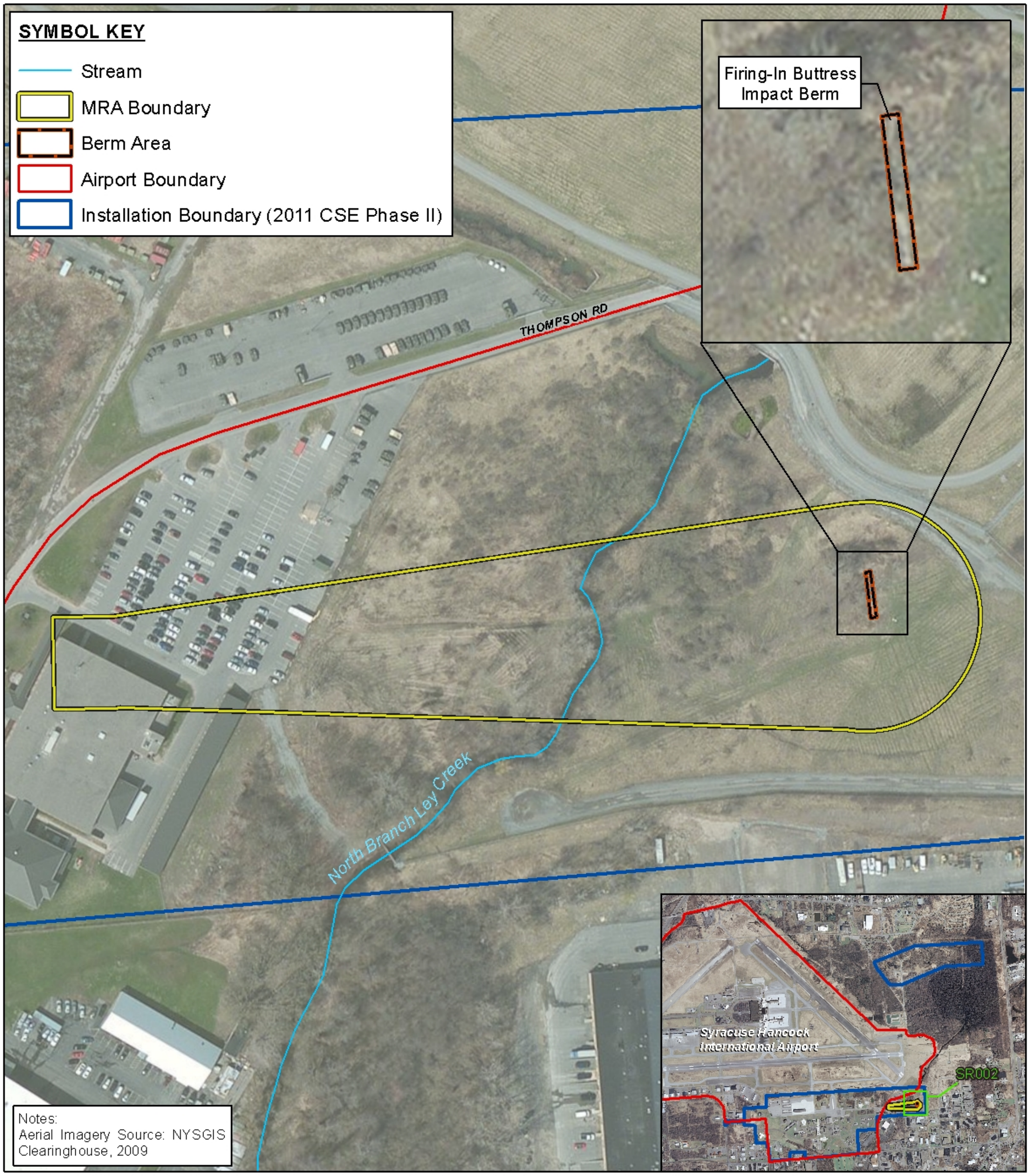
- Modified CSE Phase I (ITSI/Shaw, 2009); and,
- CSE Phase II (Sky Research, Inc. [Sky], 2011).

2.1.4.1 Modified Comprehensive Site Evaluation Phase I

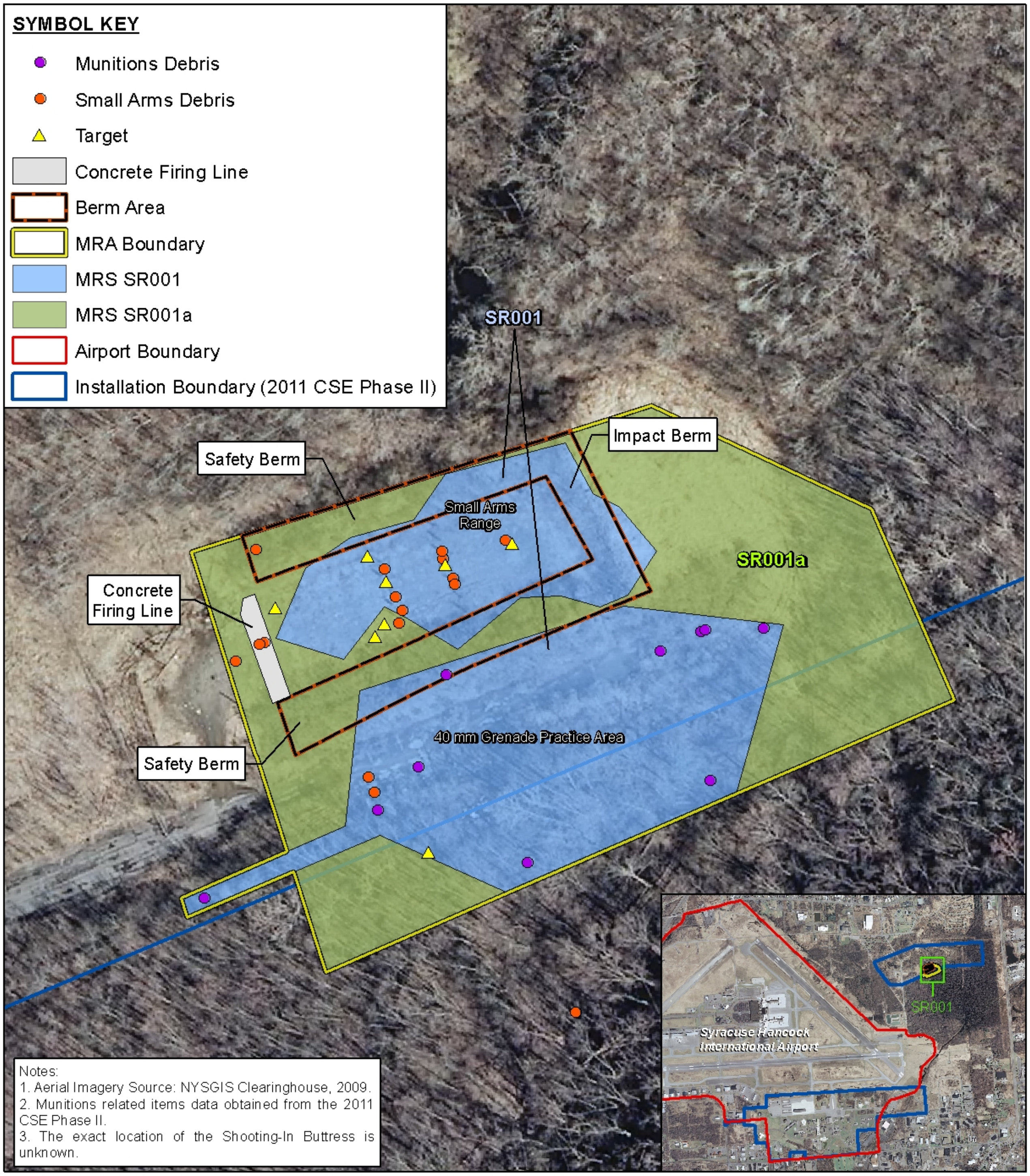
In 2009, a CSE Phase I was performed to identify potential MRAs, evaluate actual or potential releases of MC to the environment, and evaluate associated targets of concern. The CSE Phase I investigated ten potential MRAs at Hancock Field including MRAs SR001 and SR002. Based on the findings of the CSE Phase I, it was determined that there was no evidence of MC releases that would warrant immediate action. However, a potential for environmental impacts from MC to have occurred was identified at MRAs SR001 and SR002. No Further Action (NFA) or transfer to the Formerly Used Defense Sites Program was recommended for the remaining eight MRAs. The CSE Phase I identified lead, copper, and iron as the primary MCs of concern at MRAs SR001 and SR002. Additionally, a 3.5-inch high-explosive anti-tank (HEAT) rocket was identified at the Firing-In Buttress, MRA SR002, which resulted in explosives being included as constituents of concerns (COCs). It was recommended that a CSE Phase II be conducted at these two MRAs to assess the potential for environmental release of MC (ITSI/Shaw, 2009). Results of the CSE Phase I are shown on Figures 2-5 and 2-6.

2.1.4.2 Comprehensive Site Evaluation Phase II

Based on the recommendations from the CSE Phase I, a CSE Phase II was conducted for MRAs SR001 and SR002 in 2010. The objectives of the CSE Phase II were to determine whether releases of MC to the environment had occurred, determine if there was a need for an emergency

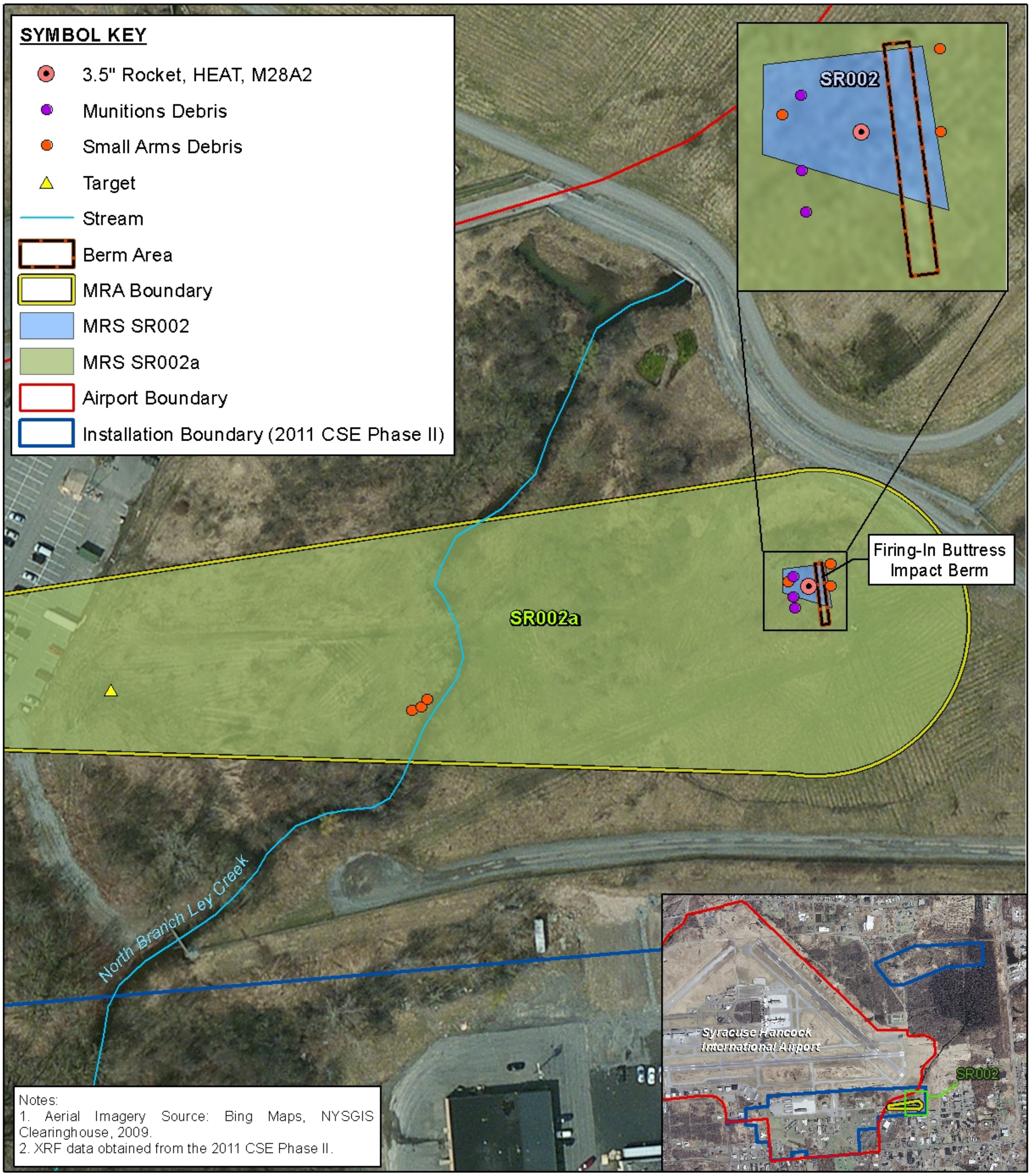


New York Air National Guard Syracuse, New York		N	**FIGURE 2-4** **MRA SR002 - Site Map** Engineering Evaluation/Cost Analysis 174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY
0 75 150 300 450 600 Feet 0 25 50 100 150 200 Meters		03/12/2012	File: ANG_Hancock_Site_Map_SR0002_ EECA.mxd
		PROJ: 912810001	Drawn: JBO



New York Air National Guard Syracuse, New York		N	**FIGURE 2-5** **CSE Phase I & II Visual Survey Results, MRA SR001** Engineering Evaluation/Cost Analysis 174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

Scale	Date	File / Drawn	
0 50 100 200 300 400 Feet	12/05/2012	File: ANG_Hancock_PhaseI_II_VisSurv_SR001_EECA.mxd	
0 25 50 100 Meters	PROJ: 912810001	Drawn: JBO	



New York Air National Guard
Syracuse, New York

FIGURE 2-6
CSE Phase I & II Visual Survey Results, MRA SR002
Engineering Evaluation/Cost Analysis
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

05/17/2012	File: ANG_Hancock_PhaseI_II_VisSurv_ SR002_EECA.mxd	
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response, and/or whether other munitions response actions were necessary. The CSE Phase II activities were conducted between 8 September and 17 September, 2010, and included visual surveys, x-ray fluorescence (XRF) sampling of surface and subsurface soil, a human health risk assessment, and an ecological risk assessment (Sky, 2012).

While the CSE Phase I identified copper, lead and iron as primary MCs of concern, MC sampling conducted during the CSE Phase II did not include the analysis of copper and iron. Based upon experience at other small arms ranges, lead is the most pervasive of these constituents. Therefore, lead soil concentrations were utilized to delineate the extent of contamination within the MRAs.

Due to the use of XRF technology to analyze lead concentrations in soil, a correlation analysis was conducted to compare XRF results and laboratory results. The method of applicability analysis concluded that an XRF reading of 261 milligrams per kilogram (mg/kg) correlated to a laboratory result of 400 mg/kg; therefore, 261 mg/kg was used as the XRF screening criterion for the delineation of lead impacted soil (Sky, 2012).

<u>MRA SR001, Small Arms Range and Shooting-In Buttress</u>

During the visual survey of MRA SR001, evidence of small arms use was observed by identifying small arms casings and lead projectiles of various calibers (Figure 2-5). In addition, the following munitions debris (MD) items were observed:

- 40-mm practice grenade debris;
- Smoke canister debris;
- Non-lethal offensive grenade debris; and,
- Small amounts of clay target debris.

The CSE Phase II indicated that no evidence of MEC was observed during the visual survey of the site. Since no MEC was identified, the collection and analysis of soil samples for explosives was not warranted.

As shown on Figure 2-7, XRF samples were collected and analyzed from MRA SR001. The XRF results ranged from 22 mg/kg to 5,217 mg/kg, and are presented in Table 2-1. Fifteen samples exceeded the modified screening level for lead of 261 mg/kg. Samples that exceeded the modified screening level were located primarily at depths of 0 to 6 inches bgs; however, 3 samples exceeded the modified screening level at the 6 to 12 inch interval and 1 sample exceeded the modified screening level at the 12 to 18 inch interval. The samples that exceeded the modified screening level were located within the small arms range, primarily between the concrete firing line and the impact berm (Figure 2-7).

As lead exceeded the modified screening level of 261 mg/kg, a Screening Level Human Health Risk Assessment (SLHHRA) and a Screening Level Ecological Risk Assessment (SLERA) were performed for MRA SR001. The results indicated that lead was present at concentrations that

Table 2-1. XRF Sampling Results
MRA SR001

Sample ID	Analysis Date/Time	Depth Interval (in. bgs)	Lead Concentration (mg/kg)
C-XR-HF-01-SS-004	9/11/2010 14:57	0 - 6	100
C-XR-HF-01-SS-009	9/11/2010 10:27	0 - 6	**336**
C-XR-HF-01-SS-101	9/11/2010 11:01	0 - 6	**648**
C-XR-HF-01-SB1-101	9/13/2010 13:23	6 - 12	88
C-XR-HF-01-SS-102	9/11/2010 9:29	0 - 6	234
C-XR-HF-01-SS-103	9/11/2010 15:11	0 - 6	**630**
C-XR-HF-01-SB1-103	9/14/2010 14:41	6 - 12	158
C-XR-HF-01-SS-104	9/11/2010 11:42	0 - 6	**1,804**
C-XR-HF-01-SB1-104	9/14/2010 13:40	6 - 12	**278**
C-XR-HF-01-SS-105	9/11/2010 9:44	0 - 6	**4,096**
C-XR-HF-01-SB1-105	9/13/2010 12:27	6 - 12	**371**
C-XR-HF-01-SB2-105	9/13/2010 16:39	12 - 18	141
C-XR-HF-01-SS-106	9/11/2010 13:15	0 - 6	**302**
C-XR-HF-01-SB1-106	9/14/2010 12:54	6 - 12	60
C-XR-HF-01-SS-107	9/11/2010 13:55	0 - 6	56
C-XR-HF-01-SS-108	9/11/2010 13:35	0 - 6	**257**
C-XR-HF-01-SB1-108	9/14/2010 14:23	6 - 12	50
C-XR-HF-01-SS-109	9/11/2010 13:47	0 - 6	261
C-XR-HF-01-SB1-009	9/13/2010 13:46	6 - 12	229
C-XR-HF-01-SS-110	9/11/2010 11:31	0 - 6	**4,411**
C-XR-HF-01-SB1-110	9/14/2010 14:33	6 - 12	123
C-XR-HF-01-SS-111	9/11/2010 12:52	0 - 6	**1,009**
C-XR-HF-01-SB1-111	9/14/2010 15:13	6 - 12	124
C-XR-HF-01-SS-112	9/11/2010 10:43	0 - 6	**5,217**
C-XR-HF-01-SB1-112	9/14/2010 13:12	6 - 12	**902**
C-XR-HF-01-SB2-112	9/14/2010 12:36	12 - 18	**323**
C-XR-HF-01-SB3-112	9/15/2010 14:57	18 - 24	172
C-XR-HF-01-SS-113	9/11/2010 15:03	0 - 6	97
C-XR-HF-01-SS-114	9/11/2010 11:13	0 - 6	**309**
C-XR-HF-01-SB1-114	9/13/2010 15:08	6 - 12	64
C-XR-HF-01-SS-151	9/11/2010 14:03	0 - 6	**294**
C-XR-HF-01-SS-152	9/11/2010 12:02	0 - 6	49
C-XR-HF-01-SS-153	9/11/2010 14:28	0 - 6	73
C-XR-HF-01-SS-154	9/11/2010 16:31	0 - 6	69
C-XR-HF-01-SS-155	9/13/2010 11:39	0 - 6	29
C-XR-HF-01-SS-156	9/13/2010 12:02	0 - 6	47
C-XR-HF-01-SS-157	9/13/2010 13:33	0 - 6	47
C-XR-HF-01-SS-158	9/11/2010 15:37	0 - 6	46
C-XR-HF-01-SS-301	9/13/2010 10:33	0 - 6	25
C-XR-HF-01-SS-302	9/13/2010 10:40	0 - 6	29
C-XR-HF-01-SS-303	9/14/2010 15:06	0 - 6	43
C-XR-HF-01-SS-304	9/13/2010 13:16	0 - 6	178
C-XR-HF-01-SS-305	9/14/2010 13:57	0 - 6	43
C-XR-HF-01-SS-306	9/14/2010 13:05	0 - 6	36
C-XR-HF-01-SS-307	9/14/2010 14:14	0 - 6	62
C-XR-HF-01-SS-308	9/14/2010 13:18	0 - 6	132
C-XR-HF-01-SS-401	9/14/2010 17:00	0 - 6	37
C-XR-HF-01-SS-402	9/14/2010 16:02	0 - 6	66

Table 2-1. XRF Sampling Results
MRA SR001

Sample ID	Analysis Date/Time	Depth Interval (in. bgs)	Lead Concentration (mg/kg)
C-XR-HF-01-SS-403	9/15/2010 13:20	0 - 6	99
C-XR-HF-01-SS-601	9/15/2010 14:12	0 - 6	78
C-XR-HF-01-SS-602	9/15/2010 15:03	0 - 6	22
C-XR-HF-01-SS-701	9/16/2010 11:54	0 - 6	199
C-XR-HF-01-SS-702	9/16/2010 11:59	0 - 6	30
C-XR-HF-01-SS-801	9/17/2010 11:54	0 - 6	27

Notes:
Highlighted cells indicate sample results that exceed the modified soil screening criteria of 261 mg/kg.
bgs – below ground surface
in. – inch(es)
mg/kg – milligrams per kilogram

may present a human health risk under a residential land use scenario. Additionally, lead exceeded ecological risk screening criterion intended to be protective of soil invertebrates, plants, and wildlife (Sky, 2012).

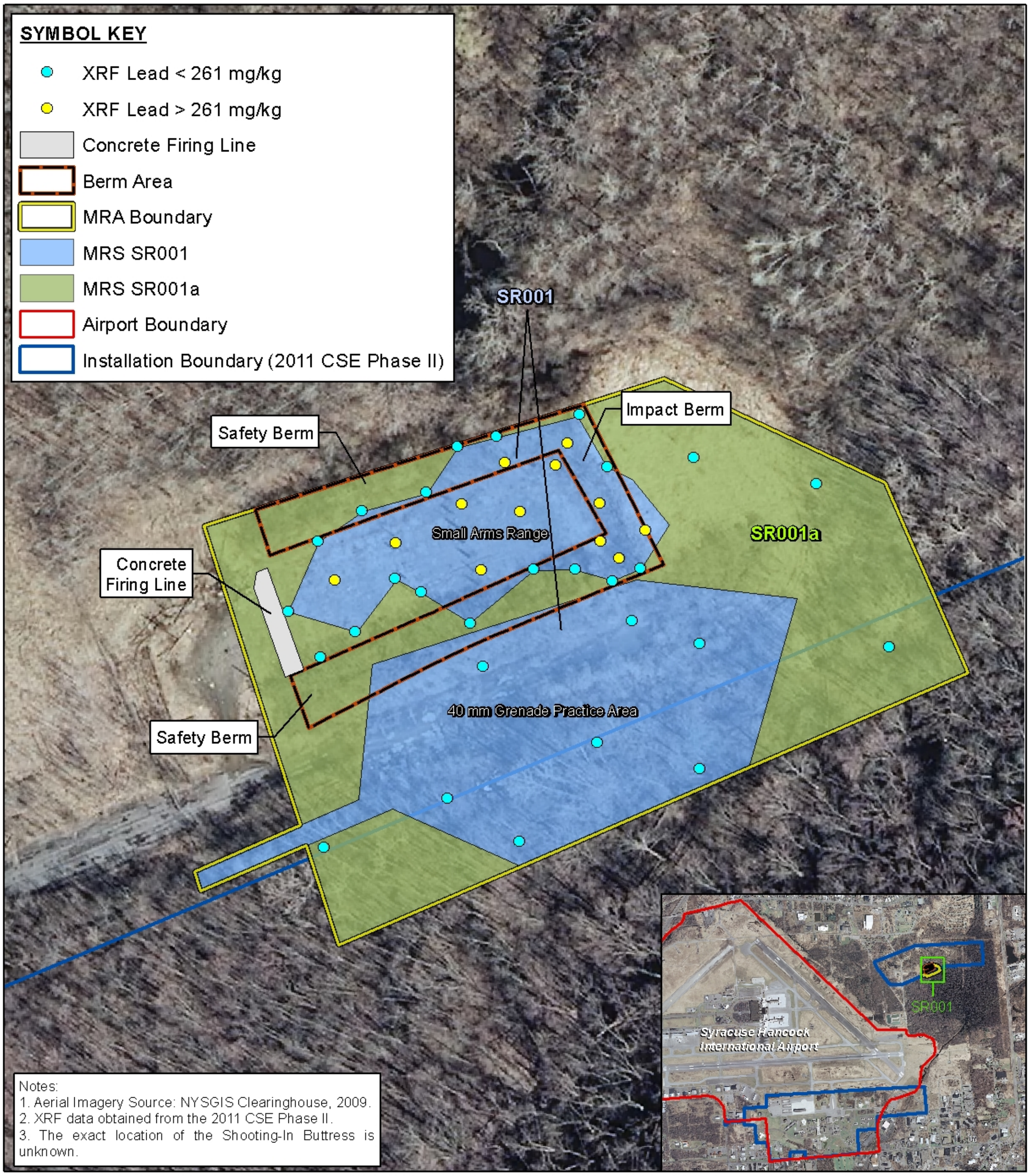
Based on the results of the CSE Phase II, MRA SR001 was divided into two MRSs. Further munitions response was recommended for approximately 1.9 acres, designated as MRS SR001 (Figure 2-7). The CSE Phase II also recommended NFA for approximately 1.8 acres, designated as MRS SR001a (Figure 2-7) (Sky, 2012).

MRA SR002, Firing-In Buttress

Evidence of small arms use was observed during the visual inspection at SR002 Figure 2-6), and included the following:

- Blank 5.56-mm casings;
- Plastic small arms 5.56-mm magazine; and,
- 0.50 caliber steel cores.

In addition to the small arms identified during the visual inspection, 20-mm target practice MD and a rocket spacer were observed (Sky, 2012). Although the CSE Phase I identified explosives as a constituent of concern due to the identification of the 3.5-inch HEAT rocket, samples were not analyzed for explosives during the CSE Phase II because no other evidence of MEC was observed. The CSE Phase II indicated that significant evidence of MEC use was not identified during the visual survey and that the rocket found at the Firing-In Buttress did not constitute a significant enough source to warrant sampling (Sky, 2012).



New York Air National Guard Syracuse, New York		N	**FIGURE 2-7** **CSE Phase II XRF Results, MRA SR001** Engineering Evaluation/Cost Analysis 174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY	
0 50 100 200 300 400 Feet			12/05/2012	File: ANG_Hancock_XRF_SR0001_ EECA.mxd
0 25 50 100 Meters			PROJ: 912810001	Drawn: JBO

As shown in Figure 2-8, XRF samples were collected and analyzed for lead at MRA SR002. The XRF results ranged from below the detection limit to 585 mg/kg, and are presented in Table 2-2. Three samples exceeded the modified screening level for lead of 261 mg/kg at depths ranging from 0 to 18 inches bgs. These samples were located within and at the center of the Firing-In Buttress (Sky, 2012).

As lead exceeded the modified screening level of 261 mg/kg, a SLHHRA and SLERA were performed for MRA SR002. The results indicated that lead concentrations were not likely to present a significant human health risk under a residential land use scenario. However, the assessment concluded that lead was present at concentrations that exceeded ecological risk screening criterion intended to be protective of soil invertebrates, plants, and wildlife.

Based on the results of the CSE Phase II, MRA SR002 was divided into two MRSs. Further munitions response was recommended for approximately 0.03 acres, designated as MRS SR002. It also recommended NFA for approximately 5.7 acres, designated as MRS SR002a (Figure 2-8).

Table 2-2. XRF Sampling Results MRA SR002

Sample ID	Analysis Date /Time	Depth (inches bgs)	Lead Concentration (mg/kg)
C-XR-HF-02-SS-201A	9/13/2010 10:16	0 - 6	103
C-XR-HF-02-SS-202	9/11/2010 15:44	0 - 6	< LOD
C-XR-HF-02-SS-203	9/11/2010 10:06	0 - 6	16
C-XR-HF-02-SS-204	9/13/2010 11:09	0 - 6	24
C-XR-HF-02-SS-205	9/13/2010 10:52	0 - 6	23
C-XR-HF-02-SS-206	9/13/2010 11:33	0 - 6	19
C-XR-HF-02-SS-207A	9/11/2010 15:50	0 - 6	30
C-XR-HF-02-SS-208	9/13/2010 11:51	0 - 6	18
C-XR-HF-02-SS-209A	9/11/2010 9:56	0 - 6	**368**
C-XR-HF-02-SB1-209B	9/14/2010 15:39	6 - 12	**585**
C-XR-HF-02-SB2-209B	9/14/2010 16:11	12 - 18	**431**
C-XR-HF-02-SB3-209B	9/14/2010 16:51	18 - 24	195
C-XR-HF-02-SS-251	9/13/2010 10:47	0 - 6	15
C-XR-HF-02-SS-252	9/13/2010 12:39	0 - 6	17
C-XR-HF-02-SS-253	9/13/2010 11:56	0 - 6	17
C-XR-HF-02-SS-254	9/13/2010 11:46	0 - 6	24
C-XR-HF-02-SS-255	9/13/2010 11:29	0 - 6	21
C-XR-HF-02-SS-256	9/13/2010 11:15	0 - 6	18
C-XR-HF-02-SS-257	9/11/2010 16:26	0 - 6	< LOD
C-XR-HF-02-SS-351	9/13/2010 11:03	0 - 6	14
C-XR-HF-02-SS-352	9/13/2010 12:34	0 - 6	22
C-XR-HF-02-SS-353	9/13/2010 10:26	0 - 6	27
C-XR-HF-02-SS-502	9/15/2010 12:11	0 - 6	14
C-XR-HF-02-SS-503B	9/14/2010 15:19	0 - 6	24
C-XR-HF-02-SS-504B	9/14/2010 15:25	0 - 6	31
C-XR-HF-02-SS-519	9/15/2010 14:39	0 - 6	13

Notes:
Highlighted cells indicate sample results that exceed the modified soil screening criteria of 261 mg/kg.
bgs – below ground surface
< LOD= below the limit of detection. The limit of detection is approximately 12 mg/kg based on the lowest observed value at Hancock Field.
mg/kg – milligrams per kilogram

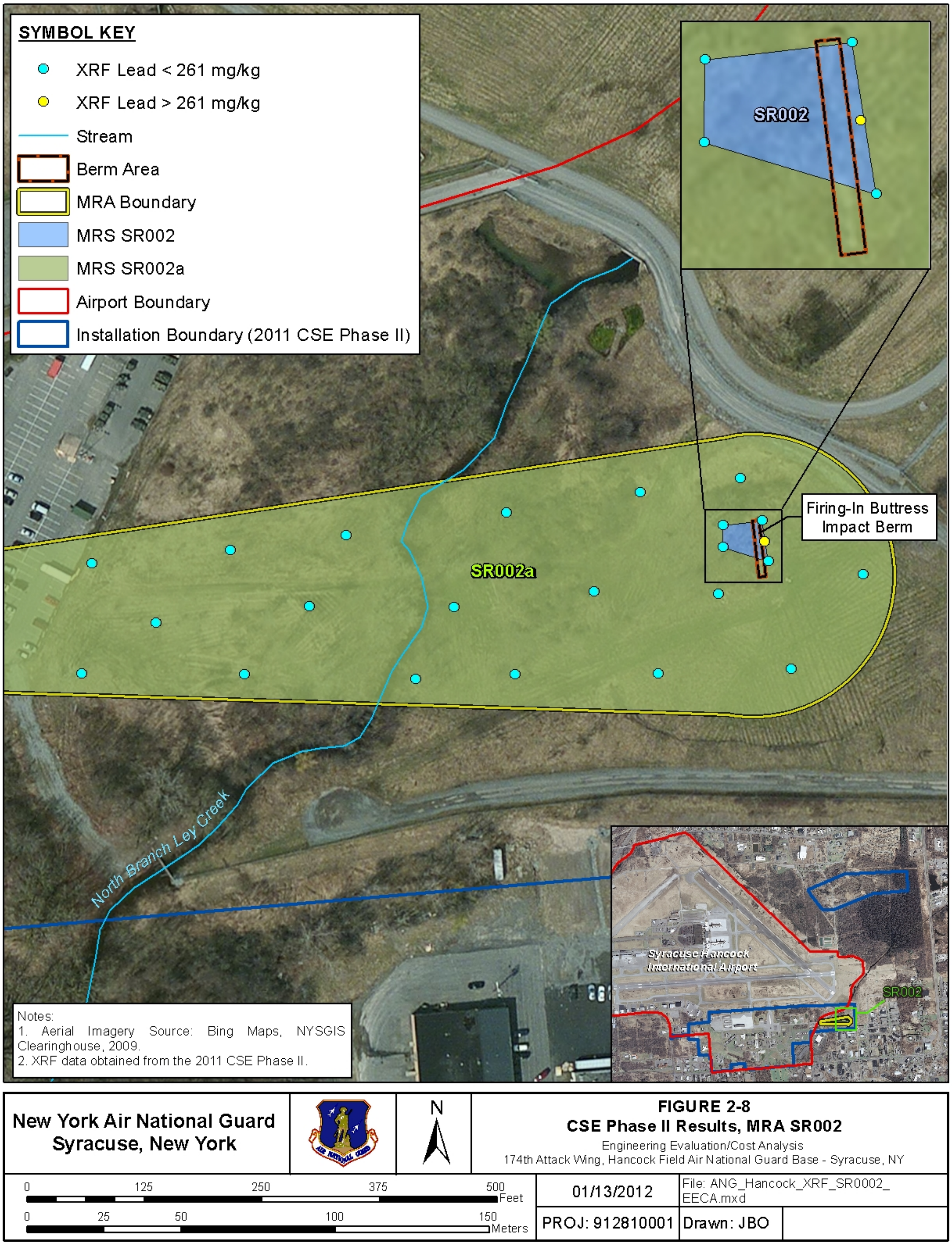


FIGURE 2-8
CSE Phase II Results, MRA SR002
Engineering Evaluation/Cost Analysis
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

2.2 SITE CONDITIONS

2.2.1 Surrounding Land Use

Hancock Field is located in Onondaga County, approximately 5 miles from downtown Syracuse New York. Land use at Hancock Field is classified as industrial. The Hancock Field facility is bordered on the north by airport property owned by the City of Syracuse, and to the east, south, and west by commercial/industrial developments.

2.2.2 Climate

The climate at Hancock Field is mild during summer and very cold during winter with abundant precipitation. Monthly mean high temperature ranges from 31 degrees Fahrenheit (°F) in January to 82°F in July. Monthly mean low temperature ranges from 15°F in January to 60°F in July. Average annual precipitation is approximately 38.3 inches. Annual mean snowfall is approximately 107.1 inches (ITSI/Shaw, 2009).

2.2.3 Topography

Hancock Field is located within the Ontario-Mohawk Lowland Region of the Central Lowland Physiographic Province, which extends to Buffalo, New York. This province has a relatively flat topography created by glacial erosion and deposition during the Wisconsin Glaciation. The installation is part of an area of flat lowlands situated between Lake Ontario and the Onondaga Escarpment in Syracuse, New York. Topography across the installation rises gradually from approximately 385 ft above mean sea level (msl) at the southeast end of the installation to approximately 425 ft above msl at the west-northwest part of the installation (ITSI/Shaw, 2009).

2.2.4 Natural and Cultural Resources

There are three animal species listed as endangered by the state of New York; including, two reptiles, the Bog Turtle and Eastern Massasauga Rattlesnake, and one animal species, the Black Tern, and are protected by the state. Six plant species identified within 4 miles of Syracuse are listed by the state as rare, vulnerable, or threatened, according to the NYSDEC Wildlife Resources Center. The six plant species are the Weak Stellate Sedge, Large Twayblade, Southern Twayblade, Pod Grass, Calypso, and Marsh Valerian. It is unknown if any of the species are present at Hancock Field. No threatened or endangered species have been observed at any of the MRSs. There are no archaeological or cultural sites present at either MRS (ITSI/Shaw, 2009).

2.2.5 Soils

Soils at Hancock Field are generally composed of silty soils with varying amounts of clay and fine to medium sand. A description of the soils for both MRSs is presented below.

Soils within MRSs SR001 and SR002 consist primarily of fill soil with smaller areas of Galen and Minoa soil series. Fill soil is difficult to characterize due to its heterogeneous nature. Land that has been affected by cutting and/or filling will exhibit varying characteristics based on the degree of alteration and the composition of fill material. The fill soil at MRSs SR001 and SR002 consists of gravel and clayey material, which may extend to greater than 2 ft below ground surface (bgs).

2.2.6 Geology and Hydrogeology

Hancock Field is located in an area of flat lowlands between Lake Ontario and the Onondaga Escarpment. Multiple layers underlie the base, including unconsolidated lake sediments from 0 to 50 ft bgs, glacial till from 50 to 100 ft bgs, and sedimentary bedrock beneath the till. The lake sediments are composed of silts with varying amounts of clay and fine to medium sand. The glacial till is composed of gravel and large cobbles in a silty clay matrix. The sedimentary bedrock consists of shale and siltstone of the Vernon Formation (ITSI/Shaw, 2009).

The lake sediments contain an unconfined, non-sole source water table aquifer, which is several ft bgs. Due to low yield resulting from low transmissivity, the aquifer is not a suitable source of potable water. A confined aquifer is found in the bedrock below the glacial till. The glacial till layer serves as a barrier to vertical groundwater migration between the overlying lake sediments and underlying sedimentary bedrock. There is a strong upward flow potential between the confined bedrock aquifer and the unconfined water table aquifer (ITSI/Shaw, 2009). Groundwater may be encountered 3 ft bgs at the MRSs SR001 and SR002 (ITSI/Shaw, 2009; Sky, 2012).

2.2.7 Hydrology

Hancock Field and its surrounding areas contain naturally occurring swamps and poorly drained areas. These natural lowlands and swamps have been drastically altered by development of this area into its current use as a transportation center and military facility. There are mapped wetlands located in the southern and eastern areas of the installation (ITSI/Shaw, 2009). In general, surface drainage near the two sites is south and southeast toward the North Branch of Ley Creek (Figure 2-2). The North Branch of Ley Creek flows from north to south across the central part of the MRA SR002, approximately 250 ft west of MRS SR002 (Sky, 2012).

2.3 CONTAMINATION ASSESSMENT

Investigations of potential MEC and MC contamination at MRSs SR001 and SR002 were completed during the CSE Phase I and II investigations (ITSI/Shaw, 2009 and Sky, 2012). The only item meeting the definition of MEC that was encountered while surveying the MRSs was a 3.5-inch HEAT rocket, identified during the CSE Phase I at MRS SR002. However, it was reported that the Firing-in Buttress was not intended for use with explosive munitions and the 3.5-inch Heat Rocket firing is believed to be an isolated occurrence (Sky, 2012). The following sections discuss actual and potential contamination within environmental media at the two MRSs.

2.3.1 Soil Contamination

Smalls arms of various calibers and/or practice grenades were used at the two Hancock Field MRSs. During the CSE Phase II, small arms MD was observed on the surface at both MRSs. Additionally, due to soil at the smalls arms range (SR001) being reworked by large machinery for maintenance, expended munitions may be present in subsurface soils. During the CSE Phase II, surface and subsurface soil samples were analyzed for lead using an XRF analyzer. The results indicated that lead was present at concentrations that exceeded the modified screening level of 261 mg/kg at both MRSs. At MRS SR001, lead-impacted soil was limited to an area primarily between the concrete firing line and the impact berm (Figure 2-5). At MRS SR002, lead-impacted soil was limited an area within the Firing-In Buttress (Figure 2-6). In general, lead concentrations above the screening level were limited to the top 6 inches of soil. However, at two locations within MRS SR001 and one location at MRS SR002, lead concentrations were above screening levels at depths ranging from 6 to 18 inches.

The CSE Phase I identified copper, lead, and iron as primary MCs of concern (Innovative Technical Solutions, Inc. 2009). As lead accounts for ~85% by weight of typical projectiles (ITRC 2003) and is the most pervasive constituent driving small arms range cleanup efforts, lead concentrations in soil were used to define the extent of contamination during the CSE Phase II (Sky, 2012). The Environmental Restoration Program, Air National Guard Investigation Guidance (ANG 2009) and the Characterization and Remediation of Soils at Closed Small Arms Firing Ranges (ITRC 2003) guidance indicate that antimony, arsenic, copper, iron, tin, and zinc are also common metals found in small arms range munitions. However, iron, tin and zinc are essential trace elements and are generally not associated with negative health effects. Antimony and arsenic are not essential trace elements but can be present under natural soil conditions and generally constitute less than 2% of the projectile by weight. For these reasons, iron, zinc, tin, arsenic and antimony will not be analyzed in soil during the NTCRA. However, copper is used in bullet jackets and can constitute upwards of 30% of typical small arms munitions by weight. Therefore, copper will be analyzed along with lead in determining the excavation extents during the NTCRA.

2.3.2 Sediment Contamination

There are no surface water bodies near MRS SR001; therefore, sediment impacts are not a concern at SR001.

The North Branch of Ley Creek flows approximately 250 ft west of MRS SR002. However, XRF Results indicate that soil impacted by lead is limited to an area within the Firing-In Buttress. Based on the distance of the creek from MRS SR002 and results of XRF soil sampling, it is unlikely that lead has impacted sediment within the creek.

2.3.3 Surface Water Contamination

The closest surface water body to either MRS is the North Branch of Ley Creek, approximately 250 ft west of MRS SR002. There are no drainage features at MRS SR001 leading to the creek. Soil samples were collected and analyzed for lead throughout MRS SR002 using XRF. Results indicate that soil impacted by lead is limited to an area within the Firing-In Buttress (SR002) and samples collected between the structure and the creek are an order of magnitude below the modified screening level for soil. Based on the information above, it is unlikely that lead has impacted surface water within the creek.

2.3.4 Groundwater Contamination

Groundwater and surface water were not evaluated during the CSE Phase I and Phase II. While groundwater pathway was determined to be potentially complete in the CSE Phase II (Sky, 2011), it is unlikely that lead has impacted groundwater at the MRSs. Since both SR001 and SR002 are located outdoors, bullets and fragments located within the investigation areas have contributed lead loading in site soils through weathering. In the weathering process, lead oxidizes and forms a variety of weathering products, such as lead oxides, sulfates, carbonates, and organic complexes. Rainfall events and humidity create a mechanism for mobility of weathering products (i.e., lead) throughout the soil profile. Of the soil series present at the MRSs (Minoa fine sandy loam and Ontario loam), carbonates are present at depths greater than 36 inches. The presence of carbonates is likely due to leaching of base cations to lower soil horizons and can be an indicator that pH increases with depth. An increasing pH and increasing carbonate concentration with soil depth suggests that lead migration to groundwater is not favorable since most metals become less mobile with increasing pH. Furthermore, since the analytical results from the CSE Phase II indicate that lead concentrations in soil are confined to the upper 18 inches, soluble lead concentrations are expected to decrease with depth and would have the ability to complex with the carbonates present at the 36 inch depth before reaching the water table at depths greater than 36 inches (3 ft).

In addition, past experience at small arms ranges has typically not identified lead in groundwater resulting from small arms training activities. However, up to seven (7) temporary monitoring wells will be installed and sampled prior to conducting the removal action to verify that small arms-related metals have not impacted groundwater.

2.4 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) was developed for both MRSs at Hancock Field, in accordance with Engineering Manual 1110-1-1200 (United States Army Corps of Engineers [USACE], 2003). The purpose of the CSM is to evaluate the media and transport mechanisms and receptors associated with identified MCs.

Evaluation of the site history, potential contaminant sources, environmental setting, and current and future land use have led to development of a CSM for MRSs SR001 and SR002. The CSM is presented in the following paragraphs and summarized in Table 2-3.

2.4.1 Source and Release Mechanisms

Metals are present at MRSs SR001 and SR002 in the form of bullets and bullet fragments from the historical use of these sites as practice firing ranges. Due to the weathering/corrosion of bullets and fragments, lead has migrated into soil at the two MRSs (Sky, 2012).

2.4.2 Fate and Transport Processes

Most of the projectiles deposited in the MRSs are in the form of intact projectiles or smaller fragments. These projectiles and fragments are subject to various physical and geochemical processes that control its mobility in the environment.

Potential migration pathways for lead at MRSs SR001 and SR002 include weathering of lead from projectiles and fragments in the soil, leaching from soil to groundwater, transport of soil via surface water flow and wind-blown deposits. Surface water can transport lead dissolved in water, bound to soil particles, or as small metallic fragments. Lead adsorbed to soil can be transported via wind as fugitive dust.

The basic geochemical processes that control the mobility of lead in the environment include:

- Oxidation/reduction – processes that affect the speciation of lead. Oxidation will convert metallic lead into more soluble forms and reduction will convert lead into relatively insoluble forms.
- Adsorption/desorption – processes by which dissolved lead ions are taken out of solution through their adsorption to the surfaces of soil or lead is removed from exchange sites through desorption.
- Precipitation/dissolution – precipitation is the process that removes lead from solution as a discrete, solid form [e.g., lead and sulfate may combine to form lead sulfate (PbSO4)]. Dissolution occurs when the solid form of lead is converted into a more soluble form.
- Complexation/chelation – processes by which lead binds with organic ligands, which may increase or decrease the mobility of lead (USEPA, 1992).

Table 2-3. Conceptual Site Model Profile Summary
MRSs SR001 and SR002

MRS	Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
SR001	**Name:** Small Arms Range and Shooting-In Buttress **Acreage:** 1.9 acres **Historic Munitions Use:** Small Arms Range; Grenade practice area	**Topography:** Relatively flat with berms constructed along three sides **Vegetation:** Shrubs and tall grasses **Surface Water:** Seeps into overburden or ponds on range floor **Soils:** Fill material consisting of clay and gravel **Geology:** Unconsolidated lake sediments, glacial till, and sedimentary bedrock beneath the till **Meteorology (Averages):** Temperature = 31 to 82°F; Annual Rainfall = 38.3 inches	**Historical Munitions Used:** 7.62-mm, .38-caliber, .45-caliber, .50-caliber munitions; 5.56-mm and 9-mm ball munitions, 40-mm practice grenades **Potential Contaminants of Concern:** Copper and Lead **Potential Media of Concern:** Surface and Subsurface Soil; Groundwater **Potential Migration Routes:** • Weathering of metals from projectiles and fragments into soil • Leaching from soil into groundwater • Transport of impacted soil via surface water flow and windblown deposits • Plant and animal uptake	**Current Land Use:** Unimproved, seldom used by ANG **Anticipated Future Land Use:** Anticipated to be transferred to the City of Syracuse **Potential Current Receptors:** • Authorized Personnel • Contractors • Visitors and Trespassers • Biota **Potential Future Receptors:** • Future Residents • On-Site Workers • Visitors and Trespassers • Biota	**Habitat Type:** Disturbed urbanized area. **Endangered/ Threatened Species:** No endangered species have been identified within the MRS

Table 2-3. Conceptual Site Model Profile Summary
MRSs SR001 and SR002 (continued)

MRS	Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
SR002	**Name:** Firing-In Buttress **Acreage:** 0.03 acres **Historic Munitions Use:** Test-firing site for aircraft weapon systems; Small Arms Range	**Topography:** Relatively flat with the Firing-In Buttress and associated impact berm constructed on the eastern side **Vegetation:** Shrubs and tall grasses **Surface Water:** Seeps into overburden groundwater table or ponds on range floor **Soils:** Fill material consisting of clay and gravel **Geology:** Unconsolidated lake sediments, glacial till, and sedimentary bedrock beneath the till **Meteorology (Averages):** Temperature = 31 to 82°F; Annual Rainfall = 38.3 inches	**Historical Munitions Used:** Aircraft munitions up to 20-mm, small arms munitions up to .50 cal **Potential Contaminants of Concern:** Copper, and Lead **Potential Media of Concern:** Surface and Subsurface Soil, Groundwater **Potential Migration Routes:** • Weathering of metals from projectiles and fragments into soil • Leaching from soil into groundwater • Transport of impacted soil via surface water flow and windblown deposits • Plant and animal uptake	**Current Land Use:** Unimproved, seldom used by ANG **Anticipated Future Land Use:** Anticipated to remain the same **Potential Current Receptors:** • Authorized Personnel • Contractors • Visitors and Trespassers • Biota **Potential Future Receptors:** • Future Residents • On-Site Workers • Visitors and Trespassers • Biota	**Habitat Type:** Disturbed urbanized area **Endangered/ Threatened Species:** No endangered species have been identified within the MRS

Of the four geochemical processes, adsorption/desorption and precipitation/dissolution are dominant. The extent to which these reactions occur depends somewhat on site conditions such as soil composition, extent of soil saturation, and soil organic matter content (ITRC, 2003).

Lead mobility is highly influenced by the pH of the environment and lead solubility is lowest in soils with a pH of approximately 4 to 11 (ITRC, 2003). Lead solubility will increase at both high (pH of approximately 11 and greater) and low (pH of approximately 4 and lower) soil pH. In soils with moderate proportions of clay and organic matter and under normal pH conditions (between 4 and 11), lead will typically have limited mobility due to complexation with organic matter, sorption on oxides and clays, and precipitation as carbonates, hydroxides, and phosphates (McBride, 1994). Because of its strong affinity for organic matter and soil particles, lead is unlikely to be displaced by other cations (USEPA, 1992). Redox conditions in soil may affect the solubility of lead by controlling the availability and stability of precipitating agents (USEPA, 1992).

Based on the information provided above and the CSE Phase II soil sampling results, lead is generally bound within the upper 18 inches at MRSs SR001 and SR002.

2.4.3 MC Exposure Pathway Analysis

Exposure to MC via food chain, sediment/surface water, groundwater, subsurface soil (>0.5 ft bgs), and surface soil (0 to 0.5 ft bgs) were evaluated in the CSE Phase II. The food chain pathway was considered complete for vegetation and wildlife. For biota, lead may be taken up by plants or soil invertebrates and enter the food chain. Lead that accumulates in tissue could be passed to higher trophic-level consumers. Based on the results of soil sampling, the sediment/surface water pathway was considered incomplete. Based on soil sampling results, it is unlikely that groundwater has been impacted by lead. However, since groundwater has not been characterized, groundwater represents a potential pathway for future residents, on-site workers, and biota via dermal contact and ingestion. Potential receptors for subsurface soil would include future residents, on-site workers, and biota via dermal contact, ingestion, and inhalation. Potential receptors of surface soil include future residents, on-site workers, visitors/trespassers, and biota via dermal contact, ingestion, and inhalation of dust particles containing lead. Conceptual Site Exposure Models for both MRSs are presented in Figures 2-9 and 2-10.

2.5 STREAMLINED RISK ASSESSMENT

A Screening Level Human Health Risk Analysis (SLHHRA) and a Screening Level Ecological Risk Assessment (SLERA) were performed during the CSE Phase II (Sky, 2012). A streamline summary of each of these is presented in the following sections. Full versions of these Risk Assessments can be found in the Final CSE Phase II Report (Sky, 2012).

Figure 2-9. MC Exposure Pathway Analysis, MRS SR001

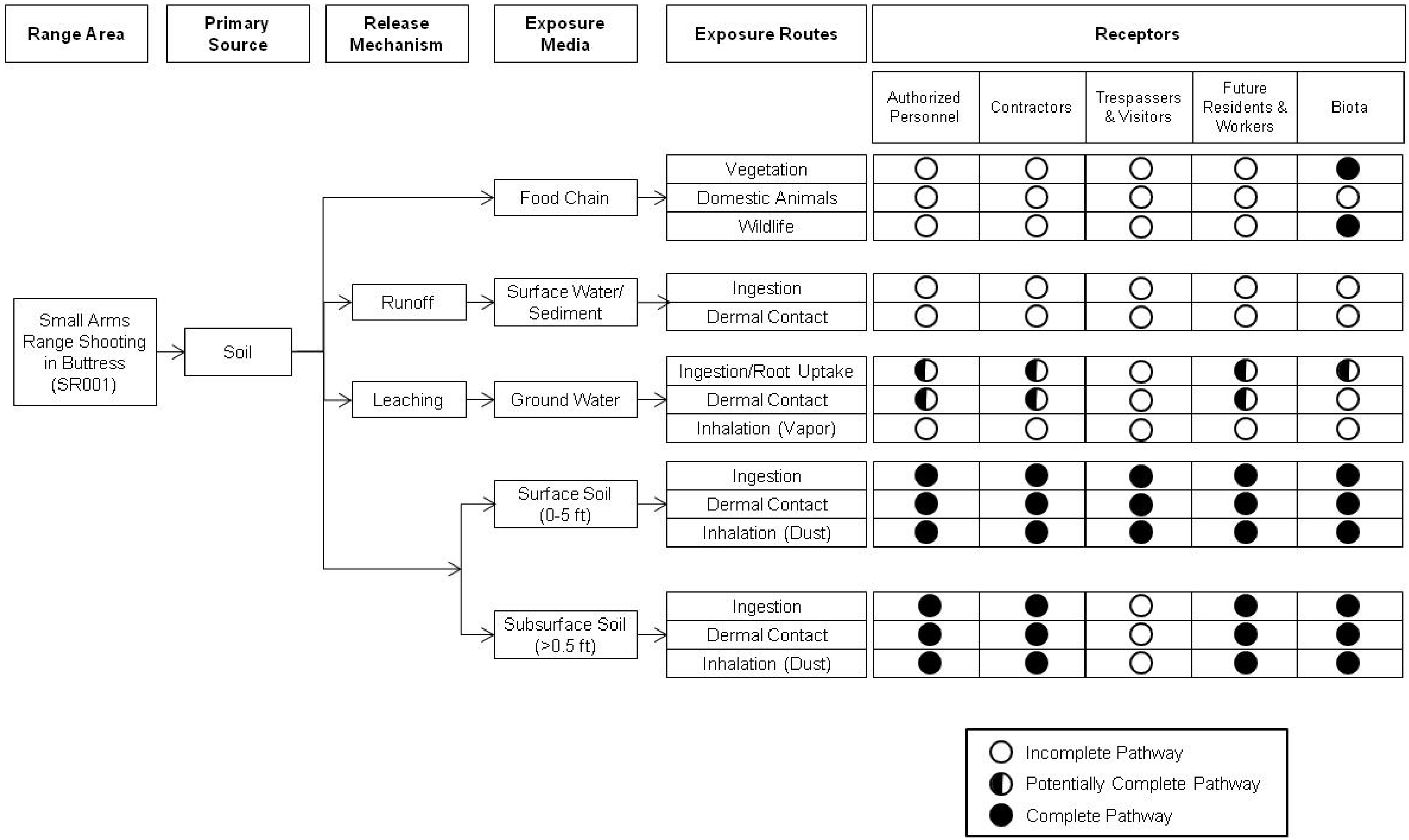
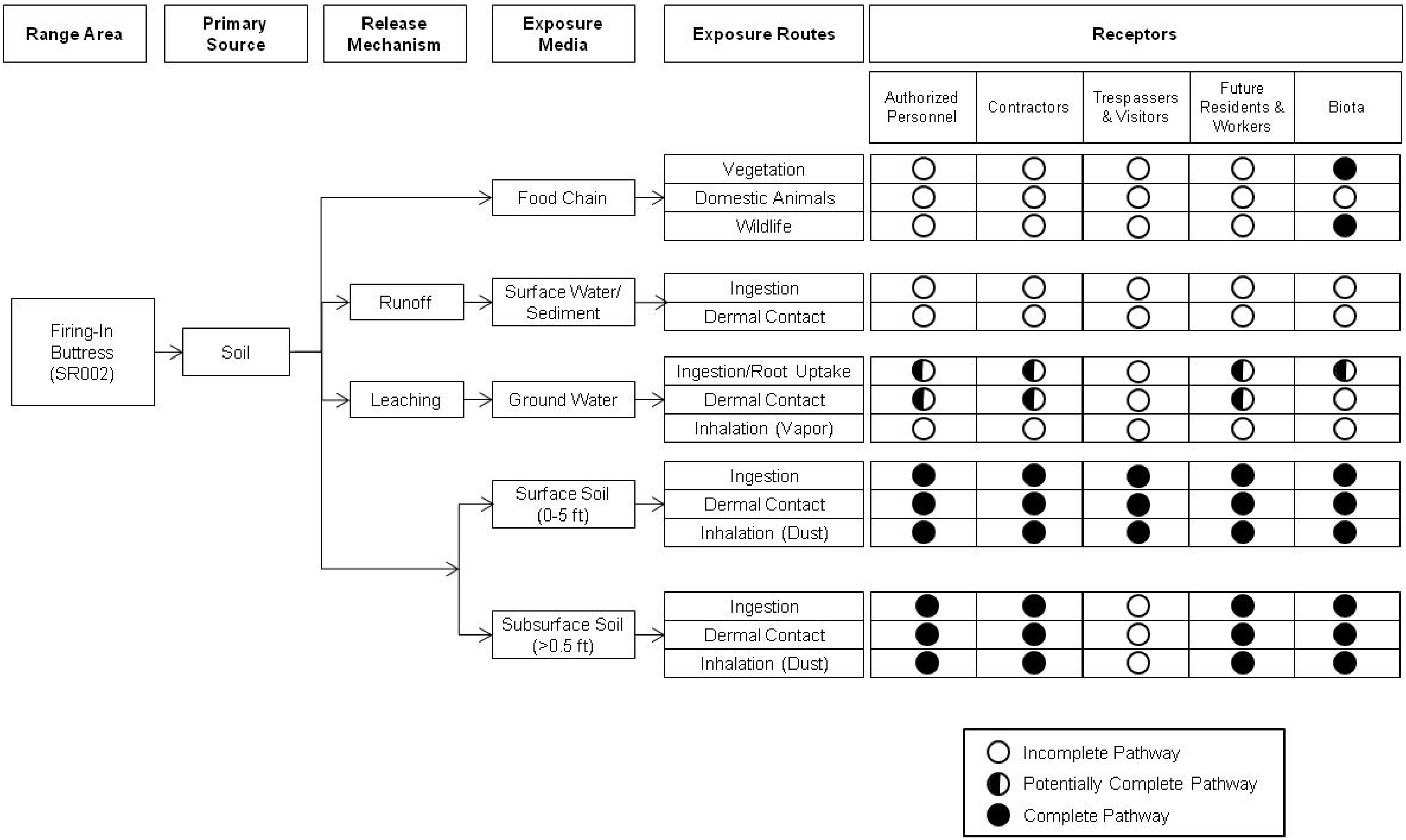


Figure 2-10. MC Exposure Pathway Analysis, MRS SR002



2.5.1 Screening Level Human Health Risk Assessment

As previously discussed, CSMs were developed to address lead environmental contamination at MRSs SR001 and SR002. The CSMs describe sources of contamination, potentially complete present-day and future exposure pathways, and possible receptors. The pathways and receptors for each MRS are described in Section 2.4 and summarized in Figures 2-7 and 2-8. This section focuses on the complete or potentially complete pathways and discusses associated human health risks.

To evaluate potential human health risks, the measured concentrations in environmental media (surface and subsurface soil samples) at each MRA were compared to the USEPA, Residential Regional Screening Level (RSL) and the NYSDEC, Residential Use Soil Cleanup Objectives (SCO) for lead of 400 mg/kg and to background soil concentrations. Groundwater, surface water, and sediment samples were not evaluated during the CSE Phase II (Sky, 2012).

MRS SR001

Surface soil samples (0 to 6 in bgs) were collected at MRS SR001 for on-site XRF lead analysis during the CSE Phase II. Lead was detected in surface soil at concentrations ranging from 22 mg/kg to 5217 mg/kg. Subsurface soil samples (6 to 18 in bgs) were collected in locations with elevated (exceeding the modified XRF soil screening criteria of 261 mg/kg) concentrations in the surface. Lead was detected in subsurface soils in concentrations exceeding the modified screening criteria in four locations to a maximum depth of 18 in bgs. Although site-specific background has not been established for Hancock Field ANGB, surface and subsurface soil samples had concentrations exceeding the 95th percentile of lead background soil concentrations in the eastern United States (38 mg/kg; USEPA, 1993) in 80% and 100%, respectively, of the samples collected (Sky, 2012).

Based upon the results of the HHRA screening for the Small Arms Range and Shooting-In Buttress (SR001), concentrations of lead in surface soil may present a human health risk under residential land use scenarios (Sky, 2012). The HHRA concluded that subsurface soils may present human health risk under residential land use scenarios.

MRS SR002

Surface soil samples (0 to 6 in bgs) were collected at MRS SR002 for on-site XRF lead analysis during the CSE Phase II. Lead was detected in surface soil at concentrations ranging from non-detected to 368 mg/kg, with only one sample exceeding the modified XRF soil screening criteria of 261 mg/kg. Two surface soil samples exceeded the 95th percentile of lead background soil concentrations in the eastern United States (38 mg/kg; USEPA, 1993). Subsurface soil samples (6 to 24 in bgs) were collected beneath the location with elevated lead concentrations in the surface. Lead was detected in each two intervals (6 to 12 in bgs and 12 to 18 in bgs) of subsurface soils in concentrations exceeding the modified screening criteria. All three subsurface samples had concentrations exceeding the 95th percentile of lead background soil concentrations in the eastern United States (Sky, 2012).

Based upon the results of the HHRA screening for the SR002 Firing-In Buttress, lead concentrations in surface and subsurface soil were found to be unlikely to present a significant human health risk under residential or industrial land use scenarios (Sky, 2012). Only a single surface soil sample and two subsurface samples (all at the same location) contained concentrations exceeding the modified screening level of 261 mg/kg. These samples were obtained at a location where small arms debris was noted. Lead concentrations decreased with depth below 6 to 12 in at this sampling location. Surface soil delineation samples collected adjacent to this location did not have lead concentrations above the 261 mg/kg XRF screening value, indicating that the area of lead contamination above screening criteria is limited. The HHRA concluded that this single location may present human health risk under a residential land use scenario (Sky, 2012).

2.5.2 Screening Level Ecological Risk Assessment

A focused SLERA was completed to assess potential adverse impacts on current or future ecological receptors exposed to MC in surface soil at Hancock Field ANGB MRSs. The assessment endpoint for the SLERA is the protection of local populations and communities of biota from adverse impacts from lead in soil. Analytical laboratory data generated during the CSE Phase II at Hancock Field ANGB (Sky, 2012) were compared to conservative ecological screening levels to determine if contaminant releases have occurred at concentrations exceeding levels of potential concern. As previously discussed, surface water, sediment, and groundwater were not sampled during the CSE Phase II investigation. Therefore, ecological screening is limited to soil results.

The ecological screening level for lead in soil is based on the lowest benchmark derived by the USEPA in the development of Eco SSLs for lead. The screening value of 11 mg/kg is based on protection of insectivorous birds, but USEPA also developed benchmarks based on protection of plants, soil invertebrates, herbivorous and carnivorous birds, and herbivorous, insectivorous, and carnivorous mammals. Eco-SSLs are, by design, highly conservative estimates of soil concentrations that could result in adverse effects in specified receptor species. The designated purpose of Eco-SSLs is for screening. As explicitly stated in the Eco-SSL document for lead (USEPA, 2005), “Eco-SSLs are not designed to be used as cleanup levels.” The conservative nature of the Eco-SSL for lead in insectivorous birds is illustrated by the fact that the final screening level (11 mg/kg) is less than both the median background soil concentration for lead (18 mg/kg) and the 95th percentile background concentration for lead (38 mg/kg) in the Eastern United States, implying that more than half of the soils in the Eastern United States could pose a potential risk to insectivorous birds from exposure to natural levels of lead.

Ecological receptors (i.e., plants, invertebrates, vertebrate herbivores, omnivores, and carnivores) could potentially be exposed to MC that may exist at the MRSs. At the areas under consideration, grass height is generally maintained by mowing. Potential ecological receptors include soil invertebrates, small mammals (i.e., meadow voles, shrews), and insectivorous birds (i.e., American robin). Likely predators utilizing the areas may include fox, kestrel and red-tail hawk.

MRS SR001

Because invertebrates and vertebrates are mobile and can be expected to traverse the entirety of the site, use of the mean lead concentration is representative of the concentration to which a mobile receptor would be exposed. The mean lead concentration in the Small Arms Range and Shooting-In Buttress (SR001) surface soil (0 to 6 in) during the CSE Phase II (Sky, 2012) was 538 mg/kg, which is greater than the 95th percentile background concentration for soils in the eastern United States (38 mg/kg; USEPA, 2003). Mean lead concentrations exceeded screening thresholds for six of the eight ecological receptors. Screening levels for invertebrates, and herbivorous mammals, are not exceeded by mean lead concentrations.

The assessment endpoint for the SLERA is the protection of local populations and communities of biota from adverse impacts. Based on the results of the focused SLERA, maximum and mean lead concentrations were orders of magnitude above the ecological risk screening criterion intended to be protective of soil invertebrates, plants and wildlife. Receptor-specific soil screening levels were also exceeded for plants, herbivorous and insectivorous birds and insectivorous and carnivorous mammals. As such, the CSE Phase II (Sky, 2012) recommended additional ecological investigation for SR001.

MRS SR002

The mean lead concentration in the Firing-In Buttress (SR002) surface soil (0 to 6 in) was 38.2 mg/kg, which is approximately equal to the 95th percentile background concentration for soils in the eastern U.S., (38 mg/kg; USEPA, 2003). Mean surface soil lead concentrations exceeded screening thresholds for only one of the eight ecological receptors. Screening levels for plants, invertebrates, herbivorous mammals, herbivorous birds, insectivorous mammals, carnivorous birds and carnivorous mammals are not exceeded by mean lead concentrations in surface soil.

Based upon the results of the focused SLERA, maximum lead concentrations exceeded the ecological risk screening criterion intended to be protective of soil invertebrates, plants and wildlife. However, mean surface soil concentrations exceeded screening criteria for only the most sensitive receptor category, and were approximately equal to the 95th percentile background concentration for the eastern U.S. Because mean concentrations are similar to published regional background values, the CSE Phase II (Sky, 2012) concluded that it is unlikely that lead concentrations at SR002 represent unacceptable risk to ecological populations.

3.0 IDENTIFICATIONOF REMOVAL ACTION OBJECTIVES

This section establishes removal action requirements and objectives for each MRS by identifying appropriate, relevant, and applicable requirements (ARARs) and establishing site-specific RAOs.

3.1 REMOVAL ACTION OBJECTIVES

RAOs are routinely developed to identify actions necessary to address potentially unacceptable human health and environmental risks due to the presence of contaminants in environmental media. RAOs typically address: (1) contaminants of concern, (2) media of concern, (3) potential exposure pathways, and (4) preliminary remediation levels. The development of these goals involves ARARs and the results of the human health and ecological risk assessments, which were conducted during the CSE Phase II. The RAOs for the two MRSs are discussed in detail in Section 3.3.

3.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs are environmental and/or public health statutes regulations, ordinances, and guidance pertaining to all aspects of potential clean-up actions. This information influences the development of removal action alternatives by establishing numerical clean-up levels, permitting, siting, disposal, operating parameters, health and safety, and monitoring standards.

There are five criteria that must be met for a standard, requirement, criteria, or limitation to be considered an ARAR, including:

1. The requirement must be promulgated;
2. The requirement must be related to a Federal/State environmental law or state siting law;
3. The requirement must be substantive;
4. The requirement must be a cleanup standard, standard of control, or requirement that specifically addresses a CERCLA hazardous substance, pollutant, or contaminant; remedial action; or remedial location; and,
5. The requirement must be applicable or relevant and appropriate.

3.3 TO BE CONSIDERED REQUIREMENTS

Non-promulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. However, such requirements may be useful and are “to be considered” (TBC). TBC requirements [40 Code of Federal Regulations (CFR) §300.400(g)(3)] complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

3.3.1 Chemical-Specific

Chemical-specific ARARs govern the level or extent of site cleanup in relation to a specific constituent. Chemical-specific ARARs are usually health- or risk-based standards that limit constituent concentrations found in or discharged to the environment. These ARARs govern the extent of site cleanup by providing cleanup levels or a basis for calculating cleanup levels. For example, the USEPA Residential RSLs for soil may be selected as the cleanup goals for the COC for the MRS. Based on this scenario, chemical-specific ARARs may be used to indicate acceptable criteria for establishing remediation and disposal requirements for assessing the effectiveness of removal action alternatives. Thus, chemical-specific ARARs establish acceptable concentrations of constituents in various media.

The chemical specific cleanup levels for soils at MRSs SR001 and SR002 were developed based on the NYSDEC Residential Use SCOs of 400 mg/kg for lead and 270 mg/kg for copper. While ecological risks have been identified at the MRSs, Eco-SSLs are, by design, highly conservative estimates of soil concentrations that could result in adverse effects in specified receptor species. The designated purpose of Eco-SSLs is for screening. As explicitly stated in the Eco-SSL document for lead (USEPA, 2005), "Eco-SSLs are not designed to be used as cleanup levels." Therefore, USEPA RSLs and NYSDEC SCOs will be used as cleanup levels for this EE/CA. After the completion of a removal action, ecological risks from the residual soils will be evaluated.

3.3.2 Location-Specific

Location-specific ARARs pertain to existing site features. Location-specific ARARs place restrictions on constituent concentrations or remedial activities solely based on site setting or location (e.g., within or adjacent to wetlands, flood plains, existing landfills, disposal areas, and places of historical or archeological significance). Location-specific ARARs place restrictions on remedial actions due to site location, such as if a site were located in a wetland or for the case of the Base, if it would interfere with an active Base mission. Although the area is considered industrial, remedial action goals have been established to allow for unlimited use/unrestricted exposure (UU/UE) for human health. This approach reduces ANG future liability; eliminates developing institutional controls, which are required with conditional site closures; and is consistent with the ANG environmental policies as well as USAF MMRP best practices.

3.3.3 Action-Specific

Action-specific ARARs pertain to proposed site removal actions and govern implementation of the selected site remedy. Action-specific ARARs set controls or restrictions on activities related to the management of contaminated and/or hazardous materials. After removal action alternatives are developed, action-specific ARARs pertaining to proposed site remedies provide a basis for assessing their feasibility and effectiveness. For example, action-specific ARARs may include hazardous waste management requirements, air and water emission standards, and Resource Conservation and Recovery Act (RCRA) landfill requirements.

3.3.4 State Requirements

State requirements are standards, requirements, criteria, or limitations in addition to the federal requirements that may need to be considered when preparing for a remedial action. Typically, these requirements are developed pursuant to a federal act or statute that has delegated authority to the state. In other circumstances, states have developed guidelines that are more stringent than federal requirements and; therefore, may take precedence over similar federal requirements. These requirements may include development of remedial programs, authorization to discharge stormwater, guidelines for threatened and endangered species, record keeping, and/or selection of soil cleanup levels.

The NYSDEC cleanup level for lead in soil is equivalent to the NYSDEC Residential Use SCOs of 400 mg/kg for lead and 270 mg/kg for copper.

3.3.5 Potential ARARs

Table 3-1 provides a list of the practicable federal and state ARARs and TBC information for the removal action at MRSs SR001 and SR002.

Table 3-1. Appropriate, Relevant and Applicable Requirements

Standard, Requirement, Criteria, or Limitation	Description	Status
Federal Requirements		
USEPA Regional Screening Level (RSL), November 2011	Chemical-specific criterion that provides calculated generic soil remediation objectives that are deemed protective of human health.	TBC
CFR Title 40 Part 266, Subpart M: *Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities – Military Munitions*	Action-specific standards that provide guidance for when military munitions become solid waste.	ARAR
State Requirements		
6 New York Codes, Rules, and Regulations (NYCRR), Part 375 (Environmental Remediation programs), Subpart 375-6 (Remedial Program Soil Cleanup Objectives)	Chemical- and location-specific requirements that provide soil cleanup objectives for restricted and unrestricted site closure. Applicable Soil Cleanup Objectives include lead (400 mg/kg) and copper (270 mg/kg).	ARAR
NYSDEC, CP51/Soil Cleanup Guidance	Chemical-specific criterion that provides the framework and procedures for the selection of soil cleanup levels appropriate for each of the remedial programs in the NYSDEC Division of Environmental Remediation (DER).	TBC

3.4 SITE SPECIFIC REMOVAL ACTION

This section describes the site-specific RAOs and schedule of the project.

3.4.1 Objective

Based on the conclusions and recommendations of the CSE Phase II Report, the RAOs for impacted soils at each MRS includes:

- Reduce human health risks associated with residual concentrations of lead above 400 mg/kg and copper above 270 mg/kg in soil from the use of small arms ammunition at MRSs SR001 and SR002.
- Reduce future hazards and risks by mitigating soils impacted by copper (concentrations greater than 270 mg/kg), lead (concentrations greater than 400 mg/kg), MD, munitions, small arms, and range related debris, thus reducing or eliminating the potential for migration of MCs at concentrations above human health risk standards to surrounding environmental media.

3.4.2 Schedule

Table 3-2 presents a schedule of upcoming deliverables. This schedule is intended as an overview of upcoming project deliverables within the overall timeline associated with the NTCRA proposed for MRSs SR001 and SR002 at Hancock Field.

Table 3-2. Upcoming Deliverable Schedule

Key Schedule Items	Approximate Dates for Finalization
Action Memorandum	February 2013
NTCRA Work Plan	March 2013
NTCRA (Field Activities)	May through June 2013
After Action Report	October 2013

4.0 IDENTIFICATION OF REMOVAL ACTION ALTERNATIVES

This section presents the removal action technologies that are potentially applicable and the results of the screening of those technologies based on the ability of each to address the RAOs for each MRS. The screening process reduces the number of potentially applicable technologies by evaluating the applicability of each technology to site and contaminant factors. Technologies deemed inefficient or not implementable were eliminated from further consideration. As summarized in Table 4-1, three removal action technologies (no action, institutional controls, and excavation and offsite disposal) were retained as alternatives for further evaluation.

Table 4-1. Preliminary Screening of Removal Action Technologies

General Remedial Action	Remediation Action	Technology	Technology Description	General Screening Comments
No Action	None	Not Applicable	No removal actions taken.	Retained. Will be considered for further evaluation.
Monitored Natural Attenuation	Monitoring	Soil monitoring	Periodic monitoring of soil contamination.	Eliminated. MNA not typically applicable for metals.
In-Situ Treatment	Bioremediation	Phytoremediation	Use of specific plants to extract metals from contaminated soil.	Eliminated. Minimal cost-effectiveness due to small areas of impact.
Institutional Controls	Land Use Restrictions	Institutional Controls	Institutional Controls (deed restrictions, ordinances, well drilling restrictions, security measures, etc.) monitoring through periodic inspections and reporting.	Retained. Will be considered for further evaluation.
Ex-Situ Treatment	Physical/Chemical	Thermal Destruction	Incinerating contaminated soil at high temperatures to recover metals.	Eliminated. High cost. Does not destroy metals and still requires waste disposal.
		Soil Washing	Separating contaminated soils based on density and grain size. Assumes contaminants are concentrated in fine particle fraction.	Eliminated. Minimal cost effectiveness due to small areas of impact.
		Stabilization	The reduction of solubility and bioavailability of metals contamination in soil through addition of phosphate, rock, lime, sulfur compounds, or sulfur polymer cement,	Eliminated. Due to the large volume of gravel and clay contained in fill material at the MRSs.
Source Removal	Excavation	Excavation and Offsite Disposal	Excavation of contaminated soil followed by disposal of treated soil at an appropriate facility.	Retained. Will be considered for further evaluation.

4.1 RATIONALE FOR SELECTION OF ALTERNATIVES

The following subsections present the rationale for the selection of removal action alternatives.

4.1.1 Alternative One: No Action

A "No Action Alternative" provides a baseline for evaluating other removal action alternatives and is compliant with USEPA guidance (USEPA, 1988). This alternative assumes that soil and groundwater at the site remain unaltered and unmonitored. Under this alternative, no remedial action will be taken, and any identified contaminants are left "as is" without the implementation of any containment, removal, treatment, or other protective measures.

4.1.2 Alternative Two: Institutional Controls

Institutional controls are non-engineering instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and/or protect the integrity of a response action. Typically, institutional controls are designed to limit land or resource use by providing information that helps modify or guide human behavior at a site. Common examples of institutional controls include zoning restrictions, building or excavation permits, well drilling prohibitions, easements, and covenants.

4.1.3 Alternative Three: Excavation, and Offsite Disposal

Excavation and offsite disposal is considered a viable option because it can successfully remove the containments from the site while minimizing impacts to Base activities. It also could be conducted in a relatively short time-frame (1 year or less).

4.1.4 Basis of Comparison of Alternatives

The removal action alternatives considered in this study were evaluated based on current and available information regarding MRSs SR001 and SR002. The three alternatives were evaluated using the nine evaluation criteria outlined by the USEPA (USEPA, 1988 and 1990). The analysis of alternatives is categorized into three broad groups based upon the function of the criteria in remedy selection. The three groups categorize the nine evaluation criteria and are organized as follows:

1) <u>Threshold Criteria</u> – criteria that each alternative must satisfy to be eligible for selection based on statutory requirements. Threshold criteria include:

   - Overall Protection of Human Health and the Environment; and,
   - Compliance with ARARs.

2) <u>Balancing Criteria</u> – technical criteria upon which the detailed analysis is primarily based. Balancing criteria include:

- Long-Term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility, or Volume;
- Short-Term Effectiveness;
- Implementability; and,
- Cost.

3) <u>Modifying Criteria</u> – criteria related to the acceptance of the removal action alternative by the public and regulatory agencies. These criteria are formally assessed after the public comment period; at which time, public/agency support is factored into the selection of the preferred alternative. Modifying criteria include:

- State/Support Agency Acceptance; and,
- Community Acceptance.

Each of the removal action alternatives represents one potential construction scenario, for which conceptual-level design and corresponding costs and time frames have been estimated. These scenarios and costs do not reflect a final design-level evaluation, but are sufficient for a relative comparison of the various alternatives that have been carried forward. This section further discusses construction elements and schedules at the conceptual level as they relate to the evaluation criteria.

4.2 DESCRIPTION OF ALTERNATIVES

4.2.1 Alternative One: No Action

A "No Action" alternative is used as a baseline from which to measure other alternatives and is compliant with USEPA guidance (USEPA, 1988). This alternative assumes that soil at the site remains unaltered and unmonitored. Under this alternative, no removal action will be taken, and any identified contaminants are left "as is" without the implementation of any containment, removal, treatment, or other protective measures. This alternative does not provide for the monitoring of soil and does not provide for any active or passive institutional controls to reduce the potential for exposure.

4.2.2 Alternative Two: Institutional Controls

This alternative would consist of the implementation of administrative and legal controls, which would minimize the potential for human exposure to contamination. When identifying viable institutional controls for a site, several keys factors must be considered, including:

- Institutional control objectives (e.g., preventing dermal contact with contaminated soils);
- Assuring that the tools and enforceable mechanisms used to meet the institutional control objectives are available under state and local law; and,

- Identifying the parties' responsibility for implementing, monitoring, and enforcing the institutional controls and assessing whether these parties have the financial and organizational capabilities and interest to reliably accomplish these tasks, short- and long-term costs (short and long term), and long-term effectiveness.

A preliminary list of stakeholders with responsibility for being involved with the decision making process includes ANG, USEPA, NYSDEC, and the City of Syracuse.

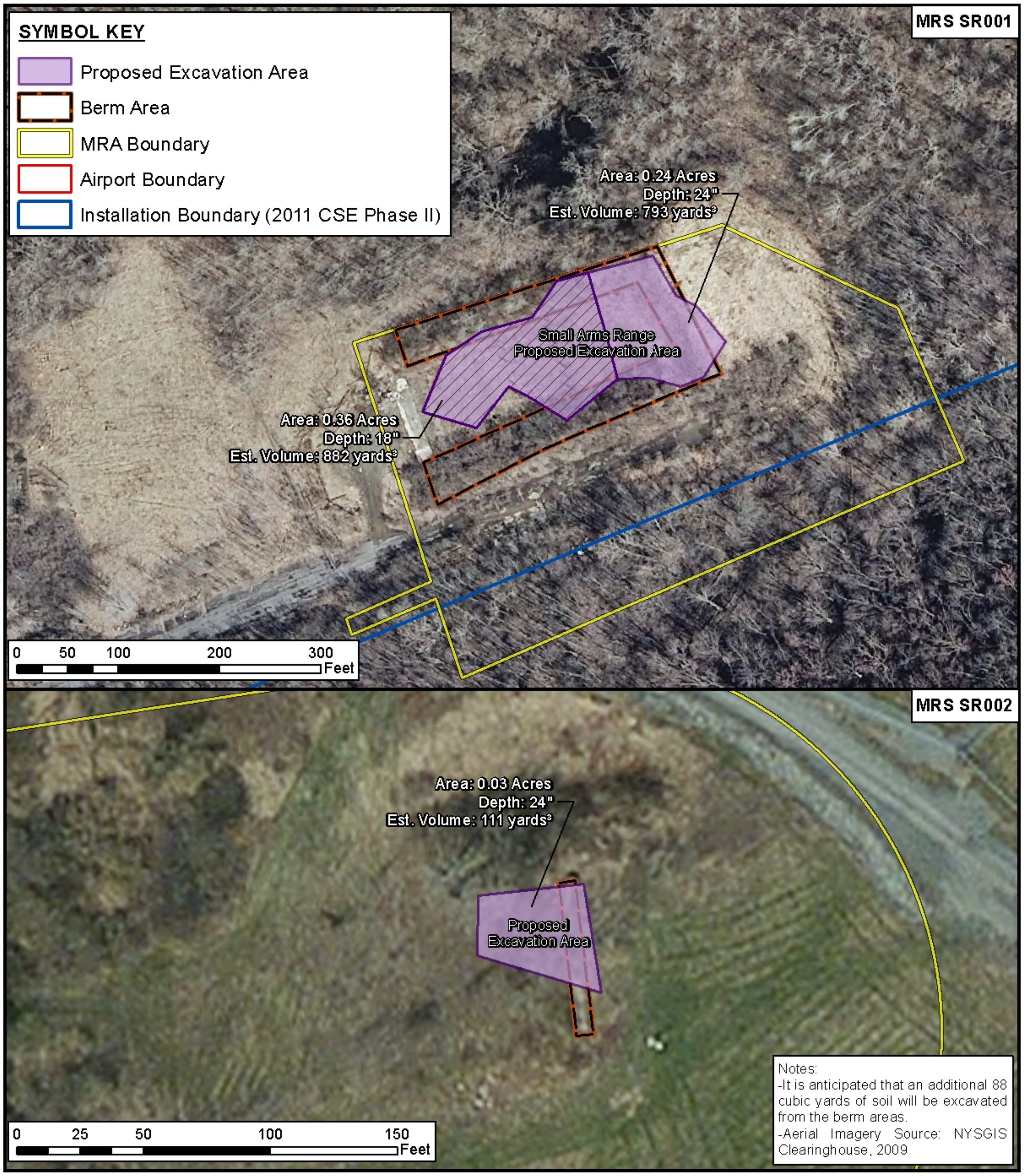
Institutional controls that may be implemented include land use controls (LUCs) and security measures. A restrictive covenant would serve as a LUC that would limit future site development and could restrict excavations on the property. A restrictive covenant would also serve to alert future landowners of the limits on land use or resources. Implementation of this LUC would restrict the use of the property and prevent potential exposure pathways (e.g., dermal contact and ingestion of lead-impacted soil). Working with the local government to notify users through a "one call" system would provide additional protection. This measure would provide a warning system to potential on-site workers that may not have access to or knowledge of what is recorded in the land records (e.g., contractors and/or utility companies).

Potential security measures would include the construction of fencing to restrict access of unauthorized personnel to the site. Additionally, signage could be added to the fenced areas to warn visitors of the risks associated with the sites. However, the implementation of any control measures would need the approval of the responsible parties and the property owner.

4.2.3 Alternative Three: Excavation and Offsite Disposal

Implementation of this alternative would include the excavation and disposal of approximately 1,874 cubic yards (CY) of lead-impacted soil within MRSs SR001 and SR002. Prior to excavation, any vegetation existing at the two MRSs will be cleared and disposed of offsite with the other non-hazardous waste materials (such as construction debris). Additionally, the demolition of some range structures may be necessary to maneuver within the site. The wooden targets located throughout the small arms range floor may be demolished along with the wooden/concrete Firing-In Buttress. All bullets found in these structures will be removed and segregated from the demolished structures. The demolished structures will be transported offsite and disposed of as non-hazardous waste. The remaining bullets will be segregated and recycled where possible.

As shown in Figure 4-1, areas to be excavated at MRS SR001 include portions of the range floor, preberm areas, portions of the safety berms, and the impact berm. The western portion of the small arms range will be excavated to an approximate depth of 18 inches for a total of approximately 882 CY of soil. The eastern portion of the small arms range will be excavated to an approximate depth of 24 inches to yield approximately 793 CY of soil. To account for the



New York Air National Guard Syracuse, New York		N	**FIGURE 4-1** **Extent of Excavation for Alternative 3** Engineering Evaluation/Cost Analysis 174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

-SCALE AS SHOWN-	12/05/2012	File: ANG_Hancock_Excav_Areas_Alt3&4_EECA_Version2.mxd	
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berm areas, an additional base excavation volume of 88 CY (100 ft of berm by 12 ft high by 2 ft deep) was included. The total soil volume to be excavated from MRS SR001 is estimated to be 1,763 CY. At MRS SR002, excavation will occur within the Firing-In Buttress impact berm. Soil within the Firing-In Buttress will be excavated to an approximate depth of 24 inches for a total of 111 CY of soil.

Combined, 1,874 CY of soil is estimated to be excavated from MRSs SR001 and SR002. Assuming an average weight of 2,700 pounds per CY, approximately 2,530 tons of soil will be generated. However, actual excavation extent will be dependent upon results from confirmatory sampling and analysis.

Because lead is the most prevalent constituent at small arms ranges, XRF analysis for lead will be used to guide the excavation to support decision making with regard to collecting confirmatory soil samples. Once XRF field screening indicates that lead is below the action level of 261 mg/kg, confirmatory soil samples will be collected from the floor and sidewall of each excavation. Confirmation sampling will be conducted using incremental sampling techniques, in accordance with the guidance provided in *Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents* (USACE, 2007). Incremental soil samples will be sent to an offsite laboratory and analyzed for copper and lead. If confirmatory soil sample results indicate remaining soils are above the RAOs, additional soil will be removed in approximate 6-inch lifts, rescreened with the XRF, and additional confirmatory samples will be collected following the procedure outlined above.

The excavated soils will be characterized for disposal using the Toxicity Characteristic Leaching Procedure (TCLP) for metals. Hazardous waste will be transported to a RCRA Subtitle C landfill, while the non-hazardous waste will be transported to a Subtitle D landfill for disposal. Subsequent to the soil removal, the site would be regraded and revegetated.

4.3 EVALUATION OF ALTERNATIVES

Each of the removal action alternatives represents one potential scenario, for which conceptual-level design and corresponding costs and time frames have been estimated. These scenarios and costs do not reflect a final design-level evaluation, but are sufficient for a relative comparison of the various alternatives that have been carried forward. This section further discusses construction elements and schedules at the conceptual level as they relate to the evaluation criteria.

4.3.1 Overall Protection of Human Health and the Environment

Removal action alternatives are assessed to determine whether they can adequately protect human health and the environment, in both the short-term and long-term, from unacceptable risks posed by contaminants by eliminating, reducing, or controlling exposure to concentrations above risk thresholds. This criterion also draws on the assessment of other evaluation criteria such as long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Alternative One, No Action, would not protect human health or the environment.

Alternative Two, Institutional Controls, would be protective of human health by restricting site access and future land use. However, this alternative would not prevent the migration of lead to additional environmental media (i.e., sediment, surface water, and groundwater).

Alternative Three, Excavation and Offsite Disposal, would be protective of human health and the environment. Excavation of the soils would remove the source of contamination at the site, thus significantly reducing the exposure and risk to human health and environmental receptors.

4.3.2 Compliance with ARARs

Alternatives are assessed to determine whether they meet ARARs or facility regulations and/or procedures. ARARs specific to the site are discussed in Section 3.2.

Alternatives One and Two do not reduce contamination levels on-site. However, the implementation of either Alternative One of Two, would comply with ARARs. Alternative Three would comply with ARARs and the site-specific clean-up levels developed for potential exposure scenarios would be met because the lead impacted soils are removed from the site. Confirmatory TCLP testing of excavated soil would be required to determine the appropriate disposal facility for excavated soils (RCRA Subtitle C facility for hazardous wastes or RCRA Subtitle D facility for non-hazardous waste).

4.3.3 Long-Term Effectiveness and Permanence

Alternatives are assessed to determine whether they provide long-term effectiveness and permanence. Factors to be considered include:

- The magnitude of residual risk associated with untreated media or treatment of residuals remaining once removal action activities are complete; and,
- The adequacy and reliability of controls, such as containment systems and institutional controls, necessary to manage untreated media or treatment residuals and wastes;

Alternative One, No Action, would not be effective over the long-term because it would not reduce the magnitude of residual risk associated with untreated soil.

Alternative Two, Institutional Controls, would be moderately effective in the long-term in that it would reduce risk to human health associated with untreated soil. Institutional controls would be reliable and enforceable. However, this alternative would not reduce the risk to the environment from untreated soil.

Reduction of COC concentrations to below cleanup levels is assured by implementing Alternative Three. Under this alternative, excavation and removal of soil would eliminate the primary source of contamination at the site and significantly reduce risk to human health and environmental receptors. Offsite migration of lead from the site would be minimized or eliminated by implementing Alternative Three.

4.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This evaluation addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contamination mobility, or reduction of total volume of contaminated material. Factors to be considered include:

- The treatment/recycling or removal process specific to site contaminants;
- The volume of material the alternative will treat;
- The degree of expected reduction in toxicity, mobility, or volume of contamination;
- The degree to which the treatment is irreversible;
- The type and quantity of residuals remaining following treatment; and,
- Whether the alternative would satisfy the statutory preference for treatment as a principal element.

As described above, Alternatives One and Two would not reduce the toxicity, mobility, or volume of contaminants on-site.

Alternative Three, Excavation and Offsite Disposal would remove the source of contamination from the site, but does not offer any treatment of contaminants, which would reduce the toxicity, mobility, or volume of waste.

4.3.5 Short-Term Effectiveness

Alternatives are assessed to determine whether they are effective in the short-term. Factors to be considered include:

- The short-term risks that might be posed to the community during implementation of the alternative;
- The potential impacts to on-site workers during removal action activities and the effectiveness and reliability of protective measures;
- The potential environmental impacts posed during removal action activities, and the effectiveness and reliability of measures taken to mitigate impacts; and,
- The time necessary to achieve the RAOs.

When determining which alternative is more effective in the short-term, risks (to the community, on-site workers or the environment) must be weighed against the time to reach cleanup levels. In this case, Alternatives One and Two would not reach the cleanup levels, nor would they be effective in protecting human health or the environment in the short-term. Under Alternative Three, the potential short-term risks associated with offsite transport of the lead-impacted soils could be minimized or eliminated by ensuring that all trucks or containers leaving the site are properly covered, and that strict soil erosion and sediment control measures are in place to prevent the offsite tracking of contaminated soil.

4.3.6 Implementability

Alternatives are assessed to determine the ease or difficulty associated with implementing the alternative. Factors to be considered include:

- The technical feasibility including the ability to construct and operate the technology, the reliability of the technology, the ease of undertaking additional remedial/removal actions if necessary, and the ability to monitor the effectiveness of the remedy;
- The administrative feasibility including the ability to coordinate efforts needed to implement the remedy and the ability and/or time required to obtain the necessary agency approvals and permits; and,
- The availability of services and materials required to implement the remedy.

When determining which alternative is more implementable, technical and administrative feasibility must be considered. Alternative One, No Action, would not require implementation, either technically or administratively. Alternative Two, Institutional Controls, would require the implementation of administrative and legal controls with the approval of multiple stakeholders. Prior to implementation, various analyses, reports, discussions, and legal contracts would have to be performed/developed to ensure acceptance and cooperation from all stakeholders.

Alternative Three, Excavation and Offsite Disposal, is implementable at the site. The remedial work can be performed using conventional construction equipment and materials, which are readily available. Offsite disposal of soil, whether classified as hazardous or non-hazardous, requires approval from the receiving facility.

4.3.7 Cost

Conceptual-level costs were estimated for each of the removal action alternatives described above, to provide a basis for comparison using USEPA guidance (USEPA, 1993 and USEPA, 2000). The cost figures are based on estimates obtained from vendors and disposal facilities, as well as previous experience and institutional knowledge. Cost estimates were compiled for the removal action alternatives using typical construction scenarios assumed for the existing conditions and may be subject to change during the final design process. The provided cost estimates are intended for comparing removal action alternatives, not for establishing project budgets. Because the removal action is not scheduled for approximately 7 months, a present worth cost was evaluated for each alternative. The cost estimates are provided in Appendix A.

No costs are associated with Alternative One, No Action.

The net present cost to implement Alternative Two, Institutional Controls, would be approximately $153,000. This cost includes negotiation of restrictions, legal research and analysis, title searches, regulatory approval, establishment of a trust, and annual inspection and reporting.

The net present total cost to implement Alternative Three, Excavation and Offsite Disposal, would be approximately $808,000. This cost includes site preparation, site controls, soil excavation, confirmatory sampling and analysis, site grading, materials, backfilling of excavation areas, site restoration, and off-site disposal costs. Due to surface soils at MRSs SR001 and SR002 potentially containing lead bullets and bullet fragments, some of the excavated soil may require disposal as a hazardous waste. For the purposes of this EE/CA, it is presumed that 75 percent of excavated soils will be disposed as hazardous waste and 25 percent of excavated soil will be disposed as non-hazardous waste.

4.3.8 State/Support Agency Acceptance

To the extent known, alternatives are assessed to determine the agency's general acceptance of the proposed alternatives. Alternative Three is anticipated to be acceptable to NYSDEC because it would meet RAOs.

4.3.9 Community Acceptance

To the extent known, alternatives are assessed to determine the community's general acceptance of the proposed alternative scenarios. With the exception of Alternatives One and Two, alternatives evaluated herein are anticipated to be considered acceptable by the (public) community because they reduce overall risk to human health and the environment. However, due to the potential risk associated with transportation of hazardous waste across public roadways, potential community concerns may arise with Alternative Three.

4.4 COMPARATIVE ANALYSIS

The three alternatives were each given a ranking (high, medium, or low) for each of the evaluation criteria. In this analysis, the removal action alternatives were compared to each other to determine which alternative best satisfied the criteria and why. A summary of the results of this analysis is provided in Table 4-2. A rating of high denotes good performance in the category, moderate denotes satisfactory performance, and low denotes unsatisfactory performance.

Alternative One, No Action, rates low on all of the evaluation criteria with the exception of compliance with ARARs, implementability and cost. Due to the lack of implementation, ARARs, and costs associated with this alternative, it received a high rating for compliance with ARARs, implementability and cost.

Alternative Two, Institutional Controls, received moderate ratings for long-term effectiveness and permanence, short-term effectiveness, implementability, and cost. Because this alternative does not remove the residual risks associated with untreated soil, this alternative received low ratings on all other criteria, with the exception of compliance with ARARs. While this alternative will not achieve RAOs, ARARs would be complied with during the implementation of this alternative.

Alternative Three, Excavation and Offsite Disposal, received high ratings for protection of human health and the environment, compliance with ARARs, long-term effectiveness and permanence, short-term effectiveness, implementability, and state agency acceptance. These high ratings were due to this alternative removing the contamination, and thus reducing the risk associated with the site. Due to this alternative not treating the contamination and potentially requiring disposal of soil as hazardous waste, this alternative received low ratings for reducing the toxicity, mobility, and volume through treatment and cost.

Table 4-2. Summary of Ranking from Detailed Analysis of Removal Action Alternatives

Evaluation Criteria	Comparative Ranking and Rationale		
	Alternative 1: No Action	Alternative 2: Institutional Controls	Alternative 3: Excavation and Offsite Disposal
Overall Protection of Human Health and the Environment	**Low** Would not be protective.	**Low** Would not be protective.	**High** Would be protective if confirmation sampling proved that contaminants are removed.
Compliance with ARARs	**High** Would comply with ARARs.	**High** Would comply with ARARs.	**High** Would comply with ARARs; Contaminants would be removed from the site.
Long-Term Effectiveness and Permanence	**Low** Would not be effective or permanent over the long-term.	**Low** Would provide effectiveness and permanence for human health if contaminants do not migrate. Is not effective in regards to the environment.	**High** Would provide long-term effectiveness and permanence at the site. Source contamination would be removed from the site. Protectiveness is achieved by the permanence of source removal.
Reduction of Toxicity, Mobility, or Volume Through Treatment	**Low** Would not reduce toxicity, mobility, or volume of contaminant.	**Low** Would not reduce toxicity, mobility, or volume of contaminant.	**Low** Disposal reduces toxicity; removes contaminant volume from the site, thereby reducing the opportunity for contaminant mobilization. Transfers volume to offsite landfill.

Table 4-2. Summary of Ranking from Detailed Analysis of Removal Action Alternatives (continued)

Evaluation Criteria	Comparative Ranking and Rationale		
	Alternative 1: No Action	**Alternative 2: Institutional Controls**	**Alternative 3: Excavation & Offsite Disposal**
Short-Term Effectiveness	**Low** No reduction in risk to the community or the environment. RAO would not be met.	**Moderate** Would reduce the risk to human health by limiting use and access. However, RAOs would not be met.	**High** Minimal risk to the community, workers, or the environment resulting from implementation if standard precautions to protect workers and local residents are implemented.
Implementability	**High** No technical or administrative activities required.	**Moderate** Would require stakeholder approval.	**High** Easy to implement. No process requirements and not labor intensive. No operations & maintenance. Approval and permits can be obtained within one year, in accordance with project specifications. Quality assurance/quality control testing required to verify compliance with TCLP thresholds.
Cost Effectiveness	**High** No cost associated with this alternative	**Moderate** Cost to implement is relatively inexpensive. Capital Costs: $67,425 O&M: $183,000 NPV: $153,000	**Low** Cost to implement (with offsite disposal of potentially hazardous waste) is relatively expensive. Capital Costs: $865,000 NPV: $808,000
State/Support Agency Acceptance	**Low** Unacceptable to NYSDEC.	**Low** Unacceptable to NYSDEC due to concentrations of contaminants remaining on-site.	**High** Likely to be acceptable to NYSDEC.
Community Acceptance	**Low** Likely to be unacceptable to the community.	**Moderate** Likely to be acceptable to the community.	**Moderate** Likely to be acceptable to the community; However, community concerns may arise due to the transportation of potentially hazardous waste on public roadways. Steps will be made to reduce this risk.

Ranking:

High = Good performance in the category.
Moderate = Satisfactory performance in the category.
Low = Unsatisfactory performance in the category.

5.0 PROPOSED REMOVAL ACTION

Alternative Three, Excavation and Offsite Disposal, is recommended as the preferred removal action alternative for MRSs SR001 and SR002 at Hancock Field. This recommendation is based on results of screening and detailed analysis of alternatives presented in this EE/CA. Removal activities would take place in accordance with an approved Action Memorandum and NTCRA Work Plan. Confirmatory sampling will be conducted to ensure that the extent of the proposed excavations meets the RAOs established for these sites.

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6.0 PUBLIC PARTICIPATION

In accordance with the USEPAs Guidance on Conducting NTCRAs under CERCLA, a Notice of Availability of the EE/CA will be placed in *The Post Standard* and a 30-day public comment period held. In addition, supporting documents (e.g., CSE Phase I and II Work Plans and Reports) will be available in the Administrative Record/Information Repository (AR/IR). Written responses to substantive public comments will be placed in the AR/IR. Written comments should be addressed to:

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7.0 REFERENCES

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APPENDIX A
Cost Estimates

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Table A-1. Alternative Two: Institutional Controls

Item	Unit Cost	Unit	Quantity	Total
1. Capital Costs				
a. Preliminary				
Negotiation of Restrictions and Prohibitions	$20,000.00	Meeting	1	$20,000.00
Legal Research and Analysis	$350.00	Hour	8	$2,800.00
Local Regulatory Approval	$500.00	DEC Review	1	$500.00
Title Searches	$1,350.00	Property	3	$4,050.00
			Subtotal	$27,350.00
b. Planning/Implementation				
Institutional Controls Implementation Plan	$11,000.00	Lump Sum	1	$11,000.00
Public Meeting	$13,000.00	Lump Sum	1	$13,000.00
Regulatory Approval of Plan	$7,000.00	Document	1	$7,000.00
Training of Registry and Property Records Office	$6,000.00	Lump Sum	1	$6,000.00
Filing and Recording ICs with Property Records Office	$75.00	Lump Sum	1	$75.00
Establishing a Trust or Posting a Bond	$3,000.00	Lump Sum	1	$3,000.00
			Subtotal	$40,075.00
2. O&M Costs				
Annual Inspection (ensure ICs are being maintained)	$1,000.00	Lump Sum	30	$30,000.00
Annual Reporting	$5,000.00	Lump Sum	30	$150,000.00
Maintenance (Fencing) – Every 5 years	$500.00	Lump Sum	6	$3,000.00
			Subtotal	$183,000.00
			Total Capital Costs	$67,425.00
			Total O&M Costs	$183,000.00
			Contingency at 10%	$25,042.50
Future Project Total (Assuming work will be conducted in September 2012)				**$275,467.50**
Project Present Worth Total (Assuming a discount rate of 7%)				**$152,401.89**

Table A-2. Alternative Three: Excavation and Offsite Disposal

Item	Unit Cost	Unit	Quantity	Total
<u>1. Capital Costs</u>				
a. Project Preparation				
Mobilization/Demobilization	$31,882.00	Lump Sum	1	$31,882.00
Site Preparation (including required demolition)	$170,491.20	Lump Sum	1	$170,491.20
Field Oversight	$19,896.00	Lump Sum	1	$19,896.00
Project Management	$2,257.00	Lump Sum	1	$2,257.00
			Subtotal	$224,526.20
b. Soil Excavation				
Excavate, Load, Transport, and Disposal (Non-Hazardous)	$63.42	Ton	632	$40,081.44
Excavate, Load, Transport, and Disposal (Hazardous)	$245.00	Ton	1898	$465,010.00
Analytical Costs (All Sampling)	$15,000.00	Lump Sum	1	$15,000.00
Field Oversight	$23,212.00	Lump Sum	1	$23,212.00
Project Management	$2,632.00	Lump Sum	1	$2,632.00
			Subtotal	$505,854.00
c. Site Restoration				
Safe Grading	$6,925.00	Lump Sum	1	$6,925.00
Hydroseeding, Fertilizer, and Mulch	$3,765.00	Acres	1.8	$6,777.00
			Subtotal	$13,702.00
d. Reporting				
Action Memorandum	$11,500.00	Lump Sum	1	$11,500.00
Non-Time Critical Removal Action Work Plan	$17,500.00	Lump Sum	1	$17,500.00
Non-Time Critical Removal Action Completion Report	$12,500.00	Lump Sum	1	$12,500.00
			Subtotal	$41,500.00
			Sum of Subtotals	$785,582.20
			Contingency at 10%	$78,558.22
Future Project Total (Assuming work will be conducted in September 2012)				**$864,140.42**
Project Present Worth Total [Assuming a discount rate of 7% and calculated from when vendor quotes were obtained (January 2012)]				**$807,607.87**