FINAL
SITE-WIDE PROPOSED PLAN

SPRING VALLEY FORMERLY USED DEFENSE SITE
WASHINGTON, DC

Contract No.: W912DR-09-D-0061, Delivery Order 0011
DERP FUDS MMRP/CWM Project No. C03DC091801 and
DERP FUDS HTRW Project No. C03DC091802

Prepared for:

US ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

US Army Corps of Engineers
BUILDING STRONG

JUNE 07, 2016

June 07, 2016

Attn: Dan Noble
CENAB-EN-HN
10 S. Howard Street
Baltimore, MD 21201-1715

Dear Mr. Noble,

ERT, Inc., is pleased to present the Final Proposed Plan for the Spring Valley FUDS Integrated Site-Wide Remedial Investigation/Feasibility Study, Washington, DC. This report is submitted under Contract W912DR-09-D-0061, Delivery Order 0011. It incorporates Stakeholder comments on the March 31, 2016 Draft-Final version of the document.

Please do not hesitate to call me at 301-323-1442 if you need anything more.

Sincerely,

ELECTRONIC SIGNATURE

Thomas J. Bachovchin, P.G.
Project Manager

DISTRIBUTION:

CENAB – Noble
CEHNC – Anderson-Hudgins
USEPA – Hirsh
DOEE – Sweeney
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Prepared for:
U.S. Army Corps of Engineers
Baltimore District

Prepared by:
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06/01/16

Thomas Bachovchin, PG — Date
Project Manager

11/09/15

Jennifer Harlan, PMP — Date
Program Manager

COMPLETION OF SENIOR TECHNICAL REVIEW

This document has been produced within the framework of the ERT, Inc. (ERT) quality management system. As such, a senior technical review has been conducted. This included review of all elements addressed within the document, proposed or utilized technologies and alternatives and their applications with respect to project objectives and framework of U.S. Army Corps of Engineers regulatory constraints under the current project, within which this work has been completed.

11/04/15

Michael Dorman, PMP — Date
Senior Technical Reviewer

COMPLETION OF INDEPENDENT TECHNICAL REVIEW

This document has been produced within the framework of ERT's quality management system. As such, an independent technical review, appropriate to the level of risk and complexity inherent in the project, has been conducted. This included a review of assumptions; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the project objectives. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

11/04/15

Sean Carney, PMP — Date
Independent Technical Reviewer

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PROPOSED PLAN FOR SPRING VALLEY FORMERLY USED DEFENSE SITE WASHINGTON, D.C.

OVERVIEW

This **Proposed Plan** was prepared for the Spring Valley Formerly Used Defense Site (**SVFUDS)** to satisfy Section 117 (a) of the **Comprehensive Environmental Response, Compensation and Liability Act** (**CERCLA**). The primary purpose of this Proposed Plan is to identify a preferred remedial alternative to mitigate unacceptable risks posed by soil contamination and unacceptable explosive hazards due to **munitions and explosives of concern** (**MEC**) that may remain within the SVFUDS, highlighting the key factors that led to identifying the Preferred Alternative of the U.S. Army Corps of Engineers (**USACE**), Baltimore District.

The Site-Wide **Remedial Investigation** Report (USACE, June 2015) (**RI** Report) identified the remaining risks/hazards in the soil (including MEC), and the Site-Wide **Feasibility Study** (**FS** Report) (USACE, November 2015) evaluated remedial alternatives to address them. The RI Report documented the site characterization work and removal actions initiated by USACE to ensure that the immediate threats to the public and environment from **MEC**, **Chemical Warfare Materiel** (**CWM**), and **Hazardous and Toxic Waste** (**HTW**)-impacted soil were addressed concurrently. The FS developed and analyzed various response actions to mitigate unacceptable risks posed by soil contamination and unacceptable explosive hazards due to MEC.

The SVFUDS RI/FS and this Proposed Plan address soil media. A separate groundwater-focused RI and FS Report will be provided as separate documents at a later date. Following those reports, a Proposed Plan and Decision Document will also be issued for groundwater at the site.

This project falls under the Military Munitions Response Program (**MMRP**) of the Defense Environmental Restoration Program (**DERP**)/**Formerly Used Defense Sites** (**FUDS**) and includes HTW-impacted media. The Department of Defense (**DoD**) established the MMRP to address **munitions constituents** (**MC**), and MEC (**unexploded ordnance** [**UXO**], **discarded military munitions** [**DMM**], and MC in high enough concentrations to pose an explosive threat) that are located on certain properties, including FUDS. Under the DERP, the U.S. Army is the DoD's lead Agency for FUDS, and USACE executes FUDS for the Army. USACE performs response activities throughout the SVFUDS in accordance with CERCLA and the **National Oil and Hazardous Substances Pollution Contingency Plan** (**NCP**), 40 C.F.R. Part 300. Region 3 of the U.S. Environmental Protection Agency (**USEPA**) and the District of Columbia Department of energy and Environment (**DOEE**) provide oversight of USACE's work at the SVFUDS pursuant to CERCLA and the NCP.

USACE, the **DOEE**, and the **USEPA**, <u>encourage the public to participate in the discussion of remedial alternatives presented in this Proposed Plan</u>; the preferred alternative may be modified, or another alternative selected, based on new information acquired during the comment period.

Words and acronyms shown in **bold font** (initial use) are defined in the Acronyms List and/or the Glossary of Terms presented in Appendix A.

Specific information on how to participate in this decision-making process is presented at the end of this plan

1.0 INTRODUCTION

USACE, in coordination with DOEE and USEPA, is proposing preferred alternatives to mitigate unacceptable risks posed by soil contamination and unacceptable explosive hazards due to MEC that may remain within the SVFUDS.

This Proposed Plan includes:

- Site background information (Section 2.0)
- Scope and role of the remedial action (Section 3.0)
- Summary of site risks (Section 4.0)
- Remedial Action Objectives (RAOs) (Section 5.0)
- Summary of alternatives analyzed (Section 6.0)
- Evaluation of the alternatives (Section 7.0)
- Selection of the preferred alternatives (Section 8.0)
- Opportunities for community participation (Section 9.0)

This Proposed Plan summarizes information that can be found in greater detail in the RI and FS Reports, as well as other documents available to the public in the designated **Administrative Record** file. The location of the Administrative Record and information on how to participate in the decision-making process is included in Exhibit 3 at the end of this Proposed Plan.

USACE will finalize the preferred alternative selection for the SVFUDS in a **Decision Document** (**DD**) after evaluating comments received from the public on this Proposed Plan and in coordination with DOEE and USEPA. The CERCLA sequence of events for the SVFUDS is summarized in Exhibit 1.

EXHIBIT 1

THE CERCLA PROCESS FOR THE SVFUDS

Prepare **Remedial Investigation Report** (Final, June 2015)

↓

Prepare **Feasibility Study Report** (Final, January 2016)

↓

Prepare **Proposed Plan** (Final, June 2016)

↓

Provide Notice of **Public Comment Period** and **Public Meeting**

Distribute **Proposed Plan** for public review

↓

Compile public comments

↓

Provide responses to public comments

Prepare the **Decision Document**

↓

Implement the **Remedial Action**

2.0 SITE BACKGROUND

2.1 Site Location

The SVFUDS comprises 661 acres in northwest Washington, D.C. This is a largely residential area with local shops and restaurants, surrounded by dense apartment buildings and/or townhouses, and spreading out into single-family homes. Land use in and around the SVFUDS is primarily low-density residential, with smaller portions zoned for commercial use. The campus of American University (**AU**), which occupies a large portion of the SVFUDS, is considered institutional use. The Dalecarlia Woods area on the western edge of the SVFUDS is zoned as Federal or public use. Figure 1 shows the SVFUDS boundary (figures are presented in Appendix B).

2.2 Site History

During World War I, the U.S. Government established the American University Experiment Station (**AUES**) to investigate the testing, production, and effects of noxious gases, antidotes and protective masks. The AUES, which was located on the grounds of the current AU, used additional property in the vicinity to conduct this research and development on CWM, including mustard and lewisite agents, as well as adamsite, irritants and smokes. The SVFUDS includes property occupied by the former AUES between 1917-1920, as well as an area adjacent to the AUES, named Camp Leach, that was established and used for staging, training, and billeting troops during World War I. After the war, these activities were transferred to other locations, the AUES was demobilized, and the site was returned to the owners.

2.3 Previous Investigations

The RI Report documents all previous investigations. The SVFUDS is an extremely complex site involving several ongoing and concurrent activities over many years. To track all of the site activities and present them in a cohesive manner, all previous activities were organized by four key types of activities conducted at the SVFUDS. The discussion below follows that organizational structure of these key activities as presented in the RI and FS reports.

Initial Investigation/Characterization

In January 1993, the U.S. Army initiated an emergency response upon discovery of a burial trench in the 52nd Court area of Spring Valley. Known as Operation Safe Removal (**OSR) FUDS**, it was essentially the start of the RI phase for the SVFUDS. Using historical documentation including reports, maps and photos, USACE established Points of Interest (**POIs**) as a means to conduct the investigations, and the findings were documented in the 1995 OSR FUDS RI report (USACE, 1995). The OSR FUDS RI Report was followed by a No Further Action Record of Decision in June 1995. In 1999, the USEPA prepared its own human health risk assessment (**HHRA**) for the SVFUDS (USEPA, 1999b), conducting an analysis of soil sampling data collected between 1993 and 1995 within the SVFUDS.

Follow-on Investigation/Characterization

The D.C. Department of Consumer and Regulatory Affairs (**DCRA**) prepared a report in 1996 based on USACE's work at the SVFUDS and recommended site-wide comprehensive geophysical investigations, soil sampling, and a health study (the current DOEE was formerly part of the DCRA). Following further USACE review of these issues, USACE conducted field investigations in the Glenbrook Road area, designated as operable unit (**OU**) 3. The USEPA also collected soil samples in this area to supplement its HHRA and based on the results, in 2000, it was determined that the area of investigation should be expanded beyond OU-3. This expanded area of investigation was designated as OU-4.

In response to significant community concerns regarding possible soil contamination, USACE, in consultation with the USEPA and the District of Columbia Department of the Environment (DDOE), now the DOEE, developed a comprehensive plan to conduct arsenic soil sampling on every property within the SVFUDS and conduct additional geophysical investigations focusing on identifying additional potential burial pits as well as individual buried munition items. The expanded area of investigation, some 577 acres, was designated as OU-5.

The soils of both OU-4 and OU-5 were characterized for arsenic and selected CWM compounds associated with AUES activities under an Engineering Evaluation/Cost Analysis (**EE/CA**) (USACE, 2003). This EE/CA established a 20 mg/kg arsenic removal goal through consensus of the Spring Valley Partners (including USACE, USEPA, and the DDOE); this goal was supported by the independent Scientific Advisory Panel, established to assist the community in understanding the approach to technical issues affecting Spring Valley.

Geophysical Investigations

Geophysical investigations were conducted on 99 residential properties between 1998 and 2011. Many were also conducted on the AU campus, and on approximately 60 acres of D.C. and federal property located east of the Dalecarlia Reservoir. The investigations were conducted in two phases: non-intrusive geophysical surveys to identify buried metallic anomalies; then, following analysis of the survey results by an Anomaly Review Board (**ARB**), excavations of metallic anomalies with characteristics of buried munition items were conducted.

Removal Actions

Concurrent with ongoing SVFUDS investigations, for specific areas, **removal actions** were determined to be warranted. In the early stages of the investigations, it was determined that arsenic in soil was the primary wide-spread contaminant and a decision was made to address it with removal actions.

Removal actions were completed as Time Critical Removal Actions (**TCRA**) or Non-Time Critical Removal Actions (**NTCRA**). For the SVFUDS, these removals were primarily excavations of arsenic contaminated soil. TCRAs were conducted on portions of the AU campus, as well as several residential properties. USACE conducted NTCRAs on 100 properties and 9 lots during the period of 2004-2012. For selected properties, USACE also used ferns that naturally extract arsenic from soil. This process, known as phytoremediation, was used to fully or partially address 21 residential properties and one lot on Washington Aqueduct property.

The determination of the nature and extent of contamination for the SVFUDS is based on the findings of each of these four primary types of activities conducted at the SVFUDS, as detailed in the RI Report.

In 2010, the Partners agreed to separate the 4825 Glenbrook Road property from the remainder of the SVFUDS and place it on its own CERCLA pathway. Accordingly, 4825 Glenbrook Road activities are not included in this Proposed Plan.

3.0 SCOPE AND ROLE OF THE REMEDIAL ACTION

The RI Report identified two levels of risk/hazard to be mitigated at the SVFUDS:

- Unacceptable risks posed by soil contamination, and
- Unacceptable hazards posed by the possible presence of MEC.

The FS was organized to address these two issues separately, evaluating various remedial action alternatives to mitigate soil contamination, and various remedial action alternatives to mitigate explosive hazards.

The scope of the **remedial action** that addresses soil contamination is to return the identified areas of contamination (Section 4.0) to a condition that eliminates unacceptable risk to human health of the people working and living in this area, and to the environment.

The scope of the remedial action that addresses potential explosive hazards posed by MEC is to reduce the potential for encountering MEC at properties within the identified areas of focus (See Section 4.0 and Figure 4), and return them to a condition that eliminates unacceptable explosive hazards to people living and working in this area.

The scope of the remedial action to address potential explosive hazards for SVFUDS properties outside the identified areas of focus is to reduce the probability of residents, maintenance workers, and visitors handling any MEC encountered. This will be accomplished by developing education and awareness initiatives to ensure the community continues to be educated about the past history of the SVFUDS.

4.0 SUMMARY OF SITE RISKS/HAZARDS

This discussion summarizes the conclusions of the RI Report with regard to both unacceptable risks posed by soil contamination, and unacceptable explosive hazards due to MEC that may remain within the SVFUDS. According to the groundwater-focused RI, soil is not significantly contributing to groundwater contamination and thus, the media are discussed in separate RI Reports.

4.1 Human Health Risks

Risk Screening

A comprehensive risk screening process was conducted to: review previous HHRAs to assess whether they remained protective relative to updated comparison or toxicological standards; conduct supplemental soil sampling to address data gaps; and identify specific areas where further quantitative risk assessment was warranted. To do this, three separate efforts were conducted, each building off the findings of the previous one.

The first of these efforts was the completion of a work plan (USACE, 2012) presenting the methodology to review five older HHRAs. This review determined whether the chemicals of potential concern (**COPCs**) identified, the exposure pathways considered, and the toxicity evaluations, would still be appropriate when considering updated USEPA guidance and site-specific background concentrations, and to identify remaining areas that require additional risk screening and risk assessment.

The second effort provided the results of the review (USACE, 2013a) of the five older HHRAs where re-screening of all soil data from SVFUDS was done using updated risk-based screening levels and background data, to ensure that any potential risks associated with soils still in place were evaluated.

The third effort presented the results (USACE, 2013b) of the completion of the recommended activities identified in the HHRA Review report (USACE, 2013a).

These three efforts concluded with the identification of **exposure units** (**EUs**) that, based on the COPCs identified and the risks calculated, required full quantitative HHRAs. These EUs, which are shown in Figure 2, include:

- The Area of Interest (**AOI**) 9 EU;
- The Spaulding-Rankin EU; and
- The Southern AU EU.

Sample results for each EU were reviewed to ensure that the identified EUs were not so large that they diluted higher concentrations of a chemical over the larger area (that is, small areas of higher concentrations were not eliminated from further consideration).

This review evaluated whether maximum concentrations of each chemical were more than 10 times higher than the average of the remaining concentrations of that chemical (i.e., identified whether the maximum concentration was an outlier). Where an outlier was determined, that sample location was removed from the data set and the EU was separately evaluated in the HHRA using the remaining samples. Any outlier locations so determined were then individually assessed for human health risks. The '10 times' procedure was completed at the screening level; more formal statistical testing, such as Rosner tests, was done as needed.

Quantitative Human Health Risk Assessment

A quantitative human health risk assessment estimates the "baseline risk," which is an estimate of the likelihood of health problems occurring if no cleanup action is taken at a site. Quantitative HHRAs were completed for the three SVFUDS EUs; they are presented in detail in the RI Report. To conduct the HHRAs for the three EUs, data previously collected during site investigation activities were used to identify and screen COPCs at each EU. For the receptors present at each EU, the HHRA estimated the magnitude of exposure to COPCs, identified potential exposure pathways, and quantified exposure. This information, in conjunction with toxicity data for the COPCs, was used to quantitatively estimate the risk posed to human receptors associated with exposure to the COPCs in soil at each of the three EUs.

The quantitative HHRAs determined which COPCs were actual **chemicals of concern** (**COCs**) in soil at each of the three EUs.

Receptors and Exposure Pathways

The AOI 9 EU comprises multiple residential properties and defines an area with common receptors and exposure pathways. The EU contains multiple POIs, with portions of it falling within the downrange impact areas of the Range Fan.

The Spaulding-Rankin EU is limited to a single residential property previously known as the Spaulding-Captain Rankin area (**SCRA**), where the Range Fan firing point and concrete shell pits were located. The EU includes multiple POIs.

Current potential exposures to surface soil evaluated in the HHRA for these two residential EUs, included outdoor workers (i.e., landscapers); and adult and child residents. Future exposures to mixed surface and subsurface soil were evaluated for outdoor workers, construction workers, and adult and child residents.

The Southern AU EU is an active university campus with no full time permanent residents, and the EU boundary defines an area with common receptors and exposure pathways. Current potential exposures to surface soil evaluated in the HHRA for this EU included outdoor workers and student recreational users (associated with a 4-year student). Future exposures to mixed surface and subsurface soil were evaluated for outdoor workers, student recreational users, construction workers, and adult and child residents (if residences were built on campus).

Summary of Human Health Risks

A response action is generally warranted if the cumulative excess carcinogenic risk to an individual exceeds 10^{-4} (1 in 10,000), or the non-carcinogenic hazard index **(HI)** value is greater than the USEPA benchmark of 1.

For the AOI 9 EU, no COCs, and therefore no unacceptable risks to human health, were identified.

For the Spaulding-Rankin EU, cobalt, posing a non-carcinogenic risk in soil, was the only COC identified.

For the Southern AU EU, the COCs are cobalt, mercury, and vanadium, posing non-carcinogenic risks in soil, and the carcinogenic polynuclear aromatic hydrocarbons (**PAHs**), posing carcinogenic risks in soil.

This means that non-carcinogenic risks in soil due to mercury and vanadium in the identified areas at the Southern AU EU, exceed the benchmark HI of 1, and response actions are required to address them. However, with regard to cobalt, USACE made a recommendation that an HI value of 2 was more appropriate than the benchmark of 1, based on the level of uncertainty associated with the provisional toxicity data used to estimate the cobalt non-cancer hazards. USEPA's stated confidence in these toxicity data is low to medium, and the practical implication is that it exaggerates risks due to cobalt. USEPA accepted USACE's recommendation, and therefore, non-carcinogenic risks in soil, due to cobalt in the identified areas at the Spaulding-Rankin and Southern AU EUs, are based on HI values exceeding 2. Where this occurs response actions are required to address it.

Carcinogenic risks in soil, due to carcinogenic PAHs in the identified areas at the Southern AU EU, exceed the excess carcinogenic risk of 1 in 10,000, and response actions are required.

Figure 3 shows the areas of potential non-carcinogenic and carcinogenic risks at the Spaulding-Ranking and Southern AU EUs.

The table below presents a summary of the human health risks determined for the EUs.

EXPOSURE UNIT	RISK	COC
SCRA	Non-carcinogenic	Cobalt
SCRA Outliers	Non-carcinogenic	Cobalt
Southern AU	Non-carcinogenic	Cobalt
Southern AU Outliers	Non-carcinogenic and Carcinogenic	Cobalt, Mercury, Vanadium, and Carcinogenic PAHs

4.2 Ecological Risks

The potential for ecological risk was also assessed as part of the RI. A Screening Level Ecological Risk Assessment (**SLERA**) is the "environment/ecology" equivalent of the human health risk assessment. The SLERA evaluated whether unacceptable adverse risks are posed to ecological receptors as a result of hazardous substance releases. The SVFUDS area was characterized with respect to physical, chemical, and ecological characteristics, and the current and anticipated future land uses. The SLERA concluded that ecological risks are negligible and that no further action on the basis of ecological risks was warranted.

4.3 Explosive Hazards

The SVFUDS geophysical investigation and anomaly removal process has provided high quality geophysical data of all key areas based on historical review of past practices and the likelihood of MEC being present. However, the presence of individual munitions-related items in the SVFUDS remains a possibility.

MEC Hazard Assessment

As described in the RI Report, the hazard due to remaining MEC was partly determined using the MEC Hazard Assessment (HA) methodology. The MEC HA evaluates potential explosive hazards, given current conditions and under various cleanup scenarios. At the SVFUDS, the **MEC HA** was organized around the past activities most likely to have resulted in MEC at the site, including ballistically fired testing, statically fired testing, and disposal activities (known and possible burial areas). The table summarizes the MEC HA scoring for these activities.

AREA or ACTIVITY	HAZARD LEVEL CATEGORY	EXPLOSIVE HAZARD CONDITION
Safety Buffer for Livens	4	Low
Impact Area for Stokes	3	Moderate
Impact Area for Livens	3	Moderate
Generic Disposal Area	3	Moderate

Based on ballistically fired testing activities, the Safety Buffer area for the Livens Projectile scored a 4 (low potential explosive hazard conditions), reflecting that few MEC items would be expected in a buffer area. The Impact Areas for both the Livens and the Stokes mortars scored a 3 (moderate potential explosive hazard conditions), suggesting the need for response actions to mitigate unacceptable explosive hazards that could exist on the properties within the impact areas.

The static test fire areas do not typically represent MEC concerns in that the testing process would have monitored individual munition items and they would not have been left behind. However, static testing activities may indicate the presence of munitions burial pits near the testing locations (within buffer zones), suggesting the need for response actions to mitigate unacceptable explosive hazards that could be associated with possible munitions burial pits.

To address possible disposal areas, a generic MEC HA that conservatively assumed a worst case disposal area/burial pit scenario was completed and the resulting score was a 3. The unknowns associated with the identified possible disposal areas, such as type and quantity of buried materials, and the moderate potential explosive hazard conditions they represent, suggest the need for response actions to mitigate unacceptable explosive hazards that could exist in these areas.

The AU Public Safety Building (PSB) is considered one of these possible disposal areas. As the PSB is an active building on the AU campus, so long as it remains in place, it effectively acts as a cap or control to contain any potential explosive hazard (that is, it prevents interaction between source and receptor). However, when the PSB is removed, the preferred explosive hazards mitigation alternative will be applied to the area and any burial pits will be properly addressed. This will include any AUES-related debris or soil contamination left by Army activity. USACE will apply the Contaminated Soil Risk RAOs described in Section 5.0, including over-excavation of soil should sampling indicate risks that need to be mitigated. Additionally, any other potential Contaminants of Concern encountered during remedial work will be addressed through discussion and establishment of a clean-up goal at the time it is encountered.

With regard to unacceptable explosive hazards receptors and pathways, the MEC pathway is considered to be complete for the properties within the identified areas of focus because there is a potential source, potential receptors, and the potential for interaction between them.

SVFUDS Munitions Response Site 01 (MRS-01) is described in the RI Report. Figure 4 presents the MRS boundary and indicates the locations of the focus areas of potential unacceptable explosive hazards relative to the boundary.

4.4 Summary of Site Risks/Hazards

Based on the HHRA, unacceptable risks are posed by soil contamination at the identified areas of the Spaulding-Rankin and Southern AU EUs, and response actions are required to mitigate them. (Note that arsenic-based soil removal actions have previously been completed).

Based on the MEC HA scores and the historical knowledge of past practices, unacceptable hazards may exist due to MEC potentially remaining within the SVFUDS, and response actions are required to mitigate them.

It is the current judgment of USACE that the preferred alternatives identified in this Proposed Plan, or one of the other alternatives considered in the detailed analysis in Section 7.0 (other than No Action), are necessary to protect public health or the environment from the actual or threatened risks or hazards described above.

5.0 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) describe what the proposed site cleanup is expected to accomplish, specifying the contaminants and/or munitions, media of concern, receptors and exposure pathways, and remediation goals that permit a range of remedial alternatives to be developed.

5.1 Site-Specific RAOs

For the SVFUDS, remedial alternatives were separately developed for the two identified levels of risk/hazard (unacceptable risks posed by soil contamination, and unacceptable explosive hazards posed by MEC).

Contaminated Soil Risk RAOs

For unacceptable risks posed by soil contamination, based on the quantitative HHRA presented in the RI Report, the COCs are cobalt, mercury, vanadium, and carcinogenic PAHs, in soil. Taking into account the COCs, the affected media, the exposure pathways, and the project goals, the SVFUDS RAOs are:

- Prevent direct contact with mercury or vanadium-contaminated soil having a non-carcinogenic HI exceeding 1. This HI value will be obtained by achieving an average concentration (95% upper confidence limit on the mean) across the EU for mercury of 1.3 mg/kg, and for vanadium of 390 mg/kg.
- Prevent direct contact with cobalt-contaminated soil having a non-carcinogenic HI exceeding 2. This HI will be obtained by achieving an average concentration (95% UCL of the mean) across the EU for cobalt of 43 mg/kg.
- Prevent direct contact with carcinogenic PAH-contaminated soil having a cancer risk in excess of 1×10^{-4}. As this represents the upper end of the acceptable cancer risk range, by remediating PAHs to background levels, risk will not exceed 1×10^{-4}. The levels are from the *SVFUDS Background Soil Sampling Report*, USACE 2008). They are:

CARCINOGENIC PAHs	
Benzo(a)anthracene = 0.358 ppm	Benzo(k)fluoranthene = 0.357 ppm
Benzo(a)pyrene = 0.375 ppm	Dibenz(a,h)anthracene = 0.51 ppm
Benzo(b)fluoranthene = 0.366 ppm	Indeno(1,2,3-c,d)pyrene = 0.335 ppm

Unacceptable Explosive Hazards RAOs

Unacceptable explosive hazards are posed by MEC potentially remaining within the SVFUDS. Combining the affected media, the exposure pathways, and the project goals, the SVFUDS RAOs are:

- Reduce the potential for encountering MEC in the identified focus areas of potential explosive hazards by investigating and removing subsurface anomalies that are most likely military munitions, to the depth of detection of the technology used.
- Reduce the probability of residents, workers, and visitors handling MEC encountered during residential or construction activities conducted within SVFUDS MRS-01, through education and awareness initiatives (in addition to the focus areas, these initiatives will also be applied to all areas of the SVFUDS to address the possibility that MEC could be relocated or, less likely, found there).

The education and awareness initiatives RAO serves as a conservative measure to ensure the entire community is educated about munitions issues even though the USACE does not propose active responses beyond the MRS-01 boundary.

5.2 Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements (**ARARs**) are any Federal or State standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate to a CERCLA site or action.

ARARs were identified during the development of remedial alternatives in the FS Report. These are the *U.S. Chemical and Biological Warfare Program, 50 United States Code (USC) 1518*, regarding disposal of such material, and *DCMR, 20 DCMR § 605.1*, regarding control of fugitive dust during remediation. No chemical or location-specific ARARs were identified for the SVFUDS. Pursuant to CERCLA/NCP, compliance with ARARs is a threshold requirement that a remedial alternative must meet in order to be eligible for selection.

6.0 SUMMARY OF REMEDIAL ALTERNATIVES

This section presents a summary of the remedial alternatives developed separately to meet the RAOs for each of the two identified levels of risk/hazard for the SVFUDS. As detailed in the FS Report, defined alternatives were evaluated against the short and long-term aspects of three broad criteria: effectiveness, implementability, and cost.

6.1 Effectiveness

This criterion was evaluated with respect to effectiveness in protecting human health and the environment, and providing reduction in toxicity, mobility, and volume. The short-term (construction and implementation period) and long-term components (effective period after the remedial action is complete) were also evaluated.

6.2 Implementability

This criterion was evaluated as a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial alternative. Technical feasibility is the ability to construct, reliably operate and maintain an alternative, while administrative feasibility refers to the ability to obtain approvals from agencies, and the availability of required goods and services.

6.3 Cost

The cost of each alternative was also evaluated. Prior estimates, sound engineering judgment, and real-world (actual) costs based on previous implementation of some of the remedial alternatives within the SVFUDS, were used to evaluate one alternative against another.

6.4 Contaminated Soil Remedial Alternatives

Based on a review of contaminated soil technologies, four remedial alternatives were identified in the FS to mitigate the unacceptable risks posed by soil contamination resulting from the identified COCs.

Contaminated Soil Alternative 1: No Further Action

The NCP requires that a No Further Action alternative be developed as a comparative baseline against which other alternatives can be evaluated. This alternative would involve leaving the identified area of risk in its current condition. Under this alternative, no remedial action would be taken, and any identified contaminants are left "as is," without the implementation of any containment, removal, treatment, or other protective actions. This alternative does not provide for the monitoring of soil and does not provide for any land use controls to reduce the potential for exposure.

The FS analysis indicated that for the SVFUDS, Alternative 1 failed key elements of the effectiveness and implementability criteria, and it was not retained for the detailed analysis described in the next section.

Contaminated Soil Alternative 2: Land Use Controls (LUCs)

The **Land Use Controls (LUCs)** alternative would include limiting access to all or portions of the identified area of risk and would call for environmental covenants, among other controls. The success of access limitations would depend on the cooperation of the regulators, the government, and the current and future property owners.

Options for limiting access include fencing specific areas (e.g., areas known to contain soil contamination); covering the areas with concrete or brick (e.g., restricting the use as a parking area or patio); or planting the areas with groundcover plants that do not require routine maintenance.

The LUC alternative would also include the development of environmental covenants, such as prohibition of routine landscaping activities, to legally bind the current and future property owner to the appropriate access and use restrictions.

However, the FS analysis indicated that for the SVFUDS, Alternative 2 failed key elements of the effectiveness and implementability criteria, and it was not retained for the detailed analysis described in the next section.

Contaminated Soil Alternative 3: Phytoremediation

Phytoremediation is a remedial technology that uses plants to remove contaminants from the environment. Alternative 3 entails installing selected plants in the contaminated soil areas, based on treatability studies conducted to determine the appropriateness of this alternative to site-specific conditions. The plants would be harvested periodically and disposed appropriately. The harvested plants would be replaced with new plants, as necessary, in order to achieve the RAO for the COCs in that area. The duration of this effort would be very site-specific and would vary depending on the COC, COC concentrations, growth rate of the plantings, depth of contamination, and climate factors.

Phytoremediation has generally been shown to be effective in removing some SVFUDS-specific COCs from soils, but a treatability study would be required to determine the true effectiveness of this alternative for all the specific COCs at the site-specific locations.

The FS analysis indicated that for the SVFUDS, Alternative 3 met key elements of the effectiveness and implementability criteria and it was retained for the detailed comparative analysis in the next section.

Contaminated Soil Alternative 4: Excavation and Off-site Disposal

Alternative 4 entails excavation of contaminated soils in the areas identified, and backfilling the areas with clean soil. Additional soil sampling would be completed and the new sample data would be used to recalculate the human health risks for that location. Once the RAOs are met, as determined by the recalculated carcinogenic and/or non-carcinogenic risks, the limits of contamination would be established. Excavation would be considered complete when the recalculated EU mean concentration is less than the cleanup standard.

Excavated soil would be characterized and transported to an appropriate off-site disposal facility. The excavated soil would be characterized in accordance with the requirements of the disposal facility. Past SVFUDS experience has shown that the vast majority of the soil would be characterized as non-hazardous, and would therefore be transported to a sanitary landfill for disposal.

The FS analysis indicated that for the SVFUDS, Alternative 4 met key elements of the effectiveness and implementability criteria and it was retained for the detailed comparative analysis in the next section.

6.5 Explosive Hazards Remedial Alternatives

The primary response action to mitigate potential explosive hazards due to MEC at the SVFUDS has been digital geophysical mapping (**DGM**) followed by excavation of the encountered anomalies. There have been multiple DGM/anomaly removal efforts throughout the history of the SVFUDS, and standard procedures have been established.

The current SVFUDS procedure is to use the EM61, an electromagnetic instrument, and the G-858, a magnetic instrument, in combination. Identified anomalies are classified using factors such as anomaly size and coincident geophysical signatures between instruments, placing them into one of four categories, A, B, C, and D, with 'A' most likely to represent a buried munition item. Advanced classification (**AC**) is a new approach to improve the efficiency of munitions response DGM by using advanced electromagnetic induction sensors and geophysical data processing software to better estimate the depth, size, wall thickness, and shape of a buried item. AC technology allows for a more informed decision as to whether the item is a potential munition that needs to be excavated, or metal clutter that can be left in the ground. Use of AC at the SVFUDS, to supplement the current procedures, was also part of the remedial alternatives evaluated.

Six remedial alternatives were identified in the FS to mitigate the potential unacceptable explosive hazards. Based on the established DGM procedures, remedial alternatives 3 through 6 (below) were developed that achieve the RAOs for explosive hazards by varying DGM coverage amount (acreage) and quantity of anomalies to dig, on a given property.

Explosive Hazards Alternative 1: No Further Action

The No Further Action alternative has been described above. With regard to explosive hazards, this alternative would leave any MEC items potentially present, in place, without further investigation or removal. This alternative does not provide for additional investigation for or removal of

MEC items, and does not provide for any active or passive land use controls to reduce the potential for exposure. Consequently, Alternative 1 failed key elements of the effectiveness and implementability criteria, and it was not retained for the detailed analysis described in the next section.

Explosive Hazards Alternative 2: LUCs

The LUCs alternative has been described above. With regard to explosive hazards, LUCs would not reduce toxicity or volume of MEC. Acceptance by the property owner and the ability to commit future owners to living in restricted surroundings, would be difficult to obtain. Consequently, Alternative 2 failed key elements of the effectiveness and implementability criteria, and it was not retained for the detailed analysis described in the next section.

Explosive Hazards Alternative 3: Full DGM Coverage, Remove All Anomalies

Alternative 3 entails conducting DGM/anomaly removal on a given subject property, specifying standards for DGM coverage (acreage) and quantity of anomalies to be removed (excavated).

The DGM coverage standard is 'full' coverage. While the DGM coverage objective is always intended to be 100% coverage, there are practical considerations for residential properties. Accordingly, full coverage is defined as using the geophysical instruments to survey all of the acreage of the property, not including beneath constructed buildings (such as houses, garages, or in-ground swimming pools) or trees older than approximately 100 years (i.e., the tree was in existence during the AUES activities and it is unlikely that MEC items would be beneath it). Full coverage would include DGM of hardscape features such as driveways, sidewalks, or patios, and also includes gardens, landscaped areas, and small trees or ornamental plants. Fences would be temporarily removed (and replaced) in order to survey the ground without interference to the DGM. This represents a higher standard of coverage than has historically been done during the RI phase, reflecting the remedial action phase of the project.

The anomaly removal quantity standard for this alternative is that all identified geophysical anomalies be removed. Removing all anomalies means that no discrimination of anomalies is necessary; anything identified as an anomaly would be excavated, and consequently, neither A-B-C-D nor AC classification of anomalies would be needed, as the objective of those schemes is to reduce the number of anomalies to excavate through characterization. Therefore, the DGM method associated with this alternative is the use of the EM61 plus the G-858, without AC instrumentation.

For the subject properties that have previously undergone DGM/anomaly removal work, the remaining anomalies, even though previously assessed to be innocuous metal debris, would be removed under this alternative. Following excavation of anomalies, the property would be restored to approximate original conditions.

Alternative 3 met key elements of the effectiveness and implementability criteria and it was retained for the detailed comparative analysis in the next section.

Explosive Hazards Alternative 4: Full DGM Coverage, Remove Selected Anomalies

Alternative 4 entails conducting DGM/anomaly removal on a given subject property, specifying full DGM coverage as described for Alternative 3 above, and an anomaly removal quantity standard of selected geophysical anomalies.

Removing selected anomalies means that only those anomalies recommended for excavation through the AC methodology would be removed. Consequently, the DGM method associated with this alternative is the use of the EM61 plus the G-858 as supplemented by the AC instrumentation.

For the subject properties that have previously undergone DGM/anomaly removal work, the remaining anomalies would be re-acquired and AC methodology would be applied to better determine whether they should be removed.

Alternative 4 met key elements of the effectiveness and implementability criteria and it was retained for the detailed comparative analysis in the next section.

Explosive Hazards Alternative 5: DGM of Accessible Areas, Remove All Anomalies

Alternative 5 entails conducting DGM/anomaly removal on a subject property, specifying a DGM coverage standard of "accessible areas" and an anomaly removal quantity standard of all anomalies to be removed.

The DGM coverage standard of "accessible areas" is defined as excluding those things not geophysically surveyed under the full coverage standard described for Alternatives 4 and 5 above, but additionally excluding rare or valuable plants, large ornamental trees (regardless of age), and areas under fences (i.e., no fence removal). However, it does include DGM of hardscape features such as driveways, sidewalks, or patios, as well as gardens and small trees or plants.

While this represents a slightly lower standard than full coverage, it is a higher standard of coverage than was done during the RI phase, reflecting the remedial action phase of the project. The intent of accessible areas coverage was to provide a standard that more realistically acknowledges the trade-off of additional investigation benefits versus disruptive impacts to a residential property.

The anomaly removal quantity standard is that all identified geophysical anomalies would be removed, as described in Alternative 3 above.

The FS analysis indicated that for the SVFUDS, Alternative 5 met key elements of the effectiveness and implementability criteria and it was retained for the detailed comparative analysis in the next section.

Explosive Hazards Alternative 6: DGM of Accessible Areas, Remove Selected Anomalies

Alternative 6 entails conducting DGM/anomaly removal on a subject property, specifying a DGM coverage standard of 'accessible areas' and an anomaly removal quantity standard of selected geophysical anomalies.

The DGM coverage standard of accessible areas is as described in Alterative 5 above, and the anomaly removal quantity standard of selected anomalies is as described in Alternative 4 above.

The FS analysis indicated that for the SVFUDS, Alternative 6 met key elements of the effectiveness and implementability criteria and it was retained for the detailed comparative analysis in the next section.

7.0 EVALUATION OF ALTERNATIVES

The broad screen described in the previous section eliminated several remedial alternatives. The ones retained for the detailed analysis are summarized below.

RISK or HAZARD	REMEDIAL ALTERNATIVE RETAINED
Soil Contamination Risks	3. Phytoremediation
	4. Excavation and Off-site Disposal
Explosive Hazards	3. Full DGM Coverage, Remove All Anomalies
	4. Full DGM Coverage, Remove Selected Anomalies
	5. DGM of Accessible Areas, Remove All Anomalies
	6. DGM of Accessible Areas, Remove Selected Anomalies

In the detailed analysis, each alternative is assessed against nine evaluation criteria (Exhibit 2) that have been developed by the USEPA to address CERCLA requirements and technical and policy considerations that have proven to be important for selecting among remedial alternatives. The nine criteria are divided into three categories; threshold, balancing and modifying. The nine criteria are used to evaluate the remedial alternative individually, and then against one another, in order to select a preferred alternative.

7.1 Individual Analysis of Contaminated Soil Remedial Alternatives

1) Overall Protection of Human Health and the Environment

This is a threshold criterion in that it must be met.

Contaminated Soil Alternative 3, Phytoremediation, is protective of public

EXHIBIT 2
NINE EVALUATION CRITERIA

Threshold Criteria:
1) Overall Protectiveness of Human Health and the Environment- alternative shall be protective of human health and the environment.

2) Compliance with ARARs- alternative must meet cleanup standards, standards of control, or other requirements that pertain to the contaminants, remedial action, or the remedial location that are found in Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or a waiver must be justified.

Balancing Criteria:
3) Long-term Effectiveness and Permanence- considers the ability of an alternative to maintain protection of human health and the environment over time.

4) Reduction in Toxicity, Mobility, or Volume through Treatment- evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

5) Short-Term Effectiveness- considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

6) Implementability- considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

7) Cost- includes the estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of plus or minus 50 percent.

Modifying Criteria:
8) State/Support Agency Acceptance- considers the acceptance of the state or support agency of the preferred alternative.

9) Community Acceptance- considers the acceptance of the community of the preferred alternative.

health and the environment. Based on the results of previous phytoremediation efforts in the SVFUDS, and the general success with metals in soil, the primary COCs to be addressed, this criterion is ranked as favorable.

Contaminated Soil Alternative 4, Excavation and Off-site Disposal, provides protection of public health and the environment by excavating site soils and achieving the RAOs for contaminated soil. Under this alternative, areas of contaminated soil would be delineated through additional sampling, and excavated. This criterion is ranked as favorable.

2) Compliance with ARARs

This is a threshold criterion in that it must be met. Contaminated Soil Alternative 3 is expected to attain all ARARs. This alternative will comply with CERCLA criteria for soil by remediating the subject soils to the RAOs, and it is therefore ranked as favorable. Contaminated Soil Alternative 4 is also expected to attain all ARARs, meeting CERCLA criteria for soil by removing the contaminated soils and leaving in-place soil that meets the RAOs, and it is therefore, ranked as favorable.

3) Long-Term Effectiveness and Permanence

Contaminated Soil Alternative 3 is moderately favorable for the long-term effectiveness criterion due to the need to potentially have different types of plants targeting different COCs. The differing plant growth needs, such as water, nutrients, and sunlight, may have the overall effect of reducing long-term effectiveness in a small area where multiple plants are competing.

Contaminated Soil Alternative 4 is favorable regarding this criterion, as the contaminated soils will be removed from the site, eliminating residual risk.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment

Both Contaminated Soil Alternatives 3 and 4 were ranked as not favorable in reducing toxicity, mobility and volume of contaminants in that contaminants are transferred (e.g., a landfill), rather than reduced through treatment.

5) Short-Term Effectiveness

Contaminated Soil Alternative 3 is not favorable in meeting the short-term effectiveness criterion because the plants have a growing and harvesting cycle that requires sufficient time. Contaminated Soil Alternative 4 is favorable in meeting this criterion because the time required to meet the RAOs is minimal, and the engineering controls to do this work safely and effectively have been well established for this type of operation in the SVFUDS.

6) Implementability

Contaminated Soil Alternative 3 is moderately favorable overall in meeting the implementability criterion. While it has worked previously within the SVFUDS for metals in soil, it has not yet been demonstrated for all the site-specific COCs and implementation would be delayed pending completion of a treatability study. While materials and services are generally available, site-specific plant needs would impact implementation of this alternative.

Contaminated Soil Alternative 4 is favorable overall in meeting the implementability criterion: construction and operational considerations and the reliability of the alternative are well established and materials and equipment required to perform the excavations are readily available.

7) Cost

The cost to implement Contaminated Soil Alternative 3 is moderate. The total estimated cost is approximately $15,000 per grid (20 feet by 20 feet by 4 feet deep) of contaminated soil. These costs include planting of a variety of selected species, maintenance, harvesting and disposal. The cost will vary for different discrete areas of contaminated soil, based on various factors including the type of plant(s) required, climate factors (e.g., amount of irrigation needed), nutrient requirements, the number of harvesting and replanting cycles required, and disposal requirements.

The cost to implement Contaminated Soil Alternative 4 is moderate to high. The total estimated cost is approximately $30,000 per grid (20 feet by 20 feet by 4 feet deep) of contaminated soil. These costs include delineation and confirmation sampling, excavation and disposal, backfilling with clean soil, and restoration of the land. Costs will vary at site-specific locations based on factors such as volume of soil removed and disposal requirements.

The costs for both alternatives are approximate, and in actual implementation, an economy of scale would reduce per-grid costs considerably.

8) State/Support Agency Acceptance

DOEE and USEPA Region 3 support the preferred Contaminated Soil alternative described in Section 8.1, but will consider all comments from the community and other stakeholders on the proposed action before concurrence in the Decision Document.

9) Community Acceptance

Comments from the community on the contaminated soil alternatives will be evaluated after the public comment period for this document ends. Community comments will be addressed in the Decision Document.

7.2 Comparative Analysis of Contaminated Soil Remedial Alternatives

Both contaminated soil alternatives were considered protective of human health and the environment. However, Contaminated Soil Alternative 4 was considered to have fewer performance unknowns than Alternative 3. Both alternatives were compliant with ARARs.

Alternative 3 was only moderately effective in the long term due to the need to potentially have different types of plants targeting different COCs, and the phytoremediation process could take a substantial length of time to reach RAOs, based on plant growth cycles. Alternative 4 was the most effective in the long term; it is a permanent remedy that leaves no unacceptable risk at the site.

Both alternatives were ranked as not favorable with regard to reducing toxicity, mobility, and volume of contaminants because they transfer contaminants to a landfill, rather than reducing them through treatment.

Alternative 3 was not favorable in meeting the short-term effectiveness criterion because the plants have a growing and harvesting cycle that requires sufficient time. Alternative 4 was favorable in meeting this criterion because the time required to meet the RAOs is minimal.

Alternative 3 was moderately favorable overall for the implementability criteria because it has not been successfully demonstrated for the site-specific COCs. However, Alternative 4 was favorable overall for the implementability criteria because construction and operational considerations and the reliability of excavation and disposal to address the contaminants are well established.

Costs generally are a function of time required to achieve the RAOs and volume of soil to be addressed, with Alternative 3 impacted more by time and Alternative 4 impacted more by volume of soil. On a per grid basis, phytoremediation is less expensive than excavation and disposal. However, phytoremediation contains more unknowns because treatability studies are needed. Therefore, while Alternative 3 is less costly than Alternative 4, based on much experience with both alternatives within the SVFUDS, the unknowns associated with phytoremediation costs are considered to be significant enough that the lower phytoremediation costs ranked only slightly more favorable than the higher excavation and disposal costs.

Table 8.1 summarizes this analysis.

7.3 Individual Analysis of Explosive Hazards Remedial Alternatives

1) Overall Protection of Human Health and the Environment

All four Explosive Hazard Alternatives (3, 4, 5, and 6) are protective of public health and the environment based on the removal of any identified anomalies that could pose an unacceptable explosive hazard. Under these alternatives, either all identified anomalies are excavated, or only anomalies identified as likely MEC or intact **munitions debris** (**MD**) are excavated. Any MEC or MD removed would be inspected to determine its explosive safety status and properly disposed of per applicable policy and regulations.

2) Compliance with ARARs

All four Explosive Hazard Alternatives are compliant with ARARs.

3) Long-Term Effectiveness and Permanence

Explosive Hazards Alternative 3 is favorable for the long-term effectiveness criterion because it addresses the magnitude of remaining hazard by employing the standard of full DGM coverage and removal of all anomalies identified. Alternatives 4, 5, and 6 were moderately favorable because they either employ full DGM coverage, but do not remove all anomalies, or they remove all anomalies but have a slightly lower DGM coverage standard.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 3 is favorable in reducing the volume of contaminants (i.e., MEC) because by employing the standard of full DGM coverage and removal of all anomalies identified, the type and quantity of anomalies that could pose explosive hazards will be reduced significantly. Alternatives 4, 5, and 6 were moderately favorable because they do not remove all anomalies or they do not provide full DGM coverage.

5) Short-Term Effectiveness

Alternatives 3 and 4 are moderately favorable in meeting the short-term effectiveness criterion because while the engineering controls to do this work safely and effectively have been well established for this work in the SVFUDS, the higher DGM coverage standard will increase the time required to meet the RAOs.

However, Alternatives 5 and 6 are favorable in meeting the short-term effectiveness criterion because the DGM coverage standard of accessible areas allows the RAOs to be achieved sooner.

6) Implementability

Alternatives 3 and 4 are moderately favorable in meeting the implementability criterion. The technical feasibility sub-criterion is only moderately favorable in that the higher DGM coverage standard may involve removal and restoration of more areas, potentially presenting challenges. The administrative feasibility sub-criterion is moderately favorable in that it would require significant coordination with the property owner to implement the extensive restoration activities that could be required.

However, Alternatives 5 and 6 are favorable in meeting this criterion because operational considerations are well established and fewer landscaped areas or trees would need to be removed under the accessible areas DGM standard. Less extensive coordination with the property owner will be required as fewer areas of landscaped vegetation or trees would need to be removed.

7) Cost

The cost to implement Alternative 3 is moderate to high. The total estimated cost is approximately $230,000 per property. This includes the assumptions under the full DGM coverage standard and all anomalies removed standard, that a certain level of disturbance to the property would require restoration. The cost to implement Alternative 4 is also moderate to high, approximately $225,000 per property. This is slightly less that Alternative 3 based on removing only selected, not all, anomalies, and impacting less of the property.

The cost to implement Alternative 5 is also moderate to high, approximately $197,500 per property. Under the accessible areas DGM coverage standard, fewer areas would be disturbed requiring restoration. The cost to implement Alternative 6 is also moderate to high, approximately $192,500 per property. Under the accessible areas DGM coverage and removal of selected anomalies standards, even fewer areas would be disturbed requiring restoration.

8) State/Support Agency Acceptance

DOEE and USEPA Region 3 support the preferred Explosive Hazards alternative described in Section 8.2, but will consider all comments from the community and other stakeholders on the proposed action before concurrence in the Decision Document.

9) Community Acceptance

Comments from the community on the contaminated soil alternatives will be evaluated after the comment period for this document ends. Community comments will be addressed in the Decision Document.

7.4 Comparative Analysis of Explosive Hazards Remedial Alternatives

Each of the four explosive hazards alternatives were considered protective of human health and the environment. However, Alternatives 3 and 5, which remove all anomalies, had fewer unknowns than the other alternatives. All four alternatives were compliant with ARARs.

Only Alternative 3 was favorable in the long term due to the higher DGM coverage and anomaly removal quantity standards. The other three alternatives were moderately favorable because relative to Alternative 3, either they had less DGM coverage, or removed fewer anomalies. Similarly, only Alternative 3 was ranked slightly higher with regard to reducing volume of MEC because more acreage would be covered and more anomalies removed.

For short-term effectiveness, the higher DGM coverage standard of Alternatives 3 and 4, and the resulting additional time and logistics involved in cutting more areas of vegetation, ranked those alternatives as moderately favorable while Alternatives 5 and 6 were favorable for this criterion.

Alternatives 3 and 4 were ranked as moderately favorable overall for the implementability criteria primarily because the higher DGM coverage standard could present challenges to the technical feasibility sub-criterion, and the administrative feasibility sub-criterion would require significant coordination with the property owner to implement the extensive restoration activities that could be required.

However, Alternatives 5 and 6 were ranked as favorable overall for the implementability criteria because fewer areas of landscaped vegetation or trees would be removed and less coordination with the property owner would be required under the accessible areas DGM standard.

Costs for the four explosive hazards remedial alternatives were primarily a function of amount of DGM coverage and the assumptions of how much additional work was involved in cutting and restoring landscaped areas of vegetation or trees. The full DGM coverage standard for Alternatives 3 and 4 was more costly than the accessible areas DGM coverage standard of Alternatives 5 and 6.

Secondarily, costs were a function of the anomaly removal quantity standard. Removing all anomalies was more costly than removing selected anomalies, but it was not a significant difference because on an individual property basis, where a large number of anomalies would not be expected, the additional cost of the AC technology activities intended to reduce the number of anomalies to be removed, tended to balance out the savings effected by not having to remove all anomalies. Accordingly, the least costly alternative was Alternative 6, where less DGM would be conducted and fewer anomalies would be removed.

Table 8.2 summarizes the analysis.

8.0 PREFERRED ALTERNATIVE

8.1 Preferred Contaminated Soil Remedial Alternative

Contaminated Soil Alternative 4, Excavation and Off-site Disposal, is the recommended preferred remedial alternative to achieve the RAOs.

Relative to Alternative 3, it was more often ranked as favorable in the nine criteria evaluation. While Alternative 3 was initially less costly than Alternative 4, the unknowns associated with it render the costing criterion only slightly more favorable than Alternative 4. Alternative 4 will meet the RAOs in the shortest time, with the fewest unknowns. It will address all COCs under all site-specific conditions, and it has been successfully conducted many times throughout the SVFUDS.

8.2 Preferred Explosive Hazards Remedial Alternative

Explosive Hazards Alternative 6, DGM of Accessible Areas, Remove Selected Anomalies, is the recommended preferred remedial alternative to achieve the explosive hazards RAOs.

Relative to the other Explosive Hazards Alternatives, Alternative 6 was more often ranked as favorable in the nine criteria evaluation. On an individual property basis, Alternative 6 is the least costly of the four alternatives, and it would show even more savings relative to the other alternatives when evaluated across all subject properties. Alternative 6 is protective of human health and the environment, is compliant with ARARs, and will meet the RAOs in the shortest time period.

As a practical consideration, education and awareness initiatives will also be applied to all areas of the SVFUDS to address the possibility that MEC could be relocated or, less likely, found there. The education and awareness initiatives RAO serves as a conservative measure to ensure the entire community is educated about munitions issues even though the USACE does not propose active responses beyond the MRS-01 boundary.

Table 8.1: Summary of Detailed Analysis of Remaining Contaminated Soil Remedial Alternatives

	Screening Criterion	Alternative 3: Phytoremediation	Alternative 4: Excavation and Off-site Disposal
Threshold	Overall Protection of Human Health and Environment	●	●
	Compliance with ARARs	●	●
Balancing	Long-Term Effectiveness	◑	●
	Reduction of Toxicity, Mobility and Volume Through Treatment[\1]	○	○
	Short-Term Effectiveness	○	●
	Implementability	◑	●
	Technical Feasibility	◑	●
	Administrative Feasibility	◑	●
	Availability of Materials and Services	◑	●
	Cost[\2]	**$15,000 per grid**[\3]	**$30,000 per grid**[\3]
Modifying[\4]	State Acceptance	○	●
	Community Acceptance	TBD	TBD

● Favorable ('YES' for threshold criteria)

◑ Moderately Favorable

○ Not Favorable ('NO' for threshold criteria)

\1 – While both alternatives reduce toxicity, mobility, and volume at the property, the statutory preference is permanent reduction through treatment; therefore, assuming landfill disposal, this criterion is not assessed as 'Favorable'.
\2 - Costs are detailed in Appendix B of the FS Report.
\3 - Based on a 20 ft by 20 ft by 4 ft deep grid of contaminated soil.
\4 – The Modifying criteria of community acceptance is 'To Be Determined' following review and input from these parties.

Table 8.2: Summary of Detailed Analysis of Remaining Explosive Hazards Remedial Alternatives

	Screening Criterion	Alternative 3: Full DGM Coverage, Remove All Anomalies	Alternative 4: Full DGM Coverage, Remove Selected Anomalies	Alternative 5: DGM of Accessible Areas, Remove All Anomalies	Alternative 6: DGM of Accessible Areas, Remove Selected Anomalies
Threshold	Overall Protection of Human Health and Environment	●	●	●	●
	Compliance with ARARs	●	●	●	●
Balancing	Long-Term Effectiveness	●	◐	◐	◐
	Reduction of Toxicity, Mobility and Volume Through Treatment\1	●	◐	◐	◐
	Short-Term Effectiveness	◐	◐	●	●
	Implementability	◐	◐	●	●
	Technical Feasibility	◐	◐	●	●
	Administrative Feasibility	◐	◐	●	●
	Availability of Materials and Services	●	●	●	●
	Cost\2	**$230,000 / property**	**$225,000 / property**	**$197,500 / property**	**$192,500 / property**
Modifying\3	State Acceptance	◐	◐	◐	●
	Community Acceptance	TBD	TBD	TBD	TBD

● Favorable ('YES' for threshold criteria)

◐ Moderately Favorable

○ Not Favorable ('NO' for threshold criteria)

\1 – For MEC, this criterion addresses volume of MEC. The 'through treatment' preference is met for anomalies removed in that they are rendered safe (no longer 'contaminants') prior to disposal.

\2 - Costs are based on a generic individual property that had no previous DGM/anomaly removal investigations. Details are provided in Appendix B of the FS.

\3 – The Modifying criteria of community acceptance is 'To Be Determined' following review and input from these parties.

9.0 COMMUNITY PARTICIPATION

USACE provides information regarding the cleanup of the SVFUDS to the public and community residents and workers through dedicated community outreach staff working side-by-side with project personnel.

Collectively, the USACE Spring Valley project team responds to community inquiries daily and through a 24-hour telephone answering service, as well as meets with concerned and impacted residents on a regular basis. The team provides monthly project updates via e-mail, mails quarterly newsletters to all addresses within the project area and the interested public at large, and when warranted, the project team sends unscheduled updates, newsletters and press releases to a diverse list of stakeholders.

Since 2001, the project team has supported the Spring Valley **Restoration Advisory Board** (**RAB**) (approximately 10 meetings per year), as well as small group briefings and public meetings to discuss significant milestones and issues of concern. These meetings are well advertised in local papers, local electronic community bulletin boards, and through mailed newsletters and postcards sent by the USACE Public Affairs Office.

The Administrative Record for the site, the USACE website, and a local Information Repository at the neighborhood library provide easy access to historical and current documents on the project progress. Through all these outreach mechanisms USACE encourages public input to ensure that the remedy selected for the SVFUDS meets the needs of the impacted community, in addition to being an effective technical solution to the problems.

USACE specifically invites comments from the community and other interested parties, not only on the preferred alternatives but also on the acceptability of all the alternatives identified in the FS Report.

Public comments that support an alternative other than the USACE preferred alternative, or that suggest improvements to the USACE preferred alternative, will be given appropriate consideration in the final selection process; the USACE preferred alternative may be modified based on any new information acquired during the public comment period. In consultation with DOEE and the USEPA, the final selection of remedial action for the SVFUDS will be finalized in a Decision Document after evaluating comments received from the public on this Proposed Plan.

<u>The dates for the public comment period, the location, date, and time of the public meeting, and the variety of ways to access copies of the Proposed Plan and supporting documents are provided in Exhibit 3 on the next page.</u>

At the public meeting, the conclusions of the RI and FS Reports will be discussed along with a summary of the preferred alternative. Attendees may bring written comments to officially submit or provide oral comments to the meeting recorder in the area reserved for this purpose. Written comments may also be mailed to the USACE address below throughout the public comment period. Comments will be summarized and responses provided in the responsiveness summary section of the Decision Document.

The Decision Document will be USACE's official record of the final remedy selection for the SVFUDS that will be submitted for approval by the Department of the Army.

EXHIBIT 3

PUBLIC COMMENT PERIOD
June 13, 2016 – July 28, 2016

PUBLIC MEETING/OPEN HOUSE
To be Held the Evening of Thursday, **July 14, 2016**, at a
Time and Location to be Determined

ADMINISTRATIVE RECORD FILE / DOCUMENT REPOSITORIES:

1. Administrative Record:
   U.S. Army Corps of Engineers
   Baltimore District (10200-C)
   10 South Howard Street
   Baltimore, MD 21201
   Attn: Spring Valley Outreach Team
   410-962-2210

2. Information Repository:
   D.C. Public Library, Reference Desk
   Tenley-Friendship Library Branch
   4450 Wisconsin Avenue, N.W.
   Washington, DC 20016
   202-727-1488

3. View the Proposed Plan and supporting documents online at:
   http://www.nab.usace.army.mil/Home/SpringValley.aspx

   Or request a copy from the community outreach team at:
   410-962-0157

FOR FURTHER INFORMATION CONTACT:
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U.S. Army Corps of Engineers, Baltimore District (10040-G)
10 South Howard Street
Baltimore, MD 21201
(410) 962-6782
Dan.G.Noble@usace.army.mil

10.0 REFERENCES

USACE 1995. *Remedial Investigation Report for the Operation Safe Removal Formerly Used Defense Site, Washington, D.C.* Prepared for USACE by Parsons Engineering Science, Inc., June 1, 1995.

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APPENDIX A – ACRONYMS/GLOSSARY OF TERMS

ACRONYMS

AC........................Advanced Classification
AOI ....Area of Interest
ARARs.................Applicable or Relevant and Appropriate Requirements
ARB ....Anomaly Review Board
AU........................American University
AUES ....American University Experiment Station
CERCLA.............Comprehensive Environmental Response, Compensation, and Liability Act
COC ....Chemical of Concern
COPC ....Chemical of Potential Concern
CWM....................Chemical Warfare Materiel
DC………………District of Columbia
DCRA ....DC Department of Consumer and Regulatory Affairs
DD………………Decision Document
DDOE ....District of Columbia Department of the Environment
DERP ....Defense Environmental Restoration Program
DGM ....Digital Geophysical Mapping
DMM....................Discarded Military Munitions
DoD......................Department of Defense
DOEE……………DC Department of Energy & Environment
EE/CA ....Engineering Evaluation/Cost Analysis
EU ....Exposure Unit
FS ....Feasibility Study
FUDS ....Formerly Used Defense Site
HHRA ....Human Health Risk Assessment
HI ....Hazard Index
HTW ....Hazardous and Toxic Waste
LUCs....................Land Use Controls
MC ....Munitions Constituents
MD ....Munitions Debris
MEC.....................Munitions and Explosives of Concern
MEC HA ....MEC Hazard Assessment
MMRP..................Military Munitions Response Program
MRS ....Munitions Response Site
NCP......................National Oil and Hazardous Substances Pollution Contingency Plan
NTCRA ....Non-time Critical Removal Action
OSR FUDS...........Operation Safe Removal FUDS
OU........................Operable Unit
PAHs....................Polynuclear aromatic hydrocarbons
POI ....Point of Interest
RAB……………..Restoration Advisory Board
RAO ....Remedial Action Objective
RI..........................Remedial Investigation
RI/FS ....Remedial Investigation/Feasibility Study
SCRA ....Spaulding-Captain Rankin area

SLERA.................Screening Level Ecological Risk Assessment
SVFUDS..............Spring Valley Formerly Used Defense Site
TCRA...................Time Critical Removal Action
USACE................U.S. Army Corps of Engineers
USEPA.................U.S. Environmental Protection Agency
UXO.....................Unexploded Ordnance

GLOSSARY OF TERMS

Administrative Record - A collection of documents containing all the information and reports generated during the entire phase of investigation and cleanup at a site, which are used to make a decision on the selection of a response action under CERCLA. This file is to be available for public review and a copy maintained near the site at the Tenley-Friendship Library.

Applicable or Relevant and Appropriate Requirements (ARARs) - Applicable requirements are cleanup standards, standards of control, and other substantive environmental protection requirements promulgated under Federal or state environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance found at a CERCLA site. Relevant and appropriate requirements are cleanup standards that, while not "applicable", address situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. Pursuant to the NCP, the term "State" includes the District of Columbia (DC). 40 C.F.R. § 300.5.

Chemicals of Concern (COCs) - Chemicals identified through the risk assessment process as the primary chemicals that may cause unacceptable human health and/or ecological risk.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - A Federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA) that concerns hazardous substances.

Chemical Warfare Materiel - Items generally configured as a munition containing a chemical compound that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. CWM includes H-series (mustard) and L-series (lewisite) blister agents in other-than-munition configurations; and certain industrial chemicals (e.g., hydrogen cyanide, cyanogen chloride, or phosgene, configured as a military munition. Due to their hazards, prevalence, and military-unique application, Chemical Agent (CA) identification sets are also considered CWM. CWM does not include: riot control devices; chemical defoliants and herbicides; industrial chemicals not configured as a munition; smoke and other obscuration producing items; incendiary producing items; or soil, water, or other media contaminated with low concentrations of chemical agents where no CA hazards exist (DoD, 2013).

Decision Document (DD) - The Department of Defense has adopted the term Decision Document for the documentation of remedial action (RA) decisions at non-National Priorities List (NPL) FUDS Properties. It is a public document that describes the cleanup action or remedy selected for a site, the basis for the choice of that remedy, and responds to public comments. The DD is based on information and technical analysis generated during the RI/FS.

Discarded Military Munitions (DMM) - Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations. (10 U.S.C. 2710(e)(2))

Exposure Unit - Used in risk assessment to define the geographical area in which a receptor is randomly exposed to a contaminated medium for a relevant exposure duration. Environmental sampling provides information about the contamination within and around an EU. Multiple EUs may be defined at a site based on the choice of a receptor, the exposure medium, and the nature of contact with the medium. Site-specific information regarding the activities of receptors should guide assumptions about the receptor's contact with exposure media. (USEPA RAGS Volume 3 Part A, Appendix C)

Feasibility Study (FS) - The FS serves as the mechanism for the development, screening, and detailed evaluation of alternative remedial actions to address issues identified in the RI.

FUDS - A Formerly Used Defense Site Project is a unique name given to an area of an eligible FUDS property containing one or more releases or threatened releases of a similar response nature, treated as a discrete entity or consolidated grouping for response purposes. This may include buildings, structures, impoundments, landfills, storage containers, or other areas where hazardous substance are or have come to be located, including FUDS eligible unsafe buildings or debris. Projects are categorized by actions described under installation restoration (hazardous, toxic, and radioactive waste [HTRW]), military munitions response program, or building demolition/debris removal.

Hazardous and Toxic Waste - A term in general use by the U.S. Army Corps of Engineers; it refers to any waste in the environment that could pose a risk to human health or the environment.

Land Use Controls (LUCs) - Physical, legal, or administrative mechanisms that restrict the use of, or limit access to, real property to prevent or reduce risks to human health and the environment.

Munitions Constituents (MC) - Any materials originating from UXO, DMM, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 U.S.C. 2710(e)(3))

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

Munitions and Explosives of Concern (MEC) - This term distinguishes specific categories of military munitions that may pose unique explosive safety risks, including:

- UXO,
- DMM, or
- MC present in high enough concentrations to pose an explosive hazard.

Munitions Response Site (MRS - A discrete location within an MRA that is known to require a munitions response (DoD, 2012).

National Oil and Hazardous Substance Pollution Contingency Plan (NCP) - Revised in 1990, the NCP provides the regulatory framework for responses under CERCLA. The NCP designates the Department of Defense as the removal response authority for ordnance and explosives hazards.

Proposed Plan - The purpose of the proposed plan is to supplement the RI/FS and provide the public with a reasonable opportunity to comment on the preferred alternative for remedial action, as well as alternative plans under consideration, and to participate in the selection of remedial action at a site.

Remedial Action - Those actions consistent with permanent remedy taken instead of, or in addition to, removal actions, in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health, welfare or the environment.

Remedial Action Objective (RAO) - Objectives established for remedial actions to guide the development of alternatives and focus the comparison of acceptable remedial action alternatives, if warranted. RAOs also assist in clarifying the goal of minimizing risk and achieving an acceptable level of protection for human health and the environment.

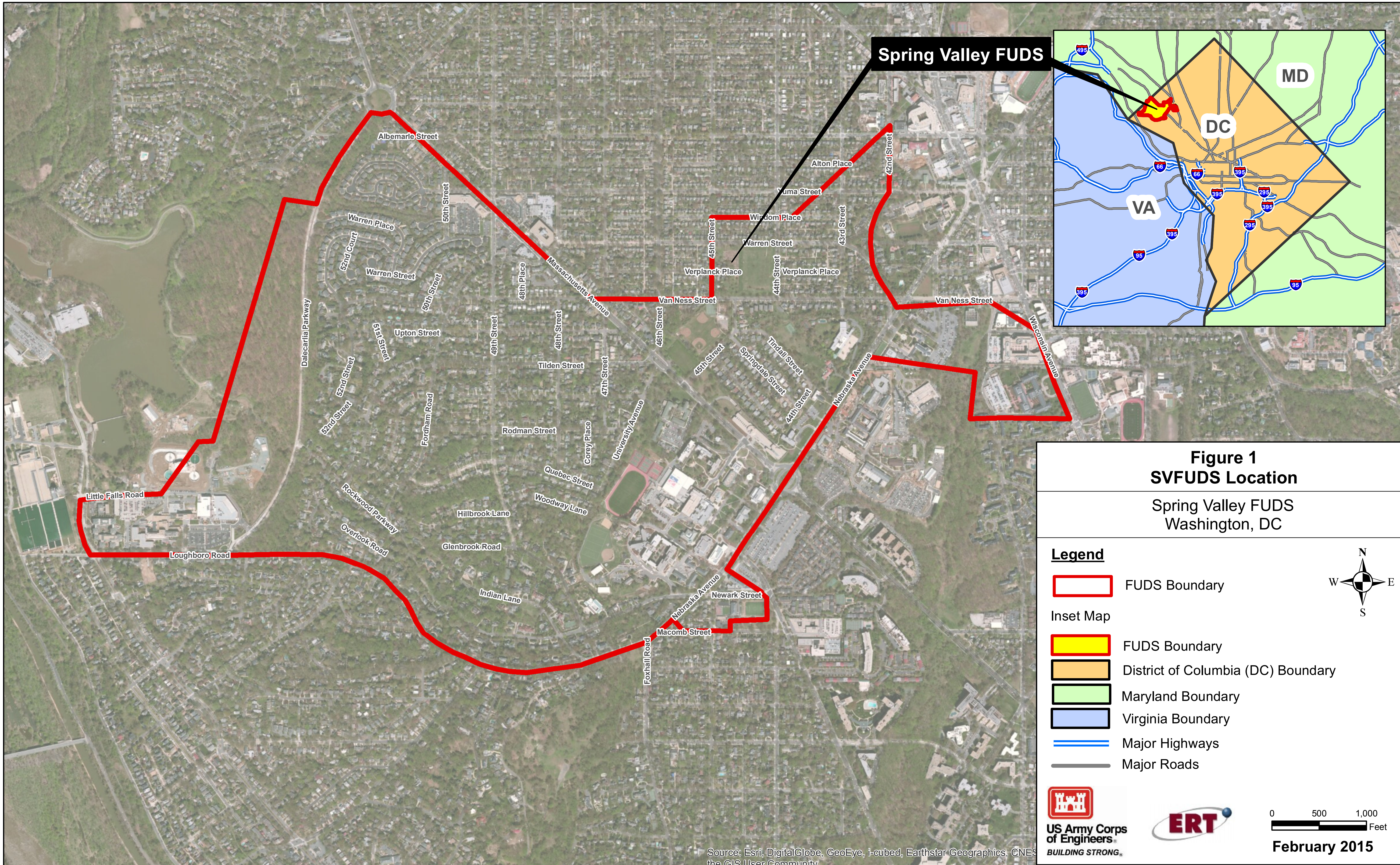
Remedial Investigation (RI) - A study of a site that provides information supporting the evaluation for the need for a remedy and/or selection of a remedy for a site where hazardous substances have been disposed of. The RI identifies the nature and extent of contamination at the site.

Removal Action - The cleanup or removal of released hazardous substances from the environment. Such actions may be taken in the event of the threat of release of hazardous substances into the environment, such actions as may be necessary to monitor, assess, and evaluate the release or threat of release of hazardous substances, the disposal of removed material, or the taking of such other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release.

Restoration Advisory Board (RAB) - A RAB is a forum for the discussion and exchange of information between representatives of the Department of Defense (DoD), regulators, state and local governments, and the affected community. RABs provide an opportunity for stakeholders to have a voice and actively participate in the review of technical documents, to review restoration progress, and to provide individual advice to decision makers regarding restoration activities at FUDS Properties and Projects.

Unexploded Ordnance (UXO) - Military munitions that (A) have been primed, fuzed, armed, or otherwise prepared for action; (B) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (C) remain unexploded whether by malfunction, design, or any other cause. (10 U.S.C. 101(e)(5)(A) through (C)).

APPENDIX B – LIST OF FIGURES


Spring Valley FUDS
MD
DC
VA
Albemarle Street
Warren Place
Warren Street
52nd Court
50th Street
48th Place
Massachusetts Avenue
Van Ness Street
45th Street
Wisdom Place
Warren Street
Verplanck Place
44th Street
Verplanck Place
43rd Street
Alton Place
Yuma Street
42nd Street
Van Ness Street
Wisconsin Avenue
Dalecarlia Parkway
51st Street
Upton Street
49th Street
48th Street
46th Street
Tilden Street
47th Street
45th Street
Springdale Street
Tindall Street
44th Street
Nebraska Avenue
52nd Street
52nd Street
Fordham Road
Rodman Street
Corey Place
University Avenue
Quebec Street
Woodway Lane
Little Falls Road
Rockwood Parkway
Hillbrook Lane
Overlook Road
Glenbrook Road
Loughboro Road
Indian Lane
Nebraska Avenue
Newark Street
Macomb Street
Foxhall Road
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES
the GIS User Community
Figure 1
SVFUDS Location
Spring Valley FUDS
Washington, DC
Legend
FUDS Boundary
Inset Map
FUDS Boundary
District of Columbia (DC) Boundary
Maryland Boundary
Virginia Boundary
Major Highways
Major Roads
N
W
E
S
US Army Corps of Engineers
BUILDING STRONG
ERT
0
500
1,000
Feet
February 2015

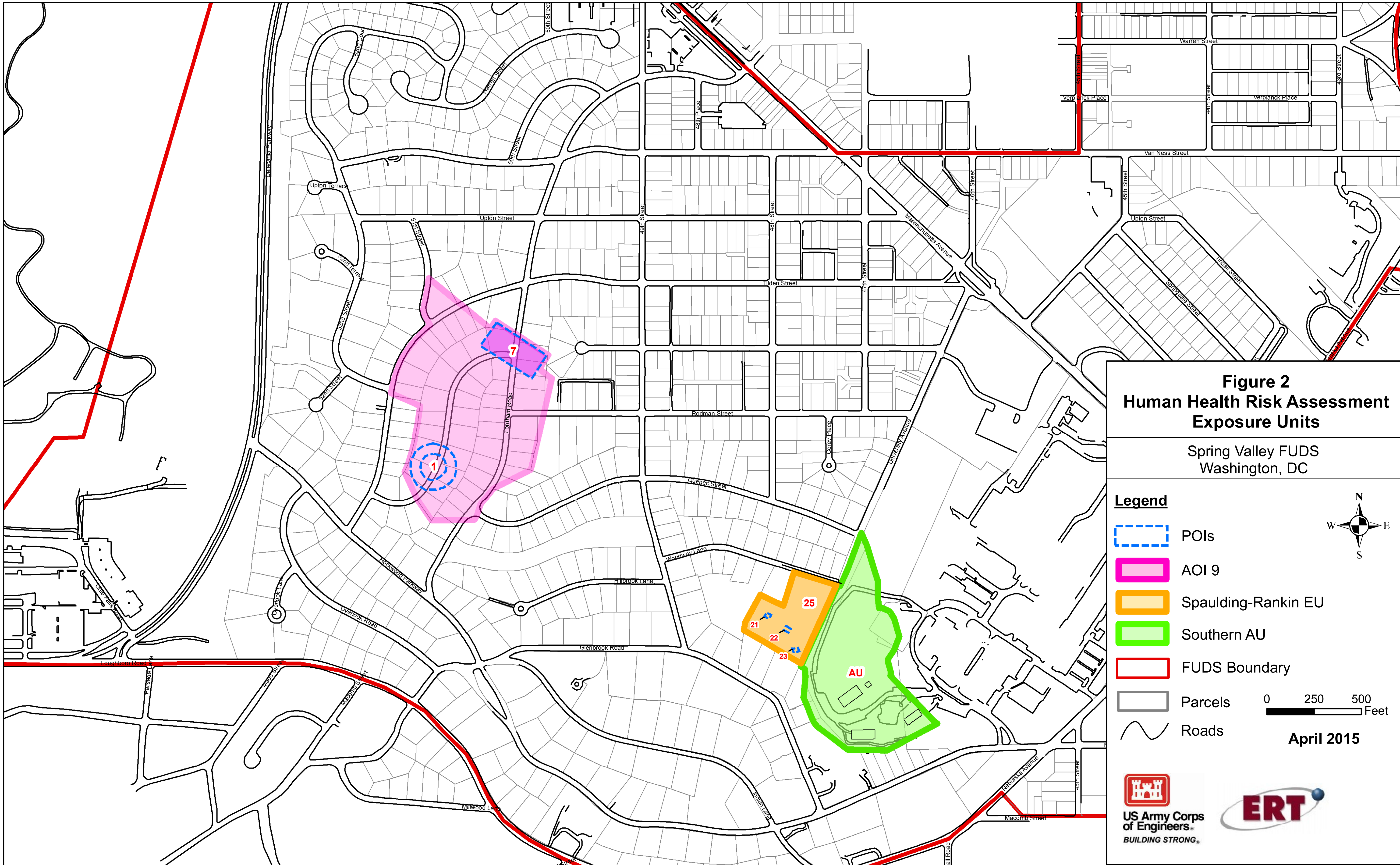
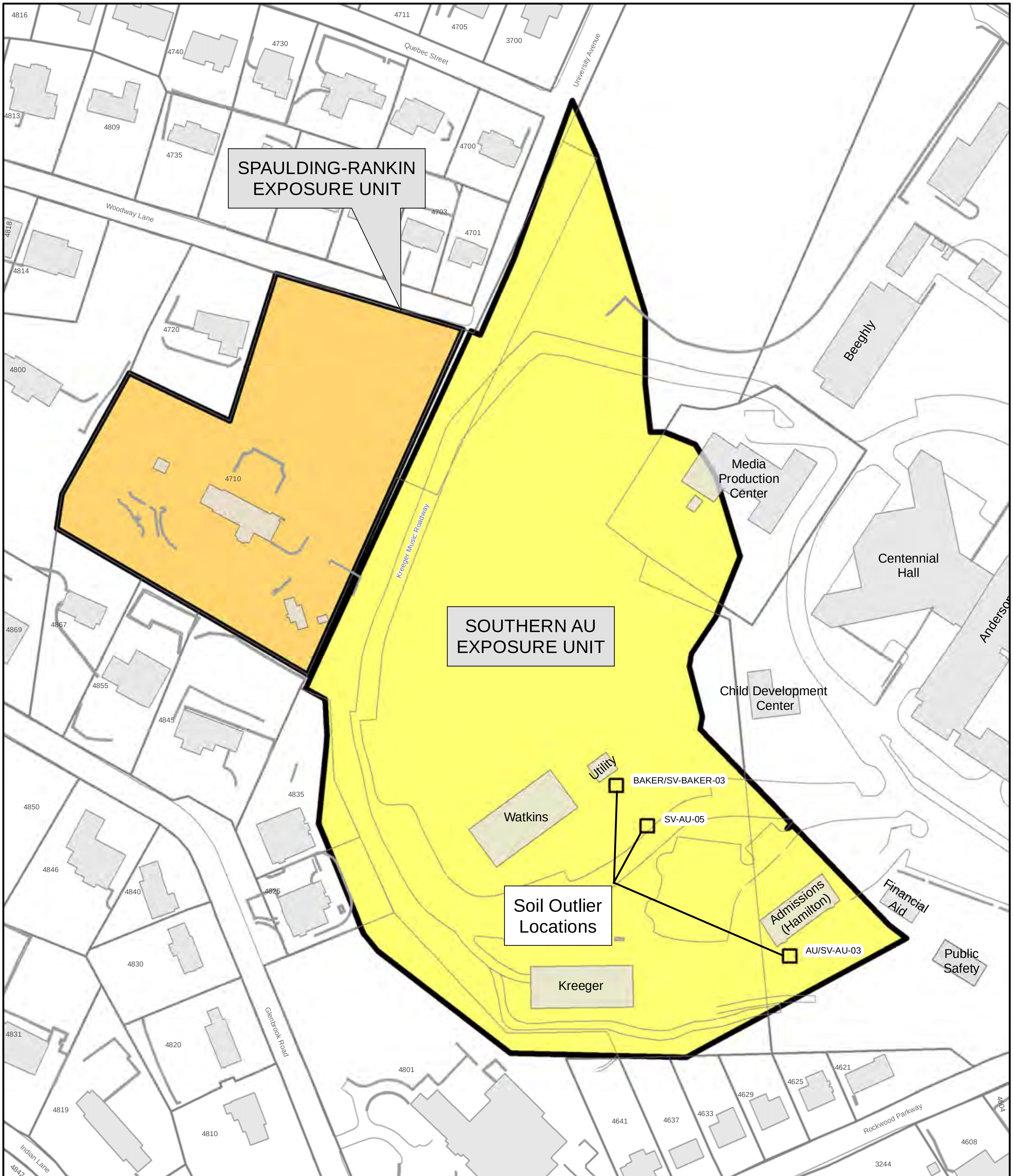


Figure 2
Human Health Risk Assessment Exposure Units

Spring Valley FUDS
Washington, DC



US Army Corps of Engineers
BUILDING STRONG
ERT

October 2015

Legend

- Areas of Potenital Non-Carcinogenic Risk
- Areas of Potential Carcinogenic/ Non-Carcinogenic Risk
- Parcels

N W E S

0 75 150 Feet

Figure 3
Areas of Carcinogenic or Non-Carcinogenic Risk in Soil

Spring Valley FUDS
Washington, DC

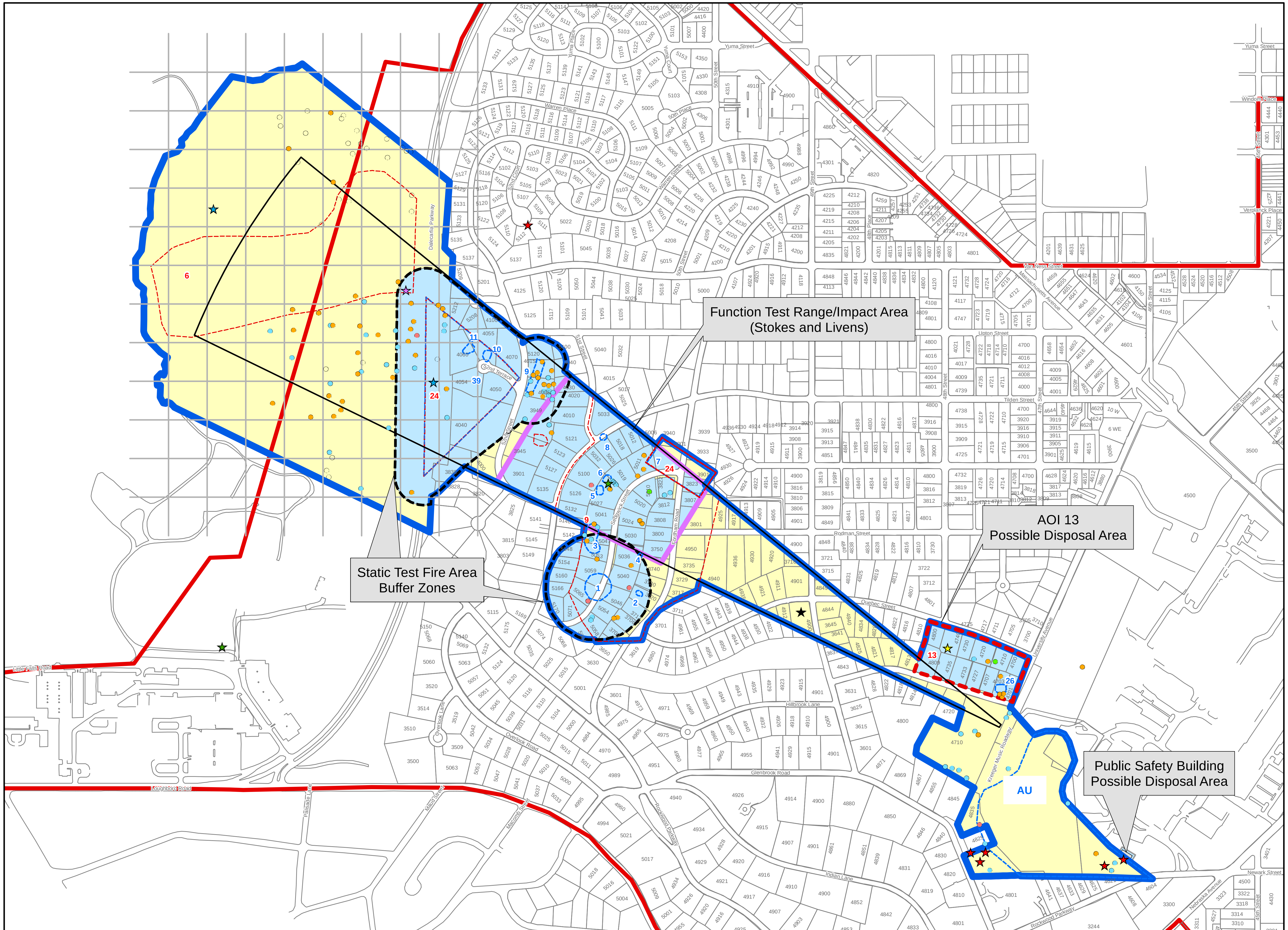


Figure 4
Response Action Areas

Spring Valley FUDS
Washington, DC

Legend

- MRS-01 Boundary (120.1 Acres)
- Areas for Education and Awareness Initiatives*
- Areas of Focus for Active Response and Education and Awareness Initiatives (40.4 Acres)

*As a practical consideration, the education and awareness initiatives will also be applied to all areas of the SVFUDS (outside the MRS-01 boundary) to address the possibility that MEC could be relocated or, less likely, found there. This serves as a conservative measure to ensure the entire community is educated about munitions issues even though the USACE does not propose active responses beyond the MRS-01 boundary.

- Buffer Zone (150 FT) of Statically Fired Testing Areas
- Range Fan
- FUDS Boundary
- Function Test Range/Impact Area (Stokes and Livens)
- Area of Interest (AOI)
- Point of Interest (POI)

Items

- Livens Projectile (MEC)
- Stokes Mortar (MEC)
- 75 mm Projectile (MEC)
- Thermite Grenade (MEC)
- Pipe with Explosives (MEC)
- Disposal Area (MEC/CWM)
- 75 mm MD
- Livens MD
- Stokes Mortar MD
- MD (miscellaneous)
- Non-AUES MD

N W E S

0 250 500 Feet

May 2016

US Army Corps of Engineers
BUILDING STRONG

ERT