

**U.S. Army Corps of Engineers  
Omaha District**

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**Draft Site-Specific Work Plan  
Camp Abbot  
FUDS ID F10OR0041**

**Site Inspections at Multiple Sites, NWO Region  
Formerly Used Defense Sites, Military Munitions  
Response Program**

**Contract No. W912DY-04-D-0010  
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## ABBREVIATIONS AND ACRONYMS

AOC	area(s) of concern
ASR	Archives Search Report
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	Conceptual Site Model
DERP	Defense Environmental Restoration Program
DMM	discarded military munitions
DoD	Department of Defense
DQO	data quality objective
EOD	explosive ordnance disposal
ERTC	Engineer Replacement Training Center
°F	degrees Fahrenheit
FUDS	Formerly Used Defense Site
GPS	global positioning system
HRS	Hazard Ranking System
IDW	investigation-derived waste
MC	munitions constituents
MDL	Method Detection Limit
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MLQ	Method Quantitative Limit
MRA	Munitions Response Area
MRS	Munitions Response Site
MRSP	Munitions Response Site Prioritization Protocol
NCP	National Contingency Plan
NDAI	No Department of Defense Action Indicated
NWO	U.S. Army Corps of Engineers, Omaha District Military Munitions Design Center
ODEQ	Oregon Department of Environmental Quality
PA/SI	Preliminary Assessment/Site Investigation
PRG	Preliminary Remediation Goals
PSAP	Programmatic Sampling and Analysis Plan
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAC	Risk Assessment Code
ROE	Right of Entry
SAP	Sampling and Analysis Plan
Shaw	Shaw Environmental, Inc.
SI	Site Inspection
SOP	Standard Operating Procedure
SSHP	Site Safety and Health Plan
SSWP	Site-Specific Work Plan
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
VSP	Visual Sampling Plan

## **1.0 INTRODUCTION**

This Site-Specific Work Plan (SSWP) presents the information necessary to conduct field activities associated with a Site Inspection (SI) conducted at the former Camp Abbot.

### **1.1 Project Authorization**

The U. S. Army Corps of Engineers (USACE) is conducting environmental response activities at Formerly Used Defense Sites (FUDS) in accordance with Engineer Regulation 200-3-1 (USACE, 2004a) and U.S. Department of Defense (DoD) management guidance for the Defense Environmental Restoration Program (DERP). USACE is conducting these activities under provision of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Executive Orders 12580 and 13016, and the National Contingency Plan (NCP). As such, USACE is required to conduct preliminary assessments (PA) and SIs (USEPA, 2005a & b and 1992b) to evaluate hazardous substance releases or threatened releases from eligible FUDS.

USACE is evaluating FUDS historically used for military training and testing under the DERP's Military Munitions Response Program (MMRP). Based on historical records, these FUDS may contain munitions and explosives of concern (MEC) or munitions constituents (MC). MEC are military munitions that may pose unique explosives safety risks, such as unexploded ordnance (UXO), discarded military munitions (DMM), or MC present in high enough concentrations to pose an explosive hazard. MC means any materials originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (U.S. Department of Army, 2005, and DoD, 2003).

Shaw Environmental, Inc. (Shaw) has prepared this SSWP for the USACE, under USACE Contract No. W912DY-04-D-0010, as a supplement to the *Final Type I Work Plan, Site Inspections at Multiple Sites, NWO Region, Formerly Used Defense Sites, Military Munitions Response Program* (Work Plan) (Shaw, 2006a). Shaw is responsible for conducting SIs at FUDS in the Northwest Region (Omaha District Military Munitions Design Center [NWO]).

### **1.2 Site Name and Location**

Camp Abbot, identification number F10OR0041, is located approximately 15 miles south of Bend, Oregon, in Deschutes County (Figure 1). This document uses the spelling of "Camp Abbot," consistent with usage in most documents from the 1940's to the *Archives Search Report* (ASR) in 1995. Other documents, including the ASR Supplement and current FUDS listings, as well as occasional older ones, refer to "Camp Abbott," or "Old Camp Abbott."

### **1.3 Scope and Objectives**

The scope of the SI is restricted to evaluation of the presence of MEC or MC related to historical use of the FUDS prior to transfer of the property. Potential releases of hazardous, toxic, or radioactive wastes are not addressed within this scope. The intent of the SI is to confirm the presence or absence of contamination from MEC and/or MC. The general approach for each SI is to conduct a records review and site reconnaissance to evaluate the presence or absence of MEC, and to collect samples at locations where MC might be expected based on the conceptual site model (CSM) (Appendix A).

The primary objective of the MMRP SI is to determine whether the FUDS property warrants further response action pursuant to CERCLA and the NCP. The SI will collect the minimum amount of information necessary to (i) eliminate from further consideration those releases that pose no significant threat to public health or the environment; (ii) determine the potential need for removal action; (iii) collect or develop additional data, as appropriate, for Hazard Ranking System (HRS) scoring by the USEPA (USEPA, 1990); and (iv) collect data, as appropriate, to characterize the release for effective and rapid initiation of the remedial investigation and feasibility study process. A secondary objective of the SI is to collect the appropriate data to complete the Munitions Response Site Prioritization Protocol (MRSPP) evaluation modules (DoD, 2005).

#### **1.4 Site Inspection Process**

The steps involved in conducting an SI include:

- Review existing data;
- Participate in the TPP process;
- Prepare the SSWP;
- Conduct the SI field activities (site reconnaissance, media sampling, and analysis); and
- Prepare the SI Report.

The TPP process is one through which project objectives and data collection processes are identified, and site stakeholders are brought together to discuss goals and objectives. This process includes the following phases: identification of the current project area, determination of data needs, development of data collection options, and finalization of the data collection program. A multi-disciplinary team of key stakeholders attends a TPP meeting(s) in order to participate in the process so SI activities can be conducted in a timely and efficient manner.

In response to development of the MRSPP, an area of concern (AOC) will be referred to as a munitions response site (MRS). Table 1 shows a preliminary correlation between AOCs and MRSs. It is noted that as a result of the SI, two or more adjacent MRSs may be combined, or several MRSs may comprise a munitions response area (MRA)

#### **1.5 TPP Summary**

The TPP Meeting for the Camp Abbot was conducted on April 4, 2006 at the Sunriver Resort, located at Sunriver, Oregon. This meeting included representatives from USACE - Omaha Military Munitions Design Center, Hazardous, Toxic, and Radioactive Waste Center of Expertise, and Seattle District, Shaw, ODEQ, Sunriver Owners Association, and Sunriver Resort.

In the TPP meeting, historical information was discussed and historical aerial photographs were reviewed. Soil, surface water, and groundwater warrant inspection to evaluate the potential presence of MEC and MC. Specific details of the TPP Meeting are contained in the Final TPP Memorandum (Shaw, 2006b).

#### **1.6 Decision Rules**

The overall objective of the SI is to determine if the FUDS can be recommended for:

- No DoD Action Indicated (NDAI); or
- Additional investigation is required based on the presence of MEC or MC above risk-based screening levels.

The following project-specific data quality objectives (DQOs) and decision rules have been developed.

**Objective 1: Determine if the site requires additional investigation or can be recommended for NDAI based on the presence or absence of MEC.**

DQO #1 – At MRSs where MEC has not been reported in the past, trained UXO personnel will conduct a visual search of the MRSs using handheld magnetometers, searching for evidence of the presence of MEC (e.g., craters and ground scars indicative of ordnance burial/ordnance disposal (OB/OD) activities, MEC on the surface, munitions debris indicative of OB/OD activities, and soil discoloration indicative of explosives). The visual search will consist of a meandering path survey along trails and in accessible areas. The following decision rules will apply:

- If no evidence of MEC is found, the MRSs will be recommended for NDAI relative to MEC.
- If evidence of MEC is confirmed, the MRSs will be recommended for additional investigation.
- If there is indication of an imminent MEC hazard, the site may be recommended for a time critical removal action (TCRA).

DQO #2 – At MRSs where MEC has been reported in the past (explosive munitions ranges and live hand grenade courts), the following decision rules will apply:

- The presence of MEC is confirmed on the basis of past finds, and these areas will be recommended for additional investigation.
- If, in the course of reconnaissance for sample targets and/or UXO avoidance, there is indication of an imminent MEC hazard, the site may be recommended for a TCRA.

**Objective 2: Determine if the site requires additional investigation or can be recommended for NDAI based on the presence or absence of MC above screening values.**

DQO#3 – Soil, sediment, and groundwater samples will be collected and analyzed as proposed in Table 3. Analytical results will be compared to screening values for human health and ecological risk assessment, and to background values for naturally occurring substances. The following decision rules will apply:

- If sample results are less than human health and ecological screening values, the MRS will be recommended for NDAI relative to MC.
- If sample results exceed both human health screening values and background values, the MRS will be recommended for additional investigation.
- If sample results do not exceed human health screening values but do exceed both ecological screening values and background values, additional evaluation of the data will be conducted in conjunction with the stakeholders to determine if additional investigation is warranted.

## 1.7 MEC Technical Approach

The technical approach is based on the Work Plan (Shaw, 2006a) and the *Formerly Used Defense Sites, Military Munitions Response Program Site Inspections, Program Management Plan* (USACE, 2005a).

If MEC is found during SI field activities, the following procedures will be followed, excerpted from Interim Guidance Document 06-05 (see Appendix B for complete document):

“a. (1) The property owner or individual granting rights of entry to the property will be notified of the hazard and advised to call the local emergency response authority (i.e., police, sheriff, or fire department). The individual will also be informed that if they do not call the local response authority within 1 hour, the individual who identified the UXO item will notify the local emergency response authority.

b. (2) The local response authority will decide how to respond to the reported incident, including deciding not to respond (e.g., if the local response authority is already aware of the hazards on the property). If the local response authority decides to respond, the individual who identified the item or his designee will mark the location of the item and provide accurate location information to the emergency response authority. The individual who identified the item or his designee will generally remain in the area until the local response authority arrives, unless specifically indicated by the appropriate response authority that the individual may leave the area.”

“(c) Neither the U.S. Army Corps of Engineers personnel, nor their contractors have the authority to call EOD to respond to an explosive hazard. This call is the responsibility of the local emergency response authority for FUDS properties and it must come through the proper chain of command on installations.”

## 1.8 SSWP Organization

This SSWP supplements the Work Plan, which includes an Accident Prevention Plan and Site Safety and Health Plan ([SSHP] Appendix D), and a Sampling and Analysis Plan ([SAP] Appendix E). The Work Plan, as amended by this SSWP, governs work that will be implemented during the SI at this FUDS. This SSWP provides additional information not available in the Work Plan, including site information (background information, summary of historical documents evaluated, and resulting data needs), a discussion of activities to be conducted prior to mobilizing to the field, a presentation of field data to be collected, and appendices with supporting documents. Specifically, this SSWP includes the following sections:

- Section 1.0 Introduction,
- Section 2.0 Site Information,
- Section 3.0 Pre-Field Activities,
- Section 4.0 Site Inspection Activities,
- Section 5.0 Investigation–Derived Waste,
- Section 6.0 Proposed Schedule,
- Section 7.0 References,
- Figures,
- Tables,
- Appendix A Conceptual Site Model,

- Appendix B USACE Interim Guidance Document 06-05 and Safety Advisory 06-2, and
- Appendix C Site Safety and Health Plan Addendum.

## **2.0 SITE INFORMATION**

The following historical and physical setting information is summarized from the ASR and ASR Supplement for the FUDS property.

### **2.1 Installation History**

Camp Abbot was established as an Engineer Replacement Training Center (ERTC) during World War II. Construction of the camp was completed in May 1943, and it operated for approximately 14 months, until June 1944. In that time, a total of 90,000 engineer soldiers were trained (up to 10,000 men at a time). Camp trainees received instruction in military construction and engineering. General and specialist training programs, in periods ranging from 5 to 17 weeks, included instruction in heavy equipment operation, fire-fighting, carpentry, demolition, tank operation and maintenance, bridge construction, infiltration, mapmaking, pipeline construction, depot storage, specialized mechanics, aerial photography, water and sewage systems, camouflage, mine detection, and bomb disarmament. The 17-week general training program, a modification of earlier strategies involving shorter training periods and greater emphasis on specialist training, at the Army's three ERTCs went into effect in August 1943.

The Camp Abbot program included three distinct phases:

- Six weeks of basic military training, including rifle marksmanship, use of hand grenades and anti-tank grenades, and defense against chemical, air, and mechanized attack;
- Eight weeks of technical training in demolitions, etc., preparing trainees for duty either as general engineers or as specialists;
- A three-week, field maneuver spent under field and combat conditions, including such team training tasks as mine laying, demolitions, and building of bridges, roads, and obstacles.

Use of munitions at ERTCs was very limited due to short supply of munitions because of the war. For example although the .50 caliber machine gun was issued to Camp Abbot, its use was limited due to short supply of ammunition and much of the machine gun training used the .30 caliber weapon, and the use of anti-tank rockets was limited to one rocket for every 50 men (Coll, 1958, p 264). A letter dated 25 September 1946 states that Camp Abbot was "dedudded" in November 1944, and that "a recent inspection of Camp Abbot was made by the Chemical Officer of the 6<sup>th</sup> U. S. Army to determine whether poisonous gases were present on the area. The inspection showed that the "land was free of any such contamination."

A War Department letter of 30 October 1946 stated that Camp Abbot "is hereby declared safe for return to private use." A letter dated 18 November 1947, relinquishing the Army's permits for use of Forest Service land, states "the lands have been examined and have been cleared of all explosives or explosive objects reasonably possible to detect by visual inspection."

### **2.2 Physical Setting**

#### **2.2.1 Access and Land Use**

Camp Abbot is accessed by taking Highway 97 south from Bend, Oregon and driving approximately 15 miles.

Current and expected future land use within the area of former Camp Abbot includes residential, recreational, and multiple Forest Service land uses. The community of Sunriver has a population of approximately 534 (U.S. Census Bureau estimate). The city of Bend, Oregon, 15 miles north of Camp Abbot, has a population of 62,937. Deschutes County has a total population of approximately 141,382.

East of the Deschutes River, much of the former Camp Abbot is now the resort and residential community of Sunriver. The privately owned area includes houses, condominiums, an airport, golf courses, bike paths, and a nature center. The portion of the former Camp Abbot west of the Deschutes River is under the control of the Forest Service and is virtually undeveloped.

### **2.2.2 Topography, Geology, and Climate**

The landscape of the former camp varies from flat areas with low grass and few shrubs in the valley of the Deschutes River, to rugged hills, buttes, and cliffs with heavy shrubs and trees west of the river.

The site is located along the Deschutes River in the High Lava Plains physiographic province of Oregon, a few miles east of the Cascade Range. The Cascade Range is a north-south trending zone of volcanic eruptive centers, including large stratovolcanoes North, Middle, and South Sister, and Mount Jefferson, which all exceed an elevation of 10,000 feet above sea level. Broad lava plateaus are interrupted by faults and fault-bounded grabens. The surficial geology of the site includes Pliocene, Pleistocene, and Holocene basaltic andesite and basalt flows that are often fractured and highly permeable (Figures 2 and 3). Deposits of alluvial and/or glacial outwash silt, sand, and gravel are present along the Deschutes River. Soils at the site are generally very thin to absent, with surface outcrops of volcanic rocks.

Camp Abbot is situated east of the Cascade Range, which strongly influences the area's climate. As air moves east over the Cascades, it descends and becomes drier. The annual average rainfall at Bend, Oregon is less than 12 inches, with average monthly precipitation ranging from a low of 0.49 inch in September to a high of 1.78 inches in December. The monthly average mean temperature ranges from 31.2 degrees Fahrenheit (°F) in December and January to 63.5 °F in July.

### **2.2.3 Groundwater**

Groundwater flow is generally toward the Deschutes Basin and Deschutes River, where fine-grained sedimentary and older volcanic units tend to divert groundwater flow to the surface, as evidenced by numerous springs feeding creeks and rivers. Precipitation readily infiltrates the permeable lava flows, particularly in the Cascade Range where both precipitation and permeability are high.

Available well records indicate that water wells are numerous in the community of Three Rivers directly south and mostly upgradient of the site (Figure 4). There are also water wells within the FUDS boundary in developed areas within and near Sunriver. Water wells are typically less than a hundred feet deep, and the depth to groundwater is a few tens of feet. Perched water near the ground surface is likely to be encountered due to low permeability silts and clays. These perched water layers likely flow to the Deschutes River or small ponds within the Sunriver community.

## 2.2.4 Surface Water

The site is located within the Upper Deschutes watershed and is drained in a generally northerly direction. The Deschutes River and two tributaries, the Little Deschutes River and Spring River, flow through the site. Several linear miles of wetland areas occur within and near the site. Upstream of Benham Falls (i.e., including the reach flowing through the site), the Deschutes River is a federally-designated Wild and Scenic River.

Due to the rapid infiltration of precipitation into the groundwater system, much of the Upper Deschutes watershed lacks a well-developed stream system. Areas of groundwater discharge to surface water are indicated by springs located within the site along the west side of the Deschutes and Spring Rivers.

The water department of the City of Bend uses surface water as its primary water source. All other water systems within Deschutes County use groundwater.

## 2.3 Previous Investigations

### 2.3.1 Historical Records Searches

Background and historical information (including references to interviews and historical documents) contained in this package were primarily obtained from the *Archives Search Report Findings* (USACE, 1995a), *Archives Search Report Conclusions and Recommendations* (USACE, 1995b), and the *ASR Supplement* (USACE, 2004b). Additional information was obtained from the following documents:

- Coll, B.D., J.E. Keith, and H.H. Rosenthal. 1958. *United States Army in World War II – The Corps of Engineers: Troops and Equipment*. Office of the Chief of Military History, United States Army.
- Weston Solutions, Inc. (Weston). 2005. *Camp Abbot FUDS Preliminary Assessment/Site Inspection Report*. TDD 01-08-0006, USEPA Contract 68-S0-01-02, prepared for U.S. Environmental Protection Agency. April.
- Willingham, W.F. 1983. *Army Engineers and the Development of Oregon: A History of the Portland District U.S. Army Corps of Engineers*.

### 2.3.2 Previous Site Work

USACE issued an ASR in 1995, which compiled available information for Camp Abbot with emphasis on types, quantities, and areas of ordnance use and disposal. An ASR Supplement, completed in 2004, identified specific AOCs.

In 2005, a Preliminary Assessment/Site Inspection Report (PA/SI) for Camp Abbot was completed for the USEPA by Weston (2005). The scope of the PA/SI largely parallels the scope of this planned SI. Samples were collected from soil, sediment, surface water, and groundwater at several AOCs. To the extent possible, this SI will utilize data previously collected for the PA/SI. Additional reconnaissance and sampling activity will be planned only to address specific data needs identified during the TPP.

Data collected during the PA/SI at a particular AOC is discussed in the CSM for the particular AOC. Areas sampled were the Landfill Area, Range Complex No. 1, and the Explosive

Munitions Ranges. One background sample each was collected from the soil, sediment, and surface water media and analyzed for metals. The data were compared to the background results and exceedances were considered significant if the sample data were greater than three times the background concentration. One groundwater sample was collected during the PA/SI. Review of the well log data shows that the well depth screened between 254 ft and 266 ft below ground surface. The depth of this screen interval indicates that the groundwater sampled during the PA/SI likely does not represent the near surface groundwater at the Camp Abbot FUDS. Therefore the data from this well will not be used in this SI.

A Risk Assessment Code (RAC) scoring was conducted by USACE in 2004. Possible scores range from 5 (no risk) to 1 (high risk). The following table summarizes the RAC determinations for the AOCs and indications of whether MEC has been found at these AOCs since the end of Army training, as summarized in the ASR Supplement:

<b>AOC</b>	<b>RAC Score</b>	<b>MEC Found</b>
Burial Pit	1	No
Anti-Tank Range	1	Yes
Chemical Training Area	1	No
Demolition Area	1	No
Grenade Courts	1	No
Mortar Range	1	Yes
Range Complex No. 1	5	No

### **3.0 PRE-FIELD ACTIVITIES**

#### **3.1 Coordination with State Historic Preservation Office**

The State Historic Preservation Office will be contacted to verify if any areas of cultural or archaeological significance have been identified in or in proximity to the MRSs at Camp Abbot.

#### **3.2 Coordination Regarding Natural Resources**

The Oregon Department of Natural Resources, as well as the U.S. Fish and Wildlife Service, will be contacted to identify any potentially impacted threatened or endangered species in the area.

#### **3.3 Review of Historical Aerial Photographs**

The historical aerial photographs of Camp Abbot will be reviewed and interpreted prior to field mobilization to aid in site reconnaissance and to refine proposed sampling point locations.

#### **3.4 Coordination of Rights of Entry**

The USACE Seattle is the geographic USACE District office responsible for Camp Abbot and for obtaining the Rights of Entry (ROEs) for properties where SI activities will be performed. Access to identified property is necessary for conducting field activities. ROEs have been obtained for all properties identified for sampling.

## 4.0 SITE INSPECTION ACTIVITIES

SI field activities to be conducted at Camp Abbot include:

- Site reconnaissance;
- Soil sampling;
- Sediment sampling;
- Groundwater sampling;
- Sampling and site information recording (using a hand-held global positioning system [GPS] unit); and
- Photo documentation.

SI field activities will be conducted in accordance with the SSHP Addendum (Appendix C). The SSHP is an addendum to the program-wide Accident Prevention Plan contained in the Work Plan. SI field activities will be documented in the field log book.

### 4.1 Key Personnel

This section identifies key project personnel and their specific roles and responsibilities for the SI conducted at Camp Abbot. Additionally, this section defines the responsibilities, authority, and the interrelationships of personnel who manage, perform, and verify activities affecting quality, particularly for personnel who need the organizational freedom and authority to:

- Initiate action to prevent the occurrence of non-conformance,
- Identify and record quality problems,
- Initiate, recommend, or provide solutions through designated channels,
- Verify the implementation of solutions, and
- Control further processing, delivery, or installation of non-conforming items until the deficiency or unsatisfactory condition has been corrected.

**Project Manager** – The Shaw Project Manager will have overall responsibility, authority, and accountability for the project. Mr. Peter Kelsall is the Project Manager. He will provide management or technical support when needed and will serve as the final reviewer on all technical documents produced for the project.

**Chemical Quality Control Officer**– The Shaw Chemical Quality Control Officer shall ensure that chemistry related objectives, including responsibilities for data quality objective definitions, sampling and analysis, project requirements for data documentation and validation, and final project reports are attained. Mr. Tim Roth will serve as the Chemical Quality Control Officer for this project.

**Health and Safety Manager** – The Shaw Health and Safety Manager is responsible for the development and implementation of the SSHP for this SI. Ms. Pamela Moore will serve as the Health and Safety Manager for this project.

**Technical Lead** – The Shaw Technical Lead will oversee the technical aspects of the inspection activities. Mr. Dale Landon will serve as the Technical Lead for this site.

**Field Team Leader** – The Shaw Field Team Leader will be responsible for the management and execution of all field project activities in accordance with the approved work plan, and federal, state, and local laws and regulations. The Field Team Leader for this site has not been identified.

During field work, the Field Team Leader will function as the primary point of contact for the stakeholders and field personnel. He will advise the Technical Lead of technical progress, needs, potential problems, and recommended solutions.

**UXO Technician** – The UXO technician will be responsible for the UXO avoidance measures to be implemented during field activities. Mr. Charles Irons, USACE database number 1136, or Mr. David Watkins, USACE database number 1420, will serve as the UXO technician on this site.

## **4.2 Field Reconnaissance**

A visual reconnaissance of the Camp Abbot acreage shown on Figures 2 through 7 will be conducted to identify evidence of MEC, range activities, and/or clearance for soil sampling. The reconnaissance team will locate and stake the proposed sampling locations.

A field reconnaissance survey for MEC is planned for the area immediately north of the Practice Grenade Courts. The ASR identified a live grenade area north of the Grenade Court identified in the ASR Supplement. The survey will consist of two meandering path visual and magnetometer surveys.

Visual reconnaissance of the Burial Pits MRS will be conducted to determine the location of the “horseshoe-shaped area, bermed and ringed with stone,” i.e., the potential disposal pit described in the ASR. This location will be surveyed by a qualified UXO technician with the aid of a hand-held magnetometer, with the objectives of assessing the presence or absence of MEC and determining appropriate MC sample locations.

The following conditions at each planned sampling location will be documented/recorded in the field log book and/or by digital photographs:

- Presence or absence of MEC/lead shot or munitions debris;
- Ground conditions, especially features that may be indicative of munitions activities;
- Coordinates of staked sampling locations (using a hand-held GPS unit);
- Access limitations;
- Vegetative cover;
- Soil conditions;
- Presence or absence of water for sediment and surface water samples; and
- Other conditions encountered that impact sample collection.

The path walked during the visual reconnaissance will be recorded using a hand-held GPS unit. Reconnaissance will be supplemented by the use of hand-held magnetometers, but will not include detailed mapping.

Shaw will document any MEC found, and proceed with MC sampling as described in the following sections.

## **4.3 Sampling**

This SSWP details sampling to be conducted, by media, at Camp Abbot as agreed upon during the April 2006 TPP Meeting and amended in response to comments on the Draft TPP Memorandum. Table 3 shows the proposed sampling approach and Table 4 provides a summary of the sampling location rationale.

If site reconnaissance indicates the need for additional samples to be taken, the total number of samples can be increased in order to determine MC present in an area. If site conditions preclude

locating or collecting samples as described in the following sections, the decision matrix presented in Table 6 will be used.

Background samples will be collected at the locations shown on Figure 8. Background samples will be collected for soil (10 samples), sediment (1 sample), and surface water (1 sample). The selection of the soil background locations was completed using VSP, computer software that allows for selection of independent sampling locations. The background sediment sampling location is from an upgradient location (Harper Bridge) within the Deschutes River. The background surface water location is from an up stream location (Harper Bridge).

#### 4.3.1 Soil

Surface soil sample locations identified for this SI (Table 5) are designed to identify the presence of MC associated with past military activities. The soil samples will be collected from the upper 6 inches of soil following removal of the vegetative cover, or deeper if site conditions indicate material has been deposited since the area was used for military activities. Surface soil samples will be 7-point composite samples, collected in accordance with the Shaw Standard Operating Procedure (SOP) T-FS-101, and the procedure described in Section 6.1.3 of Appendix E in the Work Plan. Samples collected from the subsurface (if collected), 6 – 12 inches depth will be discrete samples. Each soil sample to be analyzed for lead only will be sieved by the laboratory with a #10 sieve prior to analysis. General areas to be sampled are shown on Figures 2 through 8. Sample designations and quality assurance/quality control (QA/QC) sample requirements are summarized in Table 5.

The general rationale for collection of soil samples at the Camp Abbot MRSs are:

- **Range Complex No. 1 (Small Arms Ranges) (Figure 2)** – Soil sampling will be collected from the ground surface to assess the presence of lead related to small arms bullet fragments. No samples will be collected from the Landscape Range, Rifle Range, and Rifle/Machine Gun Range. These ranges were sampled during the PA/SI completed for the EPA by Weston (2005). Samples will be collected from the following locations:
  - **Anti-Aircraft Range:** Two surface soil samples will be collected from this range. One of the samples collected from the Anti-Aircraft Range will be offset by 10 ft from the biased sample location selected using the handheld magnetometer. This will allow for evaluating the distribution of MC at a location away from the biased location. Sample will be analyzed for lead only.
  - **Field Target and Submachine Gun Range:** Two surface soil samples are proposed at the Field Target and Sub-Machine Gun Range. Sample will be analyzed for lead only.
- **Explosive Munitions Ranges (Anti-Tank Range, Demolition Area [Demolition Pits], Mortar Range) (Figures 3, 4, and 5)** – Soil sampling will be collected from the ground surface to assess the presence of explosives (including nitroglycerin and PETN) and metals (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, molybdenum, mercury, nickel, and zinc) related to explosive munitions.

- **Anti-Tank Range (Figure 3):** One surface soil sample will be collected in the range target area to assess the presence/absence of explosives and metals related to munitions.
- **Demolition Area (Figure 4):** Three soil samples were collected from this AOC for the USEPA's PA/SI investigation (Weston, 2005). Samples were analyzed for metals and nitrogen based explosives. The analysis did not include nitroglycerin or PETN, which were components of the munitions and explosives used at the demolition area. One surface soil sample will be collected from one of the three PA/SI soil sample sites and analyzed for nitroglycerin and PETN.
- **Mortar Range (Figure 5):** Two surface soil samples will be collected in the impact area (where MEC finds were reported). One of the samples collected from the Mortar Range will be offset by 10 ft from the biased sample location selected using the handheld magnetometer. This will allow for evaluating the distribution of MC at a location away from the biased location.
- **Grenade Courts (Figure 6) -** Soil samples may be collected from the ground surface to assess the MC impacts to soil from a potential live grenade training area. Three soil samples were collected from the practice Grenade Court AOC for the USEPA's PA/SI investigation (Weston, 2005). No additional soil samples will be collected from the practice grenade courts.
  - If the planned MEC reconnaissance survey discussed above identifies an area with evidence of munitions activity beyond the area evaluated during the PA/SI, at least one additional surface soil sample will be collected. Decision as to whether more than one sample is collected will be based on the size of the area identified and amount of munitions debris encountered. A large area with a large amount of debris may require more than one sample. The sample(s) will be analyzed for explosives and select metals (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, and zinc). The metal list is based on the type of metals expected to be present in munitions.
- **Burial Pit (Figure 7) -** The vicinity of Burial Pit AOC was previously assessed during the USEPA's PA/SI (Weston, 2005), which identified the area of its activity as the landfill. However, it is not clear at this time if the PA/SI samples coincide with the specific burial pit feature that is the focus of this FUDS SI. Two soil samples (one surface and one subsurface sample) were collected from this MRS for the USEPA's PA/SI investigation (Weston, 2005). If it cannot be determined from reconnaissance that the area in question has been sampled previously, at least two additional soil samples (one surface and one subsurface sample) will be collected. Samples will be analyzed for explosives and select metals (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, and zinc). The metal list is based on the type of metals expected to be present in munitions.
- **Chemical Training Area:** No sampling is proposed at this MRS.
- **Background Soil Samples (Figure 8) -** Ten background soil samples will be collected from property within the Camp Abbot FUDS that is not within an identified MRS. The

locations shown on Figure 8 were selected using Visual Sampling Plan (VSP) software. The VSP software randomly selects sampling locations based on site layout. Following the sampling location selection by VSP several locations were moved to property parcels that had signed Rights of Entry. Background samples will be analyzed for metals only.

Soil samples will be collected using clean, new disposable sampling equipment (spoon or scoop and bowl). Non-disposable tools, such as a spade, shovel, or trowel, may be used to remove vegetation and roots prior to collection of soil or sediment sample.

#### 4.3.2 Sediment

Sediment samples will be collected in accordance with Section 5.1.2 or 5.1.3 of the *USACE Programmatic Sampling and Analysis Plan (PSAP)* (USACE, 2005b). Section 5.1.2 pertains to dry sediment sampling and Section 5.1.3 describes wet sediment sampling procedures.

Sediments will be sampled from the upper 2 inches of exposed sediments. General areas to be sampled are shown on Figures 2 through 8. Sample designations and quality assurance/quality control (QA/QC) sample requirements are summarized in Table 7.

The general rationale for collection of sediment samples at the Camp Abbot MRSs are:

- **Range Complex No. 1 (Small Arms Ranges)** – Sediment sampling will be collected from the stream bottom to assess the presence of lead related to small arms bullet fragments. No sediment samples will be collected from the Landscape Range, Rifle Range, or the Rifle/Machine Gun Range. These ranges were sampled during the PA/SI completed for the EPA by Weston (2005). Samples will be collected from the following locations:
  - One sediment sample will be collected at the Anti-Aircraft Range and analyzed for lead only.
  - One sediment sample will be collected at the Field Target and Sub-Machine Gun Range and analyzed for lead only.
- **Explosive Munitions Ranges (Anti-Tank Range, Demolition Area [Demolition Pits], Mortar Range)** – One sediment sample will be collected from along the Deschutes River to assess the presence of explosive and metal MC in stream bottoms.
  - **Anti-Tank Range:** No sediment samples will be collected from this range. A sediment sample was collected during the PA/SI (Weston, 2005) for the Landscape Range and the Anti-Tank Range.
  - **Demolition Area:** No sediment samples will be collected from this MRS. A sediment sample was collected from sediments representing both the Demolition Area and the Mortar Range.
  - **Mortar Range:** No sediment samples will be collected specifically from this MRS. A sediment sample was collected from sediments representing both the Demolition Area and the Mortar Range.
  - **General:** One sediment sample will be collected from a point along the Deschutes River down stream of the Mortar Range. The objective of this sample is to evaluate the impacts of the Mortar Range and other up stream AOCs on the overall water quality of the Deschutes River. The sample will be analyzed for

select metals (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, and zinc) and explosives.

- **Hand Grenade Courts:** One sediment sample was collected from the practice grenade courts for the USEPA's PA/SI investigation (Weston, 2005). No additional sediment samples are planned for the practice grenade courts. If field reconnaissance identifies an area with evidence of munitions activity beyond the area evaluated during the PA/SI, an additional sediment sample may be collected if a separate probable point of entry to the river is identified. The potential sample will be analyzed for explosives and select metals (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, and zinc) based on munitions used.
- **Burial Pit:** One sediment and one surface water sample were collected from this MRS for the USEPA's PA/SI investigation (Weston, 2005). If field reconnaissance determines that the "horseshoe-shaped area, bermed and ringed with stone" (the potential disposal pit) is beyond the area evaluated during the PA/SI, an additional sediment sample may be collected if a separate probable point of entry to the river is identified. The potential sample will be analyzed for explosives and select metals (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, and zinc) based on munitions used or disposed.
- **Chemical Training Area:** No sediment samples are planned from this MRS.
- **Background Sediment Samples** One background sediment sample will be collected to assess sediment conditions in streams not impacted by FUDS activities. The background sample will be collected from the Deschutes River at Harper Bridge. This location is at the up stream FUDS boundary.

### 4.3.3 Surface Water

Surface water samples will be collected in accordance with Section 5.4.2 of the PSAP (USACE, 2005b). Surface water samples will be collected before sediment samples if both sample types are to be collected. General areas to be sampled are shown on Figures 2 through 8. Sample designations and quality assurance/quality control (QA/QC) sample requirements are summarized in Table 5.

The general rationale for collection of surface water samples at the Camp Abbot MRSs are:

- **Range Complex No. 1 (Small Arms Ranges)** – No surface water samples will be collected from Range Complex No. 1 MRS.
- **Explosive Munitions Ranges (Anti-Tank Range, Demolition Area [Demolition Pits], Mortar Range)** – Two surface water samples will be collected from this MRS.
  - One surface water sample will be collected from the same location as a sediment sample collected during the PA/SI (Weston, 2005). The sample will be analyzed for total and dissolved metals (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, molybdenum, nickel, mercury, and zinc), explosives, and perchlorate.

- One surface water sample will be collected from a point along the Deschutes River down stream of the Mortar Range. The objective of this sample is to evaluate the impacts of the Mortar Range and other up stream MRSs on the overall water quality of the Deschutes River. The sample will be analyzed for metals (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, and zinc), explosives and perchlorate.
- **Hand Grenade Courts:** No surface water samples are planned for this MRS.
- **Burial Pit:** No surface water samples are planned for this MRS.
- **Chemical Training Area:** No surface water samples are planned from this MRS.

**Background Sediment Samples** One background surface water sample will be collected to assess surface water conditions in streams not impacted by FUDS activities. The background sample will be collected from the Deschutes River at Harper Bridge. This location is at the up stream FUDS boundary.

#### 4.3.4 Groundwater

Groundwater samples will be collected in accordance with Section 5.3.4 of the PSAP. Other general procedures described in the Work Plan and identified SOPs regarding activities such as field documentation, chain-of-custody, sample labeling, shipping, and packaging, and equipment decontamination will be followed as applicable. General areas to be sampled are shown on Figures 2 through 8. Sample designations and quality assurance/quality control (QA/QC) sample requirements are summarized in Table 5.

The general rationale for collection of groundwater samples at the Camp Abbot MRSs are:

- **Range Complex No. 1 (Small Arms Ranges)** – One groundwater sample will be collected from a well located near the firing position at the Landscape Range. This sample will also fill the need to collect a sample from the Anti-Tank Range in the Explosive Munitions Ranges MRS. The sample will be analyzed for explosives, perchlorate, and metals (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, and zinc.)
- **Explosive Munitions Ranges (Anti-Tank Range, Demolition Area [Demolition Pits], Mortar Range)** – One groundwater sample be collected from this MRS. The groundwater sample collected from Range Complex No. 1 above will satisfy the data gap for this MRS.
- **Hand Grenade Courts:** No groundwater samples are planned for this MRS.
- **Burial Pit:** No groundwater samples are planned for this MRS.
- **Chemical Training Area:** No groundwater samples are planned from this MRS.
- **Background Sediment Samples** No background groundwater samples will be collected.

#### **4.3.4 Analytical Program**

Samples will be analyzed using EPA SW-846 methodology as presented in Section 5.0 of the NWO FUDS Quality Assurance Project Plan (QAPP).

Definitive target analyses include the following:

- Aluminum, antimony, barium, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, and zinc by EPA SW846 Method 6020A;
- Aqueous Explosives by EPA SW846 Method 8330A;
- Soil Explosives by EPA SW846 Method 8330A;
- Perchlorate by EPA SW846 Method 6850.

Table 7 compares laboratory target analyte method quantitation limits to screening levels. Chemical data will be reported via a hard-copy data package and electronic format following the requirements referenced in Section 7.1 and 7.2 of the NWO FUDS QAPP. These data deliverables will be validated in accordance to the requirements referenced in Section 8.2 of the NWO FUDS QAPP.

#### **4.3.5 Quality Assurance/Quality Control Samples**

In accordance with the USACE PSAP, QA/QC samples will be collected. The locations planned for the collection of QA/QC samples are shown on Table 5.

The QC samples to be collected include four field duplicate samples and three matrix spike/matrix spike duplicate samples. The Omaha Design Center has directed that QA field split samples will not be collected for this site.

#### **4.3.6 Sample Preservation, Packaging, and Shipping**

Sample preservation, and packaging are provided in Table 4-1 and Table 4-2 of the NWO FUDS QAPP (USACE, 2005b). Sample shipment will follow the procedures specified in Section 4.0 of the NWO FUDS QAPP. Completed analysis request/chain of custody records per Section 7.1.3 of the NWO FUDS SAP (USACE, 2005b) will be secured and included with each shipment of coolers to GPL Laboratories, LLC.

All samples will be shipped to the following:

#### **GPL Laboratories, LLC**

7210A Corporate Court  
Frederick, MD 21703  
Phone: 301.694.5310  
Fax: 301.620.0731  
Attention: Sample Receiving/Virginia Zusman

### **5.0 INVESTIGATION-DERIVED WASTE**

Investigation-derived waste (IDW) will be managed in accordance with the Work Plan (Section 3.7, and Appendix E, SAP Section 9.0). All IDW is presumed non-hazardous unless field observations indicate otherwise. The following types of IDW will be managed as specified in the Work Plan, Appendix E, USACE Field Sampling Plan:

- Personal protective equipment and disposable equipment (i.e., disposable sampling scoop): bagged and routed to a municipal landfill;
- Excess surface soil and sediment material: returned to source (i.e., ground surface);
- Subsurface soil: returned to source (i.e., borehole and/or ground surface); and
- Groundwater, surface water, and decontamination fluid: poured onto ground surface.

## **6.0 PROPOSED SCHEDULE**

The proposed schedule for field activities and reporting is provided below. The timing of the field activities assumes there will be no delays because of inclement weather.

July 2006 – Submittal of Draft SSWP;

August 2006 – Review of Draft SSWP by USACE and ODEQ (30 days);

August 2006 – Submittal of Final SSWP,

September 2006 – Field activities;

November 2006 – Submittal of Draft SI Report;

December 2006 – Review of Draft SI Report;

January 2007 – Submittal of Draft Final SI Report;

January 2007 – Review of Draft Final SI Report; and

January 2007 – Submittal of Final SI Report.

## 7.0 REFERENCES

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- Department of Defense (DoD). 2003. *Definitions Related to Munitions Response Actions*, Memorandum, Philip W. Grone. December 18.
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- Willingham, W.F. 1983. *Army Engineers and the Development of Oregon: A History of the Portland District U.S. Army Corps of Engineers*.

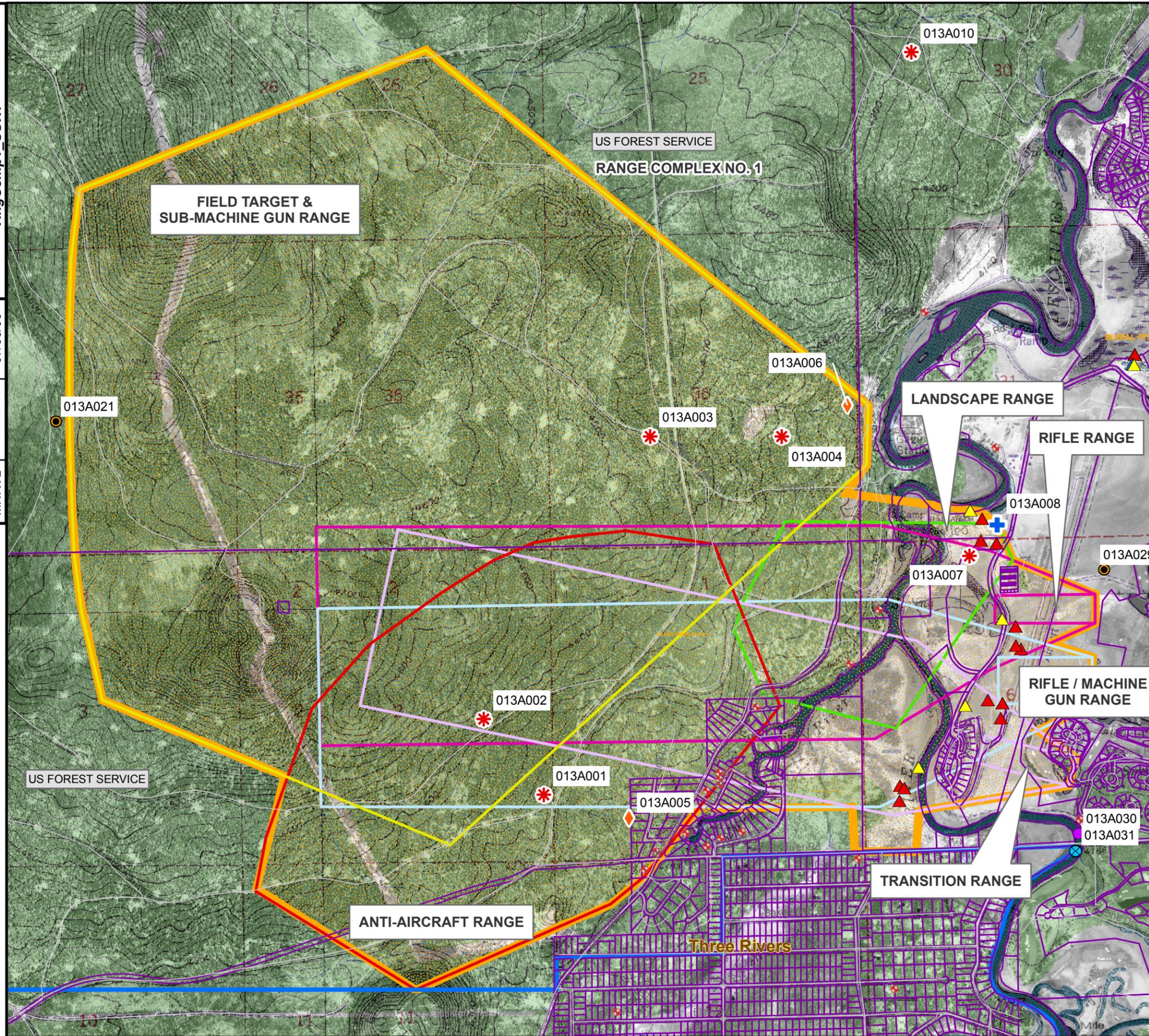
# FIGURES



DRAWING CABO\_028\_fig02  
 NUMBER RngComp1\_SSWP

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 K. Masterson 07/06/06

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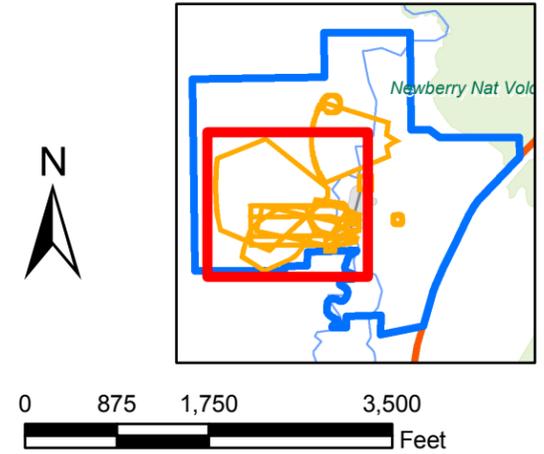
**Legend**

- Camp Abbot Property Boundary
- Camp Abbot MRSs
- Taxlot Parcels
- Groundwater Wells
- BKGR SOIL
- Background Surface Water Sample Location
- Background Sediment Sample Location
- Proposed Sediment Sample Location
- Proposed Soil Sample Location
- Proposed Groundwater Sample Location

Weston PA/SI Sample Points<sup>5</sup>

- Soil Sample
- Sediment Sample
- Surface Water Sample

- NOTES:
- 1) MRS Boundaries were derived from the Camp Abbott ASR Supplement.
  - 2) Groundwater well data were obtained from the US Geological Survey (USGS).
  - 3) Taxlot parcel data were obtained from the Deschutes County GIS office.
  - 4) These ranges are located within the Upper Deschutes Watershed.
  - 5) Obtained from Camp Abbot FUDS Preliminary Assessment/ Site Inspection Report, Weston (2005).



REFERENCE/PROJECTION: State Plane NAD 83 UTM Zone 10N

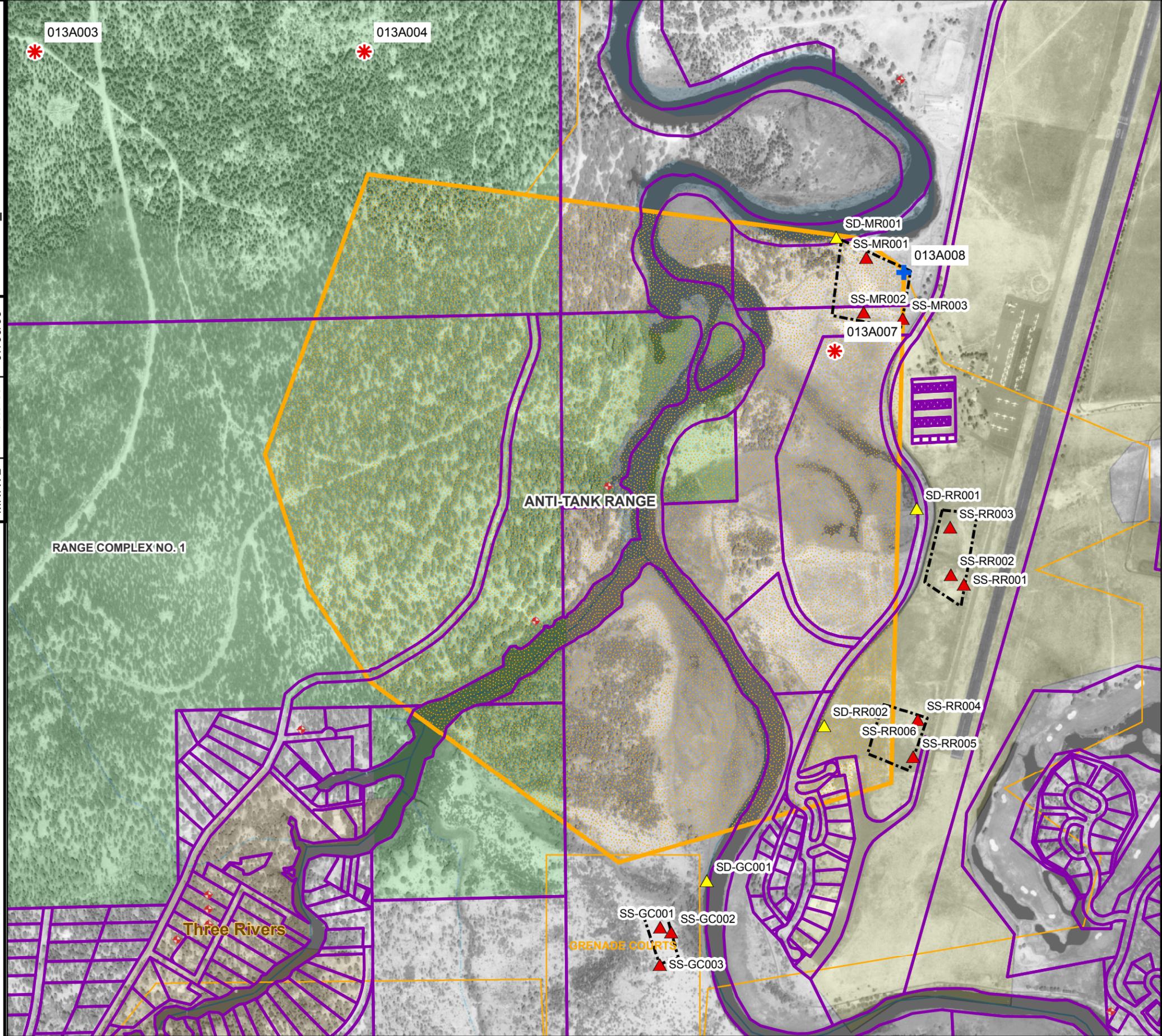
U.S. ARMY CORPS OF ENGINEERS  
 OMAHA DESIGN CENTER

**FIGURE 2**  
**MUNITIONS RESPONSE SITE**  
**RANGE COMPLEX NO. 1**  
 CAMP ABBOT

DRAWING CABO\_029\_fig03\_AntiTankRng  
 NUMBER \_SSWP

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**Legend**

- Camp Abbot Property Boundary
- Camp Abbot MRSs
- Taxlot Parcels
- Groundwater Wells
- Proposed Soil Sample Location
- Proposed Groundwater Sample Location

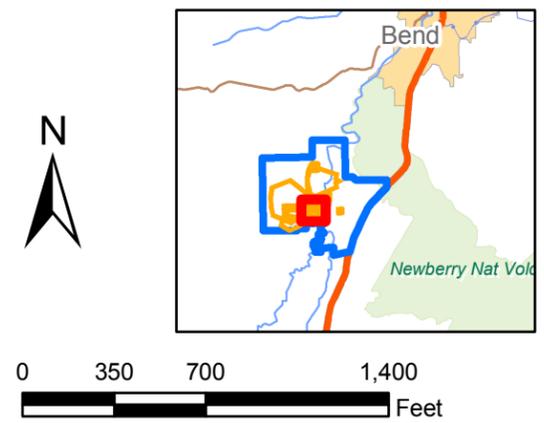
Weston PA/SI Sample Points<sup>5</sup>

- Soil Sample
- Sediment Sample
- Surface Water Sample

Weston PA/SI XRF Screening Area<sup>5</sup>

NOTES:

- 1) MRS boundaries were derived from the Camp Abbot ASR Supplement.
- 2) Groundwater well data were obtained from the US Geological Survey (USGS).
- 3) Taxlot parcel data were obtained from the Deschutes County GIS office.
- 4) These ranges are located within the Upper Deschutes Watershed.
- 5) Obtained from Camp Abbot FUDS Preliminary Assessment/ Site Inspection Report, Weston (2005).
- 6) Aerial photo from TerraServer, dated July 20, 1994.



REFERENCE/PROJECTION: State Plane NAD 83 UTM Zone 10N



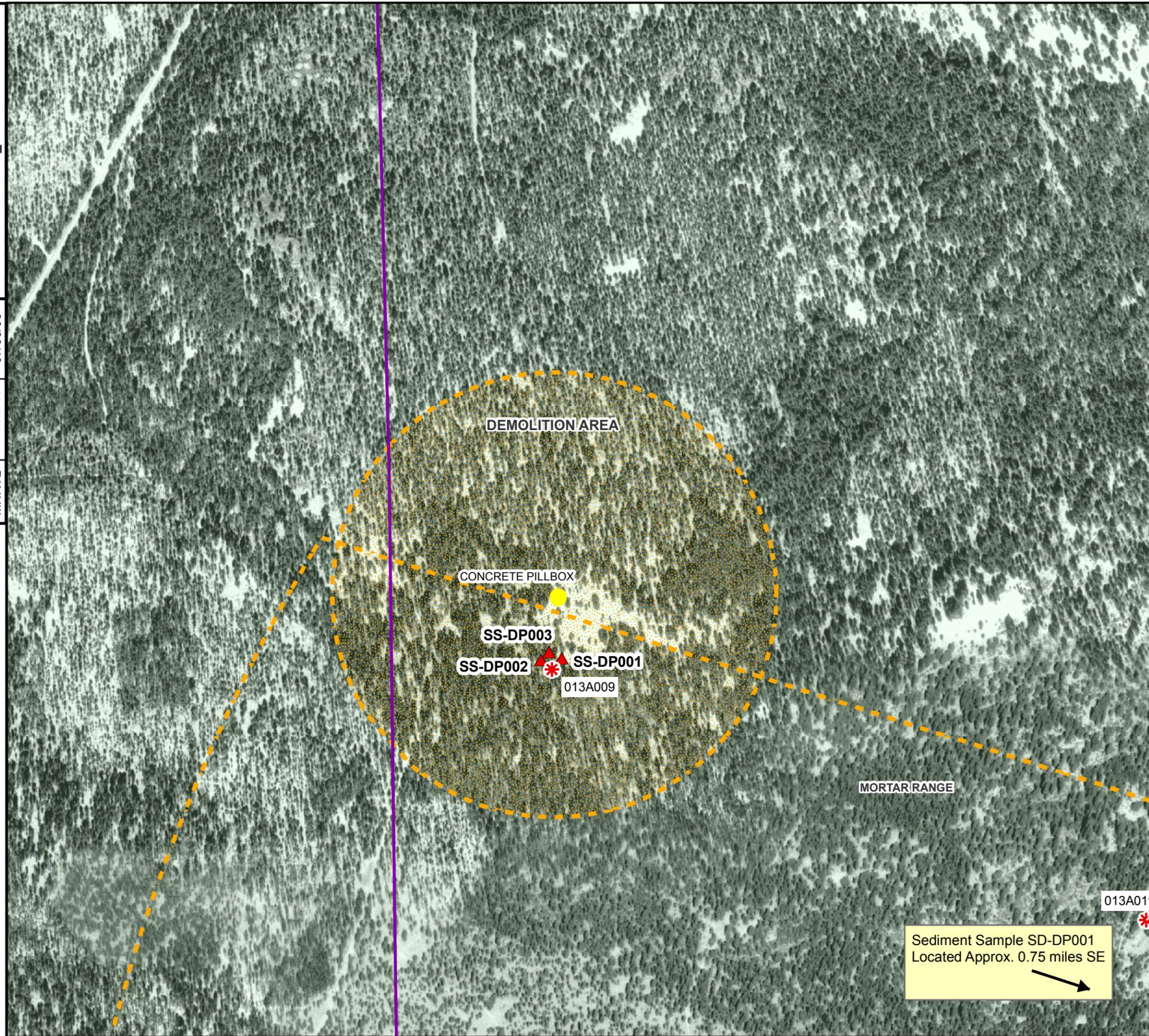
U.S. ARMY CORPS OF ENGINEERS  
 OMAHA DESIGN CENTER

**FIGURE 3**  
**MUNITIONS RESPONSE SITE**  
**ANTI-TANK RANGE**  
 CAMP ABBOT

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NUMBER DemoArea\_SWP

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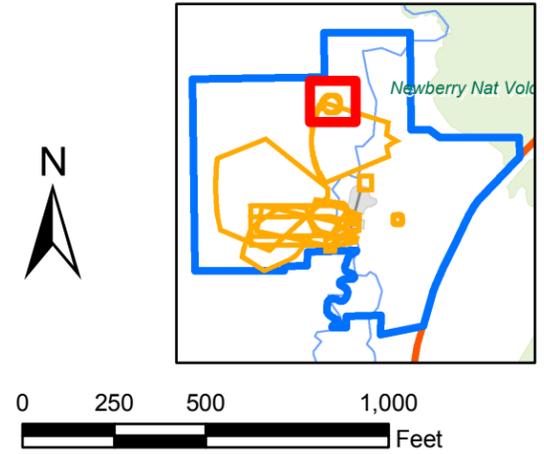
**Legend**

- Camp Abbot Property Boundary
- Camp Abbot Approximate MRS Boundary
- Taxlot Parcels
- Groundwater Wells
- Proposed Soil Sample Location

Weston PA/SI Sample Points<sup>5</sup>

- Soil Sample
- Sediment Sample

- NOTES:
- 1) MRS boundaries were derived from the Camp Abbot ASR Supplement.
  - 2) Groundwater well data were obtained from the US Geological Survey (USGS).
  - 3) Taxlot parcel data were obtained from the Deschutes County GIS office.
  - 4) These ranges are located within the Upper Deschutes Watershed.
  - 5) Obtained from Camp Abbot FUDS Preliminary Assessment/ Site Inspection Report, Weston (2005).
  - 6) Aerial photo from TerraServer, dated July 20, 1994.



REFERENCE/PROJECTION: State Plane NAD 83 UTM Zone 10N

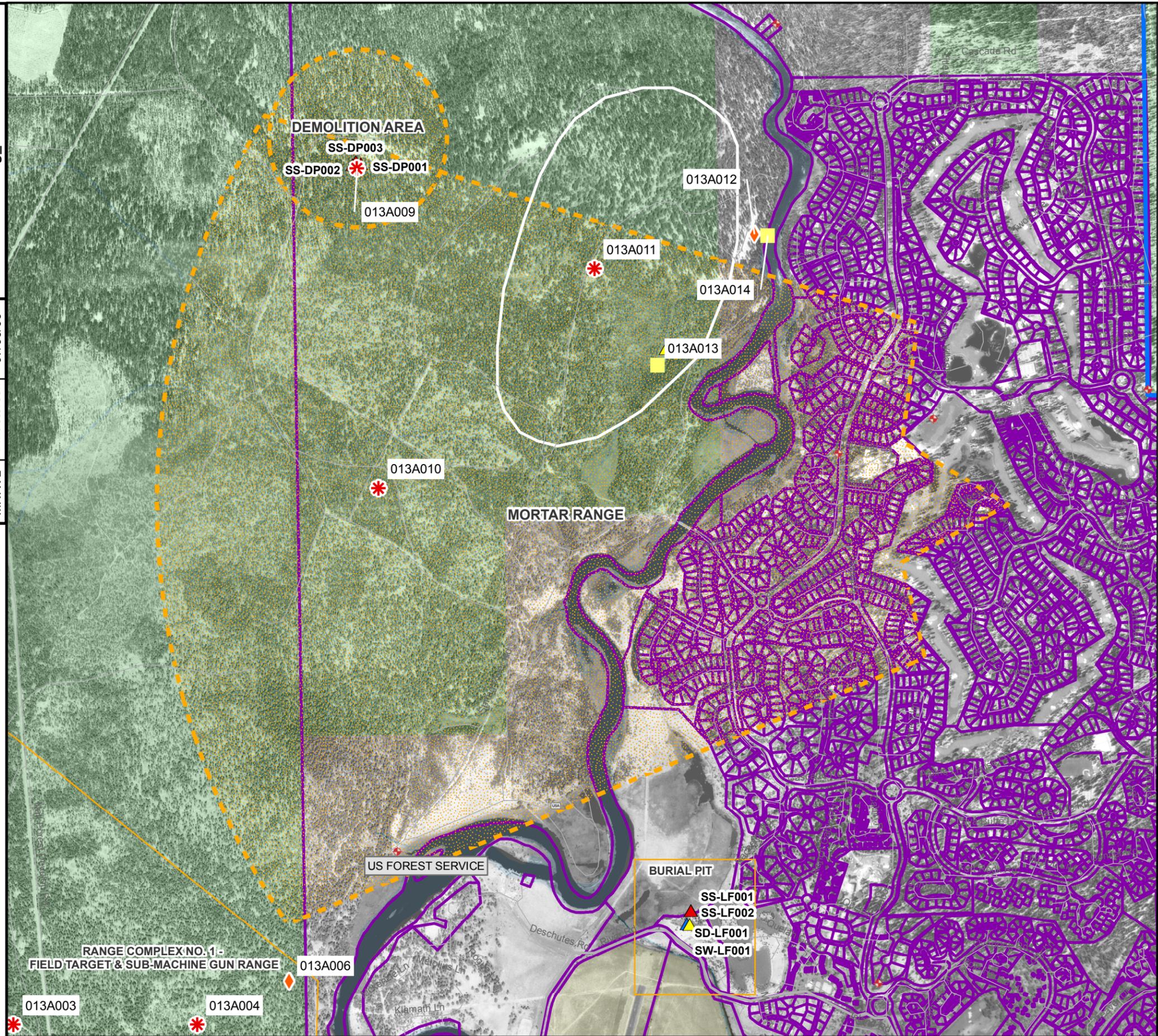
U.S. ARMY CORPS OF ENGINEERS  
OMAHA DESIGN CENTER

**FIGURE 4**  
**MUNITION RESPONSE SITE**  
**DEMOLITION AREA**  
CAMP ABBOT

DRAWING CABO\_031\_fig05  
NUMBER MortarRng\_SSWP

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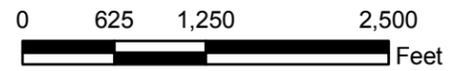
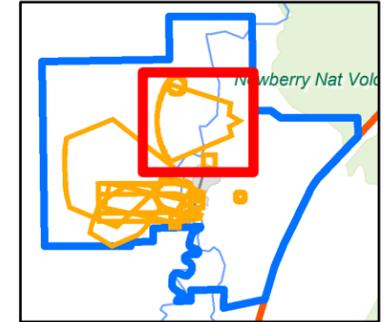
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**Legend**

- Camp Abbot Property Boundary
- Camp Abbot Approximate MRS Boundaries
- Taxlot Parcels
- Reported MEC Find Area
- Groundwater Wells
- Proposed Sediment Sample Location
- Proposed Soil Sample Location
- Proposed Surface Water Sample Location
- Weston PA/SI Sample Points<sup>5</sup>
  - Soil Sample
  - Sediment Sample
  - Surface Water Sample
- Weston PA/SI XRF Screening Area<sup>5</sup>

NOTES:  
1) MRS boundaries were derived from the Camp Abbot ASR Supplement.  
2) Groundwater well data were obtained from the US Geological Survey (USGS).  
3) Taxlot parcel data were obtained from the Deschutes County GIS office.  
4) These ranges are located within the Upper Deschutes Watershed.  
5) Obtained from Camp Abbot FUDS Preliminary Assessment/ Site Inspection Report, Weston (2005).  
6) Aerial photo from TerraServer, dated July 20, 1994.



REFERENCE/PROJECTION: State Plane NAD 83 UTM Zone 10N



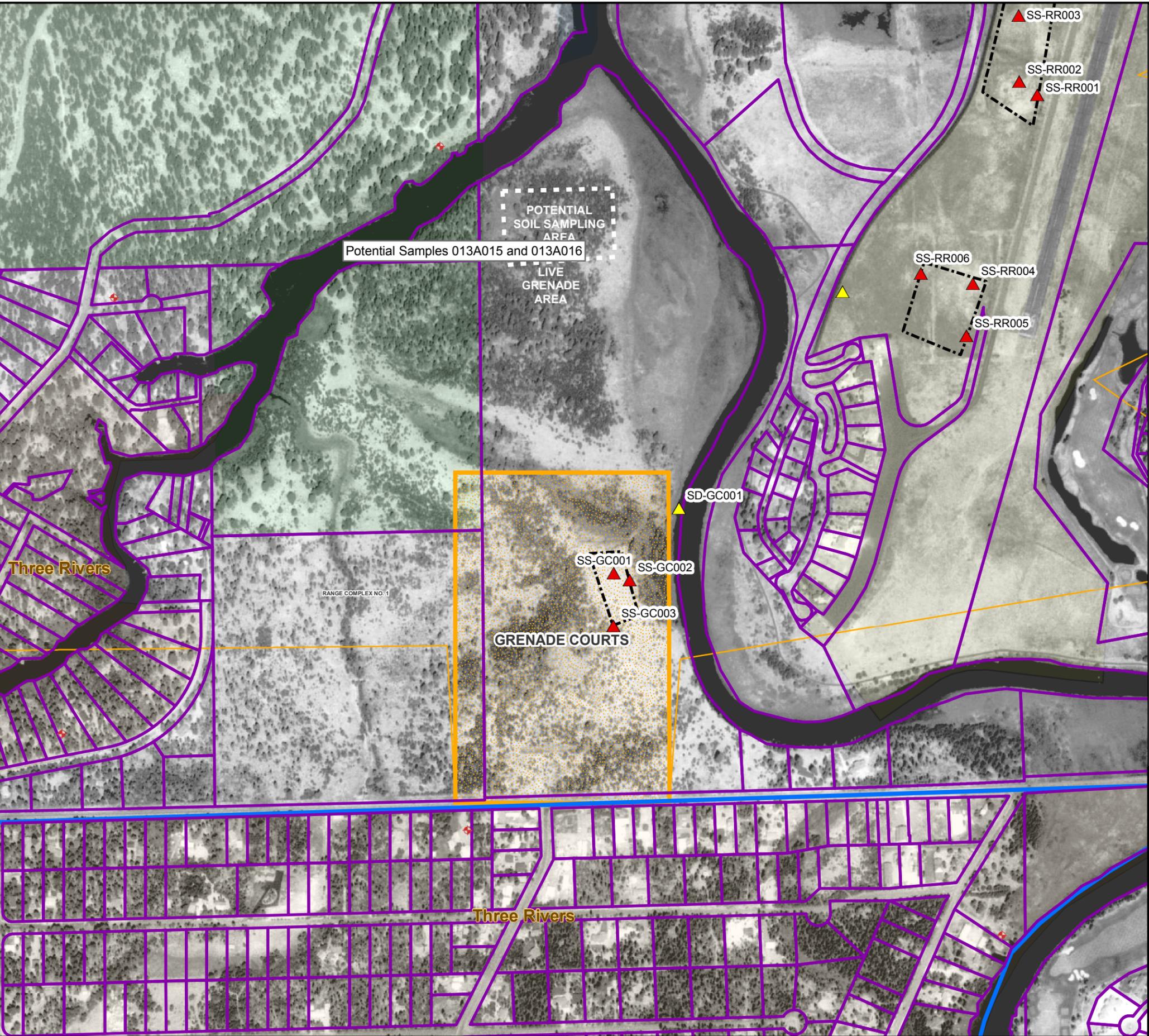
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OMAHA DESIGN CENTER

**FIGURE 5**  
**MUNITIONS RESPONSE SITE**  
**MORTAR RANGE**  
CAMP ABBOT

DRAWING CABO\_032\_fig06\_ NUMBER GrenadeCts\_SSWP

DRAWN BY K. Masterson 07/06/06

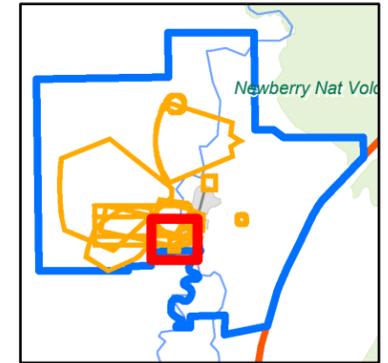
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**Legend**

- Camp Abbot Property Boundary
- Camp Abbot MRSs
- Taxlot Parcels
- Groundwater Wells
- Weston PA/SI Sample Points<sup>5</sup>**
  - Soil Sample
  - Sediment Sample
- PA/SI XRF Screening Area<sup>5</sup>
- Live Grenade Area<sup>6</sup>

- NOTES:
- 1) MRS boundaries were derived from the Camp Abbot ASR Supplement.
  - 2) Groundwater well data were obtained from the US Geological Survey (USGS).
  - 3) Taxlot parcel data were obtained from the Deschutes County GIS office.
  - 4) These ranges are located within the Upper Deschutes Watershed.
  - 5) This information was obtained from the Camp Abbot FUDS Preliminary Assessment/Site Inspection Report, Weston, April 2005.
  - 6) Area identified in Camp Abbot ASR, Appendix D.
  - 7) Aerial photo from TerraServer, dated July 20, 1994.



REFERENCE/PROJECTION: State Plane NAD 83 UTM Zone 10N

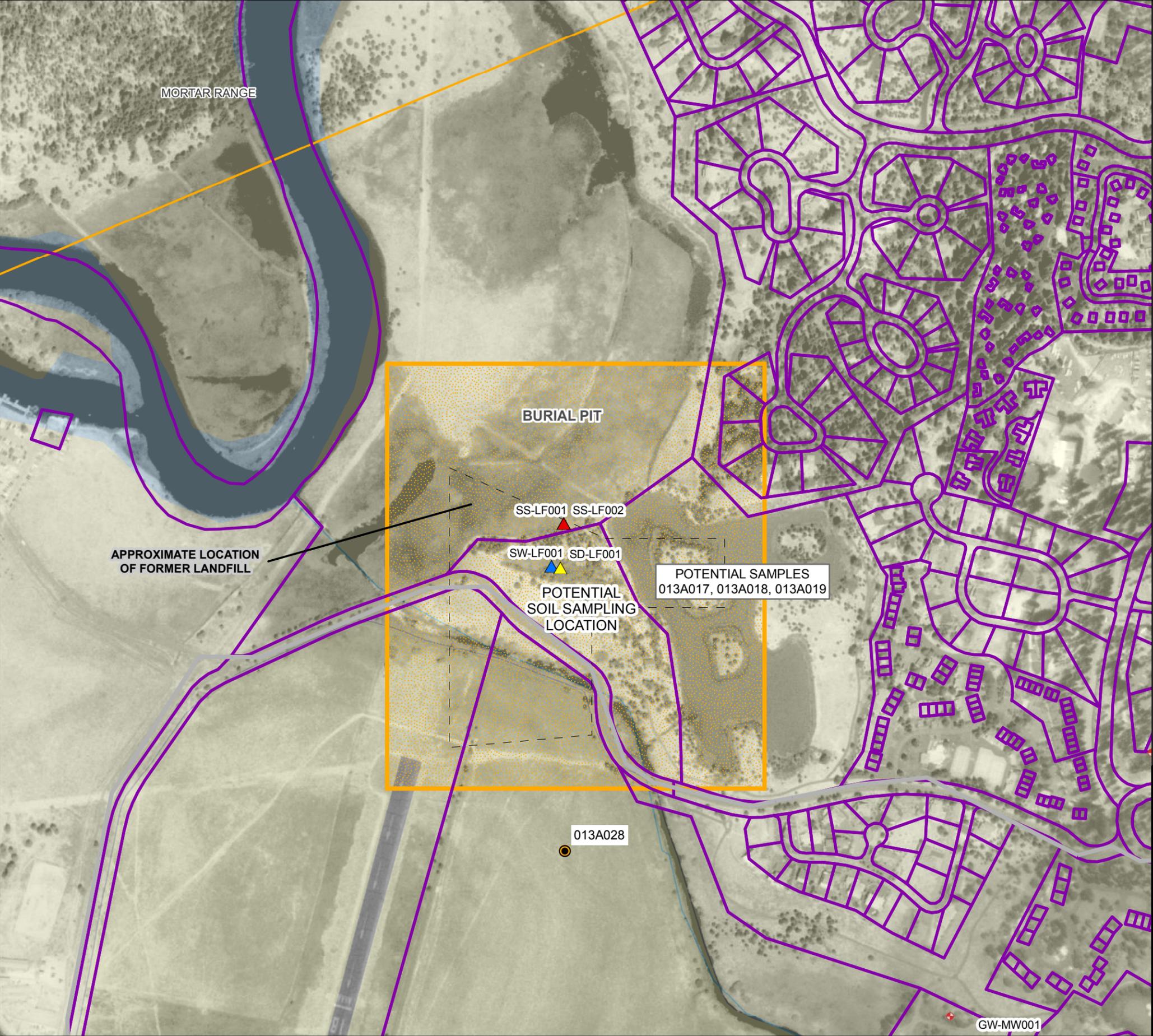


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**FIGURE 6**  
**MUNITIONS RESPONSE SITE**  
**GRENADE COURTS**  
CAMP ABBOT



OFFICE: MNRVL  
 DRAWN BY: K. Masterson  
 DRAWING NUMBER: CABO\_033\_fig07\_BurialPit\_SSWP



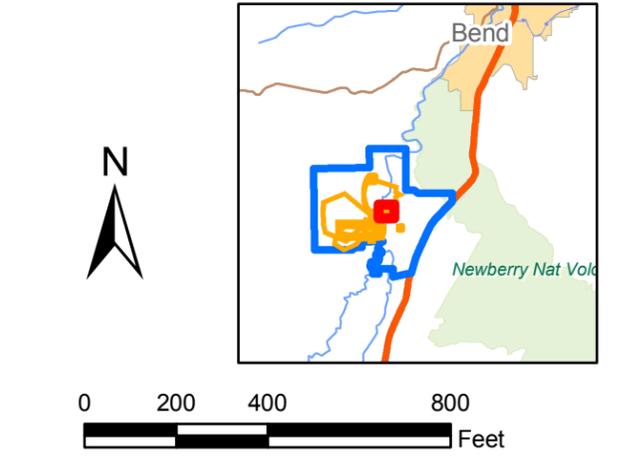
**Legend**

- Camp Abbot Property Boundary
- Camp Abbot MRSs
- Taxlot Parcels
- Groundwater Wells
- Background Soil Sample Location

Sample Points from PA/SI (Weston, 2005)<sup>5</sup>

- Soil Sample
- Sediment Sample
- Surface Water Sample

- NOTES:**
- 1) MRS boundaries were derived from the Camp Abbot ASR Supplement.
  - 2) Groundwater well data were obtained from the US Geological Survey (USGS).
  - 3) Taxlot parcel data were obtained from the Deschutes County GIS office.
  - 4) These ranges are located within the Upper Deschutes Watershed.
  - 5) Obtained from Camp Abbot FUDS Preliminary Assessment/ Site Inspection Report, Weston (2005).
  - 6) Aerial photo from Terraserver, dated July 20, 1994.



REFERENCE/PROJECTION: State Plane NAD 83 UTM Zone 10N

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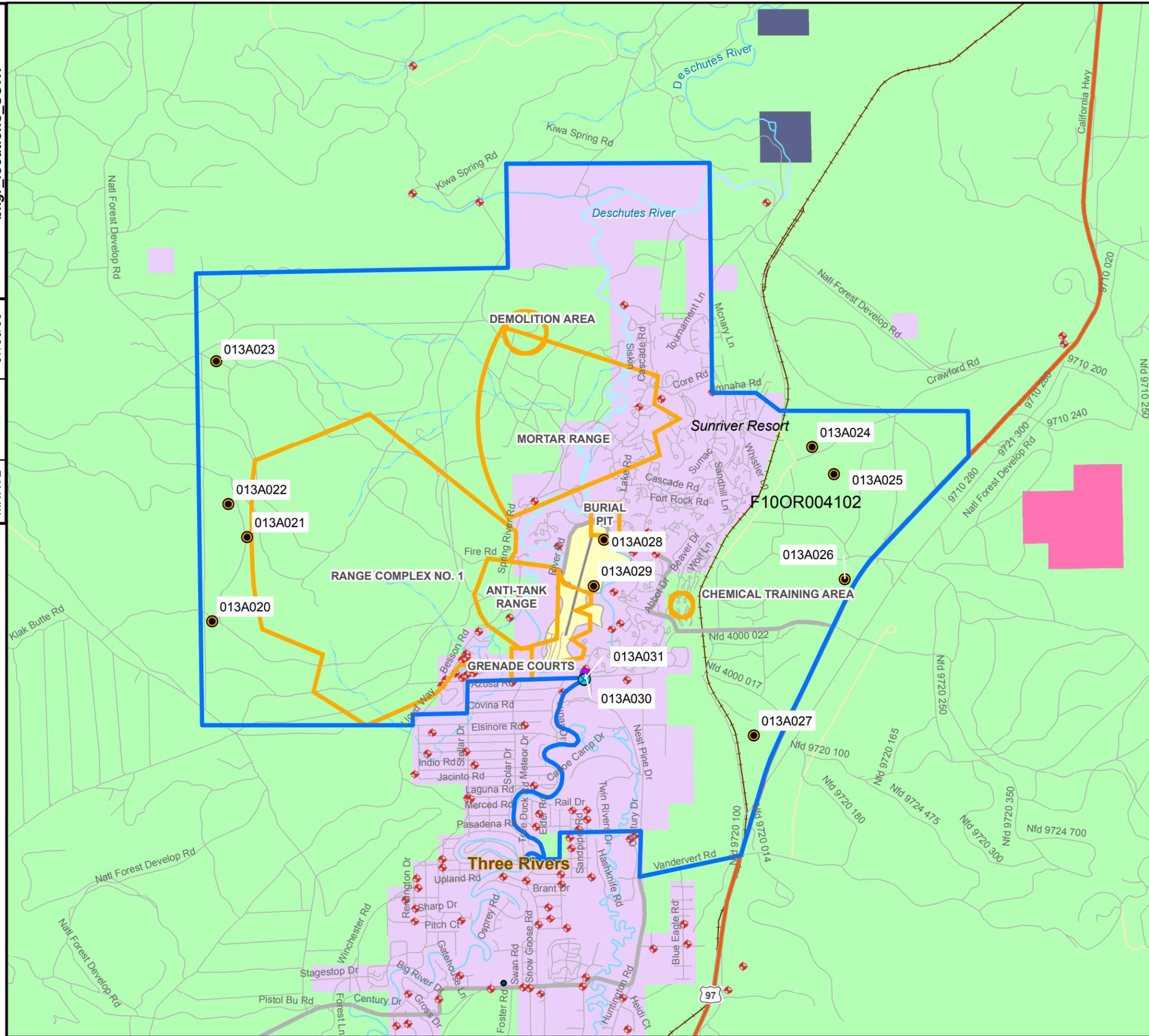
**FIGURE 7**  
**MUNITIONS RESPONSE SITE**  
**BURIAL PIT**  
 CAMP ABBOT

Shaw Environmental, Inc.

DRAWING CABO\_026\_fig08  
NUMBER bkgr\_locations\_SSWP

DRAWN BY  
K.Masterson 07/06/06

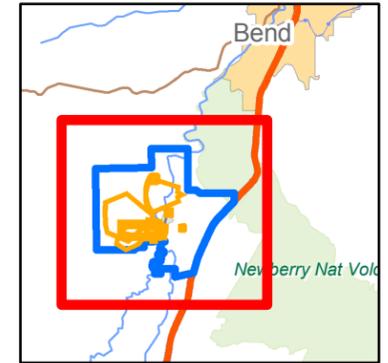
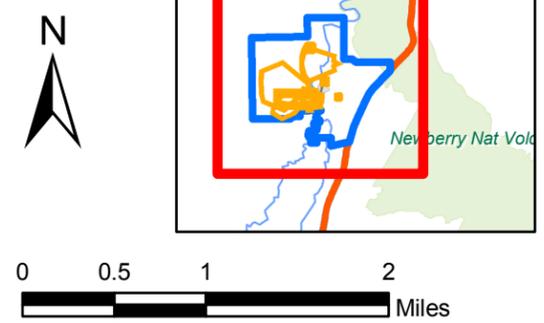
OFFICE  
MNRVL



**Legend**

- Camp Abbot Property Boundary
- Camp Abbot MRSs
- Groundwater Wells
- Privately Owned Land
- Federal Energy Regulatory Commission
- Bureau of Land Management
- Oregon Department of State Lands
- US Department of Agriculture Forest Service
- Background Sediment Sample
- Background Soil Sample
- Background Surface Water Sample

- NOTES:
- 1) MRS boundaries were derived from the Camp Abbot ASR Supplement.
  - 2) Groundwater well data were obtained from the US Geological Survey (USGS).
  - 3) Land ownership shapefile was obtained from the Oregon Geospatial Data Clearinghouse (<http://www.gis.state.or.us/data/alphalist.html>).
  - 4) These ranges are located within the Upper Deschutes Watershed.



REFERENCE/PROJECTION: State Plane NAD 83 UTM Zone 10N

U.S. ARMY CORPS OF ENGINEERS  
OMAHA DESIGN CENTER

**FIGURE 8**  
**BACKGROUND SAMPLE LOCATIONS**  
CAMP ABBOT

# **TABLES**

**Table 1  
AOC and MRS Correlation  
Camp Abbot**

<b>Munitions Response Area (MRA)</b>	<b>Munitions Response Site (MRS)</b>	<b>Defined Areas of Concern (AOCs)</b>	<b>Sub-Ranges</b>	<b>Planned Sampling (Yes/No)</b>
<b>Range Complex No. 1</b>	<b>MRS # 1</b>	<b>Range Complex No. 1</b>	<b>Rifle Range</b>	<b>No</b>
			<b>Rifle/Machine Gun Range</b>	<b>No</b>
			<b>Landscape Range</b>	<b>No</b>
			<b>Transition Range</b>	<b>No</b>
			<b>Anti-Aircraft Range</b>	<b>Yes</b>
			<b>Field Target and Sub Machine Gun Range</b>	<b>Yes</b>
<b>Explosive Munitions Ranges</b>	<b>MRS # 2</b>	<b>Anti-Tank Range</b>	<b>NA</b>	<b>Yes</b>
	<b>MRS # 3</b>	<b>Demolition Area</b>	<b>NA</b>	<b>Yes</b>
	<b>MRS # 4</b>	<b>Mortar Range</b>	<b>NA</b>	<b>Yes</b>
<b>Hand Grenade Courts</b>	<b>MRS # 5</b>	<b>Grenade Courts</b>	<b>Practice grenade Court</b>	<b>No</b>
			<b>Live Grenade Court</b>	<b>Yes</b>
<b>Burial Pit</b>	<b>MRS # 6</b>	<b>Burial Pit</b>	<b>NA</b>	<b>Yes</b>
<b>Chemical Training Area</b>	<b>MRS # 7</b>	<b>Chemical Training Area</b>	<b>NA</b>	<b>No</b>

**Table 2  
Munitions Information  
Camp Abbot**

<b>Munitions Response Site</b>	<b>AOC</b>	<b>Munitions</b>	<b>Munitions Constituents</b>
MRS # 1	Range Complex No. 1	Small Arms General	Lead, single(nitrocellulose)- or double-base (nitrocellulose and nitroglycerin) propellant;
		50 Cal. Machine Gun	Lead, single(nitrocellulose)- or double-base (nitrocellulose and nitroglycerin) propellant, perchlorate
MRS # 2	Anti-Tank Range	M6A1, Rocket, HEAT, 2.36 inch	Pentolite (Pentaerythritol tetranitrate [PETN] and TNT), Ballistite (nitrocellulose and nitroglycerin), M400 (fuze), perchlorate
		M6A3, Rocket, HEAT, 2.36 inch	Pentolite (PETN and TNT), Ballistite (nitroglycerin and nitrocellulose), M400 (fuze), perchlorate
		M9A1 Rifle Grenade Anti-Tank	Pentolite (PETN and TNT), or TNT
		M11A2 Practice Rifle Grenade	Inert
		M7A1, Practice Rocket, 2.36 inch	5 Sticks of Ballistite (nitrocellulose and nitroglycerin)
		M7A3, Practice Rocket, 2.36 inch	5 Sticks of Ballistite (nitrocellulose and nitroglycerin)
MRS # 3	Demolition Area	Explosives Detonating Cord	PETN,
		Explosives Dynamite Commercial	Nitroglycerin
		Explosives TNT	TNT
		Detonators	No Data sheets provided
		Blasting Caps Electric Commercial	Sensitive Explosive
		Fuses, Boosters, or Burstors	No data sheets provided
MRS # 4	Mortar Range	60mm HE M49	TNT, Ballistite (nitrocellulose and nitroglycerin)
		60mm Practice M50A2	Inert with black powder pellets
		81mm, HE, M43	TNT, Ballistite(nitrocellulose and nitroglycerin)
		81mm, TP M43A1	Black Powder
MRS # 5	Grenade Courts	Mk II, Hand Grenade, Frag	TNT (Flaked or Granular), older models used E.C. Blankfire Powder (nitrocellulose, barium nitrate, potassium nitrate, charcoal, and sulfur)

**Table 2 (Cont.)  
Munitions Information  
Camp Abbot**

<b>Munitions Response Site</b>	<b>AOC</b>	<b>Munitions</b>	<b>Munitions Constituents</b>
		AN-M8 Smoke Grenade HC	Hexachloroethane-zinc
		AN-M14, Incendiary Grenade	Igniter mixture III, Delay mixture V, FF mixture VII, incendiary mixture, Thermite, TH3 and thermite, plain.
		M15, Smoke Grenade, WP	White Phosphorous
		M21, Practice Hand Grenade	Black Powder
MRS # 6	Burial Pit	Small Arms General	Lead, single(nitrocellulose)- or double-base (nitrocellulose and nitroglycerin) propellant;
		Small Arms General- complete rounds	Lead, single(nitrocellulose)- or double-base (nitrocellulose and nitroglycerin) propellant; lead, brass
		Mk II, Hand Grenade, Frag	TNT (Flaked or Granular), older models used E.C. Blankfire Powder (nitrocellulose, barium nitrate, potassium nitrate, charcoal, and sulfur)
		AN-M14, Incendiary Grenade	Igniter mixture III, Delay mixture V, FF mixture VII, incendiary mixture, Thermite, TH3 and thermite, plain.
		M15, Smoke Grenade, WP	White Phosphorous
		M6A1, Rocket, HEAT, 2.36 inch	Pentolite (Pentaerythritol tetranitrate [PETN] and TNT), Ballistite (nitrocellulose and nitroglycerin),
		M7A1, Practice Rocket, 2.36 inch	5 Sticks of Ballistite (nitrocellulose and nitroglycerin)
		60mm, HE, M49	TNT, Ballistite (nitrocellulose and nitroglycerin)
		81mm, HE, M43	TNT, Ballistite (nitrocellulose and nitroglycerin)
		60mm, Practice, M50A2	Inert with black powder pellets
		Riot Control Agents	No data sheets provided
		Less Sensitive Explosives (Ammonium Nitrate, Explosive D, etc.	No data sheets provided
		Chemical ID, Toxic Gas Set M2	28 Heat-sealed Ampoules with 3.8 ounces of Mustard
Toxic Chemical Munitions	No data sheets provided		
MRS # 7	Chemical Training Area	AN-M8 Smoke Grenade HC	Hexachloroethane-zinc

**Table 2 (Cont.)  
Munitions Information  
Camp Abbot**

Munitions Response Site	AOC	Munitions	Munitions Constituents
		AN-M14, Incendiary Grenade	Igniter mixture III, Delay mixture V, FF mixture VII, incendiary mixture, Thermite, TH3 and thermite, plain.
		M15, Smoke Grenade, WP	White Phosphorous
		Pot Tear Gas M1	Chloracetophenone mixture
		Chemical ID, Toxic Gas Set M2	28 Heat-sealed Ampoules with 3.8 ounces of Mustard
		Chemical ID, Toxic Gas Set M1	24 bottles of 32 ounces of Mustard, Chlorpicrin, Lewisite, Adamsite, Chloracetophenone, Triphosgene
		Toxic Chemical Munitions	No data sheets provided

**Table 3  
Proposed Sampling Approach  
Camp Abbot**

MRS	AOC	Media	Contaminants of Concern				Survey for MEC	Comments
			Lead*	Metals**	Explosives	Perchlorate		
1	Range Complex No. 1	Soil	4	--	--	--	No	Two surface soil samples will be collected from the Anti-Aircraft Range. One of the samples collected from the will be offset by 10 ft from the biased sample location selected using the handheld magnetometer. This will allow for evaluating the distribution of MC at a location away from the biased location. Two surface soil samples will be collected Field Target and Sub-Machine Gun Range. Soil samples will be composite.
		Sediment	2	--	--	--		One sediment sample each will be collected at the Anti-Aircraft Range and the Field Target and Sub-Machine Gun Range and analyzed for lead only.
		Surface Water	--	--	--	--		No samples to be collected
		Groundwater	--	--	--	--		No Samples to be collected
2	Anti-Tank Range	Soil	--	1	1	--	No	One surface soil sample will be collected in the range target area to assess the presence/absence of explosives and metals related to munitions.
		Sediment	--	--	--	--		No samples to be collected
		Surface Water	--	--	--	--		No samples to be collected
		Groundwater	--	1	1	1		One groundwater sample will be collected from a well located near the firing position at the Anti-Tank Range. This sample will also fill the need to collect a sample from the in the Range Complex No 1 MRS Landscape Range.
3	Demolition Area	Soil	--	--	1	--	No	One surface soil sample will be collected from one of the three PA/SI soil sample sites and analyzed for nitroglycerin and PETN.
		Sediment	--	--	--	--		No samples to be collected
		Surface Water	--	--	--	--		No samples to be collected
		Groundwater	--	--	--	--		No samples to be collected
4	Mortar Range	Soil	--	2	2	--	No	Two surface soil samples will be collected in the impact area (where MEC finds were reported). One of the samples collected from the Mortar Range will be offset by 10 ft from the biased sample location selected using the handheld magnetometer. This will allow for evaluating the distribution of MC at a location away from the biased location.
		Sediment	--	1	1	--		A sediment and surface water sample will be collected from a point along the Deschutes River down stream of the Mortar Range.
		Surface Water	--	2	2	2		One surface water sample will be collected from the same location as a sediment sample collected during the PA/SI (Weston, 2005). Sample will evaluate groundwater to surface water impacts.
		Groundwater	--	--	--	--		No samples to be collected
5	Grenade Courts	Soil	--	1	1	--	Yes	If the planned MEC reconnaissance survey identifies an area with evidence of munitions activity beyond the area evaluated during the PA/SI, at least one additional surface soil sample will be collected.

**Table 3 (Cont.)  
Proposed Sampling Approach  
Camp Abbot**

MRS	AOC	Media	Contaminants of Concern				Survey for MEC	Comments
			Lead*	Metals**	Explosives	Perchlorate		
5	Grenade Courts	Sediment	--	1	1	--		If planned MEC reconnaissance identifies an area with evidence of munitions activity beyond the area evaluated during the PA/SI, an additional sediment sample may be collected if a separate probable point of entry to the river is identified.
		Surface Water	--	--	--	--		No samples to be collected
		Groundwater	--	--	--	--		No samples to be collected
6	Burial Pit	Soil	--	2	2	--	No	If reconnaissance determines that the "horseshoe-shaped area, bermed and ringed with stone" (the potential disposal pit) is beyond the area evaluated during the PA/SI, or if no soil samples were collected from within the ringed area at least two additional soil samples (one surface and one subsurface sample) will be collected.
		Sediment	--	1	1	--		If field reconnaissance determines that the "horseshoe-shaped area, bermed and ringed with stone" (the potential disposal pit) is beyond the area evaluated during the PA/SI, an additional sediment sample may be collected if a separate probable point of entry to the river is identified.
		Surface Water	--	--	--	--		No samples to be collected
		Groundwater	--	--	--	--		No samples to be collected
Background Samples		Soil	--	10	--	--	NA	Background samples to be analyzed for TAL metals only
		Sediment	--	1	--	--		Background sample to be analyzed for TAL metals only
		Surface Water	--	1	--	1		Background sample to be analyzed for TAL metals and perchlorate
		Groundwater	--	--	--	--		No samples to be collected
<b>Sample Totals</b>			6	24	13	4		

AOC -- Areas of concern

Soil samples are composite samples (7-point, wheel pattern with 2-foot radius). All other samples are discrete grab samples.

In addition to the QC samples shown above, temperature blanks will be submitted with samples; one blank per cooler.

Lead and metals by SW-846 6020A. Explosives by SW-846 8330A/Modified 8330A. Perchlorate by SW-846 8321A (Modified).

\* Analyses for lead will be performed on soil or sediment that has been passed through an ASTM No. 10 (2-mm) wire mesh sieve at the laboratory.

\*\* Select metals are: aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, and zinc.

**Table 4  
Sample Location Rationale  
Camp Abbot**

<b>Munitions Response Site</b>	<b>Area of Concern</b>	<b>Sample Location</b>	<b>Sample Media</b>	<b>Sample Location Rationale</b>
MRS #1	Range Complex No. 1	013A001	Soil	<p>Anti-Aircraft Range: Two surface soil samples will be collected from the Anti-Aircraft Range. One of the samples collected will be offset by 10 ft from the biased sample location selected using the handheld magnetometer. This will allow for evaluating the distribution of MC at a location away from the biased location.</p> <p>Field Target and Submachine Gun Range: Two surface soil samples are will be collected from the Field Target and Sub-Machine Gun Range. Samples will be analyzed for lead only.</p> <p>One sediment sample will be collected at the Anti-Aircraft Range and analyzed for lead only.</p> <p>One sediment sample will be collected at the Field Target and Sub-Machine Gun Range and analyzed for lead only.</p>
		013A002	Soil	
		013A003	Soil	
		013A004	Soil	
		013A005	Sediment	
		013A006	Sediment	
MRS #2	Anti-Tank Range	013A007	Soil	One surface soil sample will be collected in the Anti-Tank Range target area to assess the presence/absence of explosives and metals related to munitions. The sample will be analyzed for explosives and metals.
		013A008	Groundwater	One groundwater sample will be collected from a well located near the firing position of the Anti-Tank Range. This sample will also fill the need to collect a sample from the Landscape Range in MRS #1. The sample will be analyzed for explosives, perchlorate, and metals
MRS #3	Demolition Area	013A009	Soil	Three soil samples were collected from this MRS for the USEPA's PA/SI investigation (Weston, 2005). Samples were analyzed for metals and nitrogen based explosives. The analysis did not include nitroglycerin or PETN, which were components of the munitions and explosives used at the demolition area. One surface soil sample will be collected from one of the three PA/SI soil sample sites and analyzed for nitroglycerin and PETN.
MRS #4	Mortar Range	013A010	Soil	<p>Two surface soil samples will be collected in the impact area (where MEC finds were reported). One of the samples collected from the Mortar Range will be offset by 10 ft from the biased sample location selected using the handheld magnetometer. This will allow for evaluating the distribution of MC at a location away from the biased location. Samples will be analyzed for explosives and metals</p> <p>One sediment sample will be collected from a point along the Deschutes River down stream of the Mortar Range. The objective of this sample is to evaluate the impacts of the Mortar Range and other up stream</p>
		013A011	Soil	
		013A012	Sediment	

**Table 4 (Cont.)  
Sample Location Rationale  
Camp Abbot**

<b>Munitions Response Site</b>	<b>Area of Concern</b>	<b>Sample Location</b>	<b>Sample Media</b>	<b>Sample Location Rationale</b>
				MRSs on the overall water quality of the Deschutes River. Samples will be analyzed for metals and explosives.
		013A013	Surface Water	One surface water sample will be collected from the same location as a sediment sample collected during the PA/SI (Weston, 2005). The sample will be analyzed for total and dissolved metals), explosives, and perchlorate.
		013A014	Surface Water	One surface water sample will be collected from a point along the Deschutes River down stream of the Mortar Range. The objective of this sample is to evaluate the impacts of the Mortar Range and other up stream MRSs on the overall water quality of the Deschutes River. Samples will be analyzed for dissolved and total metals), explosives and perchlorate.
MRS #5	Grenade Courts	013A015	Soil	If the planned MEC reconnaissance survey identifies an area with evidence of munitions activity beyond the area evaluated during the PA/SI, at least one additional surface soil sample will be collected. The sample(s) will be analyzed for explosives and metals.
		013A016	Sediment	If field reconnaissance identifies an area with evidence of munitions activity beyond the area evaluated during the PA/SI, an additional sediment sample may be collected if a separate probable point of entry to the river is identified. The potential sample will be analyzed for explosives and metals.
MRS #6	Burial Pit	013A017	Soil	If reconnaissance determines that the “horseshoe-shaped area, bermed and ringed with stone” (the disposal pit) is beyond the area evaluated during the PA/SI, or if no soil samples were collected from within the ringed area at least two additional soil samples (one surface and one subsurface sample) will be collected. Samples will be analyzed for explosives and metals.
		013A018	Soil	
		013A019	Sediment	If field reconnaissance determines that the “horseshoe-shaped area, bermed and ringed with stone” (the disposal pit) is beyond the area evaluated during the PA/SI, an additional sediment sample may be collected if a separate probable point of entry to the river is identified. The potential sample will be analyzed for explosives and metals.
MRS #7	Chemical Training Area	Not Applicable	Not Applicable	Not Applicable

**Table 5  
Sample Designations and Analyses  
Camp Abbot**

Military Response Site (MRS)	AOC	Sample Location	Sample Type	Sample Number	Sample Media	QA/QC Samples		EPA Method
						Field Duplicate	MS/MSD	
1	Range Complex No. 1	013A001	Composite	NWO-013-0001	Soil	NWO-013-0002		* Lead only by SW846 6020A
		013A002	Composite	NWO-013-0003	Soil			
		013A003	Composite	NWO-013-0004	Soil			
		013A004	Composite	NWO-013-0005	Soil			
		013A005	Discrete	NWO-013-1001	Sediment			
		013A006	Discrete	NWO-013-1002	Sediment			
2	Anti-Tank Range	013A007	Composite	NWO-013-0006	Soil		NWO-013-0006MS/MSD	Selected Metals** by SW846 6020/7471A , Explosives by SW846 8330A and NG and PETN by SW846 8330A (Modified)
		013A008	Discrete	NWO-013-3001	Groundwater		NWO-013-3001MS/MSD	Selected Metals** by SW846 6020/7470A , Explosives by SW846 8330A, NG and PETN by SW846 8330A (Modified), and Perchlorate by SW846 6850
3	Demolition Area	013A009	Composite	NWO-013-0007	Soil			NG and PETN only by SW846 8330A (Modified)
4	Mortar Range	013A010	Composite	NWO-013-0008	Soil			Selected Metals** by SW846 6020/7471A , Explosives by SW846 8330A, NG and PETN by SW846 8330A (Modified)
		013A011	Composite	NWO-013-0009	Soil			
		013A012	Discrete	NWO-013-1003	Sediment	NWO-013-1005		
		013A013	Discrete	NWO-013-2001	Surface water	NWO-013-2002		Selected Metals** by SW846 6020/7470A , Explosives by SW846 8330A, NG and PETN by SW846 8330A (Modified), and Perchlorate by SW846 6850
		013A014	Discrete	NWO-013-2003	Surface water			
5	Grenade Courts	013A015	Composite	NWO-013-0010 (Optional)	Soil			Selected Metals** by SW846 6020/7471A , Explosives by SW846 8330A and NG and PETN by SW846 8330A (Modified)
		013A016	Discrete	NWO-013-1004 (Optional)	Sediment			

**Table 5 (Cont.)  
Sample Designations and Analyses  
Camp Abbot**

Military Response Site (MRS)	AOC	Sample Location	Sample Type	Sample Number	Sample Media	QA/QC Samples		EPA Method
						Field Duplicate	MS/MSD	
6	Burial Pit	013A017	Composite	NWO-013-0011 (Optional)	Soil			Selected Metals** by SW846 6020/7471A , Explosives by SW846 8330A and NG and PETN by SW846 8330A (Modified)
		013A018	Discrete	NWO-013-0012 (Optional)	Soil			
		013A019	Discrete	NWO-013-1006 (Optional)	Sediment			
NA	Background Samples	013A020	Composite	NWO-013-5001	Soil		NWO-013-5001MS/MSD	TAL List Metals by SW846 6020/7471A
		013A021	Composite	NWO-013-5002	Soil			
		013A022	Composite	NWO-013-5003	Soil			
		013A023	Composite	NWO-013-5004	Soil			
		013A024	Composite	NWO-013-5005	Soil			
		013A025	Composite	NWO-013-5006	Soil			
		013A026	Composite	NWO-013-5007	Soil			
		013A027	Composite	NWO-013-5008	Soil			
		013A028	Composite	NWO-013-5009	Soil			
		013A029	Composite	NWO-013-5010	Soil	NWO-013-5011		
		013A030	Discrete	NWO-013-5012	Sediment			
		013A031	Discrete	NWO-013-6001	Surface water			TAL List Metals by SW846 6020/7470A and Perchlorate by SW846 6850

Notes:

AOC – area of concern

EPA – Environmental Protection Agency

MS/MSD – matrix spike/matrix spike duplicate

NG – Nitroglycerine

PETN - pentaerythritol tetranitrate

TAL – target analyte list

\* Analyses for lead only will be performed on soil or sediment that has been passed through an ASTM No. 10 (2-mm) wire mesh sieve at the laboratory.

\*\* Selected metals are aluminum, antimony, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, magnesium, molybdenum, mercury, nickel, and zinc.

**Table 6**  
**Sample Decision Matrix**  
**Camp Abbot**

<b>Planned Field Action</b>	<b>Condition Encountered</b>	<b>Alternative Action</b>
Soil Sampling	Sample material cannot be collected at a planned sampling location.	Offset to a sample location 10 feet to the north of the planned sampling location (if necessary offset to the east, west, or south to find suitable material). Document the location in the field log book and collect GPS coordinates of the actual sample location.
Sediment Sampling	Sample material cannot be collected at a planned sampling location.	Offset to a sample location 10 feet up or down stream of the planned sampling location. Document the location in the field log book and collect GPS coordinates of the actual sample location.
Surface Water Sampling	Sample material cannot be collected at a planned sampling location.	Offset to a sample location 10 feet up or down stream of the planned sampling location. Document the location in the field log book and collect GPS coordinates of the actual sample location.
Groundwater Sampling	Well is not accessible	Select a near by well located within the upper water bearing zone. Document the location in the field log book and collect GPS coordinates of the actual sample location.

**Table 7**  
**Soil Laboratory Method Quantitation Limits &**  
**Human Health Screening Values**  
**State of Oregon Standards Based on USEPA Region 9 <sup>a</sup>**

Potential Contaminant of Concern	Abbreviation	CAS No.	Laboratory Method Detection Limit (mg/kg)	USEPA Region 9 Human Health Screening Values		
				Residential PRG <sup>b</sup> (mg/kg) <sup>b</sup>	SSLs <sup>c</sup> DAF=1 (mg/kg)	SSLs <sup>c</sup> DAF=20 (mg/kg)
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.075	4.4		
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	0.050	3,100		
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	0.040	16		
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	0.020	1,800		
1,3-Dinitrobenzene	1,3-DNB	99-65-0	0.020	6.1		
2,4-Dinitrotoluene <sup>d</sup>	2,4-DNT	121-14-2	0.040	0.72	0.00004	0.0008
2,6-Dinitrotoluene <sup>d</sup>	2,6-DNT	606-20-2	0.040	0.72	0.00004	0.0008
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	0.040	12		
2-Nitrotoluene	2-NT	88-72-2	0.075	0.88		
3-Nitrotoluene	3-NT	99-08-1	0.050	730		
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	0.040	12		
4-Nitrotoluene	4-NT	99-99-0	0.040	12		
Nitrobenzene	NB	98-05-3	0.020	20	0.007	0.1
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	0.065	610		
Pentaerythritol tetranitrate	PETN	78-11-5	0.50	NVA	NVA	NVA
Nitroglycerin	NG	55-63-0	10	35		
Aluminum	Al	7429-90-5	20.0	76,000		
Antimony	Sb	7440-36-0	0.5	31	0.30	5
Barium	Ba	7440-38-2	0.5	5,400	82	1,600
Cadmium	Cd	7440-43-9	0.5	37	0.4	8
Chromium <sup>e</sup>	Cr	7440-47-3	1.0	210	2	38
Cobalt	Co	7440-48-4	0.5	900		
Copper	Cu	7440-50-8	1.0	3,100		
Iron	Fe	7439-89-6	15.0	23,000		
Lead	Pb	7439-92-1	1.0	400		
Magnesium	Mg	7439-95-4	25.0			
Manganese	Mn	7439-96-5	0.5	1,800		
Molybdenum	Mo	7439-98-7	0.5	390		
Mercury	Hg	7439-97-6	0.06	23		
Nickel	Ni	7440-02-0	1.0	1,600	7	130
Zinc	Zn	7440-66-6	2.0	23,000	620	12,000
Perchlorate	ClO <sub>4</sub>	14797-73-0	3.0	7.8		

DAF = Dilution Attenuation Factor  
PRG = Preliminary Remediation Goal  
SSL = Soil Screening Level  
mg/kg = milligrams per kilogram.

**Table 7 (Cont.)**  
**Soil Laboratory Method Quantitation Limits &**  
**Human Health Screening Values**  
**State of Oregon Standards Based on USEPA Region 9 <sup>a</sup>**

<sup>a</sup> If laboratory cannot meet any of the preferred QLs with routine SW 846 methodology (as supported by MDLs that are no greater than 1/3 QL), laboratory's QL must be identified in laboratory submittal as failing to meet the QL. Some screening values cannot be obtained with routine methodology to the QL. In those cases, the QL achievable with a routine SW 846 methodology would be accepted.

<sup>b</sup> PRGs from Region 9 PRG Table dated October 2004 and addendum dated 28 December 2004, based on single chemical.

<sup>c</sup> SSLs from Region 9 PRG Table dated October 2004 and revision note dated 28 December 2004.

<sup>d</sup> Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

<sup>e</sup> Total chromium values used.

**Table 8**  
**Groundwater Laboratory Method Quantitation Limits &**  
**Human Health Screening Values**  
**State of Oregon Standards Based on USEPA Region 9<sup>a</sup>**

Potential Contaminant of Concern	Abbreviation	CAS No.	Laboratory Method Detection Limit (µg/L)	USEPA Region 9 Tap Water PRG <sup>b</sup> (µg/L)	Federal Drinking Water Criteria MCLs <sup>c</sup> (µg/L)
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.8	0.61	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	0.4	1,800	
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	0.3	2.2	
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	0.2	1,100	
1,3-Dinitrobenzene	1,3-DNB	99-65-0	0.2	3.6	
2,4-Dinitrotoluene <sup>d</sup>	2,4-DNT	121-14-2	0.3	0.099	
2,6-Dinitrotoluene <sup>d</sup>	2,6-DNT	606-20-2	0.3	0.099	
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	0.2	7.3	
2-Nitrotoluene	2-NT	88-72-2	0.4	0.049	
3-Nitrotoluene	3-NT	99-08-1	0.8	120	
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	0.2	7.3	
4-Nitrotoluene	4-NT	99-99-0	0.4	0.66	
Nitrobenzene	NB	98-05-3	0.2	3.4	
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	0.75	360	
Pentaerythritol tetranitrate	PETN	78-11-5	1.3		
Nitroglycerin	NG	55-63-0	0.5	4.8	
Aluminum	Al	7429-90-5	6.0E-02	36,000	50 <sup>e</sup>
Antimony	Sb	7440-36-0	1.0E-03		
Barium	Ba	7440-38-2	5.0E-03	2,600	2,000
Cadmium	Cd	7440-43-9	5.0E-04	18	5
Chromium <sup>f</sup>	Cr	7440-47-3	2.0E-03	110	100
Cobalt	Co	7440-48-4	1.0E-03	730	
Copper	Cu	7440-50-8	3.0E-03	1,500	1,000 <sup>e</sup> 1,300 <sup>g</sup>
Iron	Fe	7439-89-6	5.0E-02	11,000	300 <sup>e</sup>
Lead	Pb	7439-92-1	1.0E-03		15 <sup>g</sup>
Magnesium	Mg	7439-95-4	1.0E-01		
Manganese	Mn	7439-96-5	2.0E-03	880	50 <sup>e</sup>
Mercury	Hg	7439-97-6	3.0E-04	11	2
Molybdenum	Mo	7439-98-7	5.0E-03	180	
Nickel	Ni	7440-02-0	1.0E-03	730	
Zinc	Zn	7440-66-6	1.0E-02	11,000	5,000 <sup>e</sup>
Perchlorate	ClO <sub>4</sub>	14797-73-0	3.0	3.6	

**Table 8 (continued)**  
**Groundwater Laboratory Method Quantitation Limits &**  
**Human Health Screening Values**  
**State of Oregon Standards Based on USEPA Region 9 <sup>a</sup>**

MCL = Maximum Contaminant Level

PRG = Preliminary Remediation Goal

µg/L = micrograms per liter

<sup>a</sup> If laboratory cannot meet these QLs with routine SW 846 methodology (as supported by MDLs that are no greater than 1/3 QL), laboratory's QL must be identified in laboratory submittal as failing to meet the QL. Some screening values cannot be obtained with routine methodology to the QL. Note that no surface water samples are planned at this time. If surface water is collected, additional human health screening criteria will be compiled.

<sup>b</sup> Region 9 PRG Table dated October 2004 and revision note dated 28 December 2004, based on single chemical.

<sup>c</sup> Primary MCL from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004, is listed unless otherwise indicated.

<sup>d</sup> Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

<sup>e</sup> Secondary MCL from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004.

<sup>f</sup> Total chromium values used if available.

<sup>g</sup> Action level from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004.

**Table 9**  
**Surface Water Laboratory Method Quantitation Limits and Human Health Screening**  
**Criteria at Oregon Sites<sup>a</sup>**

Analyte	Abbreviation	CAS Number	Laboratory Method Detection Limit (µg/L)	USEPA Region 9 Tap Water PRG <sup>b</sup> (µg/L)	Oregon DEQ Water Quality Criteria <sup>c</sup>	
					Water and Fish Ingestion <sup>d</sup> (µg/L)	Fish Consumption Only <sup>e</sup> (µg/L)
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.8	0.61		
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	0.4	1,800		
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	0.3	2.2		
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	0.2	1,100		
1,3-Dinitrobenzene	1,3-DNB	99-65-0	0.2	3.6		
2,4-Dinitrotoluene <sup>g</sup>	2,4-DNT	121-14-2	0.3	0.099	0.11 <sup>h</sup>	9.1 <sup>h</sup>
2,6-Dinitrotoluene <sup>g</sup>	2,6-DNT	606-20-2	0.3	0.099		
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	0.2	7.3		
2-Nitrotoluene	2-NT	88-72-2	0.4	0.049		
3-Nitrotoluene	3-NT	99-08-1	0.8	120		
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	0.2	7.3		
4-Nitrotoluene	4-NT	99-99-0	0.4	0.66		
Nitrobenzene	NB	98-05-3	0.2	3.4	19,800	
Nitroglycerin	NG	55-63-0	0.75	4.8		
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	1.3	360		
Pentaerythritol tetranitrate	PETN	78-11-5	0.5			
Aluminum	Al	7429-90-5	6.0E-02	36,000		
Antimony	Sb	7440-36-0	1.0E-03	15	146	45,000
Barium	Ba	7440-38-2	5.0E-03	2,600	1,000	
Cadmium	Cd	7440-43-9	5.0E-04	18	10	
Chromium <sup>i</sup>	Cr	7440-47-3	2.0E-03	110	50	
Cobalt	Co	7440-48-4	1.0E-03	730		
Copper	Cu	7440-50-8	3.0E-03	1,500		
Iron	Fe	7439-89-6	5.0E-02	11,000	300	
Lead	Pb	7439-92-1	1.0E-03		50	
Magnesium	Mg	7439-95-4	1.0E-01			
Manganese	Mn	7439-96-5	2.0E-03	880	50	100
Mercury	Hg	7439-97-6	3.0E-04	11	0.144	0.146
Molybdenum	Mo	7439-98-7	5.0E-03	180		

**Table 9 (Cont.)  
Surface Water Laboratory Method Quantitation Limits and Human Health Screening  
Criteria at Oregon Sites <sup>a</sup>**

Analyte	Abbreviation	CAS Number	Laboratory Method Detection Limit (µg/L)	USEPA Region 9 Tap Water PRG <sup>b</sup> (µg/L)	Oregon DEQ Water Quality Criteria <sup>c</sup>	
					Water and Fish Ingestion <sup>d</sup> (µg/L)	Fish Consumption Only <sup>e</sup> (µg/L)
Nickel	Ni	7440-02-0	1.0E-03	730	13.4	100
Zinc	Zn	7440-66-6	1.0E-02	11,000		
Perchlorate	ClO <sub>4</sub>	14797-73-0	3.0	24 <sup>j</sup>		

MCL = Maximum Contaminant Level

PRG = Preliminary Remediation Goal

µg/L = micrograms per liter

<sup>a</sup> If laboratory cannot meet these QLs with routine SW 846 methodology (as supported by MDLs that are no greater than 1/3 QL), laboratory's QL must be identified in laboratory submittal as failing to meet the QL. Some screening values cannot be obtained with routine methodology to the QL.

<sup>b</sup> Preliminary Remediation Goal (PRG) table, dated October 2004 and revision note dated 28 December 2004. Values are based on a single chemical.

<sup>c</sup> Values from Oregon DEQ Water Quality Criteria (OAR 340 Division 41, Table 20).

<sup>d</sup> Values represent the maximum ambient water concentration for consumption of both contaminated water and fish or other aquatic organisms.

<sup>e</sup> Values represent the maximum ambient water concentration for consumption of fish or other aquatic organisms.

<sup>f</sup> Values represent the drinking water Maximum Contaminant Level.

<sup>g</sup> Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

<sup>h</sup> Value is based on a cancer risk of  $1.0 \times 10^{-6}$ .

<sup>i</sup> Because the form of chromium has not yet been determined, the values for Chromium VI are used as a conservative measure.

<sup>j</sup> Value based on memorandum from Department of Defense entitled "Policy on DoD Required Actions Related to Perchlorate", dated 26 January 2006.

**Table 10**  
**Laboratory Method Quantitation Limits & Ecological Screening Values for State of Oregon Sites**

Potential Contaminant of Concern	CAS #	MDL (mg/kg)	Ecological Screening Values <sup>a</sup>	
			Sediment Ecological Screening Levels (µg/L)	Soil Ecological Screening Levels (µg/kg)
<b>Explosives</b>				
(RDX) Hexahydro-1,3,5-trinitro-1,3,5-triazine	121-82-4	0.075	0.13	7.5
(HMX) Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	2691-41-0	0.050	0.0047	27
(2,4,6-TNT) 2,4,6-Trinitrotoluene (4)	118-96-7	0.040	0.92	6.4
(1,3,5-TNB) 1,3,5-Trinitrobenzene	99-35-4	0.020	0.024	0.376
(1,3-DNB) 1,3-Dinitrobenzene	99-65-0	0.020	0.067	0.655
(2,4-DNT) 2,4-Dinitrotoluene (1)	121-14-2	0.040	0.290	1.28
(2,6-DNT) 2,6-Dinitrotoluene (1)	606-20-2	0.040	1.9	0.0328
(2-Am-DNT) 2-Amino-4,6-dinitrotoluene	35572-78-2	0.040	7	2.1
(2-NT) 2-Nitrotoluene	88-72-2	0.075	5.6	2.0
(3-NT) 3-Nitrotoluene	99-08-1	0.050	4.9	2.4
(4-Am-DNT) 4-Amino-2,6-dinitrotoluene	19406-51-0	0.040	1.9	0.73
(4-NT) 4-Nitrotoluene	99-99-0	0.040	1.0	4.4
(NB) Nitrobenzene	98-95-3	0.020	32	8
(NG) Nitroglycerin	55-63-0	10	1,700	71
(Tetryl) Methyl-2,4,6-trinitrophenylnitramine	479-45-8	0.065	100	0.99
(PETN) Pentaerythritol Tetranitrate	78-11-5	0.50	120,000	0.5
<b>Metals</b>				
Aluminum	7429-90-5	20.0	2.80E+02	50
Antimony	7440-36-0	0.5	3.00E+00	5
Barium	7440-38-2	0.5	4.80E+01	85
Cadmium	7440-43-9	0.5	3.00E-03	4
Chromium <sup>h</sup>	7440-47-3	1.0	3.70E+01	0.4
Cobalt	7440-48-4	0.5	2.30E+02	20
Copper	7440-50-8	1.0	1.00E+01	50
Iron	7439-89-6	15.0	2.00E+01	10
Lead	7439-92-1	1.0	3.50E+01	16
Magnesium	7439-95-4	25.0	NVA	NVA/Nutrient
Manganese	7439-96-5	0.5	1.10E+03	100
Molybdenum	7439-98-7	0.5	2.00E-01	0.1
Mercury	7439-97-6	0.06	NVA	2
Nickel	7440-02-0	1.0	1.80E+01	30
Zinc	7440-66-6	2.0	9.80E+01	32875

MDL = Method Detection Limits; NVA = No Value Available; µg/kg = micrograms per kilogram; µg/L = micrograms per liter

Ecological Screening Levels (ESL), US EPA Region 5, August 2003.

Note: The laboratory MQL values in bold exceed the EPA Region 5 ESL standards. The state regulator will be contacted to discuss a variance.

<sup>a</sup> Final Screening Value selected using the following hierarchy: 1. State Value (Oregon); 2. USEPA Region State Located In (USEPA Region 10); 3. Lower of Talmage et al. [TAL] (1999) or LANL (2005) values.

**APPENDIX A**  
**CONCEPTUAL SITE MODEL**

## Conceptual Site Model

A site-specific CSM summarizes available site information and identifies relationships between exposure pathways and associated receptors. A CSM is used to determine the data types necessary to describe site conditions and quantify receptor exposure, and discusses the following information:

- Current and future land use;
- Potential contaminant sources (i.e., lead projectiles in an impact berm);
- Affected media;
- Governing fate and transport processes (e.g., surface water runoff and/or groundwater migration);
- Exposure media (i.e., media through which receptors could contact site-related contamination);
- Routes of exposure (e.g., inhalation, incidental ingestion, and dermal contact); and
- Potential human and/or representative ecological receptors at the exposure point. Receptors likely to be exposed to site contaminants are identified based on current and expected future land uses.

The CSM is evaluated for completeness and further developed as needed through TPP meetings. The Camp Abbot AOCs are discussed in separate groupings based on similar historical use, and potential MEC and MC, as follows:

- Range Complex No. 1 (Small Arms Ranges),
- Explosive Munitions Ranges, including
  - Anti-Tank Range,
  - Demolition Area,
  - Mortar Range;
- Grenade Courts;
- Burial Pit;
- Chemical Training Area.

CSMs are presented for these AOC groups. MEC and MC are analyzed individually within each CSM.

## **Conceptual Site Model – Range Complex No. 1 (Small Arms Ranges)**

The Range Complex No. 1 AOC includes the several sub-ranges where various small arms range activities took place. Some of these ranges were previously assessed during the USEPA's PA/SI (Weston, 2005). The range names used here are consistent with the ASR Supplement (2004); corresponding range names used in the PA/SI are provided in parentheses:

- Rifle Range (Northern Rifle Range)
- Rifle/Machine Gun Range (Southern Rifle Range)
- Landscape Range (Machine Gun Range)
- Transition Range
- Anti-Aircraft Range
- Field Target and Sub-Machine Gun Range

### **Current and Future Land Use**

- Four of the ranges were located on the east side of the Deschutes River, with safety fans extending west of the river. These ranges are located in the area of the airport. Residential lots are adjacent to or slightly within the boundaries of some of these ranges.
- Two of the ranges were located west of the Deschutes River. The Anti-Aircraft Range includes some residential lots and Forest Service land; the Field Target and Sub-Machine Gun Range is wholly on Forest Service land.

### **Former Range Use**

- The ranges were used by the Army between 1943 and 1944.
- Weapons used at these ranges were limited to general small arms.
- At some ranges, firing would have taken place from fixed positions or within a restricted area up to a fixed limit of advance. Small arms fire may have been directed toward targets in front of man-made backstop berms.
- At the Anti-Aircraft Range and the Field Target and Sub-Machine Gun Range, small arms fire would tend to be dispersed over a wider area due to the variety of target positions and/or firing positions.
- General small arms (up to .50-caliber) may have been used at these ranges. However, although ERTCs were issued the .50 caliber machine gun, the use of this weapon was limited due to a limited supply of ammunition, and much machine gun training used the .30 caliber weapon (Coll, 1958, p. 264).

## **MEC Evaluation**

### **Types of MEC**

- The munitions used at these AOCs were limited to small arms rounds, which do not pose a significant explosive hazard.
- The potential for unexploded ordnance (UXO) to be present at these locations is low, although the potential exists that some unknown activities involving explosive MEC may have taken place at these locations.
- Greater potential for explosive MEC is present in portions of these ranges that overlap other types of ranges (i.e., the Anti-Tank Range and Grenade Courts).

### **Surface Exposure Pathway**

- Slight MEC risk is associated with potential for unknown use of explosive MEC at the small arms ranges.

### **Subsurface Exposure Pathway**

- Slight MEC risk is associated with potential for unknown use of explosive MEC at the small arms ranges.

## **MC Evaluation**

### **Types of MC**

- The anticipated MC at the small arms ranges is lead from the munitions (small arms) debris.
- A relatively small quantity of copper and antimony is present in military bullets. Because lead accounts for more than 96 percent of the bullet mass, analysis for lead alone will be adequate as an indicator of MC contamination.
- A significant perchlorate source has not been identified with these AOCs. Although .50 caliber weapons may have been used at some of these ranges, the potential period of use was short (14 months) and the available supply of ammunition at the ERTCs is known to have been limited.

### **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** Soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a source of potential surface water, groundwater, or air contamination.
- **Surface Water/Sediment:** Surface water may act as a migration pathway from potential sources of contamination in soil. Accumulation of lead may occur in sediment along surface water migration pathways. Sediment will be the primary sample medium to

assess surface water pathways. In addition, surface water may act as an exposure pathway from groundwater to surface water via seeps and springs.

- **Groundwater:** Groundwater is considered a potentially affected media because it is likely to be present at shallow depths beneath the ground surface. However, the presence of springs in this area indicates that groundwater is discharging to the surface water pathway.
- **Air:** Inhalation of MC in vapor form is not a pathway of concern for non-volatile MC under normal environmental conditions. Potential inhalation of soil particles is included in the development of health-based screening values for soil.

Potential exposure media include soil, surface water/sediment, and groundwater. A pathway evaluation for these media is discussed below and provided in Table 3 of the Final TPP Memo.

## **Conceptual Site Model – Explosive Munitions Ranges**

The explosive munitions range AOCs include three ranges where various munitions activities took place. One of these ranges (Demolition Area) was previously assessed during the USEPA's PA/SI (Weston, 2005). The range names used here are consistent with the ASR Supplement (2004); the corresponding range name used in the PA/SI is provided in parentheses:

The explosive munitions range AOCs at Camp Abbot include:

- Anti-Tank Range
- Demolition Area (Demolition Pits)
- Mortar Range

### **Current and Future Land Use**

- The Anti-Tank range is located on Forest Service land (mostly west of the Deschutes River) and land associated with the Sunriver Resort (between the airport landing strip and the river). A few residential lots extend into the extreme southern limit of the range's safety fan.
- The Demolition Area is located wholly on Forest Service land.
- The estimated area of the Mortar Range (per the ASR Supplement) encompasses an impact area (based on MEC encounters) on Forest Service land west of the Deschutes River. An estimated firing position is shown in an area of private residential properties within Sunriver, east of the river.

### **Former Range Use**

- The ranges were used by the Army between 1943 and 1944.
- The period of use for the Demolition Area may have been more limited. Three-week team training exercises were not begun at Camp Abbot until December 1943 (Coll and others, 1958, pp. 265-266). A Camp Abbot newspaper article dated 12 February 1944 refers to a "new assault and demolitions course."

- The article states that the new course “incorporates many problems of actual warfare, including barbed wire entanglements and machine gun fire.” Steps in the course included:
  - Use of a tank, directing simulated fire (using set charges to give the appearance of shells fired from the tank’s guns) at enemy machine gun nests and pill boxes,
  - A demolitions squad using Bangalore torpedoes to clear barbed wire entanglements,
  - A flame-thrower crew “running the distance and taking full advantage of cover and shell holes, to burn what remains of the ‘enemy’ from its positions,” and
  - The demolitions squad “setting charges which complete destruction of the fortifications.”
- The ASR Supplement provided an estimated boundary of the Mortar Range, based on reported finds of 60 millimeter (mm) and 81 mm mortars, assuming firing directed to the west from a position east of the river shown as a “tactical area” on historic maps. It is considered probable that mortar fire may have been directed to the north from a position west of the river, particularly if firing was conducted as part of the assault and demolitions training described above.
- A generalized, visual representation of the CSM for explosive munitions ranges is presented in.

## **MEC Evaluation**

### **Types of MEC**

- Specific munitions for the explosives munitions range AOCs are presented in Table 1 of the Final TPP Memo. Some munitions were in short supply at the ERTCs, including anti-tank rockets (the allowance for was one rocket for every 50 men) and flame throwers (Coll, 1958, p. 264).
- In addition to the munitions listed in Table 1 of the Final TPP Memo, the ASR identified the use of heavy artillery, assumed to include 57 mm, 75 mm, and/or 76 mm rounds. The potential for artillery rounds is supported by a reported find at an unknown location west of Sunriver and the Deschutes River.
- A 2.36-inch rocket was reportedly found in the area of the Anti-Tank Range.
- Mortar rounds, both 60 mm and 81 mm, were reportedly found in the area of the Mortar Range.
- Other reports of MEC encounters may be associated with one or more of these ranges, but specific locations are not known.
- There is a potential hazard from MEC, as indicated by reported encounters of explosive MEC as recently as 1988.

## **Surface Exposure Pathway**

- The potential route of human exposure to MEC or munitions debris includes direct contact by vehicles, foot traffic, or handling. Human exposure would potentially include residents, workers, and recreational users.
- The potential route of wildlife exposure to MEC or munitions debris would be by direct contact.

## **Subsurface Exposure Pathway**

- The potential routes of human exposure to MEC or munitions debris would be through intrusive activity, environmental processes (erosion, freeze-thaw, etc.), or geologic instability.
- The potential route of wildlife exposure to MEC or munitions debris would be by burrowing activities or geologic instability.

## **MC Evaluation**

### **Types of MC**

- The anticipated MC at the explosive munitions ranges is primarily residual explosive compounds from munitions that underwent low-order detonation or from undetonated munitions.
- There is a potential for the presence of elevated concentrations of metals. Sources primarily would include the metallic content of the projectiles and other munitions components. Small quantities of metals were also used in tracers, incendiary mixtures, and in primary explosives.
- A significant perchlorate source has not been identified with these AOCs. Although .50 caliber weapons may have been used at some of these ranges, the potential period of use was short (14 months) and the available supply of ammunition at the ERTCs is known to have been limited.

### **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** Soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a source of potential air, surface water, or groundwater contamination.
- **Surface Water/Sediment:** Surface water may act as a migration pathway from potential sources of contamination in soil. Accumulation of metals and explosives may occur in sediment along surface water migration pathways. Sediment will be the primary sample medium to assess surface water pathways. . In addition, surface water may act as an exposure pathway from groundwater to surface water via seeps and springs.
- **Groundwater:** Groundwater is considered a potentially affected media because it is likely to be present at shallow depths beneath the ground surface. However, the presence of

springs in this area indicates that groundwater is discharging to the surface water pathway. Therefore, evaluation of MC in shallow groundwater at these AOCs west of the Deschutes River will be through surface water.

- Air: Inhalation of MC in vapor form is not a pathway of concern for non-volatile MC under normal environmental conditions. Potential inhalation of soil particles is included in the development of health-based screening values for soil.

## **Conceptual Site Model – Grenade Courts**

The Grenade Courts AOC was previously assessed during the EPA's PA/SI (Weston, 2005) and was identified in that report as the Grenade Court. The ASR (Appendix D) identified a Live Grenade Area located north of the Grenade Court identified in the ASR Supplement.

### **Current and Future Land Use**

- The AOC is located on Forest Service land.
- The AOC is adjacent to a residential area and the Deschutes River and Spring Creek, and thus receive considerable recreational use.

### **Former Range Use**

- The Grenade Courts were used by the Army between 1943 and 1944.
- The courts were used for training in the use of live (explosive) and/or training hand grenades.
- Grenades were thrown from individual throwing bays constructed from sandbags or concrete, or from a trench.
- Grenades were thrown toward targets in an impact area approximately 25 yards from the throwing line.
- A safety zone of approximately 600 feet would have been established around the court.
- No specific information is available for the Live Grenade Area.

### **MEC Evaluation**

#### **Types of MEC**

- The munitions used likely included the Mk II fragmentation hand grenade.
- M21 Practice grenades, which contained only small spotting charges of black powder, also may have been used.
- Other types of grenades, including smoke and incendiary grenades, may have been used, although quantities would have been limited due to the short duration use and the amount of time trainees spent in non-military training.
- Although no MEC has been reported in the area of the former grenade courts, some potential for the presence of MEC exists.

## **Surface Exposure Pathway**

- The potential route of human exposure to MEC or munitions debris includes direct contact by vehicles, foot traffic, or handling. Human exposure would potentially include residents, workers, and recreational users.
- The potential route of livestock and wildlife exposure to MEC or munitions debris would be by direct contact.

## **Subsurface Exposure Pathway**

- The potential routes of human exposure to MEC or munitions debris would be through intrusive activity, environmental processes (erosion, freeze-thaw, etc.), or geologic instability.
- The potential route of wildlife exposure to MEC or munitions debris would be by burrowing activities or geologic instability.

An analysis of the exposure pathways and receptors for MEC are provided in Table 3 of the Final TPP Memo.

## **MC Evaluation**

### **Types of MC**

- The anticipated MC at the Grenade Courts is primarily residual explosive compounds from grenades that underwent high-order (normal) or low-order detonation, or from undetonated munitions. The explosive charges used in the Mk II grenades were 2 ounces of trinitrotoluene (or E. C. Blankfire powder, consisting largely of nitrocellulose, in older models).
- There is a potential for the presence of elevated concentrations of metals from the grenade housing and components.
- The potential for other MC related to the possible limited use of smoke and incendiary grenades is considered to be very low and will not be addressed further.

### **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** Soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a source of potential air, surface water, or groundwater contamination.
- **Surface Water/Sediment:** Surface water may act as a migration pathway from potential sources of contamination in soil. Accumulation of explosives and metals may occur in sediment along surface water migration pathways.
- **Groundwater:** Groundwater is considered a potentially affected media because it is likely to be present within a few feet of the surface. However, groundwater is likely to be discharging to surface water along the nearby rivers, but the possibility, though unlikely,

of a groundwater pathway to receptors remains due to the presence of nearby water wells located upgradient and cross gradient.

- Air: Inhalation of MC in vapor form is not a pathway of concern for non-volatile MC under normal environmental conditions. Potential inhalation of soil particles is included in the development of health-based screening values for soil.

## **Conceptual Site Model – Burial Pit**

The vicinity of Burial Pit AOC was previously assessed during the USEPA's PA/SI (Weston, 2005), which identified the area of its activity as the landfill. However, it is not clear at this time if the PA/SI samples coincide with the specific burial pit feature that is the focus of this FUDS SI.

### **Current and Future Land Use**

- The AOC is located centered at the Sunriver Nature Center, where recreational and educational use would occur.
- Nearby properties (within the AOC boundary as currently configured) are owned by other Sunriver entities and appear to include open space and the northern portion of the airport landing strip.
- Residential properties are located within or near the eastern boundary of the AOC.
- The Deschutes River flows past the northwest corner of the AOC, suggesting an additional source of recreational access to the area.

### **Former Range Use**

- The landfill was used by the Army between 1943 and 1944.
- Air photo review conducted for the ASR found evidence that the landfill had expanded eastward between 1951 and 1968, indicating continued use of the landfill by others following closure of Camp Abbot.
- A site inspection conducted for the ASR in 1995 identified a horseshoe-shaped area, bermed and ringed with stone, as a potential ordnance disposal pit.
- If the pit was used for ordnance disposal, any munitions used at Camp Abbot (as identified in the ASR Supplement and summarized in Table 1 of the Final TPP Memo) potentially may have been placed in the pit.
- The ASR states that “local inhabitants indicate that both OE (*ordnance and explosives*) and CWM (*chemical warfare materiel*) contamination may be buried in the old landfill,” although there is no indication of the basis of this idea.
- There is evidence that chemical agents were used on a limited basis at Camp Abbot and therefore may have been disposed in the pit. A camp newspaper article (ASR, Appendix G-3) refers to a training program that included identity of agents, and refers to actual use of mustard and vesicant gases (indicating likely use of gas identification sets).

- The training program described above was a 34-hour specialist course taught for 30 officers and noncommissioned officers. There is no indication that chemical training of this type was part of the general program for enlisted personnel, and the quantity of chemical agents used at Camp Abbot was likely very small.

## **MEC Evaluation**

### **Types of MEC**

- Any munitions used at Camp Abbot may have been placed in the burial pit.
- Although no MEC has been reported in the area of the landfill, some potential for the presence of MEC in exists, primarily in the subsurface.

### **Surface Exposure Pathway**

- The potential route of human exposure to MEC or munitions debris includes direct contact by vehicles, foot traffic, or handling. Human exposure would potentially include residents, workers, and recreational users.
- The potential route of wildlife exposure to MEC or munitions debris would be by direct contact.

### **Subsurface Exposure Pathway**

- The potential routes of human exposure to MEC or munitions debris would be through intrusive activity, environmental processes (erosion, freeze-thaw, etc.), or geologic instability.
- The potential route of wildlife exposure to MEC or munitions debris would be by burrowing activities or geologic instability.

An analysis of the exposure pathways and receptors for MEC are provided in Table 3 of the Final TPP Memo.

## **MC Evaluation**

### **Types of MC**

- The anticipated MC at the Burial Pit potentially includes explosives from undetonated munitions and metals from munitions components.
- Any of the small quantity of chemical agents that may have been released in this area would not be expected to have persisted and/or have been released in quantities that would pose a significant risk of environmental contamination.
- The potential for other MC related to the possible limited use of smoke and incendiary grenades is considered to be very low and will not be addressed further.

### **Overview of Pathways**

Affected media and potential pathways for MC include:

- Soil: Soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a source of potential air, surface water, or groundwater contamination.
- Surface Water/Sediment: Surface water may act as a migration pathway from potential sources of contamination in soil. Accumulation of explosives and metals may occur in sediment along surface water migration pathways.
- Groundwater: Groundwater is considered a potentially affected media because it is likely to be present within a few feet of the surface. Groundwater is likely to be discharging to surface water along the nearby river, but the possibility of a groundwater pathway to receptors remains due to the presence of nearby water wells.
- Air: Inhalation of MC in vapor form is not a pathway of concern for non-volatile MC under normal environmental conditions. Potential inhalation of soil particles is included in the development of health-based screening values for soil.

## **Conceptual Site Model – Chemical Training Area**

### **Current and Future Land Use**

- This AOC is located on privately owned land in an area of private residential lots within Sunriver.

### **Former Range Use**

- The area was used by the Army between 1943 and 1944.
- Historical maps indicate a gas chamber was located here, where soldiers were trained in the proper use of gas masks (Photograph 1). Training likely included exposure to tear gas.
- There is evidence that chemical agents other than tear gas were used on a limited basis at Camp Abbot. A camp newspaper article (ASR, Appendix G-3) refers to a 34-hour specialist course taught for 30 officers and noncommissioned officers. The training program included “repair of gas masks, protective measures against all types of chemical warfare agents, offensive use of gas, first aid measures, knowledge and identity of gasses, fighting incendiaries, handling violent mobs with gas, and night reconnaissance of gassed areas.” There is no indication that chemical training of this type was part of the general program for enlisted personnel.
- Due to the location of this area, adjacent to the cantonment area and in close proximity to the base hospital, it is highly unlikely that any conventional weapons or chemical agents were used here, with the possible exception of chemical identification “sniff” sets, which contained several 4-ounce glass bottles variously containing 50 cubic centimeters of charcoal saturated with agent gas or small quantities of solid agents, and intended for indoor use (Photograph 2).
- Table 2 of the Final TPP Memo lists potential MEC and MC that were used at this AOC. It is unknown if all of these munitions were used at the Chemical Training Area.

- The quantity of chemical agents used at Camp Abbot was likely very small.

### **MEC Evaluation**

#### **Types of MEC**

- Based on the location of this AOC relative to the cantonment and the types of activities that may have occurred here, neither conventional explosive MEC nor chemical agents are expected to be present at this AOC.

### **MC Evaluation**

#### **Types of MC**

- Any chemical agents that may have been released in this area, e.g., small quantities of gas associated with use of identification “sniff” sets, would not be expected to persist, and therefore, would not pose a significant risk of environmental contamination.

**APPENDIX B**  
**USACE INTERIM GUIDANCE DOCUMENT 06-05**  
**AND SAFETY ADVISORY 06-2**



DEPARTMENT OF THE ARMY  
HUNTSVILLE CENTER, CORPS OF ENGINEERS  
P.O. BOX 1600  
HUNTSVILLE, ALABAMA 35807-4301

REPLY TO  
ATTENTION OF:

MAR 16 2006

CEHNC-OE-CX

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Procedure for Preliminary Assessment (PA) and Site Inspection (SI) Teams that Encounter Unexploded Ordnance (UXO) While Gathering Non-UXO Field Data, Military Munitions Center of Expertise (MM CX) Interim Guidance Document (IGD) 06-05

1. PURPOSE: This procedure describes the responsibilities of project teams during the preliminary assessment and site investigation phases should unexploded ordnance (UXO) be discovered.
2. APPLICABILITY: This guidance is applicable to the geographic military Districts, Military Munitions Response Program (MMRP) Design Centers, Major Subordinate Commands (MSCs), and designated Remedial Action Districts performing MMRP response actions.
3. REQUIREMENTS AND PROCEDURES:
  - a. During site visits to formerly used defense site (FUDS) properties to gather PA or SI information, in the rare instance that a UXO-qualified individual identifies an item that is an explosive hazard, the following actions will occur:
    - (1) The property owner or individual granting rights of entry to the property will be notified of the hazard and advised to call the local emergency response authority (i.e., police, sheriff, or fire department). The individual will also be informed that if they do not call the local response authority within 1 hour, the individual who identified the UXO item will notify the local emergency response authority.
    - (2) The local response authority will decide how to respond to the reported incident, including deciding not to respond (e.g., if the local response authority is already aware of the hazards on the property). If the local response authority decides to respond, the individual who identified the item or his designee will mark the location of the item and provide accurate location information to the emergency response authority. The individual who identified the item or his designee will generally remain in the area until the local response authority arrives, unless specifically indicated by the appropriate response authority that the individual may leave the area.
    - (3) During the SI, the state regulator may also be notified at their request.

MAR 16 2006

CEHNC-OE-CX

SUBJECT: Procedure for Preliminary Assessment (PA) and Site Inspection (SI) Teams that Encounter Unexploded Ordnance (UXO) While Gathering Non-UXO Field Data, Military Munitions Center of Expertise (MM CX) Interim Guidance Document (IGD) 06-05

b. During site visits to active installations or Base Realignment and Closure (BRAC) sites to gather PA or SI information, in the rare instance that a UXO-qualified individual identifies an item that is an explosive hazard, the following actions will occur:

(1) The installation point of contact (POC) or the BRAC coordinator will be notified of the hazard and requested to notify explosive ordnance disposal (EOD) through their channels.

(2) The installation/EOD will make the determination if they are going to respond to the incident. The installation/EOD may be aware of the hazards at the site and make the decision not to respond. If the installation/EOD decides to respond, the individual who identified the item or his designee will mark the location and provide accurate location information to the installation/EOD unit and will remain in the area unless the installation/EOD unit requests otherwise.

c. Neither the US Army Corps of Engineers personnel, nor their contractors have the authority to call EOD to respond to an explosive hazard. This call is the responsibility of the local emergency response authority for FUDS properties and it must come through the proper chain of command on installations.

d. AR 75-14 and AR 75-15 contain the information on how EOD responds to explosives hazards.

4. EFFECTIVE DATES: The requirements and procedures set forth in this interim guidance are effective immediately. They will remain in effect indefinitely, unless superseded by other policy or regulation.

5. POINT OF CONTACT: If you need additional information, please contact Mr. Brad McCowan at 256-895-1174.



CAROL A. YOUKEY, P.E.  
Chief, Center of Expertise for Ordnance  
and Explosives Directorate



DEPARTMENT OF THE ARMY  
HUNTSVILLE CENTER, CORPS OF ENGINEERS  
P.O. BOX 1600  
HUNTSVILLE, ALABAMA 35807-4301

May 23, 2006

REPLY TO  
ATTENTION OF:

OE Safety Division for Ordnance  
and Explosives Directorate

Shaw Environmental  
4171 Essen Lane  
Baton Rouge, Louisiana 70809

Dear Sir/Madam:

This is Safety Advisory 06-2 – Munitions and Explosives of Concern (MEC) Safety During Site Inspections (SI), Pre-Work Plan Visits, Archive Search Reports (ASR) Investigations and Other Site Visits of a Non-Intrusive Nature.

Reference EP 75-1-1, EP 385-1-95a, and Interim Guidance Document (IGD), March 15, 2006.

The following procedures will be followed if an item is found that has an explosive hazard during the activities identified in the subject line:

- a. MEC items are not to be moved or disturbed during the above subject SI, Pre-Work Plan visits, ASR Investigations and other site visits of a non-intrusive nature.
- b. The locations of any discovered explosive hazardous items should be marked for accurate relocating purposes and the information provided to the designated Point of Contact (POC) and any emergency response authorities as may be required.
- c. During site visits to active Installations and/or Base Realignment and Closure (BRAC) sites the identified Installation POC or the BRAC coordinator should be notified of discovered MEC hazards. They then will request any appropriate emergency response action as deemed necessary through their channels if required.
- d. When a site visit is on a Formerly Utilized Defense Site, the property owner shall be notified in the event of finding any found explosive hazards along with the location of the explosive item(s) found, the property owner should then in turn notify their local emergency response authorities.

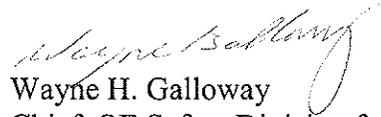
e. During these site visits all required MEC security requirements should be implemented as necessary and required. All team members are to be instructed in and made aware of any MEC security requirements.

f. All team members will be briefed on these procedures prior to any site investigations being performed and daily before any work begins.

This Safety Advisory is intended to serve as an explosives safety reminder.

Comments or questions about this Safety Advisory can be directed to the undersigned at (256) 895-1598/82.

Sincerely,



Wayne H. Galloway  
Chief, OE Safety Division for  
Ordnance and Explosives Directorate

**APPENDIX C**  
**SITE SAFETY AND HEALTH PLAN ADDENDUM**

<b>ADDENDUM OR-2 TO SITE SAFETY AND HEALTH PLAN (SSHP)  REVIEWS AND APPROVAL</b> US Army Corps of Engineers, Omaha District		This SSHP is a part of the Omaha District Safety Program. Please read and comply with USACE EM 385-1-1 and CENWO OM 385-1-1.
Reviewer	Date	Signatures
<b>Authored by:</b> Pamela Moore		<b>Signature:</b>
<b>Peer Review by:</b> Dale Landon		<b>Signature:</b>
<b>Quality Control Review (QCR) by:</b> Paul Sadowski		<b>Signature:</b>
<b>Project Manager Reviewed by:</b> Peter Kelsall		<b>Signature:</b>
<b>Reviewed by:</b>		<b>Signature:</b>
<b>USACE Omaha District MM DC OE Safety Specialist Review:</b>		<b>Signature:</b>
<b>CENWO Safety and Occupational Health Office (SOHO)  Review:</b> Melissa Johnson, CENWO-SO		<b>Signature:</b>
<b>USACE Omaha District MM DC Project Manager Approval:</b>		<b>Signature:</b>

<b>ADDENDUM OR-2 TO SITE SAFETY AND HEALTH PLAN (SSHP)</b> <b>TITLE PAGE</b> US Army Corps of Engineers, Omaha District	This SSHP is a part of the Omaha District Safety Program. Please read and comply with USACE EM 385-1-1 and CENWO OM 385-1-1.
PROJECT NAME: FUDS SI – CAMP ABBOT	
<b>PURPOSE OF ADDENDUM:</b>  This Addendum provide details specific to activities at this FUDS that were not provided in the approved Accident Prevention Plan and Site Safety and Health Plan included in the “Final Type I Work Plan, Site Inspections at Multiple Sites, NWO Region” (Shaw, 2006).	
<b>DESCRIBE THE CHANGES EFFECTED BY THIS ADDENDUM:</b>  As stated in the Purpose of the Addendum, site specific supplemental information is included in this Addendum.	

## SITE SAFETY AND HEALTH PLAN ADDENDUM

FOR

Site Name:	Camp Abbot
Site Location:	Camp Abbot is located approximately 15 miles south of Bend, Oregon in Deschutes Counties.
Purpose of Visit:	Site Inspection of the FUDS for MEC reconnaissance and MC sampling.
Date(s) of Site Visit:	Approximately August 2006

Office:	Shaw Environmental, Inc. Richland Washington office
Address:	1045 Jadwin Ave, Suite C Richland, Washington 99352
Telephone:	(509) 943-6728

Date Prepared: 6 July 2006

Site inspection work at this FUDS will be conducted in accordance with the approved Accident Prevention Plan and Site Safety and Health Plan (SSHP) included in the "Final Type I Work Plan, Site Inspections at Multiple Sites, NWO Region" (Shaw, 2006). This Addendum provides details specific to activities at this FUDS that were not provided in the SSHP.

I. SITE DESCRIPTION AND PREVIOUS INVESTIGATIONS  
 (For complete background, see text and figures of Site-Specific Work Plan included with this document. A brief summary follows.)

A. SITE DESCRIPTION:

- o Size: Seven MRSs covering approximately 9,600 acres.
- o Present Usage (Check all that apply)

<input type="checkbox"/> Military	<input checked="" type="checkbox"/> Recreational	<input type="checkbox"/> Agricultural
<input checked="" type="checkbox"/> Residential	<input checked="" type="checkbox"/> Commercial	<input checked="" type="checkbox"/> Landfill
<input checked="" type="checkbox"/> Natural Area	<input type="checkbox"/> Industrial	
<input type="checkbox"/> Other Specify		

<input type="checkbox"/> Secured	<input type="checkbox"/> Active	<input type="checkbox"/> Unknown
<input checked="" type="checkbox"/> Unsecured	<input checked="" type="checkbox"/> Inactive	

B. PAST USES:

Camp Abbot was operated between May 1943 and June 1944 as an Engineer Training Replacement Center During World War II. Camp trainees received instruction in military construction and engineering. Including heavy equipment operation, fire-fighting, carpentry, demolition, tank operation and maintenance, bridge construction, infiltration, mapmaking, pipeline construction, deport storage, specialized mechanics, aerial photography, water and storage systems, camouflage, mine detections, and bomb disarmament. Camp Abbot was “dedudded” in November 1944. The Camp was declared surplus in 1946.

C. SURROUNDING POPULATION:

<input checked="" type="checkbox"/> Rural	<input checked="" type="checkbox"/> Residential	<input type="checkbox"/> Commercial
<input type="checkbox"/> Urban	<input type="checkbox"/> Industrial	
<input type="checkbox"/> Other Specify		

D. PREVIOUS SAMPLING/INVESTIGATION RESULTS:

Several MEC finds have been reported (ASR, ASR Supplement, private citizens) throughout the FUDS. USEPA completed a Preliminary Assessment/Site Inspection in 2005 (Weston, 2005) to evaluate impacts of the FUDS. The data in the report did not show any adverse impacts related to activities at Camp Abbot.

(1) MEC ENCOUNTERED: See SSWP figure for specific locations of MEC finds.

Location:	Description:
Anti-Tank Range	2.36-in rocket dud
Mortar Range	60 and 81 mm mortars
No specific location	Bazooka rocket, bullets, hand grenades
Grenade Courts	Grenade spoon
Cliffs Northwest of Airport across Cardinal Landing Bridge	Spent mortar and rocket rounds
West of Deschutes River along Forest Rd 40	2.36-in rocket

(2) SAMPLES: (Air, Water, Soil, and Vegetation): Soil, sediment and water samples previously collected indicated no impacts from Camp Abbot activities (Weston, 2005).

Chemical	Concentration	Media	Location
None	None	None	None

## II. DESCRIPTION OF ON-SITE ACTIVITIES:

<input checked="" type="checkbox"/> Walk Through	<input checked="" type="checkbox"/> Drive Through	<input type="checkbox"/> Fly Over
<input checked="" type="checkbox"/> On-Road	<input type="checkbox"/> Off-Road	<input checked="" type="checkbox"/> On-Path
<input checked="" type="checkbox"/> Off-Path		
<input checked="" type="checkbox"/> Other Specify: Soil, sediment and water sampling		

### Activities/Tasks to be Performed (Summarize)

A visual reconnaissance of selected portions of the MRSs will be performed. The inspection will be conducted by a qualified unexploded ordnance (UXO) technician, with the aid of a hand-held magnetometer, to look for evidence of munitions activity and to assure that personnel avoid any potential MEC. Reconnaissance will follow a meandering survey path within the MRSs, including areas of reported MEC finds, but also including selected outlying portions of the MRSs, during which visual observations and magnetic anomalies will be noted. Special attention will be given to physical features such as depressions, craters, or pits that could be present at impact locations of munitions. A global positioning system (GPS) unit will be used to record the survey path and the location of any MEC, munitions debris, or other significant features (such as remnant evidence of targets or other range-related structures) observed.

Soil, sediment, surface water, and groundwater sampling will be performed at locations that have been cleared by the UXO technician. Sampling locations will be recorded using GPS. Sampling protocols will be as specified in the SSWP and the Type 1 Work Plan. Soil, sediment, and groundwater samples will be collected of determine MC impacts.

III. SITE PERSONNEL AND RESPONSIBILITIES:

A. USACE PROJECT MANAGER:

NAME:	John Miller
OFFICE:	USACE - Omaha District
ADDRESS:	106 South 15 <sup>th</sup> St. Omaha, NE 68102
PHONE:	(402) 221-7720

RESPONSIBILITIES:

Manage the DoD FUDS program; ensure work is conducted in accordance with applicable federal and USACE regulations; coordinate with stakeholders.
--------------------------------------------------------------------------------------------------------------------------------------------------

B. SHAW PROJECT MANAGER

NAME:	Peter Kelsall
ADDRESS:	9201 E. Dry Creek Road Centennial, CO 80112
OFFICE:	Shaw Environmental, Inc.
PHONE:	(303) 793-5252

RESPONSIBILITIES:

Overall project management and primary point of contact to USACE. Manage and integrate team members. Oversee cost and schedule monitoring and control.
--------------------------------------------------------------------------------------------------------------------------------------------------------

C. Technical Lead

NAME:	Dale Landon
ADDRESS:	1045 Jadwin Ave. Suite C Richland, Washington 99352
OFFICE:	Shaw Environmental, Inc.
PHONE:	(509) 946-2069 (o), (509) 521-1437 (c)

RESPONSIBILITIES:

Technical management of SI activities. Oversight/direction of field team.
---------------------------------------------------------------------------

D. Field Team Leader

NAME:	TBD
ADDRESS:	
OFFICE:	Shaw Environmental, Inc.
PHONE:	

RESPONSIBILITIES:

Conducts reconnaissance and/or sampling activity in accordance with work plan objectives. Serves as Site Safety and Health Officer, ensuring compliance with SSHP requirements. Conducts kickoff safety briefing and daily tailgate briefings.

E. UXO TECHNICIAN:

NAME:	Charles Irons, Shaw Environmental, Inc.
ADDRESS:	9201 E. Dry Creek Road Centennial, CO 80112
OFFICE:	Shaw Environmental, Inc.
PHONE:	303-793-5208 (via Z. Tuta)

Or

NAME:	Dave Watkins, Shaw Environmental, Inc.
ADDRESS:	9201 E. Dry Creek Road Centennial, CO 80112
OFFICE:	Shaw Environmental, Inc.
PHONE:	303-793-5208 (via Z. Tuta)

RESPONSIBILITIES:

UXO escort and MEC avoidance.

E. FIRST AID/CARDIO PULMONARY RESUSCITATION (CPR) Certified:

NAME:	TBD
ADDRESS:	
OFFICE:	
PHONE:	

RESPONSIBILITIES:

Administer First Aid/CPR in the event of emergencies.

F. TEAM MEMBERS (Other than those listed above.)

NAME:	TBD
ADDRESS:	
OFFICE:	
PHONE:	

RESPONSIBILITIES:

Inspection of vehicles, equipment, and first aid kits as scheduled and/or necessary.
--------------------------------------------------------------------------------------

IV. HAZARD ANALYSIS:

A. Safety and Health Hazards Anticipated:

<input checked="" type="checkbox"/> Heat Stress	<input checked="" type="checkbox"/> Cold Stress	<input checked="" type="checkbox"/> Tripping Hazard
<input type="checkbox"/> Noise	<input type="checkbox"/> Electrical	<input type="checkbox"/> Falling Objects
<input checked="" type="checkbox"/> Foot Hazard	<input checked="" type="checkbox"/> Biological	<input type="checkbox"/> Overhead Hazard
<input type="checkbox"/> Radiological	<input type="checkbox"/> Confined Space	<input type="checkbox"/> Water
<input checked="" type="checkbox"/> Explosive	<input checked="" type="checkbox"/> Climbing	<input type="checkbox"/> Flammable
<input type="checkbox"/> Other Specify		

B. Overall Hazard Evaluation:

<input type="checkbox"/> High	<input type="checkbox"/> Moderate	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Unknown
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JUSTIFICATION: (Provide a brief justification supporting the overall evaluation.)

Munitions debris has been documented or observed near the MRSs.
-----------------------------------------------------------------

V. ACCIDENT PREVENTION:

A. General Precautions:

Prior to the on-site visit to Camp Abbot, all team members will be required to read the SSHP and this Addendum, and sign the form acknowledging that they have read and will comply with it. In addition, the SSHO shall hold a brief tailgate meeting in which site-specific topics regarding the day's activities will be discussed. If a hazardous condition arises, team members are to stop work, evacuate the area, and notify the SSHO.

VI. STANDARD OPERATION SAFETY PROCEDURES, ENGINEERING CONTROLS, AND WORK PRACTICES:

A. SITE RULES/PROHIBITIONS: At any sign of hazardous conditions, stop tasks, evacuate area, and notify the Camp Abbot SSHO and Shaw PM. Smoking, eating, and drinking allowed in designated areas only.

B. MATERIAL HANDLING PROCEDURES: Do not handle.

C. DRUM HANDLING PROCEDURES: N/A.

D. CONFINED SPACE ENTRY: N/A.

E. IGNITION SOURCE AND ELECTRICAL PROTECTION: Smoke in designated areas.

F. SPILL CONTAINMENT: N/A.

G. EXCAVATION SAFETY: N/A.

H. ILLUMINATION: Work during daylight hours only.

I. SANITATION: Use on-site and/or off-site facilities.

J. BUDDY SYSTEM: To be adhered to at all times.

K. ENGINEERING CONTROLS: N/A.

L. HEAT/COLD STRESS: Dress appropriately. Take sufficient breaks and drink plenty of fluids. Watch for signs/symptoms of cold/heat stress. Monitoring may be applicable depending on the site weather conditions and type of personal protection equipment (PPE) worn.

M. ORDNANCE:

(1) General Information:

- a. The cardinal principle to be observed involving explosives, ammunition, severe fire hazards, or toxic materials is to limit the exposure to a minimum of personnel, for the minimum amount of time, to a minimum amount of hazardous material consistent with a safe and efficient operation.
- b. Old, damaged, and possibly deteriorated explosive-loaded ordnance requires extreme caution. Some explosives may react with metals, other explosives, air, or chemicals in the earth to produce extremely sensitive explosive compounds.

- c. When chemical agents may be present, further precautions are necessary. If the munition item has green markings leave the area immediately, since it may contain chemical filler.
  - d. Consider ordnance that has been exposed to fire as extremely hazardous. Chemical and physical changes may have occurred to the contents that render it more sensitive than it was in its original state.
- (2) On-Site Instructions:
- a. DO NOT touch or move any ordnance items regardless of the marking or apparent condition.
  - b. DO NOT visit an ordnance site if an electrical storm is occurring or approaching. If a storm approaches during a site visit, leave the site immediately and seek shelter.
  - c. DO NOT use radio or cellular phones in the vicinity of suspect ordnance items.
  - d. DO NOT walk across an area where the ground cannot be seen. If dead vegetation or dead animals are observed, leave the area immediately due to potential chemical agent contamination.
  - e. DO NOT drive vehicles into suspected MEC areas; use clearly marked lanes.
  - f. DO NOT carry matches, lighted cigarettes, lighters, or other flame producing devices into a MEC site.
  - g. DO NOT rely on color codes for positive identification of ordnance items or their contents.
  - h. Approach ordnance items from the side, avoid approaching the front and rear areas.
  - i. Always assume ordnance items contain a live charge until it can be determined otherwise.
- (3) Specific Action upon Locating Potential Ordnance:
- a. DO NOT touch, move, or jar any ordnance item, regardless of its apparent condition.
  - b. If consistent with SI objectives, the UXO Technician may approach the item cautiously; take photographs and provide a full description. Take notes of the markings or any other identifiers/features.
  - c. DO NOT be misled by markings on the ordnance item stating "practice," "dummy," or "inert." Even practice bombs have explosive charges that are used to mark/spot the point of impact; or the item could be mismarked.
  - d. DO NOT roll an ordnance item over or scrape the item to identify the markings.
  - e. The location of any ordnance items found during the site investigation should be clearly marked so it can be easily located and avoided.
  - f. The USACE Project Manager will be notified upon location of any UXO. Additional notifications will be made as detailed in the Work Plan and the following USACE documents included in this document package:
    - Interim Guidance Document 06-05, 15 March 2006

- Safety Advisory 06-02, 23 May 2006

N. POISONOUS SNAKES OR INSECTS:

- (1) DO NOT handle any snake even those that appear to be dead.
- (2) Avoid areas of limited visibility such as tall grass or heavy vegetation.
- (3) Roll sleeves down and use insect repellent.

O. POISONOUS PLANTS:

- (1) Avoid areas of limited visibility such as tall grass or heavy vegetation.
- (2) Roll sleeves down and use barrier cream and wear gloves.

P. OTHER (Specify):

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VII. SITE CONTROL AND COMMUNICATIONS:

A. SITE MAP: See attached.

B. SITE WORK ZONES: N/A

C. BUDDY SYSTEM: To be adhered to at all times.

D. COMMUNICATIONS:

- (1) ON-SITE: Verbal communications will be used among team members to communicate to each other on-site. If this communication is not possible, the following hand signals will be used.

GRIP PARTNER'S WRIST OR BOTH HAND AROUND WAIST

- Leave the area immediately.

HAND GRIPPING NOSE – Unusual smell detected.

THUMBS UP – OK, I am alright or I understand.

THUMBS DOWN – No, negative.

- (2) OFF-SITE: Off-site communications will be established on every site. Communications may be established by using an on-site cellular phone or by locating the nearest public phone or private phone that may be readily accessed.

Cellular Phone: (TBD)

Public/Private phone

Other. TBD on-site before commencing site visit.

(3) EMERGENCY SIGNALS: In the case of small groups, a verbal signal for emergencies shall suffice. The emergency signal for large groups should be incorporated at the discretion of the UXO Technician.

Verbal

Nonverbal (Specify)

#### VIII. EMERGENCY RESPONSE:

- a. Team members are to be alert to the dangers associated with the site at all times. If a hazardous condition arises, stop work, evacuate the immediate area, and notify the Camp Abbot SSHO and Shaw PM.
- b. FIRST AID. A first aid kit and emergency eye wash (as applicable) will be located in the field vehicle. If qualified persons (i.e., a fire department, medical facility, or physician) are not accessible within 5 minutes of the site, at least two team members will be qualified to administer first aid and CPR.
- c. EMERGENCY TELEPHONE NUMBERS:

1. MEDICAL FACILITY:	(541) 382-4321
2. FIRE DEPARTMENT:	(541) 593-8622 or 911
3. POLICE DEPARTMENT:	(541) 593-1014 or 911
4. Deschutes County Sheriff	(541) 388-6655 or 911
5. POISON CONTROL CENTER	(800) 222-1222
6. USACE OMAHA PM: John Miller	(402) 221-7720
7. DISTRICT PM: Bill Graney, Mike Nelson	(206) 764-3494, (206) 764-3458
8. SHAW PM: Peter Kelsall	(303) 793-5252
9. TECHNICAL LEAD: Dale Landon	(509) 946-2069 (o), (509) 521-1437 (c)

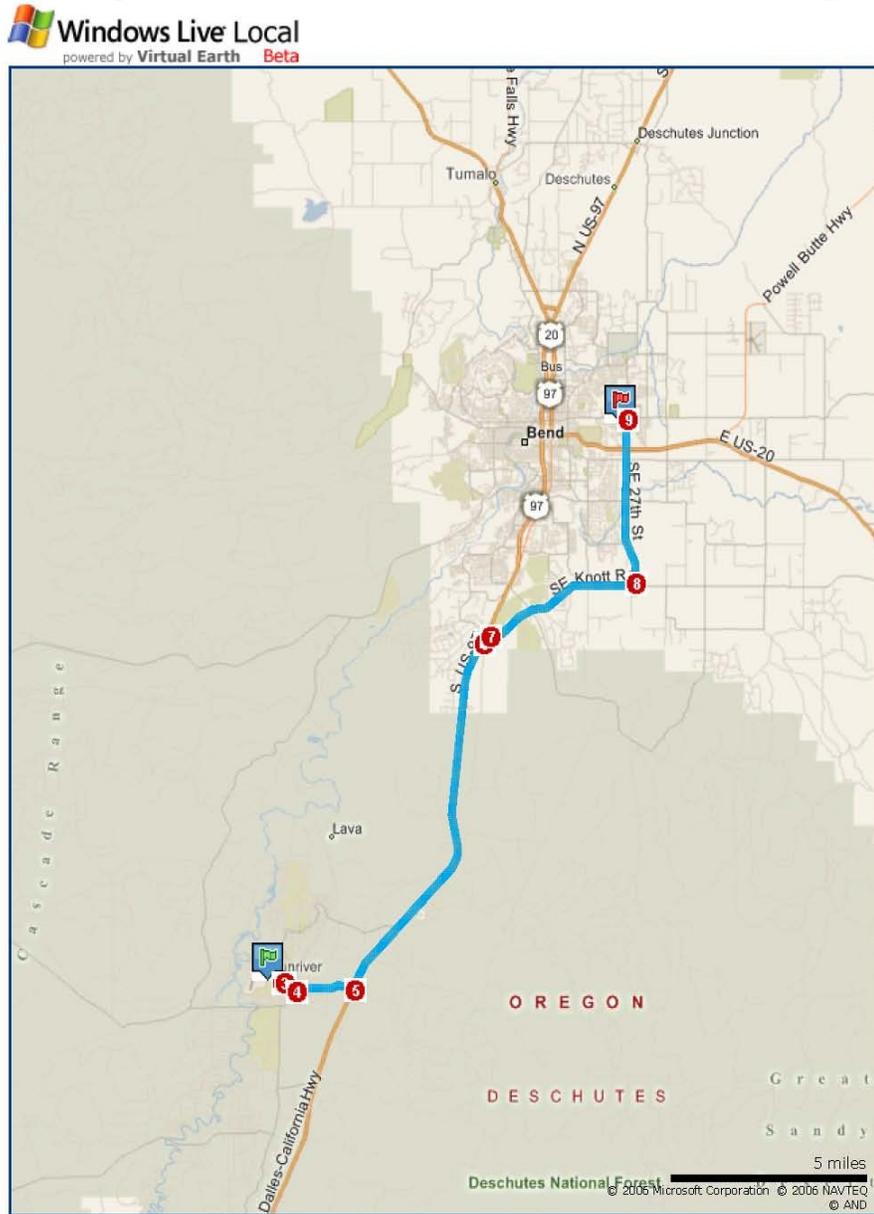
d. NEAREST EMERGENCY MEDICAL FACILITY:

**Directions to Hospital--Camp Abbot, Sunriver Oregon**

<p><b>St Charles Medical Center - Bend</b>                  2500 NE Neff Rd                  Bend OR 97701  <b>(541) 382-4321</b>                  Hours of Operation  <b>Open 24 hours</b></p>	<p><b>Services Provided</b></p>	<ul style="list-style-type: none"> <li>- Hospitals</li> <li>- Emergency Care</li> <li>- Intensive Care</li> <li>- Rehabilitation</li> <li>- PET Scans</li> <li>- Outpatient Care</li> <li>- MRIs</li> </ul>	<ul style="list-style-type: none"> <li>- Referrals</li> <li>- Surgery</li> <li>- X-rays</li> <li>- Inpatient Care</li> <li>- MRI Services</li> <li>- CAT Scans</li> </ul>
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<b>Direction</b>	<b>Distance</b>
<b>Start: Depart on Center Dr (East for 0.3 mil)</b>	0. miles
<b>1. Keep Right onto Local Road(s) for 43 yards.</b>	0.3 miles
<b>2. At roundabout, take the First exit onto Local road(s)</b>	0.1 miles
<b>3. Bear RIGHT (East) onto Abbott Dr</b>	0.4 miles
<b>5. Bear LEFT (East) onto CR-40 [S Century Dr]</b>	1.5 miles
<b>6. Turn LEFT (North) onto US-97</b>	9.4 miles
<b>7. Keep RIGHT onto Ramp for 0.2 mil towards Knott Rd./Baker Rd.</b>	0.3 miles
<b>8. Turn RIGHT (East) onto (SE) Knott Rd</b>	4.2 miles
<b>9. Road name changes to (SE) 27<sup>th</sup> St</b>	3.9 miles
<b>10. Turn LEFT (West) onto NE Neff Rd</b>	0.2 miles
<b>End: Arrive 2500 NE Neff Rd, Bend, OR 97701</b>	

Figure 1: Map of Route to St. Charles Medical Center, Bend, Oregon



## CLINIC FOR NON-LIFE-THREATENING MEDICAL TREATMENT

The following occupational health clinics are approved by Health Resources for non-life-threatening medical treatment of Shaw employees:

Location	City	Clinic	Address	Zip	Telephone	Contact
Bend, OR	Bend	<a href="#">Immediate Care Center: Mt. Bachelor Clinic: Occ. H</a>	1302 North East 3rd Street	97701	541-388-7799	Gutierrez, Claudia

### IX. MONITORING EQUIPMENT AND PROCEDURES:

a. Exposure Monitoring: Air monitoring is not required for the field activity planned at this site.

b. Heat/Cold Stress Monitoring: Control measures described in Section 4.4 of the SSHP will be applied as required by prevailing site conditions.

### X. PERSONAL PROTECTIVE EQUIPMENT:

a. GENERAL: Typically, for site work, Level D is required. Team members should avoid wearing outer or undergarments made of wool, silk, or synthetic textiles such as rayon or nylon. These materials can generate sufficient static charge to ignite explosives. Hard hats will be worn if an overhead hazard exists, safety glasses will be used if an eye hazard is present, and gloves and sturdy boots will be worn.

#### b. SITE WORK:

Level of Protection:

Initial: Level D  Modified (specify)

N/A

Contingency: Evacuate site if higher level of protection is needed.

### XI. DECONTAMINATION PROCEDURES:

Decontamination procedures are not anticipated for this site investigation. Team members are cautioned not to walk, kneel, or sit on any surface with potential leaks, spills, or contamination.

## XII. TRAINING:

All site personnel will have completed the training required by EM 385-1-1 and 29 CFR 1910.120(e). The Shaw PM will verify that all on-site personnel have completed the appropriate training. Additionally, the UXO Technician assigned to this field reconnaissance will inform personnel before entering, of any potential site specific hazards and procedures regarding MEC.

All site personnel shall be briefed on chemical warfare materiel hazards, avoidance, and first aid.

## XIII. LOGS, REPORT, AND RECORDKEEPING:

Site logs are maintained by the Shaw PM. This is to include historical data, personnel authorized to visit the site, all records, standard operating procedures, and plans.

## XIV. GENERAL:

The number of persons visiting the site will be held to a minimum. The more persons on-site, the greater potential for an accident. The Field Team Leader may modify the SSHP, if site conditions warrant it and by the concurrence of the Shaw PM, and without risking the safety and health of the team members. This modification will be coordinated with the team members, and the Field Team Leader will notify the Shaw PM of any change as the situation allows.

**SAFETY BRIEFING CHECKLIST**  
(Check subjects discussed)

SITE NAME: Camp Abbot	DATE/TIME:        /        /
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**GENERAL INFORMATION**

- PURPOSE OF VISIT
- IDENTIFY KEY SITE PERSONNEL
- TRAINING AND MEDICAL REQUIREMENTS

**SPECIFIC INFORMATION**

- SITE DESCRIPTION/PAST USES
- RESULTS OF PREVIOUS STUDIES
- POTENTIAL SITE HAZARDS
- MEC SAFETY PROCEDURES
- SITE SOPs
- SITE CONTROL AND COMMUNICATIONS
- EMERGENCY RESPONSE
  - LOCATION OF FIRST AID KIT
  - EMERGENCY PHONE NUMBERS & LOCATION
  - LOCATION OF NEAREST MEDICAL FACILITY & LOCATION OF MAP TO FACILITY
  - PPE AND DECONTAMINATION

Stress the following during the briefing: If hazardous conditions arise, stop work, evacuate the area, and notify the Camp Abbot SSHO and Shaw PM immediately.

PLAN ACCEPTANCE FORM

SITE SAFETY AND HEALTH PLAN AND ADDENDUM

FOR

Site Name: Camp Abbot

Location: Deschutes County, Oregon

I have read and agree to abide by the contents of the Site Safety and Health Plan and Addendum and I have attended the Safety Briefing for the aforementioned site.

NAME (PRINTED)	OFFICE	SIGNATURE	DATE

Person presenting the safety briefing:

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
DATE