

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

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**Final Technical Project Planning  
Memorandum  
Northwest Maneuver Area  
FUDS Property No. F10OR0208**

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

**Contract No. W912DY-04-D-0010  
Delivery Order No. 003**

**October 2007**

  
**Shaw**® Shaw Environmental, Inc.

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**Final Technical Project Planning Memorandum**

**Site Inspection  
Northwest Maneuver Area  
Formerly Used Defense Site  
FUDS Property No. F10OR0208**

**Military Munitions Response Program**

Documentation for Technical Project Planning Meeting  
Bend, Oregon  
Held April 26, 2007

Hosted by:

U.S. Army Corps of Engineers

Prepared by:

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## ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
AOC	area of concern
ASR	Archives Search Report
BLM	Bureau of Land Management
CSM	conceptual site model
DoD	U.S. Department of Defense
DQO	Data Quality Objective
FUDS	Formerly Used Defense Site
HRS	Hazard Ranking System
IEP	Important Ecological Place
MC	munitions constituents
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MRSPP	Munitions Response Site Prioritization Protocol
NDAI	No Department of Defense Action Indicated
NWMA	Northwest Maneuver Area
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
PRG	Preliminary Remediation Goal
RI/FS	Remedial Investigation/Feasibility Study
ROE	right-of-entry
Shaw	Shaw Environmental, Inc.
SI	Site Inspection
SLERA	screening level ecological risk assessment
SSWP	Site-Specific Work Plan
T&E	threatened and endangered
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
UTM	Universal Transverse Mercator
UXO	unexploded ordnance

## *Administrative Information*

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This Technical Project Planning (TPP) Memorandum is one in a series of documents used during the Site Inspection (SI) process to document the information collected and processes used to evaluate Formerly Used Defense Sites (FUDS) for the possible presence of munitions and explosives of concern (MEC) and/or munitions constituents (MC). TPP meeting information provided in this Memorandum reflects both the original version of information shared with meeting participants, as well as changes/updates to site-specific information obtained during the TPP meeting.

The TPP meeting for the Northwest Maneuver Area (NWMA) was conducted on April 26, 2007 at the Bend Senior Citizen Center located in Bend, Oregon. Representatives from the U.S. Army Corps of Engineers (USACE) - Omaha Design Center, USACE - Seattle District, the Oregon Department of Environmental Quality (ODEQ), and Shaw Environmental, Inc. (Shaw) were in attendance. In addition, representatives of the Bureau of Land Management (BLM) and U.S. Forest Service (USFS) were in attendance. A separate public meeting was scheduled for the evening of April 26, 2007; however, no participants attended. A site tour was not conducted as part of this meeting.

This TPP Memorandum documents discussions from the TPP meeting and includes the sections described below:

- **Administrative Information:** includes meeting logistics and the list of attendees;
- **Site Inspection Objectives:** provides the goal and objectives of the SI, roles and responsibilities, the SI process, and the TPP process;
- **Background Information:** includes site and project history, area physical setting, a summary of previous environmental work, and an introduction to the areas of concern (AOCs) addressed by the SI;
- **Conceptual Site Model (CSM):** used to identify environmental attributes, potential human and ecological receptors in the area's environment, and the relationships between these factors;
- **Proposed Sampling Scheme:** used to describe the type and quantity of samples to be taken, and the analytical methods to be used for characterizing the AOC;
- **TPP Notes and Data Quality Objectives (DQOs):** used to capture project and site-specific information as discussed during the TPP meeting to ensure the necessary and appropriate information is shared among meeting participants, and that meeting participants concur with the identified goal, objectives, and approach used to complete the SI process; and
- **Worksheets:** includes the Site Information Worksheet, Draft Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps, and Hazard Ranking System (HRS) Data Gaps.

## Technical Project Planning Meeting Summary of Agreements

The TPP meeting for the Northwest Maneuver Area FUDS was held on April 26, 2007 at the Bend Senior Citizen Center located in Bend, Oregon. In attendance were representatives of the following:

- USACE - Omaha Design Center,
- USACE - Seattle District,
- ODEQ,
- Shaw,
- USFS, and
- BLM.

Shaw reviewed site information and presented a summary of the proposed SI approach for the NWMA, addressing MEC reconnaissance and MC sampling. The site was used for large-scale troop maneuvers from September through November 1943, reportedly using only blanks and inert munitions. ODEQ was in general agreement with the approach and the decision rules that were developed. ODEQ may provide further review and comments on the approach and decision rules as documented in this TPP Memorandum and eventually in the Site-Specific Work Plan (SSWP) for the FUDS. Key agreements reached at the meeting included:

**Areas of Concern:** One specific AOC has been identified within the site, an Anti-tank Minefield, as presented in the *Archives Search Report (ASR)* (USACE, 1995). However, the NWMA also consists of additional FUDS (Central Oregon Air to Air Gunnery Range, Camp Abbot, Fort Rock Maneuver Area, Redmond Precision Bombing Range, Redmond Air to Ground Gunnery Range, and Redmond Army Airfield). Two of these FUDS, Camp Abbott and the Central Oregon Air to Air Gunnery Range, are being evaluated under the Military Munitions Response Program (MMRP).

**Reconnaissance Objectives:** The TPP team agreed that the SI would include visual field reconnaissance activities in Christmas Valley (location of anti-tank minefield) and the 1943 maneuver route. ODEQ requested that reconnaissance also be performed at the Redmond Precision Bombing Range and the Redmond Air to Ground Gunnery Range. Reconnaissance will be performed to:

- Confirm site conditions and land usage,
- Observe evidence of MEC and munitions history, and
- Select optimal sample locations (biased toward evidence of MEC, if observed).

The proposed field investigation and sampling to be conducted at the NWMA will be conducted in a phased approach. The first phase will consist of visual field reconnaissance surveys at various locations throughout the NWMA FUDS to determine the presence of MEC and to identify potential sampling locations. Collection of samples at identified locations will be the second phase of the investigation.

**MC Sampling:** The TPP team agreed in principle that sampling for MC is appropriate for the site. However, since the TPP meeting, it has been decided that sampling locations can not be identified until completion of the reconnaissance phase. The analytical parameters for the samples will be determined based on the evidence of MEC, but will likely consist of select metals and explosives.

**Background Sampling:** The TPP team agreed in principle that background sampling for the site is appropriate.

**Screening Values:** ODEQ indicated at a previous TPP meeting for the Kingsley Firing Range Annex that the EPA Region 9 residential soil and tap water Preliminary Remediation Goals (PRGs) for human health screening values have not been updated for a number of years. Therefore, ODEQ requested that EPA Region 6 PRGs be used for evaluation. The Region 6 PRGs will also be used for screening at the NWMA.

**Other Stakeholders:** Representatives of the BLM and USFS, who own a large portion of the land within the NWMA, were present at the TPP meeting and were provided the right-of-entry (ROE) request documentation. Private landowners will be provided an opportunity to review this TPP Memorandum and other documents pertaining to the site, as well as the ROE request documentation. Information provided by landowners with respect to site history, site conditions, land use, or other information relevant to the SI will be shared with the TPP team.

The USACE - Seattle District indicated that they would contact the applicable Indian tribes regarding the planned investigation.

**Site:** Northwest Maneuver Area  
**Location:** Bend, Oregon  
**USACE District:** Seattle  
**TPP #1 Meeting Location:** Bend Senior Citizen Center, Bend, Oregon  
**TPP #1 Meeting Date:** April 26, 2007

**AGENDA**

**Thursday April 26, 2007**

- **Convene at Bend Senior Citizen Center**
  - **Introductions**
  - **Review Site Inspection Objectives**
    - **Goals, Objectives, and Roles and Responsibilities**
    - **Site Inspection Process**
    - **Technical Project Planning Process**
    - **Review of Background Information**
- **Technical Project Planning Discussion**
- **Public Meeting (evening – no participants attended)**

Name	Organization
Dick Devlin	USACE-Seattle
Mike Nelson	USACE-Seattle
John Miller	USACE-Omaha
Dale Landon	Shaw
Tony Searls	Shaw
Michael Renz	ODEQ
David Anderson	ODEQ
Paul Claeysens	US Forest Service
Lawrence Thomas	Bureau of Land Management

## 1.0 *Site Inspection Objectives*

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### 1.1 *Goal*

- The USACE is conducting SIs of FUDS properties to determine if any MEC or related MC is present on property formerly owned or leased by the U.S. Department of Defense (DoD).

### 1.2 *Objectives*

- Determine if the site requires further response action under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 due to the presence of MEC or MC.
- Collect minimum information needed to:
  - Eliminate a site from further consideration if:
    - No evidence of MEC and
    - Concentrations of MC in site media samples are below background or below risk-based screening levels.
  - Determine the potential need for initiation of the Remedial Investigation/Feasibility Study (RI/FS) if:
    - Evidence of MEC identified or
    - Concentrations of MC in site media exceed background and risk-based screening levels.
  - Determine the potential need for a removal action based on risk to site users from MEC.
  - Provide sufficient data for the U.S. Environmental Protection Agency (USEPA) to complete the HRS.
  - Evaluate the FUDS using the MRSPP.

### 1.3 *Roles and Responsibilities*

- **USACE:** Acts as the executing agency for the U.S. Department of Defense with regard to the FUDS program. In this role, the USACE has decision making authority and is responsible for ensuring work is conducted in accordance with applicable USACE and federal guidance. Additionally, USACE coordinates and works with project team members to meet needs expressed by regulatory agencies and stakeholders.
- **Regulatory Agency:** Participates in planning of SI activities to ensure the project meets applicable state standards and requirements.
- **Property Owner(s):** Provides available and pertinent information about the area, provides insight on current and anticipated future land uses for the property, and participates in project team discussions.
- **Shaw:** As a contractor to the USACE, conducts work on behalf of the USACE, provides TPP materials, makes site information available to the project team through a web-based information portal, and conducts and reports SI activities.

### 1.4 *Site Inspection Process*

- Data review,
- TPP,

- Site-Specific Work Plan,
- SI field activities – reconnaissance, sampling, and analysis, and
- SI Report.

### *1.5 Technical Project Planning Process*

- Conduct TPP meeting(s)\* with key organizations and stakeholders,
- Identify stakeholder(s) concerns,
- Identify all AOCs for this SI,
- Review site information,
- Verify current and anticipated future land use,
- Develop CSM,
- Identify data gaps,
- Plan how to address data gaps,
- Develop DQOs for meeting SI requirements, and
- Concur on SI field work approach.

\* A second TPP meeting will be held after the Draft Final SI Report has been submitted for review in order to discuss the results and recommendations of the SI.

## 2.0 Background Information

Historical information contained in this package was obtained from the ASR (USACE, 1995) and the *ASR Supplement* (USACE, 2004) for the NWMA.

### 2.1 Site Name and Location

The NWMA, property number F10OR0208, is located in central to south-central Oregon and consists of approximately 8 million acres, including portions within Jefferson, Deschutes, Crook, Grant, Lake, Harney, and Klamath counties (Figure 1). Encompassed in its boundary are six separate FUDS (Figure 2). They are as follows:

- Central Oregon Air to Air Gunnery Range F10OR017000
- Camp Abbot F10OR004100
- Fort Rock Maneuver Area F10OR018000
- Redmond Precision Bombing Range F10OR021900
- Redmond Air to Ground Gunnery Range F10OR021700
- Redmond Army Air Field F10OR002800

Of these, only Camp Abbot and the Central Oregon Air to Air Gunnery Range FUDS are included in the MMRP Inventory in the *Defense Environmental Programs Annual Report to Congress Fiscal Year 2006* (DoD, 2006). An SI has been conducted for both Camp Abbot and the Central Oregon Air to Air Gunnery Range FUDS.

### 2.2 Range Inventory

The NWMA is included in the MMRP Inventory (DoD, 2006) with range information as follows:

Range Name	Range Identification	Approximate Area (acres)	UTM Coordinates (meters)
Anti-tank Minefield	F10OR020801R01	18	X: 682026.58 Y: 4793815.25

Coordinates for the range are in Universal Transverse Mercator (UTM), Zone 11, NAD 83.

The ASR Supplement (USACE, 2004) identifies the range as being located on private land in the Fort Rock Valley approximately 7 miles northwest of the Town of Christmas Valley (Figure 3). The ASR Supplement indicates that the size of the anti-tank minefield range is based on an assumed “standard pattern” practice minefield site. This would result in a minefield three rows deep, each row with three belts of mines, yielding a total depth of about 300 feet. The length of the minefield would have been dependent on the terrain and is estimated to be about 1,200 feet.

Assuming a conservative explosive safety distance of 200 feet, the resultant range cell would total approximately 18 acres.

## **2.3 Property History**

The information presented in the following sections is primarily obtained from the ASR (USACE, 1995) and the ASR Supplement (USACE, 2004).

### **2.3.1 Historical Military Use**

- The Maneuver Area, consisting of 6,890,880.08 acres of land, was acquired by special use permit by the U.S. Government from the Department of Agriculture and the Department of Interior in 1943. Coupled with the lands of six DoD sites within the boundary of the NWMA, total acreage available for the NWMA exceeded 8 million acres.
- Prior to DoDs use of the site, it was comprised of six DoD sites, small farms and ranches, and federal resource agency's owned/managed lands.
- Land was used by the DoD to facilitate a large-scale force-on-force exercise during September, October, and November 1943, prior to deployment of the Fourth Army into its World War II theatre of operations.
- Between 75,000 and 100,000 troops and 12,000 vehicles participated in the war games.
- The 3-month exercise was separated into eight "problems" for the troops to complete:
  - Problem #1: Seize Horse Ridge located 17 miles east of Bend, Oregon.
  - Problem #2: Fighting took place on the 6,000-foot slopes of Hampton Buttes, located 2 miles north of the Central Oregon Highway. Fighting extended 20 miles south to Yreka Butte.
  - Problem #3: Fighting in an area approximately 30 miles southwest of Burns, Oregon in a rough triangle bounded by Glass Buttes, a highway junction, and the hamlet of Wagonfire. The fiercest fighting was being waged along a 20-mile front near Wagonfire.
  - Problem #4: Highlands south of Stauffer. Forces attacked astride a new 37-mile military highway south of Wagonfire (Larcey Boulevard) and Silver Lake. The main axis of the attack was through Christmas Valley. Units were noticed in the areas ranging from 15 miles north of Stauffer to the south near Alkali Lake.
  - Problem #5: Seize Horse Ridge, Bear Creek Buttes, Seven Mile Ridge, Cougar Mountain, North Table Mountain, Squaw Butte, and Watkins Butte. Fort Rock area was also a battle scene northward and on either side of China Hat Road and north to meet Highway 20 near Milican.
  - Problem #6: Horse Ridge and Bear Creek Butte were defended.
  - Problem #7: Forces crossed the Deschutes River to attack Kline Butte and head toward Bend.
  - Problem #8: Areas included north of Bend, Sisters, Alfalfa, and the Deschutes River.
- Six DoD sites are included within the boundary of the NWMA. The NWMA consists of over 8 million acres with the inclusion of these other DoD sites.

- The six DoD sites include Central Oregon Air to Air Gunnery Range, Camp Abbot, Fort Rock Maneuver Area, Redmond Precision Bombing Range, Redmond Air to Ground Gunnery Range, and Redmond Army Airfield.

### *2.3.2 Munitions Information*

- The Lakeview District BLM office reported an anti-personnel fragmentation bomb was found in 1986 near Silver Lake, Oregon.
- Historical records indicate that 11 intact M1B1 anti-tank training mines were found in 1987 on the property of Mr. Terry Gratrix located 6 miles northwest of the town of Christmas Valley, Oregon.
- A teardrop shape AN-Mk 43 practice bomb was found in 1988 in the sand dunes approximately 14 miles north of the town of Christmas Valley, Oregon.
- While conducting a site survey of a related FUDS property, personnel from the St. Louis District completed the site inspection for the NWMA by inspecting the property of Mr. Gratrix on May 22, 1995. Four additional anti-tank training mines were observed. It was noted that the mines were apparently excavated and removed to the location where they were observed.
- Records indicate that the units trained with blanks and inert munitions during the 1943 maneuvers. However, according to press accounts, live ammunition was on hand but it was not to be fired. The ammunition was present in containers so that soldiers already proficient in firing would learn how to better handle live rounds. Reportedly, ammunition requirements ran around 2,000 tons, and it was moved place to place to provide that phase of realism (Edwards, 1943).
- During the site inspection in 1994, St. Louis District personnel interviewed Sgt. Terry Silbaugh of the Deschutes County Emergency Services (Sheriff's Office) who indicated the locations of munitions recovery as recently as 1988. Items recovered included 2.36-inch rocket, artillery, and mortar rounds. It was indicated by the inspection team that these items were probably the result of activities from Camp Abbot, the Redmond Precision Bombing Range, and the Redmond Air-to-Ground Gunnery Range. The Prineville District BLM office reported ordnance was found in the Milican area (timeframe unknown).
- Deschutes County Emergency Services reported artillery round found west of Sunriver, Oregon (timeframe unknown – likely associated with Camp Abbot activities).
- Deschutes County Emergency Services reported ordnance found in sand dunes approximately 4 miles west and one mile north of Alfalfa, Oregon (timeframe unknown).
- Sunriver Nature Center found spent mortar and rocket rounds near a cliff northwest of the airstrip (timeframe unknown, associated with Camp Abbot activities).
- Bend District office reported a bazooka round was located approximately 1-1/2 miles west of Sunriver (timeframe unknown, associated with Camp Abbot activities).

### *2.3.3 Ownership History*

- DoD acquired 6,890,880.08 acres of land in 1943 from the Department of Agriculture and the Department of Interior under special use permit. Coupled with the lands of six DoD sites

within the boundary of the NWMA, total acreage available for the NWMA exceeded 8 million acres.

- Prior to DoDs use of the NWMA, the site was comprised of six defense sites, small farms and ranches, and federal resource agencies owned/managed lands.
- Currently, the vast majority of the site is federally owned open range and forest land. However, private entities do own portions.

## ***2.4 Physical Setting***

### ***2.4.1 Topography and Vegetation***

- Located in the Columbia Intermontane province and the Basin and Range province of the Columbia Intermountain physiographic region.
- Bedrock in the area consists almost entirely of basalt lava flows. The lava plateaus are interspersed with many rhyolitic deposits and rhyolite volcanic structures. There are also some deposits of light colored volcanic ash.
- The low topographical features are sand dunes, alkali lakes, and shorelines of ice-age lakes. The elevated features are prominently volcanic in origin. Another type of elevated feature is the ash-ring volcano.
- The site is currently used for cattle grazing, agriculture, and timber production purposes.

### ***2.4.2 Surface Water***

- The large area is drained by many streams, with the Deschutes and the John Day Rivers being the largest. Both rivers drain north to the Columbia River.
- Many of the sites are dry lake beds for much of the year.
- Figure 4 presents the surface water drainage for the area surrounding the anti-tank minefield, the only identified AOC. If additional AOCs are identified as a result of the visual field reconnaissance activities, the figures will be modified as required.

### ***2.4.3 Sensitive Environments***

- The U.S. Fish and Wildlife Service (USFWS) indicated the following federally protected species may be found in the vicinity of the NWMA:
  - Columbian white-tailed deer (endangered),
  - Bald eagle (threatened),
  - Brown pelican (endangered),
  - Marbled murrelet (threatened),
  - Snake River Chinook salmon (threatened),
  - Snake River sockeye salmon (endangered),
  - Oregon silver spot butterfly (threatened),
  - White-footed vole (candidate),
  - Pacific-western big eared bat (candidate),
  - Northern red-legged frog (candidate),
  - Tall bugbane (candidate), and
  - Howell's montia (candidate).

- The Oregon Department of Fish and Wildlife (ODFW) indicated the following state threatened and endangered (T&E) species occur in the vicinity of the site:
  - Bull trout (critical),
  - Cascades frog (critical),
  - Spotted frog (critical),
  - American peregrine falcon (endangered),
  - Bald eagle (endangered),
  - Northern spotted owl (threatened),
  - Black-backed woodpecker (critical),
  - Burrowing owl (critical),
  - Ferruginous hawk (critical),
  - Flammulated owl (critical),
  - Lewis' woodpecker (critical),
  - Northern goshawk (critical),
  - Pileated woodpecker (critical),
  - Red-necked grebe (critical),
  - Three-toed woodpecker (critical),
  - White-headed woodpecker (critical),
  - American martin (critical),
  - Pacific western big-eared bat (critical), and
  - Wolverine (threatened).
- Additional information will be acquired from the ODFW and the USFWS.
- Table 1 presents the Army's checklist for Important Ecological Places (IEPs). Based on the above information, the NWMA is considered an IEP.
- Figure 5 presents the sensitive receptor locations surrounding the anti-tank minefield, the only identified AOC. If additional AOCs are identified as a result of the visual field reconnaissance activities, the figure will be modified as required.

#### 2.4.4 *Climate*

- The climate is controlled primarily by air masses that move eastward from the Pacific Ocean, across western Oregon, and into central Oregon.
- The climate is moderate with cool, wet winters and warm, dry summers.
- Orographic processes result in larger amounts of precipitation in the western portion (in the Cascade Range) that diminish rapidly toward the east.
- Temperatures also vary considerably. Conditions are warmer at lower elevations.
- In the southeast, the site is very dry and the rainfall is very scarce. The western edge of the site is semi-arid.
- The average annual precipitation ranges from about 25 inches per year along the western part of the area to approximately 10 inches per year in the southeastern part of the site.
- Average snowfall for the area is about 17 inches.

- The average maximum and minimum temperatures are 63 degrees Fahrenheit (°F) and 33°F, respectively.
- The average wind speed is 7 miles per hour.

## ***2.5 Geologic and Hydrogeologic Setting***

### ***2.5.1 Bedrock Geology***

- The area is underlain by Quaternary and Tertiary volcanic and sedimentary rocks.
- Bedrock beneath the NWMA consists almost entirely of basalt lava flows interspersed with many rhyolitic deposits and rhyolite volcanic structures. There are also some deposits of light colored volcanic ash.
- In the southern half of the site, the area is covered by extensive faulting (northwest-southeast trending faults). The faults are collectively named the Brothers fault and there are at least 25 of them present within the site area.
- Everywhere south of the Brothers fault, the lava plateau is broken into big fault block mountain ranges and valleys. North of the Brothers fault, the lava plateau is relatively intact and unbroken by faulting (Alt and Hyndman, 1990).

### ***2.5.2 Overburden Soils***

- Where there are soils present in the site area, they are very thin. For the most part, the surface is mainly composed of various outcropping rocks, mostly basalt.
- In some areas, fault block valley floors are present that are filled with muddy sediments that were washed into them from neighboring mountains.
- The Miocene age fills and sediments are mostly gravelly and silty sand in nature.
- The upper elevations are covered mainly with coniferous forests, while at the lower elevations the areas are arid and dominated by grassland, sagebrush, and juniper.

### ***2.5.3 Hydrogeology***

- The occurrence and movement of groundwater and the interaction of groundwater and streams are controlled by the distribution and permeability of the depositional sequence.
- The Cascade Range crest is the principal source of recharge for the groundwater system.
- Groundwater flows eastward from the Cascade Range and then generally northward through permeable Quaternary and Tertiary deposits.
- About half of the groundwater discharges to spring-fed streams along the margins of the range. The remaining groundwater flows through the subsurface, mainly through the permeable volcanic rocks.

## ***2.6 Population and Land Use***

### ***2.6.1 Nearby Population***

- Portions of the NWMA are included in Jefferson, Deschutes, Crook, Grant, Lake, Harney, and Klamath counties.

- The ASR chose Deschutes County and the City of Bend, Oregon as a representative demographic area for the NWMA.
- Approximately 67,125 residents reside in Bend per 2005 census population estimates (U.S. Census Bureau, 2000). Bend consists of approximately 21 square miles of area with a population density of 3,196.4 persons per square mile.

### ***2.6.2 Land Use***

- The NWMA contains several small communities and incorporated areas.
- Vast majority of the site is federally owned open range and forest land.
- Current land use is for cattle grazing, agriculture, timber production purposes, and recreation.
- The eastern portion of the site is used for cattle grazing and the western portion supports a dense pine forest.

### ***2.6.3 Area Water Supply***

- Domestic wells located within 4 miles of the site are presented on Figure 6.

## ***2.7 Previous Investigations for MC and MEC***

- Figures 2 and 3 present a layout of the NWMA.
- An ASR was issued in August 1995. The ASR documented that the NWMA was used for military maneuvers during September, October, and November 1943. Historical records indicate that no live munitions were used during the maneuvers.
- There are several documented reports of ordnance being found within the NWMA FUDS boundary. These include practice anti-tank training mines, an AN-Mk 43 practice bomb, 2.36-inch rocket, artillery, mortar rounds, and anti-personnel fragmentation bombs.
- An ASR Supplement was completed in 2004 and indicated one range, the Anti-tank Minefield (USACE, 2004).
- The munitions potentially used at the NWMA and the associated MC are presented in Table 2.

## ***2.8 Other Land Uses that May Have Contributed to Contamination***

- Activities from the other six FUDS located within the boundary of the NWMA.

## ***2.9 Other Investigations***

- Two (Camp Abbot and Central Oregon Air to Air Gunnery Range) of the six FUDS located within the NWMA boundary had ASR and ASR Supplements conducted and are currently being investigated under the MMRP. The Findings and Determination of Eligibility for the remaining four FUDS found them to have been formerly used by DoD but at the time of determination there was no evidence of unsafe conditions resulting from DoD use. However, these four locations will be evaluated under the NWMA SI.
- The Redmond Army Airfield was used in conjunction with a remote bombing range and an air-to-ground gunnery range.

- Consisted of 1,730 acres BLM land that was transferred to the Army Air Force April 25, 1945.
- Site determined excess September 1946.
- Conveyed property to the City of Redmond on October 3, 1947.
- Currently used as the Redmond Municipal Airport.
- Findings and Determination of Eligibility signed November 2, 1986 (no unsafe conditions resulting from DoD use).
- The Fort Rock Maneuver Area was used by the U.S. Army, Army Ground Forces as a maneuver area from July 1943 to April 1945.
  - Consisted of 275,000 acres Department of Agriculture and Department of Interior land that were transferred under special use permit to the DoD in July and October 1943.
  - The DoD relinquished portions of the site in December 1944 and April 1945.
  - Findings and Determination of Eligibility signed May 27, 1989 (no unsafe conditions resulting from DoD use).
- The Redmond Air to Ground Gunnery Range was used by the Army Air Corps for an aircraft gunnery range.
  - Consisted of 10,745 acres BLM land acquired on August 14, 1943 and 2,351 acres of privately-owned lands also acquired in 1943.
  - Site determined excess September 1946.
  - Findings and Determination of Eligibility signed July 14, 1989 (no unsafe conditions resulting from DoD use).
- The Redmond Precision Bombing Range was used by the Army Air Corps for an aircraft bombing range.
  - Consisted of 1,266 acres BLM lands that were transferred to the Army Air Force August 14, 1943 and 1,335 acres of private land acquired also in 1943.
  - Site determined excess October 1946.
  - Findings and Determination of Eligibility signed July 14, 1989 (no unsafe conditions resulting from DoD use).

## 3.0 *Conceptual Site Model*

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### 3.1 *Overview*

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 site conditions and future land use;
- Potential contaminant sources (e.g., metals and explosives from bombs);
- 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 and additional investigation.

### 3.2 *Background*

- During the months of September, October, and November 1943, the 4th Corps of the U.S. Army engaged in a series of war maneuvers on 8 million acres of Oregon land. The military units participating in the maneuvers reportedly carried live ammunition into the field to create an atmosphere of realism; however, all records indicate it was not fired. Historical documentation reports only practice ammunition was used. Even the bombers participating in the exercises dropped bags of flour to mark the location of hits. While some live fire was found in the NWMA, indications are this material was overflow from the live fire exercises performed on one of the six FUDS within the boundary of the NWMA.

#### 3.2.1 *History of Use*

- Used during September, October, and November 1943 by the 4th Corps of the U.S. Army for a series of war maneuvers.
- There are several documented reports of ordnance being found on the NWMA.
  - Eleven intact M1B1 anti-tank training mines were found in 1987 on the property of Mr. Terry Gratrix located outside the town of Christmas Valley, Oregon.
  - In 1988 in the sand dunes near the town of Christmas Valley, a teardrop shape AN-Mk 43 practice bomb was discovered.

- The USACE St. Louis District located four additional anti-tank mines on the property of Mr. Gratrix during a site visit the week of May 22, 1995.
- The Lakeview District BLM office reported an anti-personnel fragmentation bomb was found in 1986 near Silver Lake.
- The Lakeview District BLM office reported ordnance was found in the Lake Abert area in approximately 1973.
- The Prineville District BLM office reported ordnance was found in the Milican area (timeframe unknown).
- Deschutes County Emergency Services reported artillery round found west of Sunriver, Oregon (timeframe unknown).
- Deschutes County Emergency Services reported ordnance found in sand dunes approximately 4 miles west and one mile north of Alfalfa, Oregon (timeframe unknown).
- Sunriver Nature Center found spent mortar and rocket rounds near a cliff northwest of the airstrip (timeframe unknown, associated with Camp Abbot activities).
- Bend District office reported a bazooka round was located approximately 1-1/2 miles west of Sunriver (timeframe unknown, associated with Camp Abbot activities).

### 3.2.2 *Munitions and Associated MC*

<b>Area of Concern</b>	<b>Munitions</b>	<b>Munitions Constituents</b>
Anti-tank Minefield	Practice land mines	Sheet metal (chromium, iron, copper, lead, manganese, and nickel)
	Fuze .32-caliber blank	Lead and aluminum Black powder (potassium nitrate, sulfur, and charcoal) Red phosphorus

Additionally within the NWMA, and mainly near the town of Christmas Valley, the ASR and ASR Supplement report that the following munitions and associated MC were found.

<b>Munitions</b>	<b>Munitions Constituents</b>
Small arms (.30- and .45-caliber)	Brass (copper and zinc), aluminum, antimony, barium, lead, single-base (nitrocellulose) powder, double-base (nitrocellulose and nitroglycerin) powder
4.5-pound Navy practice bomb (AN-Mk 43)	Cast iron (iron) or steel (chromium, iron, copper, lead, manganese, and nickel)
Spotting Charge	Black powder (potassium nitrate, sulfur, and charcoal)

### 3.2.3 *Previous MEC Finds*

- Anti-tank mines and practice bomb near the town of Christmas Valley.

### ***3.2.4 Previous MC Sample Results***

- None.

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

- The NWMA contains several small communities and incorporated areas.
- Vast majority of the site is federally owned open range and forest land.
- Current land use is for cattle grazing, agriculture, and timber production purposes; this should continue into the future.

### ***3.2.6 Ecological Receptors***

- This FUDS does qualify as an IEP because the habitat is known to be used by state and/or federal designated or proposed designated T&E species.

## ***3.3 MEC Evaluation***

- Only documented use was from September to November 1943 for troop maneuvers using blank ammunition and sacks of flour for bombs.
- A 4.5-pound Navy practice bomb was found in the sand dunes near Christmas Valley. No other MEC or munitions debris associated with the bomb has been reported.
- Practice anti-tank mines were found in Christmas Valley. No other MEC or munitions debris associated with the mines has been reported. The fuze contained black powder or red phosphorus.
- Anti-personnel fragmentation bomb was found near Silver Lake. No other MEC or munitions debris associated with the bomb has been reported.
- Some 2.36-inch rocket, artillery, and mortar rounds found in Deschutes County.
- The vast majority of the site is federally owned open range and forest land. Other portions are privately owned.
- Site is currently used for cattle grazing, agriculture, timber production, and recreation.
- The eastern portion of the site is used for cattle grazing and the western portion supports a dense pine forest.
- Portions of the site have restricted access.

### ***3.3.1 MEC Evaluation/Investigation Needed***

- The first phase of investigation will consist of conducting visual field reconnaissance of Christmas Valley and the 1943 maneuver route by a qualified unexploded ordnance (UXO) technician with the aid of a hand-held magnetometer. Additional visual field reconnaissance will be conducted at other identified “support” sites and sites identified by the public during the TPP process that are within the NWMA FUDS. At the TPP meeting, ODEQ requested field reconnaissance be conducted at the Redmond Air to Ground Gunnery Range and the Redmond Precision Bombing Range. The findings of the initial reconnaissance will be used to determine the areas of concern and potential sampling locations for the second phase of activities. This information will be documented in the Draft SSWP, and the CSM (included

in the SSWP) will be updated, as necessary. The level of evaluation will be dependent on the amount of historic information available that documents potential sources.

### **3.4 MC Pathway Evaluation**

- Munitions debris from practice anti-tank mines in the site soils near Christmas Valley consists mainly of steel (chromium, copper, iron, lead, manganese, and nickel) and lead, aluminum, black powder (potassium nitrate, sulfur, and charcoal), and red phosphorus from the fuze.
- Munitions debris from 4.5-pound practice bomb found by a landowner in the sand dunes near the town of Christmas Valley consists mainly of cast iron (iron) or steel (chromium, copper, iron, lead, manganese, and nickel).
- Small arms casings consisting of brass (copper and zinc).

#### **3.4.1 Overview of Pathways**

Affected media and potential pathways for MC include:

- Soil: Soil is the primary medium of concern due to the presence of munitions debris (i.e., landmines) and possibly MC in the soil resulting from the discharge of munitions. The soil also serves as a secondary source of air contamination.
- Sediment: Sediment is a potentially affected media.
- Surface Water: Surface water is a potentially affected media.
- Groundwater: Groundwater is a potentially affected media since the migration of MC directly to groundwater from soil is considered to be possible.
- Air: Air is a possible completed pathway through inhalation of contaminated soil particles. The pathway is considered to be complete.

An analysis of exposure pathways and receptors for MEC is provided in Table 3.

#### **3.4.2 Terrestrial Pathway**

##### **3.4.2.1 Sources of MC**

- MC from the spotting charges could include black powder.
- MC from the landmine fuze could include black powder or red phosphorous.
- Most substantiated reports of munitions (anti-tank minefield) were found near the town of Christmas Valley.

##### **3.4.2.2 Migration Pathway**

- Wildlife in the area potentially may be exposed to MC through soil.
- Humans may come in contact with MC contamination through intrusive and non-intrusive work and recreational activities in areas where munitions debris may be present.

##### **3.4.2.3 Land Use and Access**

- The NWMA contains several small communities and incorporated areas.
- Current land use is for cattle grazing, agriculture, timber production, and recreation and it is assumed that the land will be used the same in the future.

- Some of the land is privately owned. The vast majority of the site is federally owned open range and forest land.
- Access to portions of the site is restricted.

#### *3.4.2.4 Human Receptors*

- The most likely current and future human receptors at the site would be the landowners and recreational users.

#### *3.4.2.5 Ecological Assessment*

- The site has been determined to be an IEP based on potential for T&E to use the property.
- The potential T&E species are listed in Section 3.2.6.
- The pathway for ecological receptors is complete.

### *3.4.3 Surface Water/Sediment Pathway*

Surface water and sediment is a completed pathway at the NWMA. The large area is drained by many streams, with the Deschutes and the John Day Rivers being the largest. Both rivers drain north to the Columbia River.

#### *3.4.3.1 Sources of MC*

- Metals (chromium, copper, iron, lead, manganese, and nickel).

#### *3.4.3.2 Migration Pathway*

- The potential routes of human exposure to contaminated surface water include incidental ingestion of, dermal contact with, and inhalation of surface water.
- The potential routes of livestock and wildlife (including aquatic organisms) exposure to contaminated surface water include ingestion of and direct contact with surface water.
- The potential routes of human exposure to contaminated sediment include incidental ingestion of and dermal contact with sediment.
- The potential routes of livestock and wildlife exposure to contaminated sediment include ingestion of and direct contact with sediment.

#### *3.4.3.3 Surface Water Use and Access*

- Recreation and wildlife.

#### *3.4.3.4 Human Receptors*

- Residents and recreational users.

#### *3.4.3.5 Ecological Assessment*

- According to the ASR, federal and state T&E species may be present in the vicinity of the site.

### *3.4.4 Groundwater Pathway*

- The potential routes of human exposure to contaminated groundwater include ingestion, dermal contact, and inhalation where groundwater is used as a water supply.

- The potential route to wildlife is through direct exposure and ingestion.

### ***3.4.5 Air Pathway***

- Air is a possible completed pathway through inhalation of contaminated soil particles. Exposure to the air pathway is considered in the human health screening values and is not assessed further here.

### ***3.4.6 MC Evaluation/Investigation Needed***

- Sampling locations and analysis will be identified in the SSWP following completion of the visual field reconnaissance phase.

### ***3.5 CSM Summary/Data Gaps***

- MEC was established when training anti-tank mines were found near Christmas Valley by a private resident and by USACE St. Louis personnel. Additionally, an AN-Mk 43 practice bomb was discovered near Christmas Valley.
- MC from the fuze and spotting charges could include black powder, and red phosphorous. Metals from anti-tank mines and a bomb body could include aluminum, chromium, iron, copper, lead, manganese, and nickel.

## 4.0 Proposed Field Investigation

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The proposed field investigation and sampling to be conducted at the NWMA will be conducted in a phased approach. The first phase will consist of visual field reconnaissance surveys at various locations throughout the NWMA FUDS to determine the presence of MEC and to identify potential sampling locations. These areas will include, but are not limited to: Christmas Valley; the route of the 1943 maneuvers; the Redmond Air to Ground Gunnery Range; and the Redmond Precision Bombing Range. Collection of samples at identified locations will be the second phase of the investigation. The analytical parameters for the samples will be determined based on the evidence of MEC, but will likely consist of select metals and explosives.

The investigation approach and sampling locations will be defined in an SSWP that will be submitted to Oregon Department of Environmental Quality and other stakeholders for review. The SSWP will reference technical details including sampling and analytical methods that are described in the *Type I Work Plan, Site Inspections at Multiple Sites* prepared by Shaw and submitted to the USACE as final in February 2006 (Shaw, 2006).

The first phase of investigation will consist of a visual field reconnaissance survey by a trained UXO technician using a hand-held magnetometer will be performed in various locations near the town of Christmas Valley and in areas where the 1943 maneuvers took place to assess the presence or absence of MEC and to document the current site conditions. Additionally, the ODEQ requested conducting visual reconnaissance of the Redmond Air to Ground Gunnery Range and the Redmond Precision Bombing Range. Since the TPP meeting, individuals have been contacted who may have additional information regarding activities at select locations. These locations will also have visual field reconnaissance performed. The findings of the initial reconnaissance will be used to determine the areas of concern and potential sampling locations for the second phase of activities. This information will be documented in the Draft SSWP, and the CSM (included in the SSWP) will be updated, as necessary. The level of evaluation will be dependent on the amount of historic information available that documents potential sources.

During reconnaissance, several transects will be walked during which visual observations and magnetic anomalies will be noted. Transects will be recorded using a global positioning system, and appropriate features influencing the survey will be noted, such as vegetation density and type, topography, etc. If MEC is found, the qualified UXO technician will attempt to make a determination of the hazard, and appropriate notifications will be made as detailed in the *Type I Work Plan, Site Inspections at Multiple Sites* (Shaw, 2006) and SSWP. Digital photographs will be taken to document significant features.

## 5.0 *Technical Project Planning and Development of Data Quality Objectives*

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### 5.1 *TPP Process*

- The USACE TPP process is a four-phase process:
  - Identify the current project,
  - Determine data needs,
  - Develop data collection options, and
  - Finalize data collection program.
- The purpose of TPP is to develop DQOs that document how the project makes decisions.
- DQOs are intended to capture project-specific information such as the intended data use(s), data needs, and how these items will be achieved.
- Information captured through DQOs will be used as a benchmark for determining whether identified objectives are met.

### 5.2 *TPP Phases*

#### **Phase I: Identify the Current Project**

1. Team members identified to date include: USACE – representatives from the Omaha Design Center and the Seattle District, Shaw as a USACE contractor, the Oregon Department of Environmental Quality, and the leaseholders.

**Question: Is there any person or organization missing from this Team?**

*Yes. EPA Region 10 was notified of the meeting but did not attend. The USACE will contact applicable tribal interests.*

2. The AOC identified is:

- Anti-tank mine field.

**Question: Are there any other AOCs to be identified?**

*The ODEQ requested conducting visual reconnaissance at the Redmond Precision Bombing Range and Redmond Air to Ground Gunnery Range. Additional AOCs may be identified based on the conducting visual reconnaissance within the NWMA.*

3. Based on information available about the site and shared through discussions with the USACE, are there concerns about this area that have been expressed by the Oregon Department of Environmental Quality or USEPA, as well as by landowners.

**Question: Are there additional concerns or issues from landowners or other stakeholders regarding the Northwest Maneuver Area?**

*No.*

**Question: Are there any administrative or stakeholder concerns or constraints that would prevent site inspection activities from going forward on the decision path for this site?**

*No.*

## **Phase II: Determine Data Needs**

- Existing site information includes an ASR and ASR Supplement both prepared by the USACE in 1995 and 2004, respectively.

**Question: Are there any other pertinent documents relating to the site available?**

*A Supplemental Historic Records Search was conducted by Shaw (subcontracted to TLI Solutions) for the NWMA. No new pertinent information was found. Additional record searches are being conducted by the USACE relating to the historical use of the FUDS located within the NWMA FUDS.*

- The site-specific approach for this SI involves collating and assessing available site information, to include site geology, hydrogeology, groundwater, surface water, ecological information, human use/access, and current and future land uses, as well as considering conduct of site inspection and sampling activities.

**Question: Are there any other site aspects/information that should be considered?**

*The SI at the NWMA will be conducted in a phased approach. The first phase will be visual reconnaissance surveys at various locations throughout the NWMA FUDS to determine the presence of MEC and to identify potential sampling locations. Collection of samples at identified locations will be the second phase of the SI activities.*

Based on site use, soil is the primary affected medium at the NWMA. Sediment/surface water is a potential pathway of MC because of the area is drained by many streams, with the Deschutes and John Day rivers being the largest. Groundwater is a potential pathway since MC could be introduced to the groundwater through the soils. Air is also a potential pathway if soil particles become airborne. Considering current and future land use, primary receptors of any contaminants that may be present would most likely be residents, recreational users, and animals using the area.

**Question: Do team members concur with the Conceptual Site Model?**

*Yes.*

- Technical considerations and/or constraints need to be identified and addressed before conducting any additional sampling, and would depend on the approach and additional data needs decided upon by team members.

**Questions:**

- Are any data missing?**

*Limited data exists regarding documented MEC findings. Many of the findings are not consistent with the use of the NWMA FUDS as a maneuver area for 3 months. Records are being searched to determine the historical usage of the other FUDS located within the NWMA FUDS.*

- **What is the nature of needed data?**

*Historic records of site usage and identified locations of MEC findings.*

- **What data gaps would additional data meet for making a decision about the site?**

*Additional data may explain why some of the MEC findings are not consistent with use of the NWMA as a maneuver area in 1943.*

- **Are there any considerations/constraints that need to be addressed for collecting additional data?**

*A visual reconnaissance should be performed at suspect locations within the NWMA to confirm MEC findings, identify new MEC findings, and identify potential sample locations.*

### **Phase III: Develop Data Collection Options**

#### 7. Proposed approach:

1. Conduct visual surface reconnaissance with magnetometer focused near the town of Christmas Valley, in the areas of the 1943 maneuvers, at the Redmond Air to Ground Gunnery Range, the Redmond Precision Bombing Range, and at other suspect locations.
2. Identify potential representative sample locations and sample.
3. Find suitable soil background sample locations and sample.
4. Find suitable sediment background sample location and sample.
5. Find suitable groundwater sample location and sample.
6. Determine collection of both composite and discrete samples and analysis depending on the results of the visual reconnaissance survey.

**Question: Based on the desired decision endpoints and information known to date, what additional information is needed to reach a determination of No DoD Action Indicated (NDAI) or further action?**

*None identified.*

**Question: Are the stakeholders in agreement with the sampling approach program?**

*During the TPP meeting, a limited sampling program was presented to address the anti-tank minefield and the 1943 maneuver area. However, since the meeting, additional information has become available regarding other potential sample locations. Based on visual field reconnaissance activities, final sampling locations and approach will be presented in the SI work plan.*

**Question: Are the stakeholders in agreement with the proposed approach for collecting background data?**

*Stakeholders agreed with the approach presented at the TPP meeting. However, based on the potential for newly identified sampling locations, the background sampling approach will be revised as needed and presented in the SI work plan.*

## Phase IV: Finalize Data Collection Program

### 8. Background data.

Site sampling results will be compared to background concentrations. Site will be considered NDAI for MC if site results do not exceed background.

**Question: What background data will be used for evaluation?**

*Background data will be collected as part of the field activities.*

**Are background data sets available from previous site studies?**

*No.*

**Are background data sets available from statewide studies?**

*Information may possibly exist from the United States Geological Survey (USGS). However, the detection methods and analytical methods would need to be reviewed for appropriateness.*

**If background data are to be collected as part of the SI, how many samples will be collected and what methods will be used to define the background range and compare to site sample results?**

*The background sampling approach will be presented in the draft SI work plan.*

### 9. Human health screening level risk assessment.

Sample results that exceed background will be compared to screening values. Site will be considered NDAI for MC if site results do not exceed screening values (depending also on ecological evaluation). What concentrations of potential contaminants of concern (metals and explosives) lead to decision end-points for human health?

Note: Oregon State standards are provided in Tables 4 and 5.

**Question: Are these the correct standards to be applied as screening values for human health risk assessment?**

*Yes.*

### 10. Ecological screening level risk assessment.

The USACE has defined a process for conducting screening level ecological risk assessment (SLERA). A determination is first made whether the site qualifies as an IEP. A second determination is made whether the site is managed for ecological purposes. If neither criterion is met, then a SLERA is not required and the process is limited to making observations during the site visit of any acute effects to flora and fauna that may be related to MC. If the site does qualify as an IEP or is managed for ecological purposes, site results that exceed background will be compared to ecological screening values. The site will be considered NDAI for MC if site results do not exceed screening values (depending also on human health evaluation).

**Does the site qualify as an IEP?**

*Yes.*

**Is the site managed for ecological purposes?**

*No.*

If the site is an IEP or is managed for ecological purposes, what concentrations of potential contaminants of concern (metals and explosives) lead to decision end-points for ecological risk?

Note: Oregon State standards are provided in Tables 6 and 7.

**Question: Are these the correct standards to be applied as screening values for ecological risk assessment?**

*Yes.*

**11. Other sampling issues.**

**Question: Are there any additional sampling and analysis methodologies needed for all team members to arrive at a decision end-point?**

*The sampling and analysis methodologies will be discussed in the draft SI work plan. It will be based on existing knowledge of the NWMA and any additional information gleaned from the visual field reconnaissance activities performed.*

**Question: Given the additional sampling and analysis methodologies, are there impacts to the project schedule that need to be accommodated?**

*Yes. The schedule will be extended due to the need for a two-phased approach at the NWMA to first perform a visual field reconnaissance prior to determining the sampling strategy based on the presence of MEC.*

## 6.0 Data Quality Objectives

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Upon agreement at the TPP meeting, the following decision rules will be applied with regard to MC sampling results:

- Below background values = NDAI.
- Above background values but below risk-based screening levels = NDAI.
- Above risk-based screening levels and background values = RI/FS.

The following expanded project objectives 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 – Utilizing trained UXO personnel and handheld magnetometers, a visual search will be conducted searching for physical evidence to indicate the presence of MEC (e.g., MEC on the surface, munitions debris, craters, soil discoloration indicative of explosives). The visual search will consist of areas near the town of Christmas Valley and the 1943 maneuver areas. At the TPP meeting, ODEQ requested reconnaissance at the Redmond Air to Ground Gunnery Range and the Redmond Precision Bombing Range. Additional information has been found since the TPP meeting that indicates the potential for the presence of MEC. A visual field reconnaissance will be performed of these locations.

- The following reconnaissance results would support a recommendation for further action with respect to MEC:
  - Direct evidence is found of the presence of MEC (from historical records or SI activities) or evidence of potential MEC that is inconsistent with the NWMA CSM (e.g., use of munitions containing high explosives).
  - Direct evidence of MEC is not found, but abundant munitions debris is identified suggesting a potential for the presence of MEC.
- The following reconnaissance results would support a recommendation for NDAI with respect to MEC:
  - Direct evidence of MEC is not found; munitions debris is isolated and consistent with the NWMA CSM.
  - No evidence of MEC, munitions debris, or magnetic anomalies is identified.
- If there is indication that site users are exposed to MEC hazard, the site will be recommended for a removal action.

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

DQO #2 – Soil and sediment samples will be collected and analytical results will be compared to background. USGS background information (if available) will also be included in the

evaluation, provided the analytical data meet data quality requirements developed for the SI. The following decision rules will apply:

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

**Objective 3: Obtain data required for Hazard Ranking System scoring.**

Data required for HRS scoring are identified in the HRS Data Gaps worksheet.

**Objective 4: Obtain data required for MRSP ranking.**

Data required for MRSP ranking are identified in the MRSP worksheet.

## **Next Steps**

- USACE will obtain necessary rights-of-entry based on sample locations.
- Shaw will prepare the Draft and Final TPP Memorandum and distribute for concurrence.
- Shaw will prepare the Draft SSWP for review and comment, and publish the Final SSWP.
- Shaw will conduct field work.
- Shaw will prepare the Draft SI Report and submit for USACE review.
- Shaw will prepare the Draft Final SI Report and submit for stakeholder review.
- USACE/Shaw will schedule a second TPP meeting to review comments on the Draft Final SI Report.

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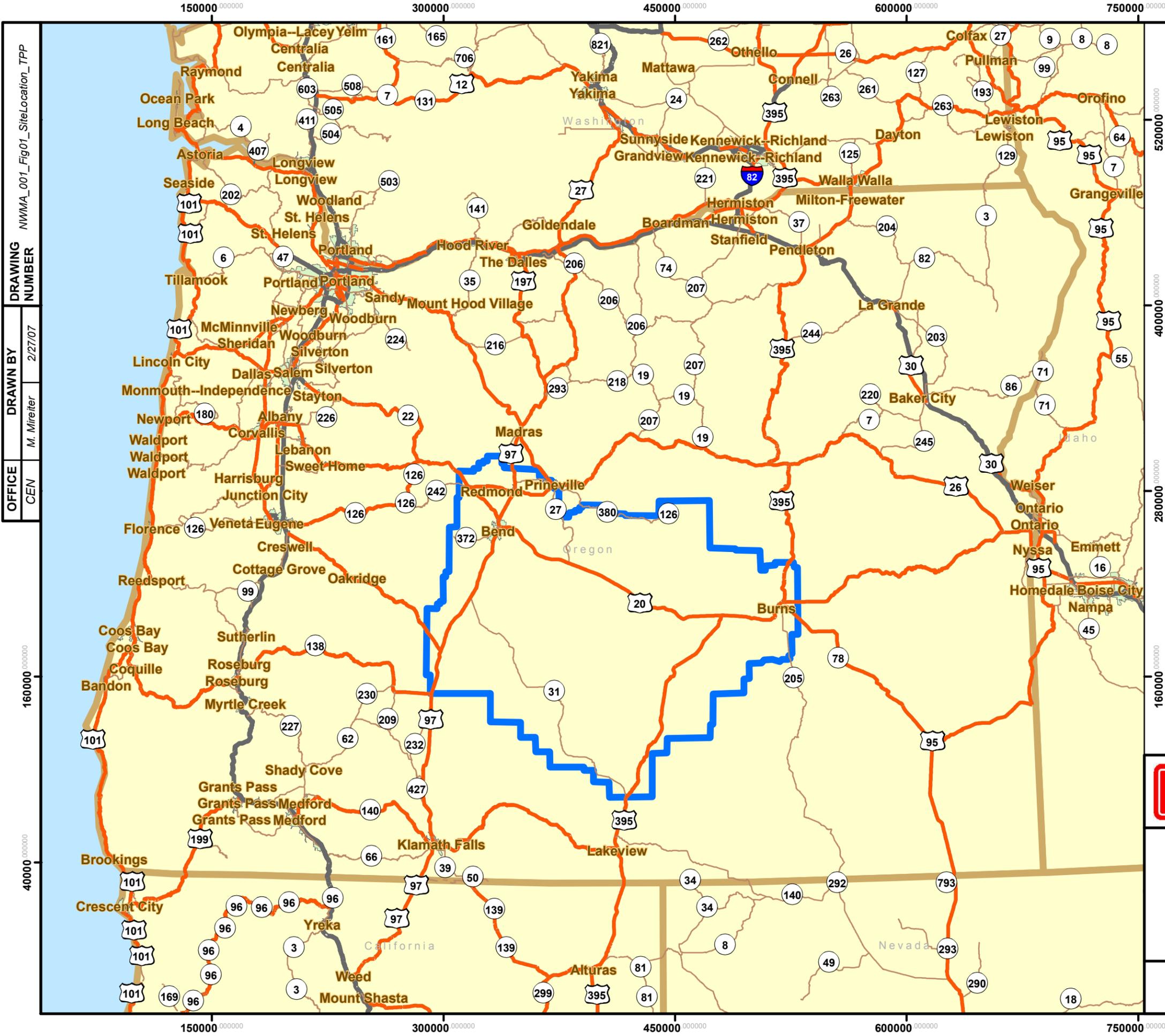
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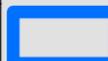
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# *Figures*

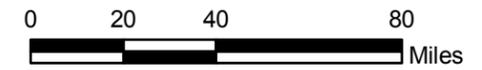


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 DRAWN BY: M. Mireiter  
 DATE: 2/27/07  
 OFFICE: CEN

**Legend**

 Northwest Maneuver Area FUDS Boundary

NOTES:  
 1) FUDS boundary was derived from the Northwest Maneuver Area ASR Supplement.



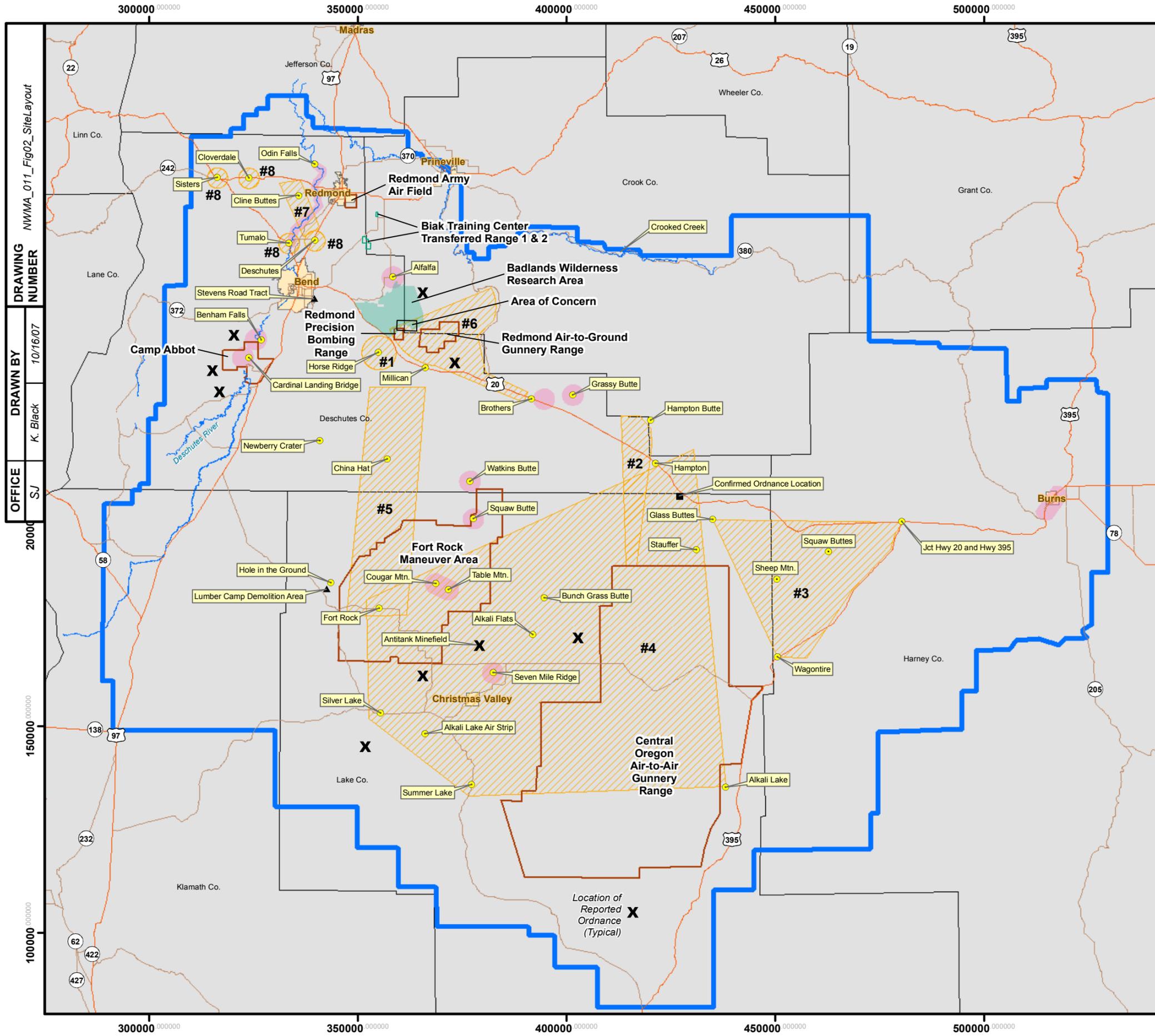
REFERENCE/PROJECTION: NAD 83 HARN Oregon Statewide Lambert



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**FIGURE 1**  
**SITE LOCATION**  
 NORTHWEST MANEUVER AREA





**Legend**

- Northwest Maneuver Area FUDS Boundary
- Badlands Wilderness Research Area
- Biak Training Center Areas of Interest
- Approximate Location of 1943 Maneuver Exercises (See Section 2.3.1)
- Approximate Location of 1943 Areas of Interest (See Section 2.3.1)
- Location of Reported Ordnance
- Confirmed Location of Ordnance
- Additional FUDS Located Within the Northwest Maneuver Area
- County Boundary

NOTES:  
 1) Northwest Maneuver Area FUDS boundary and range boundary obtained from the Northwest Maneuver Area ASR Supplement.



0 10 20 40 Miles  
 REFERENCE/PROJECTION: NAD 83 HARN Oregon Statewide Lambert

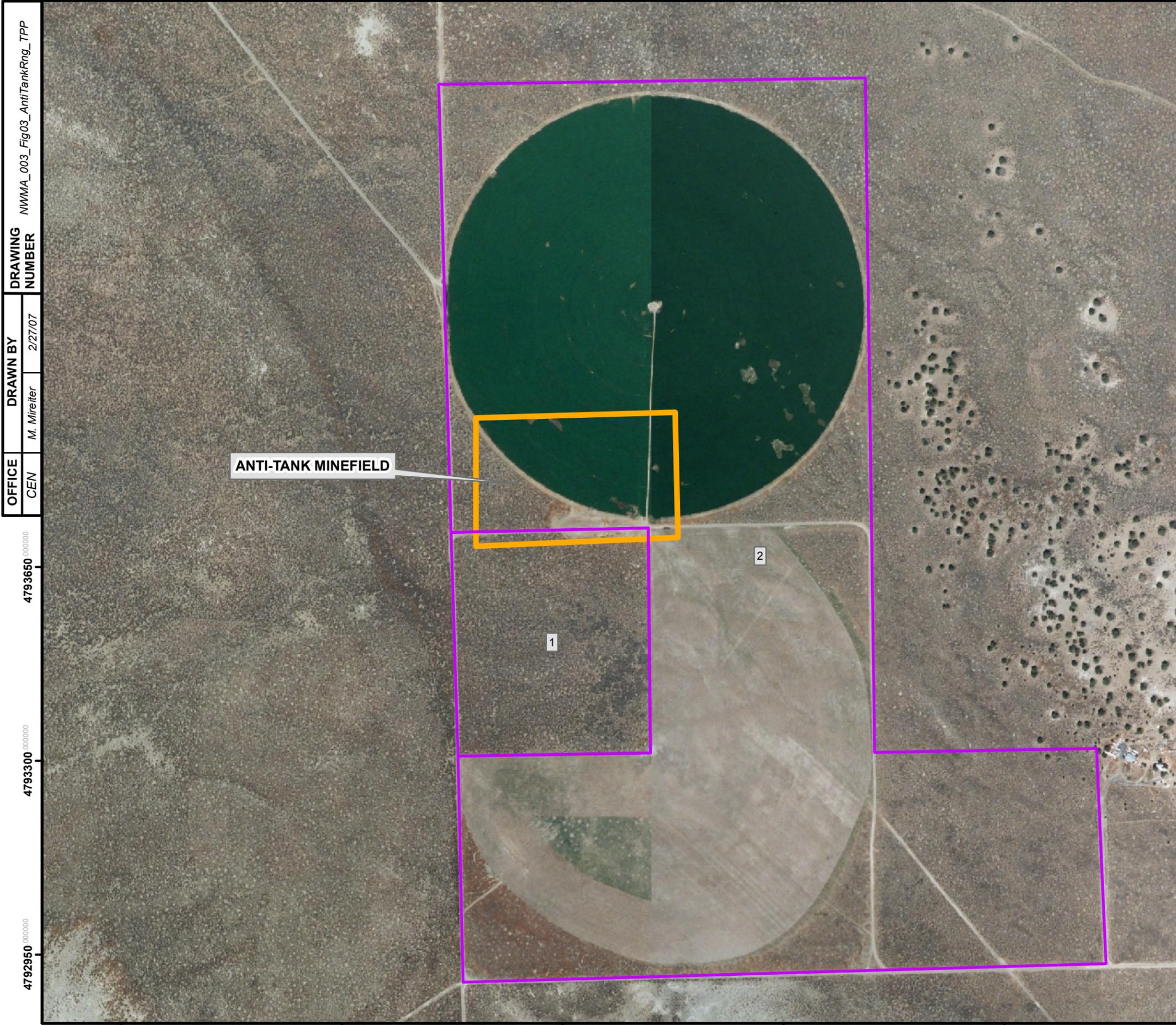
DRAWING NUMBER: NWMA\_011\_Fig02\_SiteLayout  
 DRAWN BY: K. Black  
 DATE: 10/16/07  
 OFFICE: SJ

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**FIGURE 2**  
**SITE LAYOUT**  
 NORTHWEST MANEUVER AREA

Shaw Environmental, Inc.

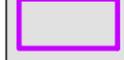
681200.000000 681600.000000 682000.000000 682400.000000 682800.000000



OFFICE: CEN  
DRAWN BY: M. Mireiter  
DRAWING NUMBER: NWMA\_003\_Fig03\_AntiTankRng\_TPP  
2/27/07

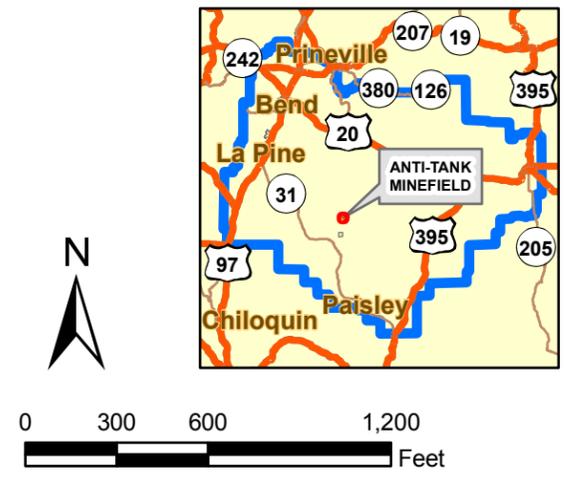
4793650.000000  
4793300.000000  
4792950.000000

**Legend**

-  Anti-tank Minefield Boundary
-  Parcel Ownership Boundary
-  Parcel Designation Number

NOTES:

- 1) FUDS boundary and range boundary obtained from the Northwest Maneuver Area ASR Supplement.
- 2) Parcel boundaries and ownership information obtained from the Lake County Assessor's office.
- 3) Aerial photo (Lake County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



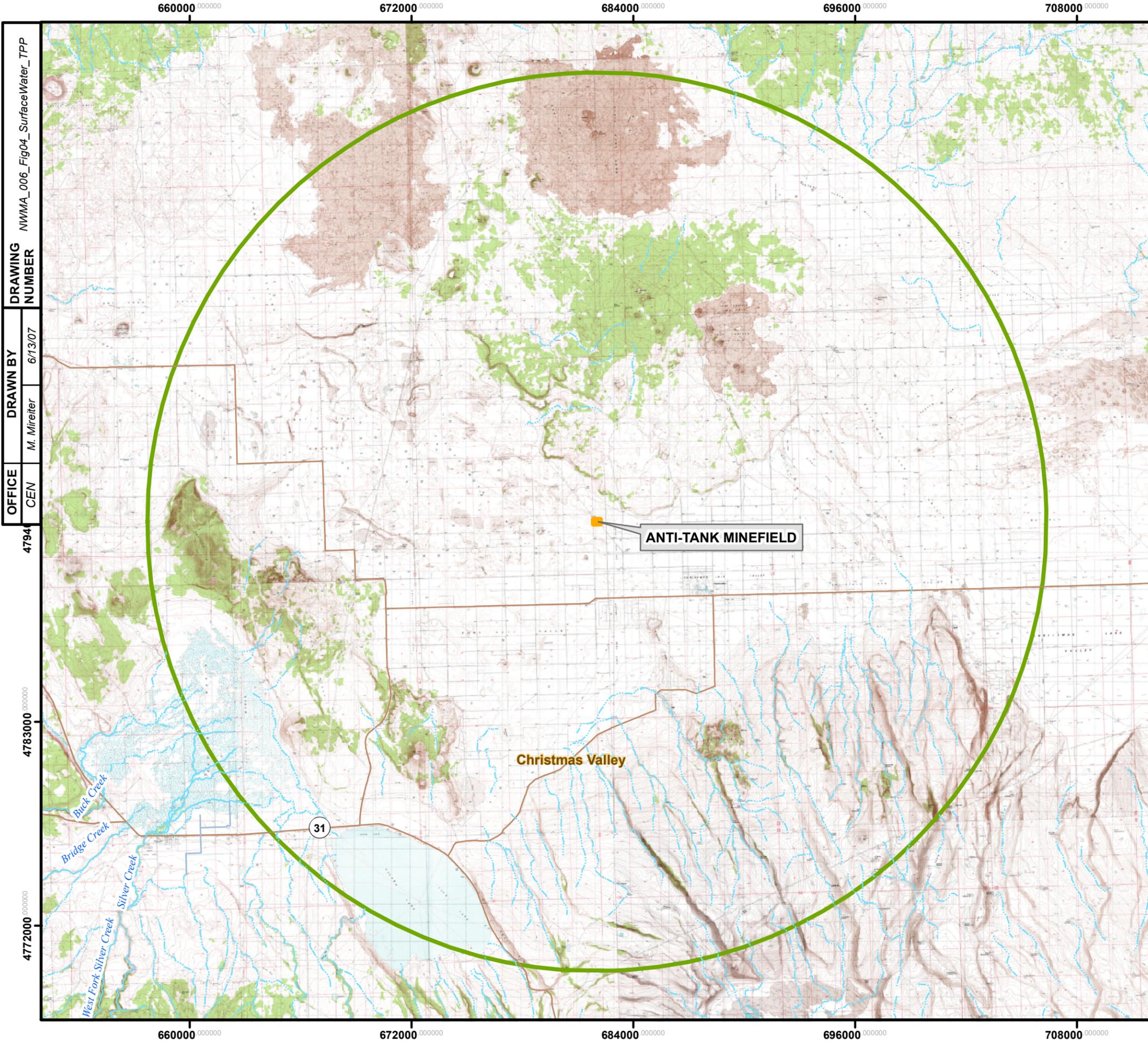
REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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**FIGURE 3**  
**ANTI-TANK MINEFIELD**  
**CURRENT AERIAL**  
NORTHWEST MANEUVER AREA

 Shaw Environmental, Inc.

681200.000000 681600.000000 682000.000000 682400.000000 682800.000000



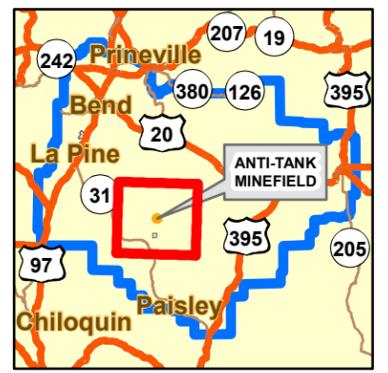
DRAWING NUMBER: NWMA\_006\_Fig04\_SurfaceWater\_TPP  
 DRAWN BY: M. Mireiter  
 DATE: 6/13/07  
 OFFICE: CEN  
 NUMBER: 4794

**Legend**

- Perennial Stream
- Intermittent Stream
- Intermittent Canal
- Anti-tank Minefield Boundary
- 15-Mile Radius From Anti-tank Minefield Range Boundary

**NOTES:**

- 1) FUDS boundary and range boundary obtained from the Northwest Maneuver Area ASR Supplement.
- 2) Topo map (Lake County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.

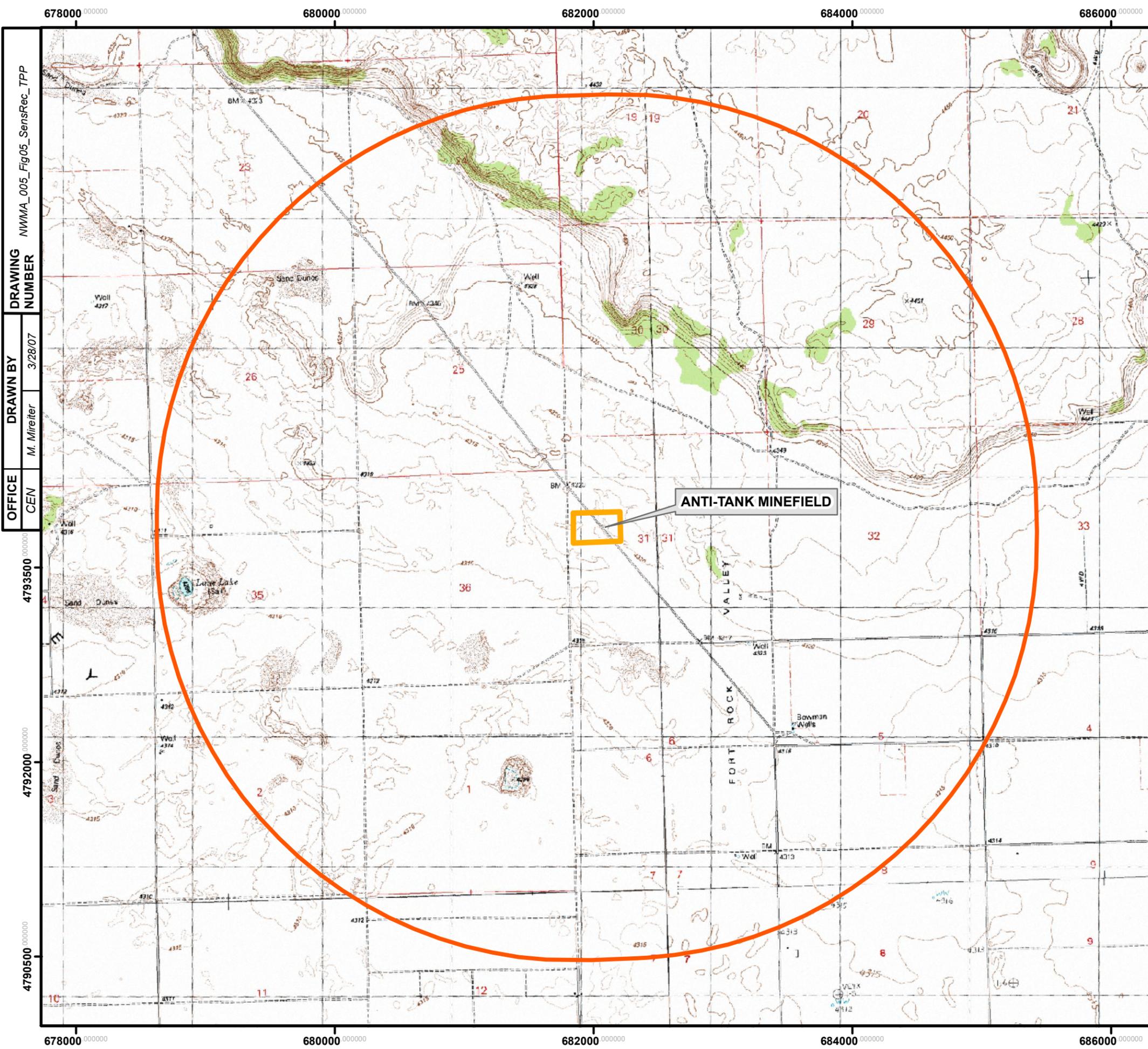


REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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**FIGURE 4**  
**SURFACE WATER DRAINAGE**  
 NORTHWEST MANEUVER AREA

**Shaw** Shaw Environmental, Inc.



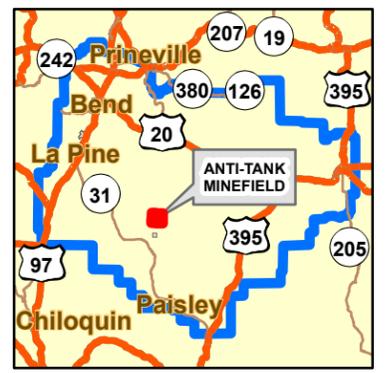
DRAWING NUMBER: NMMA\_005\_Fig05\_SensRec\_TPP  
 DRAWN BY: M. Mireiter  
 DATE: 3/28/07  
 OFFICE: CEN

**Legend**

- Anti-tank Minefield Boundary
- 2-Mile Radius From Anti-tank Minefield Range Boundary

**NOTES:**

- 1) FUDS boundary and range boundary obtained from the Northwest Maneuver Area ASR Supplement.
- 2) There are no schools, churches, hospitals, etc. within 2 miles of the range boundary.
- 3) Topo map (Lake County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.

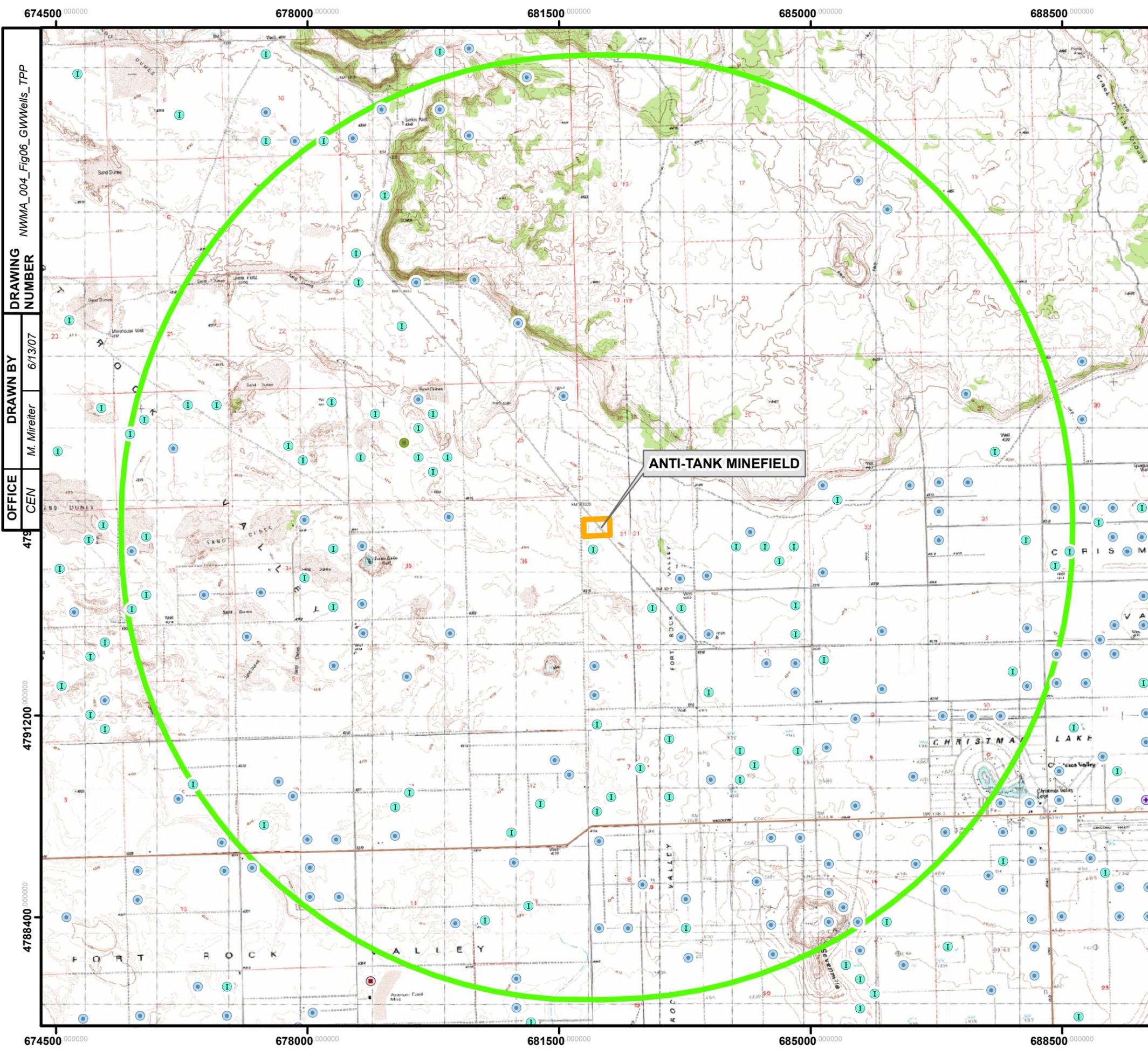


REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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**FIGURE 5**  
**SENSITIVE RECEPTOR LOCATIONS**  
 NORTHWEST MANEUVER AREA



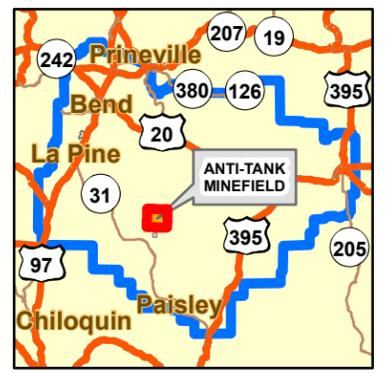


DRAWING NUMBER: NWMA\_004\_Fig06\_GWwells\_TPP  
 DRAWN BY: M. Mireiter  
 DATE: 6/13/07  
 OFFICE: CEN  
 NUMBER: 478

### Legend

- Anti-tank Minefield Boundary
- 4-Mile Radius From Anti-tank Minefield Boundary
- Industrial Well
- Public Well
- Livestock Well
- Irrigation Well
- Domestic Well

- NOTES:
- 1) FUDS boundary and range boundary obtained from the Northwest Maneuver Area ASR Supplement.
  - 2) Groundwater well information obtained from the State of Oregon, Water Resources Department. Wells are plotted in the center of either the Township/Range/Section, Township/Range/Section/Quarter, or Township/Range/Section/Quarter/Quarter depending on available well data.
  - 3) Topo map (Lake County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

**U.S. ARMY CORPS OF ENGINEERS**  
**OMAHA DESIGN CENTER**

**FIGURE 6**  
**GROUNDWATER WELLS**  
**WITHIN 4-MILE RADIUS**  
 NORTHWEST MANEUVER AREA



# *Tables*

**Table 1**  
**Army Checklist for Important Ecological Places <sup>a</sup>**  
**Northwest Maneuver Area, Oregon**

		Yes / No	Comments
1	Locally important ecological place identified by the Integrated Natural Resource Management Plan, BRAC Cleanup Plan or Redevelopment Plan, or other official land management plans	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Site includes Deschutes National Forest, assumed to have official land management plan, as a guiding principle of the USFS is to “use an ecological approach to the multiple-use management of the National Forests.”
2	Critical habitat for Federal designated endangered or threatened species	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
3	Marine Sanctuary	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
4	National Park	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
5	Designated Federal Wilderness Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
6	Areas identified under the Coastal Zone Management Act	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
7	Sensitive Areas identified under the National Estuary Program or Near Coastal Waters Program	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
8	Critical areas identified under the Clean Lakes Program	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
9	National Monument	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
10	National Seashore Recreational Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
11	National Lakeshore Recreational Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
12	Habitat known to be used by Federal designated or proposed endangered or threatened species	<input checked="" type="checkbox"/> / <input type="checkbox"/>	ASR states that 1 mammal, 3 bird, 2 fish, and 1 butterfly federal T&E species may be within the Site boundary.
13	National preserve	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
14	National or State Wildlife Refuge	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
15	Unit of Coastal Barrier Resources System	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
16	Coastal Barrier (undeveloped)	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
17	Federal land designated for protection of natural ecosystems	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Site includes Deschutes National Forest, assumed to have protection of natural ecosystems as policy goal – see # 1.
18	Administratively Proposed Federal Wilderness Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
19	Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
20	Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which fish spend extended periods of time	<input type="checkbox"/> / <input checked="" type="checkbox"/>	

**Table 1 (Cont.)**

		<b>Yes / No</b>	<b>Comments</b>
21	Terrestrial areas utilized for breeding by large or dense aggregations of animals	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
22	National river reach designated as Recreational	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
23	Habitat known to be used by state designated endangered or threatened species	<input checked="" type="checkbox"/> / <input type="checkbox"/>	ASR states that 1 fish, 2 amphibian, 2 mammal, and 14 bird state T&E species may be within the Site boundary.
24	Habitat known to be used by species under review as to its Federal endangered or threatened status	<input checked="" type="checkbox"/> / <input type="checkbox"/>	ASR states 2 mammal, 1 amphibian, 2 plant candidate federal T&E species may be within Site boundary.
25	Coastal Barrier (partially developed)	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
26	Federally designated Scenic or Wild River	<input checked="" type="checkbox"/> / <input type="checkbox"/>	The Deschutes River that flows through the Site is a federally-designated Wild and Scenic River
27	State land designated for wildlife or game management	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
28	State-designated Scenic or Wild River	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
29	State-designated Natural Areas	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
30	Particular areas, relatively small in size, important to maintenance of unique biotic communities	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
31	State-designated areas for protection or maintenance of aquatic life	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
32	Wetlands	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Wetlands likely along Deschutes and John Day Rivers.
33	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Soils within some areas of the Site are generally very thin to absent, with surface outcroppings of volcanic rocks in the Camp Abbott FUDS local.

a – Based on EPA, 1990, 55 FR 51624, Table 4-23 – Sensitive Environments Rating Values, Dec. 14, 1990; EPA, 1997, ERAGS, Exhibit 1-1 List of Sensitive Environments

**Table 2**  
**Potential MEC and MC at Northwest Maneuver Area**

<b>Range Areas</b>	<b>Munitions ID</b>	<b>Munitions</b>	<b>Associated MC</b>
Anti-Tank Minefield	Practice land mine	M1B1	Sheet metal (chromium, copper, iron, lead, manganese, and nickel)
	Fuze	M1 (.32 caliber blank)	Aluminum, lead, Black powder (potassium nitrate, sulfur, charcoal) Red phosphorus
Maneuver Area	Small Arms	.30 and .45 caliber blanks	Brass (copper and zinc), aluminum, antimony, barium, lead Nitrocellulose Nitroglycerin
Sand Dunes	Practice Bomb	45-pound MK43	Cast iron (iron) or steel (chromium, copper, iron, lead, manganese, and nickel)
	Spotting charge		Black powder (potassium nitrate, sulfur, and charcoal)

**Table 3  
MEC and MC Exposure Pathway Analysis  
Northwest Maneuver Area**

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media (Potential Contaminant Sources) (Fate and Transport)	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Anti-Tank Minefield and 1943 Maneuver Area	MEC	MEC in the form of <i>unexploded</i> practice bomb spotting charges may exist on the land surface.  MEC in the form of <i>unexploded</i> practice anti-tank mines may exist on the land surface.	<b>Surface Soil</b> <ul style="list-style-type: none"> <li>MEC (unexploded practice landmines and bombs) are a hazard.</li> <li>MEC (unexploded practice landmines bombs) reported on surface.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Vehicle and foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Vehicle and foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>Locations and type of MEC</li> </ul>	<ul style="list-style-type: none"> <li>Historical documents indicate that the NWMA was used from September – November 1943 for troop exercises with practice ammunition. However, ordnance has been found at the NWMA, specifically including practice anti-tank mines and a 45-pound practice bomb.</li> <li>A field reconnaissance survey by a trained unexploded ordnance (UXO) technician using a hand-held magnetometer will be performed in the areas of Christmas Valley and the maneuver areas to assess the presence or absence of munitions and explosives of concern (MEC) and to document the current site conditions. The ODEQ also requested a reconnaissance survey of the Redmond Air to Ground Gunnery Range and the Redmond Precision Bombing Range. Visual reconnaissance will be conducted at additional areas within the NWMA FUDS.</li> </ul>
			<b>Subsurface Soil</b> <ul style="list-style-type: none"> <li>MEC (unexploded practice landmines and bombs) are a hazard.</li> <li>MEC (unexploded practice landmines bombs) reported in subsurface</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Intrusive activities</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Intrusive activities</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Burrowing</li> </ul>	<ul style="list-style-type: none"> <li>Locations and type of MEC</li> </ul>	<ul style="list-style-type: none"> <li>Historical documents indicate that the NWMA was used from September – November 1943 for troop exercises with practice ammunition. However, ordnance has been found at the NWMA, specifically including practice anti-tank mines and a 45-pound practice bomb.</li> <li>A field reconnaissance survey by a trained UXO technician using a hand-held magnetometer will be performed in the areas of Christmas Valley and the maneuver areas to assess the presence or absence of MEC and to document the current site conditions. The ODEQ also requested a reconnaissance survey of the Redmond Air to Ground Gunnery Range and the Redmond Precision Bombing Range. Visual reconnaissance will be conducted at additional areas within the NWMA FUDS.</li> </ul>
	MC	Black powder, red phosphorous, sheet metal (chromium, iron, copper, lead, manganese, and nickel), steel, lead, aluminum	<b>Soil</b> <ul style="list-style-type: none"> <li>Directly affected.</li> <li>Potential metals contamination from munitions used.</li> <li>Spotting charges do not contain hazardous components.</li> <li>Fuze does not contain hazardous substances.</li> <li>Fate &amp; Transport: secondary source of potential sediment, surface water, and air contamination.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Incidental ingestion</li> <li>Dermal contact</li> <li>Inhalation of soil particles</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Incidental ingestion</li> <li>Dermal contact</li> <li>Inhalation of soil particles</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Ingestion</li> <li>Direct Contact</li> </ul>	<ul style="list-style-type: none"> <li>Metals and explosives data are needed.</li> </ul>	<ul style="list-style-type: none"> <li>The location and number of soil samples collected and the analytical methods will be determined following completion of the visual field reconnaissance surveys.</li> </ul>
			<b>Sediment/Surface Water</b> <ul style="list-style-type: none"> <li>Potentially affected media – numerous streams and rivers</li> <li>Potential metals contamination</li> <li>Spotting charges and fuze do not contain hazardous substances</li> <li>Fate &amp; Transport: via surface runoff from impacted soil</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Incidental ingestion</li> <li>Dermal contact</li> <li>Inhalation of surface water</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Incidental ingestion</li> <li>Dermal contact</li> <li>Inhalation of surface water</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Ingestion</li> <li>Direct Contact</li> </ul>	<ul style="list-style-type: none"> <li>Metals and explosives data are needed.</li> </ul>	<ul style="list-style-type: none"> <li>The location and number of sediment samples collected and the analytical methods will be determined following completion of the visual field reconnaissance surveys.</li> </ul>
			<b>Groundwater</b> <ul style="list-style-type: none"> <li>Potentially affected media due to leaching of contaminants through the soil.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Incidental ingestion</li> <li>Dermal contact</li> <li>Inhalation of groundwater</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Incidental ingestion</li> <li>Dermal contact</li> <li>Inhalation of groundwater</li> </ul>	<ul style="list-style-type: none"> <li>Potentially complete pathway.</li> </ul> Exposure routes: <ul style="list-style-type: none"> <li>Ingestion</li> <li>Direct Contact</li> </ul>	<ul style="list-style-type: none"> <li>Metals and explosives data are needed.</li> </ul>	<ul style="list-style-type: none"> <li>The location and number of groundwater samples collected and the analytical methods will be determined following completion of the visual field reconnaissance surveys.</li> </ul>
			<b>Air</b> <ul style="list-style-type: none"> <li>Potentially affected media due to blowing soil.</li> </ul>	Potentially complete Pathway  Exposure routes: Inhalation	Potentially complete Pathway  Exposure routes: Inhalation	Potentially complete Pathway  Exposure routes: Inhalation	<ul style="list-style-type: none"> <li>Metals and explosives data are needed.</li> </ul>	Will use soil analytical data in risk screening

**Table 4**  
**Human Health Screening Criteria for Soil/Sediment at Oregon Sites<sup>a</sup>**  
**Northwest Maneuver Area, Oregon**

Analyte	Abbreviation	CAS No.	EPA Region 6 Human Health Media-Specific Screening Levels		
			Residential MSSL <sup>b</sup> (mg/kg)	Industrial MSSL <sup>c</sup> (mg/kg)	SSLs <sup>d</sup> DAF=1 (mg/kg)
<b>Explosives</b>					
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	4.4	17	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	3,100	34,000	
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	16	64	
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	1,800	21,000	
1,3-Dinitrobenzene	1,3-DNB	99-65-0	6.1	68	
2,4-Dinitrotoluene <sup>e</sup>	2,4-DNT	121-14-2	0.72	2.8	0.00004
2,6-Dinitrotoluene <sup>e</sup>	2,6-DNT	606-20-2	0.72	2.8	0.00003
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2			
2-Nitrotoluene	2-NT	88-72-2	2.8	14	
3-Nitrotoluene	3-NT	99-08-1	1,600	23,000	
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0			
4-Nitrotoluene	4-NT	99-99-0	38	190	
Nitrobenzene	NB	98-05-3	20	110	
Nitroglycerin	NG	55-63-0			
Pentaerythritol tetranitrate	PETN	78-11-5			
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	240	2,700	
<b>Metals/Inorganics</b>					
Aluminum	Al	7429-90-5	76,000	100,000	
Chromium <sup>f</sup>	Cr	7440-47-3	210	500	2
Copper	Cu	7440-50-8	2,900	42,000	
Iron	Fe	7439-89-6	55,000	100,000	
Lead	Pb	7439-92-1	400	800	
Manganese	Mn	7439-96-5	3,200	35,000	
Nickel	Ni	7440-02-0	1,600	23,000	7

DAF = Dilution Attenuation Factor  
MSSL = Medium-Specific Screening Levels  
SSL = Soil Screening Level

mg/kg = milligrams per kilogram.

<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

<sup>b</sup> MSSLs from Region 6 MSSL Table dated February 21, 2007 based on residential exposures to single chemical. The background information for these values is presented in *EPA Region 6 Human Health Medium-Specific Screening Levels* (December 2006).

<sup>c</sup> MSSLs from Region 6 MSSL Table dated February 21, 2007 based on industrial outdoor worker exposures to single chemical. The background information for these values is presented in *EPA Region 6 Human Health Medium-Specific Screening Levels* (December 2006).

<sup>d</sup> SSLs from Region 6 MSSL Table dated February 21, 2007. These values have not been generated from the soil-screening calculations. The values have been copied from the August 1998 Region 6 MSSL document and spot-checked using the latest EPA guidance (EPA, December 2006).

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

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

**Table 5**  
**Human Health Screening Criteria for Groundwater at Oregon Sites<sup>a</sup>**  
**Northwest Maneuver Area**

Analyte	Abbreviation	CAS No.	Laboratory Method Detection Limit (µg/L)	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-trinitrophenyl nitramine	Tetryl	479-45-8	0.75	360	
Nitroglycerin	NG	55-63-0	0.5		
Aluminum	Al	7429-90-5	60	36,000	
Chromium <sup>e</sup>	Cr	7440-47-3	2.0	110	100
Copper	Cu	7440-50-8	3.0	1,500	1,300 <sup>f</sup>
Iron	Fe	7439-89-6	5.0	11,000	
Lead	Pb	7439-92-1	1.0		15 <sup>f</sup>
Manganese	Mn	7439-96-5	2.0	880	
Nickel	Ni	7440-02-0	1.0	730	

MCL = Maximum Contaminant Level  
 PRG = Preliminary Remediation Goal  
 µg/L = micrograms per liter

- a 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.
- b Region 9 PRG Table dated October 2004 and revision note dated 28 December 2004, based on single chemical.
- c Primary MCL from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004, is listed unless otherwise indicated.
- d Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.
- e Total chromium values used if available.
- f Action level from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004.

**Table 6**  
**Selection of Ecological Soil Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)**

Parameter	ODEQ Level II Screening Level <sup>a</sup>	Proposed Benchmarks									Potential Bio Accumulative Constituent? <sup>h</sup>	Final Ecological Screening Value Soil <sup>i</sup> (mg/kg)	Practical Quantitation Limit (mg/kg)
	Lowest Value for Plants/Inverts./ Birds/Mammals (mg/kg)	Region 5 ESLs <sup>b</sup> (2003) (mg/kg)	Region 7 <sup>c</sup> (mg/kg)	Region 8 <sup>d</sup> (mg/kg)	Region 10 <sup>e</sup> (mg/kg)	Other Values: Talmage et al. (1999) <sup>f</sup> or LANL (2005) <sup>g</sup> (mg/kg)							
<b>Metals/Inorganics</b>													
Aluminum	50	NVA	50	EPA-R4	NVA		50	EPA-R4	5.5	LANL		50	20.0
Chromium (total)	0.4	0.4	26	SSL	26	SSL	26	SSL	2.3	LANL	Yes	0.4	1.0
Copper	50	5.4	60	ORNL	190	Dutch	60	ORNL	10	LANL	Yes	50	1.0
Iron	10	NVA	200	EPA-R4	NVA		200	EPA-R4	NVA			10	15.0
Lead	16	0.0537	11	SSL	11	SSL	11	SSL	14	LANL	Yes	16	1.0
Manganese	100	NVA	100	EPA-R4	NVA		100	EPA-R4	50	LANL		100	0.5
Nickel	30	13.6	30	ORNL	30	ORNL	30	ORNL	20	LANL	Yes	30	1.0

**Table 6 (Cont.)**  
**Selection of Ecological Soil Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)**

Parameter	ODEQ Level II Screening Level <sup>a</sup>	Proposed Benchmarks									Potential Bio Accumulative Constituent? <sup>h</sup>	Final Ecological Screening Value Soil <sup>i</sup> (mg/kg)	Practical Quantitation Limit (mg/kg)
	Lowest Value for Plants/Inverts./ Birds/Mammals (mg/kg)	Region 5 ESLs <sup>b</sup> (2003) (mg/kg)	Region 7 <sup>c</sup> (mg/kg)	Region 8 <sup>d</sup> (mg/kg)	Region 10 <sup>e</sup> (mg/kg)	Other Values: Talmage et al. (1999) <sup>f</sup> or LANL (2005) <sup>g</sup> (mg/kg)							
<b>Explosive</b>													
2,4-Dinitrotoluene	NVA	1.28	1.28	EPA-R4	NVA		1.28	EPA-R4	0.52	LANL		1.28	0.040
2,6-Dinitrotoluene	NVA	0.0328	0.0328	EPA-R4	NVA		0.0328	EPA-R4	0.37	LANL		0.0328	0.040
2-Amino-4,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		2.1	LANL		2.1	0.040
4-Amino-2,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		0.73	LANL		0.73	0.040
1,3-Dinitrobenzene	NVA	0.655	0.655	EPA-R4	NVA		0.655	EPA-R4	0.073	LANL		0.655	0.020
HMX	NVA	NVA	NVA		NVA		NVA		27	LANL		27	0.050
Nitrobenzene	8	1.31	1.31	EPA-R4	NVA		1.31	EPA-R4	2.2	LANL		8	0.020
RDX	NVA	NVA	NVA		NVA		NVA		7.5	LANL		7.5	0.075
1,3,5-Trinitrobenzene	NVA	0.376	0.376	EPA-R4	NVA		0.376	EPA-R4	6.6	LANL		0.376	0.020
2,4,6-Trinitrotoluene	NVA	NVA	NVA		NVA		NVA		6.4	LANL		6.4	0.040
2-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		2.0	LANL		2.0	0.075
3-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		2.4	LANL		2.4	0.050
4-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		4.4	LANL		4.4	0.040
Tetryl	NVA	NVA	NVA		NVA		NVA		0.99	LANL		0.99	0.065
Nitroglycerin	NVA	NVA	NVA		NVA		NVA		71	LANL		71	10

NVA: No value available

**Table 6 (Cont.)**  
**Selection of Ecological Soil Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)**

<sup>a</sup>Oregon Department of Environmental Quality Screening Level Values (December 2001).

<sup>b</sup>Ecological Screening Levels (ESLs), U.S.EPA Region 5, August 2003.

<sup>c</sup>USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: USEPA EcoSSLs; ORNL Efroymson values; USEPA Region 4 values; other published values.

<sup>d</sup>USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: USEPA SSLs; Dutch Intervention Values or ORNL Efroymson values.

<sup>e</sup>USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.

<sup>f</sup>Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel, 1999, Nitroaromatic Munition Compounds: Environmental Effects and Screening Values, **'Revisions Environmental Contaminant Toxicology.'**

<sup>g</sup>Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.

<sup>h</sup>Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation. Potential bioaccumulative potential from: Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).

<sup>i</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. (1999) or LANL (2005) values.

EPA-R4=USEPA Region 4

LANL= Los Alamos National Laboratory

SSL=USEPA Eco Soil Screening Levels

Dutch=Dutch Intervention Values

ORNL= Oak Ridge National Laboratory Ecological PRGs (Efroymson et al)

**Other References:**

U.S. Environmental Protection Agency, 2005, Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs), Office of Solid Waste and Emergency Response, website version last updated March 15, 2005: <http://www.epa.gov/ecotox/ecossl>.

U.S. Environmental Protection Agency, 2001, Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: <http://www.epa.gov/region4/waste/ots/ecolbul.htm>.

Efroymson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. Preliminary Remediation Goals for Ecological Endpoints. Lockheed Martin Energy Systems, Inc. (ORNL) ES/ER/TM-162/R2.

Dutch Intervention Values:

Swartjes, F.A. 1999. Risk-based Assessment of Soil and Groundwater Quality in the Netherlands: Standards and Remediation Urgency. Risk Analysis 19(6): 1235-1249

The Netherlands Ministry of Housing, Spatial Planning and Environment's Circular on target values and intervention values for soil remediation

[http://www2.minvrom.nl/Docs/internationaal/S\\_I2000.pdf](http://www2.minvrom.nl/Docs/internationaal/S_I2000.pdf) and Annex A:

Target Values, Soil Remediation Intervention Values and Indicative Levels for Serious Contamination [http://www2.minvrom.nl/Docs/internationaal/annexS\\_I2000.pdf](http://www2.minvrom.nl/Docs/internationaal/annexS_I2000.pdf) were also consulted.

**Table 7**  
**Selection of Ecological Sediment Screening Toxicity Values for Constituents of**  
**Potential Ecological Concern (Oregon Sites)**

Parameter	ODEQ Screening Level Values <sup>a</sup> (mg/kg) Freshwater	Region 5 Ecological Screening Levels <sup>b</sup> (mg/kg)	EPA Region 7 <sup>c</sup> (mg/kg)		EPA Region 8 <sup>d</sup> (mg/kg)		EPA Region 10 <sup>e</sup> (mg/kg)		Other Values: Talmage et al. (1999) <sup>f</sup> or LANL (2005) <sup>g</sup> (mg/kg)		Potential Bioaccumulative Constituent? <sup>g</sup>	Final Ecological Screening Value Sediment <sup>h</sup> (mg/kg)	Practical Quantitation Limit (mg/kg)
<b>Metals/Inorganics</b>													
Aluminum	NVA	NVA	NVA		NVA		NVA		2.80E+02	LANL		2.80E+02	20.0
Chromium	3.70E+01	4.34E+01	4.34E+01	MAC	4.34E+01	MAC	4.34E+01	MAC	5.60E+01	LANL	Yes	3.70E+01	1.0
Copper	1.00E+01	3.16E+01	3.16E+01	MAC	3.16E+01	MAC	3.16E+01	MAC	1.70E+01	LANL	Yes	1.00E+01	1.0
Iron	NVA	NVA	NVA		NVA		NVA		2.00E+01	LANL		2.00E+01	15.0
Lead	3.50E+01	3.58E+01	3.58E+01	MAC	3.58E+01	MAC	3.58E+01	MAC	2.70E+01	LANL	Yes	3.50E+01	1.0
Manganese	1.10E+03	NVA	NVA		NVA		NVA		7.20E+02	LANL		1.10E+03	0.5
Nickel	1.80E+01	2.27E+01	2.27E+01	MAC	2.27E+01	MAC	2.27E+01	MAC	3.90E+01	LANL	Yes	1.80E+01	1.0

**Table 7 (Cont.)**  
**Selection of Ecological Sediment Screening Toxicity Values for Constituents of**  
**Potential Ecological Concern (Oregon Sites)**

Parameter	ODEQ Screening Level Values <sup>a</sup> (mg/kg) Freshwater	Region 5 Ecological Screening Levels <sup>b</sup> (mg/kg)	EPA Region 7 <sup>c</sup> (mg/kg)	EPA Region 8 <sup>d</sup> (mg/kg)	EPA Region 10 <sup>e</sup> (mg/kg)	Other Values: Talmage et al. (1999) <sup>f</sup> or LANL (2005) <sup>g</sup> (mg/kg)	Potential Bioaccumulative Constituent? <sup>h</sup>	Final Ecological Screening Value Sediment <sup>i</sup> (mg/kg)	Practical Quantitation Limit (mg/kg)
<b>Explosives</b>									
RDX	NVA	NVA	NVA	NVA	NVA	1.30E-01	TAL	1.30E-01	0.075
HMX	NVA	NVA	NVA	NVA	NVA	4.70E-02	TAL	4.70E-02	0.050
1,3,5-Trinitrobenzene	NVA	NVA	NVA	NVA	NVA	2.40E-02	TAL	2.40E-02	0.020
1,3-Dinitrobenzene	NVA	8.61E-03	NVA	NVA	NVA	6.70E-02	TAL	6.70E-02	0.020
2,4-Dinitrotoluene	NVA	1.44E-03	NVA	NVA	NVA	2.90E-01	LANL	2.90E-01	0.040
2,6-Dinitrotoluene	NVA	3.98E-03	NVA	NVA	NVA	1.90E+00	LANL	1.90E+00	0.040
2,4,6-TNT	NVA	NVA	NVA	NVA	NVA	9.20E-01	TAL	9.20E-01	0.040
2-Amino-4,6,-Dinitrotoluene	NVA	NVA	NVA	NVA	NVA	7.00E+00	LANL	7.00E+00	0.040
4-Amino-2,6,-Dinitrotoluene	NVA	NVA	NVA	NVA	NVA	1.90E+00	LANL	1.90E+00	0.040
2-Nitrotoluene	NVA	NVA	NVA	NVA	NVA	5.60E+00	LANL	5.60E+00	0.075
3-Nitrotoluene	NVA	NVA	NVA	NVA	NVA	4.90E+00	LANL	4.90E+00	0.050
4-Nitrotoluene	NVA	NVA	NVA	NVA	NVA	1.00E+01	LANL	1.00E+01	0.040
Nitrobenzene	NVA	1.45E-01	NVA	NVA	NVA	3.20E+01	LANL	3.20E+01	0.020
Tetryl	NVA	NVA	NVA	NVA	NVA	1.00E+02	LANL	1.00E+02	0.065
Nitroglycerin	NVA	NVA	NVA	NVA	NVA	1.70E+03	LANL	1.70E+03	10

NVA = No Value Available

**Table 7 (Cont.)**  
**Selection of Ecological Sediment Screening Toxicity Values for Constituents of**  
**Potential Ecological Concern (Oregon Sites)**

<sup>a</sup>Oregon Department of Environmental Quality Screening Level Values (December 2001).

<sup>b</sup>Ecological Screening Levels (ESLs), U.S.EPA Region 5, August 2003.

<sup>c</sup>USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); ORNL froymson values (ORNL, 1977).

<sup>d</sup>USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); Canadian ISQG values (CCME, 2003) or ORNL Efroymsen values (ORNL, 1977).

<sup>e</sup>USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.

<sup>f</sup>Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel (TAL), 1999, Nitroaromatic Munition Compounds: Environmental Effects and Screening Values, Revisions Environmental Contaminant Toxicology.'

<sup>g</sup>Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.

<sup>h</sup>Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation. Potential bioaccumulative potential from: Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).

<sup>i</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.

**Note:** The Talmage [TAL] screening values assume 10% organic carbon in the sediment.

MAC=MacDonald Consensus Values

EPRGs=Oak Ridge National Laboratory Ecological PRGs

ISQGs=Canadian Interim Sediment Quality Guidelines

LALN=Los Alamos National Laboratory

TAL=Talmage et al (1999)

**Other References:**

Efroymsen, R.A., et al., 1997, Preliminary Remediation Goals (EPRGs), ORNL, ES/ER/TM-162/R2,

Canadian Interim Sediment Quality Guidelines (ISQGs) Summary Table, CCME, December 2003.

MacDonald, D.D, C.G. Ingersoll and T.A. Berger, 2000, Development and Evaluation of Consensus-Based Sediment Quality Criteria for Freshwater Ecosystems, Archives of Environmental Contamination and Toxicology 39:20-31.

# ***Draft Worksheets***

## Site Information Worksheet

Site: Northwest Maneuver Area

Project: MMRP FUDS

	Site Information Needed <sup>a</sup>	Suggested Means to Obtain Site Information	Potential Source(s) of Site Information	Responsible for Obtaining	Deadline for Obtaining Site Information
1	Schedule for Sampling	Consultation	ODEQ and landowners	Shaw	Prior to field work
2	Access Agreements	Rights of Entry requests	Landowners	USACE	Prior to field work
3	Areas of Cultural Significance within AOC	SHPO	Phone SHPO	Shaw	Prior to field work

**Munitions Response Site Prioritization Protocol (MRSP) Data Gaps**  
32 CRF Part 179

Installation: Northwest Maneuver Area  
AOC: Anti-tank Minefield  
RMIS Range ID: F10OR020801R01

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type	x			M1B1 practice anti-tank mine, Mk 43 45-lb practice bomb with black powder, small arms (.30 caliber and .45 caliber)
	2	Source of Hazard	x			Troop maneuver area. Source of discovered ordnance unknown.
	3	Location of Munitions	x			Historical evidence indicates ordnance has been found on the Northwest Maneuver Area. .
	4	Ease of Access	x			Partial barrier
	5	Status of Property				x Non-DoD control
	6	Population Density				x < 100 persons per square mile
	7	Population Near Hazard				x 0 inhabited structures w/in 2 miles
	8	Activities/Structures				x Agricultural - irrigated crops and livestock grazing
	9	Ecological and/or Cultural Resources		confirm State Historical Preservation Office		x Ecological resources present
	10	<b>EHE Module Score</b>				
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration				x Historical evidence indicates that CWM are not present
	12	Sources of CWM				x Historical evidence indicates that CWM are not present
	13	Location of CWM				x Historical evidence indicates that CWM are not present
	14	Ease of Access				x No barrier
	15	Status of Property				x Non-DoD control
	16	Population Density				x < 100 persons per square mile
	17	Population Near Hazard				x 0 inhabited structures w/in 2 miles
	18	Activities/Structures				x Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources				x Ecological resources present
	20	<b>CHE Module Score</b>				
Health Hazard Evaluation (HHE)	21	HHE Factor Levels	x	Contaminant hazard evaluation pending analytical results		
	22	HHE Three-Letter Combination Levels	x	Contaminant hazard evaluation pending analytical results		
	23	HHE Module Ratings	x	Contaminant hazard evaluation pending analytical results		
	24	HHE Module Rating	x	Contaminant hazard evaluation pending analytical results		
<b>MRS Priority</b>	25	<b>MRS Priority (Based on Highest Hazard Evaluation Module Rating)</b>	x	<b>Evaluation pending filling of data gaps</b>		

To be completed by USACE once all data gaps are filled.

## Northwest Maneuver Area HRS Data Gaps

Information required to complete the MEC-HRS data collection form:

Item	Number	Comment – Missing Data Element
1	1.8	Confirm the latitude / longitude of potential source(s) and the accuracy of the information (in meters)
2		Source scale (i.e., 1:24,000, etc.)
3	1.12	Site Permits
4	2.3	Confirm no tribal lands within 4 miles or surface water within 15 miles
5	2.4	Confirm if there are other NPL sites within 1 mile of the site
6	2.5	Confirm property owners
7	5.3	Population within 1 mile, within 4 miles
8	6	Water use (GW within 4 miles, SW within 15 miles)
9	6.1	Total drinking water population served
10	6.2	Type of drinking water supply system (GW or SW?)
11	6.3	Other water uses of GW within 4 miles
12	6.4	Depth to aquifer within 4 miles
13	7.1	Confirm existence of sensitive or potentially vulnerable environment