



Headquarters Marine Corps

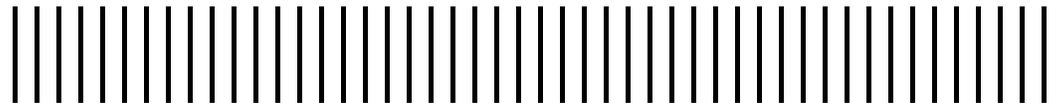
Code LFL ▪ 2 Navy Annex ▪ Washington, D.C. 20380

FINAL

Range Environmental Vulnerability Assessment

Marine Corps Mountain Warfare Training Center
Bridgeport, California

September 2008



Report Prepared By:

Malcolm Pirnie, Inc.

2000 Powell Street, Suite 1180
Emeryville, CA 94608
(510) 596-3060

4418024

**MALCOLM
PIRNIÉ**

Contents

Executive Summary	ES-1
1. Introduction	1-1
1.1. Purpose	1-1
1.2. Scope and Applicability	1-1
1.3. Report Organization	1-5
2. Summary of Data Collection Effort	2-1
3. Conceptual Site Model	3-1
3.1. Installation Overview	3-4
3.1.1. Installation Background	3-4
3.1.2. Installation Layout	3-4
3.2. Land Ownership, Use, and IAs	3-5
3.3. Physical Features of the Study Area	3-10
3.4. Surface Hydrology	3-10
3.4.1. Regional Climate Data	3-11
3.4.2. Designated Beneficial Uses of Surface Waters	3-13
3.4.3. U.S. Environmental Protection Agency Section 303(d) Water Quality Limited Segments	3-14
3.5. Base Lithology	3-14
3.6. Hydrostratigraphic Units and Groundwater Flow	3-15
3.7. Receptors	3-16
3.7.1. Surface Water	3-16
3.7.2. Groundwater	3-17
3.7.3. Endangered/Threatened Species	3-17
3.7.4. Cultural Resources	3-18
3.8. Additional Installation Information	3-19
3.8.1. Historical Lead Study Results	3-19
3.8.2. Water Quality Considerations	3-19
3.8.2.1. Site and Regional pH Evaluation	3-20
3.8.2.2. USGS Gauging Station Lead Results	3-20
3.8.2.3. Installation Water Supply Well Lead Results	3-20
3.8.2.4. Perchlorate	3-22
4. Munitions Constituents Loading Rates and Assumptions	4-1
4.1. Indicator MC	4-2
4.2. Munitions Expenditure Records	4-2
4.3. Loading Areas	4-3
4.4. SAR Assumptions and Lead Loading Estimates	4-3

4.4.1. Assumptions Based on Type of Training Exercise 4-4
 4.4.2. Estimated Lead Loading Rates for Training Activities 4-5
 4.5 Demonstration Area Evaluation 4-5

5. Small Arms Range Assessments 5-1

5.1. Summary of the SARAP 5-1
 5.2. R-100 5-5
 5.2.1. Site Background 5-5
 5.2.2. Assessment Results 5-6
 5.3. R-200 5-6
 5.3.1. Site Background 5-6
 5.3.2. Assessment Results 5-8
 5.4. R-300 5-8
 5.4.1. Site Background 5-8
 5.4.2. Assessment Results 5-9
 5.5. R-400/R-800..... 5-10
 5.5.1. Site Background 5-10
 5.5.2. Assessment Results 5-11
 5.6. R-500 5-11
 5.6.1. Site Background 5-11
 5.6.2. Assessment Results 5-12
 5.7. R-600 5-13
 5.7.1. Site Background 5-13
 5.7.2. Assessment Results 5-14
 5.8. R-700 5-15
 5.8.1. Site Background 5-15
 5.8.2. Assessment Results 5-16
 5.9. Sniper-1/Sniper-2 5-16
 5.9.1. Site Background 5-16
 5.9.2. Assessment Results 5-17
 5.10. Sniper-3/Sniper-4 5-18
 5.10.1. Site Background 5-18
 5.10.2. Assessment Results 5-19

6. References 6-1

Tables

Table ES-1	Range Summary	ES-3
Table ES-2	Summary of SAR Assessment Results	ES-5
Table 3-1	Range Summary	3-6
Table 3-2	Installation and Regional pH Data.....	3-21
Table 3-3	Installation and Regional Lead Data	3-22
Table 4-1	Estimated Lead Loading Rates for Training Activities	4-5
Table 5-1	Summary of SAR Assessment Results	5-3

Figures

Figure ES-1	Operational Ranges and TAs.....	ES-2
Figure 1-1	Site Location Map.....	1-2
Figure 1-2	Installation Layout	1-3
Figure 3-1	CSM of the Geology and Hydrogeology: MCMWTC Bridgeport, CA	3-2
Figure 3-2	Watersheds and Streams.....	3-3
Figure 3-3	Map of Proposed Wilderness Planning Areas	3-9
Figure 3-4	Water Quality Evaluation Locations	3-12
Figure 5-1	Operational SARs.....	5-4

Appendices

- A. Small Arms Range Assessment Protocol
- B. Small Arms Range Assessments

Acronyms

Acronym	Definition
µg	Microgram
°F	Degrees Fahrenheit
bgs	Below Ground Surface
CA	California
CAR	Critical Aquatic Refuge
CDFG	California Department of Fish and Game
cfs	Cubic Feet per Second
CSM	Conceptual Site Model
Demo	Demonstration (area)
DHS	Department of Health Services
DoD	Department of Defense
FSEIS	Final Supplemental Environmental Impact Statement
GIS	Geographic Information System
HA	Hydrologic Area
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HQMC	Headquarters Marine Corps
Hwy	Highway
IA	Interagency Agreement
kg	Kilogram
lb	Pound
LCT	Lahontan Cutthroat Trout
L	Liter
m	Meter
MC	Munitions Constituents
MCMWTC	Marine Corps Mountain Warfare Training Center
mg	Milligram
MSSC	Mountain Scout/Sniper Course
MYLF	Mountain Yellow-Legged Frog
NRHP	National Register of Historic Places
PCT	Paiute Cutthroat Trout
PPB	Parts Per Billion
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
REVA	Range Environmental Vulnerability Assessment
RWQCB	Regional Water Quality Control Board
SAR	Small Arms Range
SARAP	Small Arms Range Assessment Protocol

Acronym	Definition
SNFPA	Sierra Nevada Forest Plan Amendment
SOP	Standard Operating Procedure
SSURGO	Soil Survey Geographic Database
SWDIV	Southwest Division
TA	Training Area
TMDL	Total Maximum Daily Load
TNT	Trinitrotoluene
U.S.	United States
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
UST	Underground Storage Tank
WMLC	Winter Mountain Leader Course
yr	Year
YT	Yosemite Toad

Executive Summary

The United States (U.S.) Marine Corps (Marine Corps) Range Environmental Vulnerability Assessment (REVA) program meets the requirements of the current Department of Defense Directive 4715.11 *Environmental and Explosives Safety Management on Operational Ranges within the United States* and Department of Defense Instruction 4715.14 *Operational Range Assessments*.

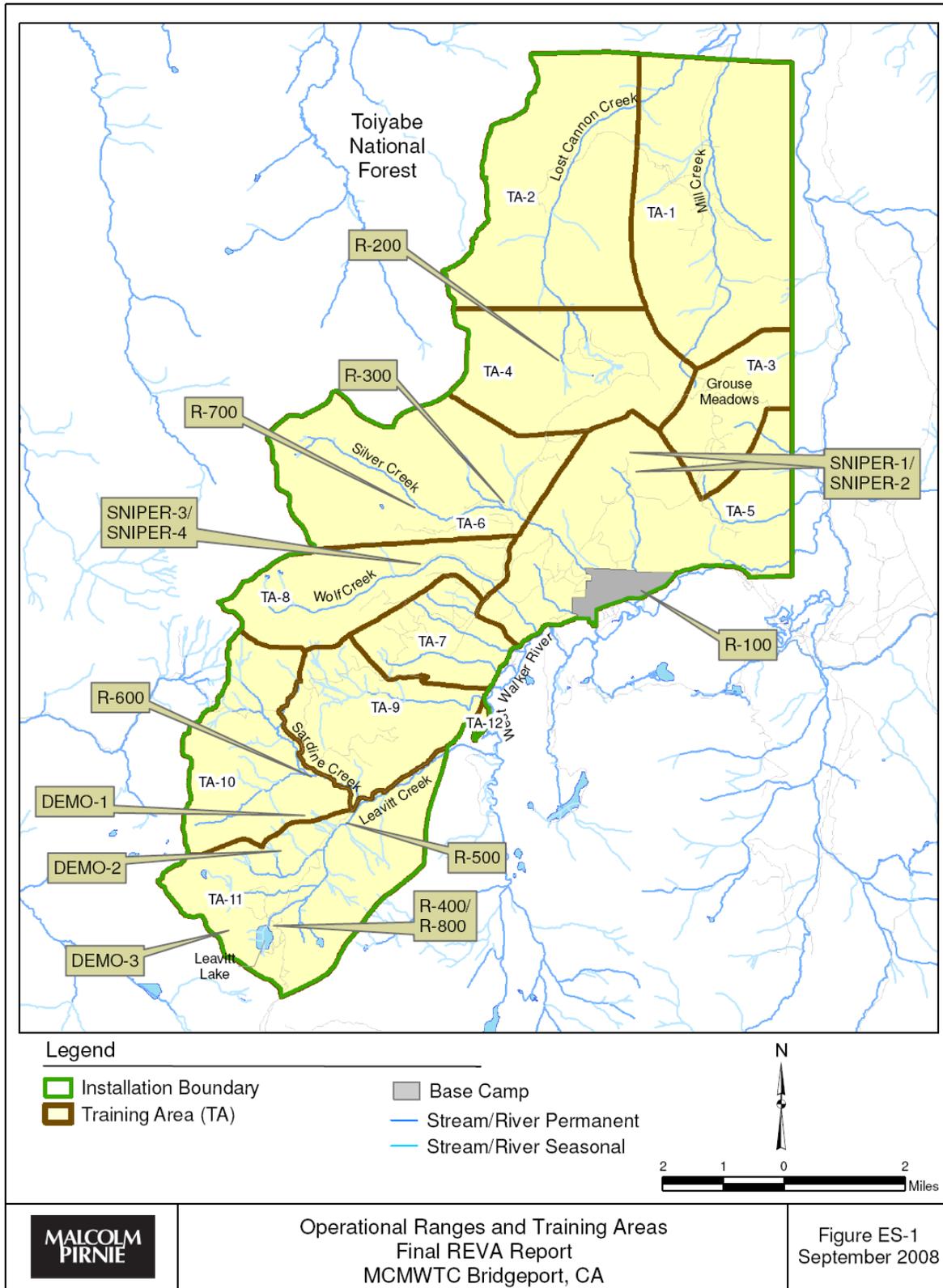
The purpose of REVA is to identify whether there is a release or substantial threat of a release of munitions constituents (MC) from the operational range or range complex areas to off-range areas. At other installations, this is accomplished through the use of fate and transport modeling and analysis of the indicator MC based upon site-specific environmental conditions at the operational ranges and training areas. However, live fire for operational ranges at Marine Corps Mountain Warfare Training Center (MCMWTC) Bridgeport, California, is primarily on small arms ranges (SARs); therefore, qualitative assessments were conducted to evaluate the potential for MC releases to off-range areas.

This report presents the assessment results for the operational ranges and training areas (TAs) at MCMWTC Bridgeport. It is the first comprehensive report on MC associated with the operational ranges at MCMWTC Bridgeport and serves as the baseline of environmental conditions of the ranges.

MCMWTC Bridgeport maintains operational ranges (including SARs) as part of the cold weather orienteering, mobility, and survival training activities conducted at the installation. MCMWTC Bridgeport is located on approximately 53,000 acres in the Toiyabe National Forest in the eastern Sierra Nevada Mountains. The elevation of MCMWTC Bridgeport is 6,762 feet at Base Camp; elevations in the TAs rise to 11,459 feet. The installation is bounded on two sides by federal wilderness areas and is 11 miles northeast of Yosemite National Park. MCMWTC Bridgeport also includes cargo delivery and flight operations at the Sweetwater Flight Strip on U.S. Forest Service (USFS) land approximately 35 miles to the east in Nevada.

Current, as well as historical, uses of the operational ranges and TAs at MCMWTC Bridgeport were assessed under REVA. The TAs at MCMWTC Bridgeport include TA-1 through TA-12. Figure ES-1 identifies the TAs and the operational ranges located in each TA. Table ES-1 summarizes location and use information for the operational ranges and TAs.

Figure ES-1: Operational Ranges and TAs



P:\6285\024\GIS\Bridgeport\024-June08_Fig ES-1.mxd

Table ES-1: Range Summary

TA Name	Fixed Range	Use	Size (acres) ^a	Notes / Action Items
TA-1		TA	6,930	
TA-2		TA	5,941	
TA-3 ^b		TA	1,617	
TA-4		TA	3,717	
	R-200	SAR		Summit Meadows Ambush Site with multiple firing points
	R-201 ^c	SAR		Historical munitions use, currently part of maneuver area
	R-202 ^c	SAR		Historical munitions use, currently part of maneuver area
TA-5		TA	6,560	
	R-100	SAR		Pistol, shotgun, and M16 range
	Sniper-1/Sniper-2	SAR		Aspen Bowl; each a single static firing point for snipers
TA-6		TA	5,447	
	R-300	SAR		Silver Creek Range with multiple firing points
	R-700	SAR		Shepherd's Cabin Range with multiple firing points
TA-7		TA	1,555	
TA-8		TA	2,791	
	Sniper-3/Sniper-4	SAR		Wolf Creek; each a single static firing point for snipers
TA-9		TA	2,729	
TA-10 ^e		TA	3,100	
	R-600	SAR		Sardine Biathlon Range with multiple firing points
	Demo-1	Demonstration area		Anti-personnel obstacle demonstration (snow avalanche)
TA-11 ^e		TA	4,830	
	Demo-2	Demonstration area		Anti-personnel obstacle demonstration (snow avalanche)
	Demo-3	Demonstration area		Anti-personnel obstacle demonstration (snow avalanche)
	R-400/R-800 ^f	SAR		Leavitt Lake Ambush Site and Live Fire and Maneuver
	R-500	SAR		Leavitt Mountain Leader Ambush Range with multiple firing points
TA-12	Climbing area	Climbing area	N/A	

Total Operational Range Area
45,217^g

^aTotal TA acreages are based on the 2003 Section 366 Report; however, acreages are not consistent with Interagency Agreement (IA) per MCMWTC Bridgeport and USFS liaison. Approximately 46,000 acres are included in the IA north of State Highway (Hwy) 108. The IA does not include TA-11 or portions of TA-10 located south of Hwy 108. As a result, acreages listed for individual TAs may be incorrect. Surface danger zones for individual ranges within TAs are found in the MCMWTC Range Regulations (2001).

^bGrouse Meadows, located in TA-3, is noted to be a location where anti-personnel demonstrations (tree fall) or "demos" are performed; there is no formally recognized fixed physical location for this activity.

^cKnown ranges with historical use (R-201 and R-202) are noted in this table, though not the associated figure.

^dC4 is composed of 96% Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), a REVA indicator MC. Source: MCMWTC Range Regulations (2001), Section 4009, Demolitions, Booby Traps, and Pyrotechnics.

^eTA-11 and portions of TA-10 south of Hwy 108 are used by MCMWTC Bridgeport through an annual special use permit from the USFS for winter use only.

^fRanges R-400 and R-800 are located adjacent to Leavitt Lake. It is also noted that a biathlon course used by MCMWTC Bridgeport is in this area. Very limited munitions use, involving firing small arms into the southern side of the bowl surrounding Leavitt Lake is associated with this course. The area is not formally recognized in the MCMWTC Range Regulations (2001).

^gThe total area is presented as shown in the 366 Report and is correct for the total area covered north of Hwy 108. It is also noted that an additional 7,000 acres south of Hwy 108 are used under annual permit from the USFS, including portions of TA-10 and all of TA-11. There are also 480 acres in Nevada at Sweetwater Strip, but no ordnance use or delivery occurs there. The sum of these three areas used by MCMWTC Bridgeport is approximately 53,000 acres (IA area, Special Use area, and Sweetwater Strip).



Twelve operational SARs were identified within the TAs (USMC, 2001):

- R-100
- R-200
- R-300
- R-400/R-800
- R-500
- R-600
- R-700
- Sniper-1/Sniper-2
- Sniper-3/Sniper-4

The typical REVA assessment includes a screening model for octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, trinitrotoluene, RDX, and perchlorate, while the SARs are evaluated qualitatively for lead. Live fire for operational ranges at MCMWTC Bridgeport is primarily on SARs. Therefore, only qualitative assessments for SARs, using the SAR Assessment Protocol (Appendix A), were conducted for MCMWTC Bridgeport operational ranges.

The SARs are qualitatively reviewed and assessed to identify factors that influence the potential for lead migration, including:

- design and layout,
- physical and chemical characteristics of the area, and
- current and past operation and maintenance practices.

In addition, potential receptors and pathways have been identified relative to the SARs being assessed. The results of the SAR Assessments suggest minimal to moderate environmental concern evaluation rankings, which do not require further action. Preliminary work conducted in 1997 by the U.S. Army Corps of Engineers on the only fixed pistol range at MCMWTC Bridgeport, R-100, did not find lead to be migrating off range at that location. Table ES-2 identifies the results of the SAR Assessments for MCMWTC Bridgeport.

The four demonstration ranges at MCMWTC Bridgeport are not considered areas of concern for small arms use or other MC. In addition, severe restrictions on the use of tracers, pyrotechnics, and non-small-arms munitions are in place to promote public and fire safety. A limited amount of smoke grenades and illumination devices is also issued for use at MCMWTC Bridgeport; some of these munitions contain the indicator MC. However, the devices do not represent a source of lead, as installation personnel stated that expended devices and duds are recovered immediately after exercises to alleviate explosive safety concerns. There is the potential that some MC may be released to the environment when the items are expended. However, with the limited sporadic use of these munitions and the fact that the majority of the MC are consumed when the items are expended, the potential for MC loading to be present at levels that may have the potential to result in an off-range release is considered negligible.

Two former range areas were identified as other than operational ranges and, therefore, excluded from REVA because they are addressed under the Military Munitions Response Program. The Sweetwater Flight Strip in Nevada was also screened from REVA modeling or SAR Assessment because personnel interviews and document reviews during the REVA site visit indicated that no munitions are or have been used at that facility.

Table ES-2: Summary of SAR Assessment Results

Range Number/Name	Surface Water Environmental Concern	Groundwater Environmental Concern
R-100	Minimal to moderate	Minimal to moderate
R-200	Minimal to moderate	Moderate
R-300	Minimal to moderate	Moderate
R-400/R-800	Moderate	Moderate
R-500	Minimal to moderate	Minimal to moderate
R-600	Minimal to moderate	Minimal to moderate
R-700	Minimal to moderate	Moderate
Sniper-1/Sniper-2	Minimal ^a	Minimal ^b
Sniper-3/Sniper-4	Minimal ^b	Minimal ^b

^a Original protocol environmental concern evaluation ranking was minimal to moderate; the ranking was adjusted based on professional judgment.

^b Original protocol environmental concern evaluation ranking was moderate; the ranking was adjusted based on professional judgment.

1. Introduction

1.1. Purpose

The United States (U.S.) Marine Corps (Marine Corps) Range Environmental Vulnerability Assessment (REVA) program was developed to support the Marine Corps Range Sustainment Program. REVA meets the requirements of the current Department of Defense (DoD) Directive 4715.11 *Environmental and Explosives Safety Management on Operational Ranges within the United States* and DoD Instruction 4715.14 *Operational Range Assessments*.

The Marine Corps has implemented its REVA program at Marine Corps Mountain Warfare Training Center (MCMWTC) Bridgeport, California (CA) (Figure 1-1). The REVA program is a screening-level evaluation of the potential for munitions constituents (MC) to migrate from operational range areas to off-range areas at an installation. The REVA program screens the MC loading areas through an interactive process using simple, conservative surface water and groundwater models or qualitative assessments for small arms ranges (SARs) to evaluate if MC could migrate off range. SARs are assessed qualitatively through the REVA SAR Assessment Protocol (SARAP) (Appendix A). As a component of the Marine Corps Range Sustainment Program, the REVA operational range assessments enhance the Marine Corps' ability to prevent or respond to a release or substantial threat of a release of MC from an operational range or range complex to off-range areas.

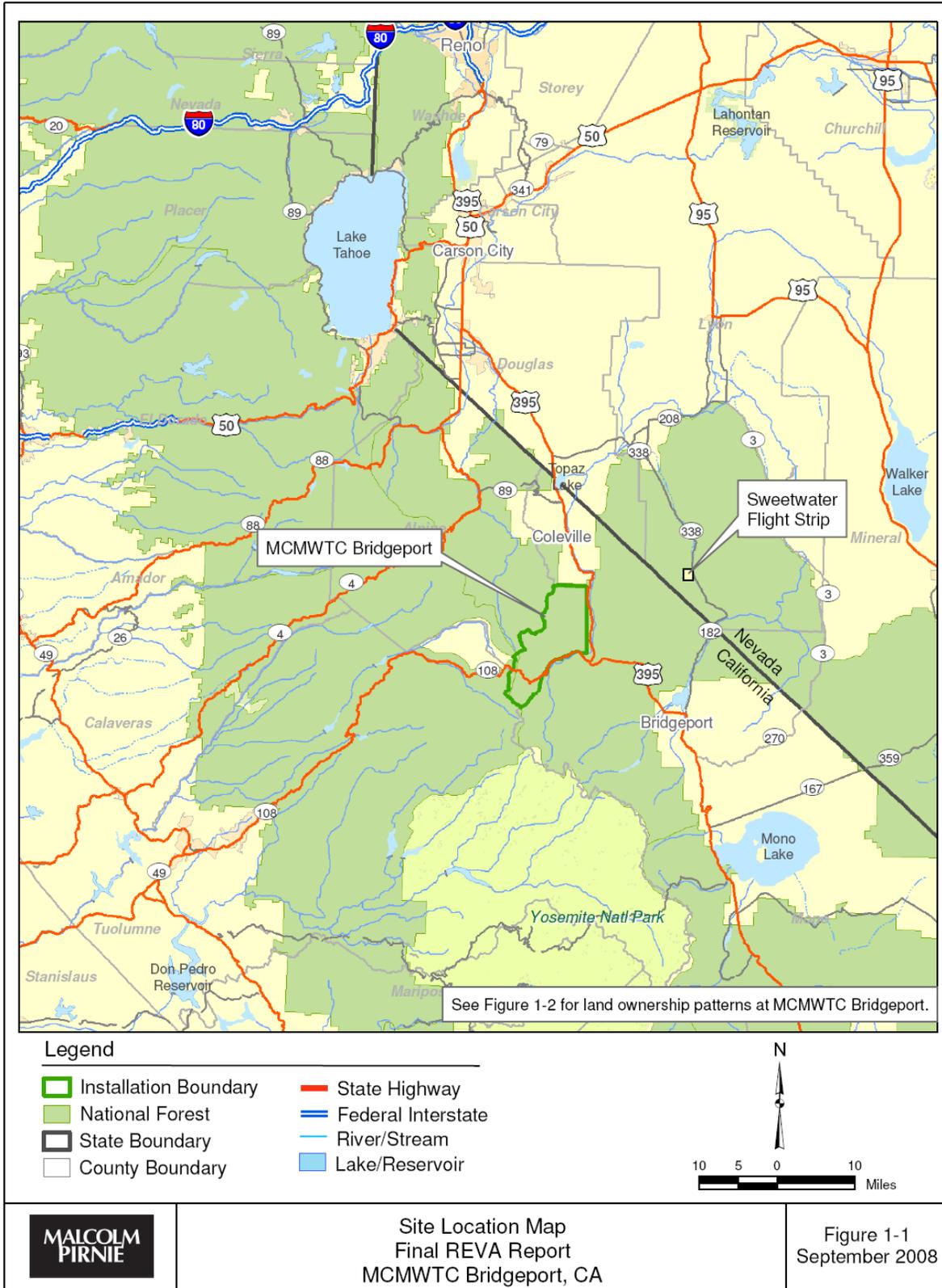
This report presents:

- qualitative assessment results for the operational ranges and training areas (TAs) within the MCMWTC Bridgeport boundaries and
- a baseline of environmental conditions of the operational ranges at MCMWTC Bridgeport.

1.2. Scope and Applicability

The REVA for MCMWTC Bridgeport includes all operational ranges and TAs managed by the installation (Figure 1-2).

Figure 1-1: Site Location Map



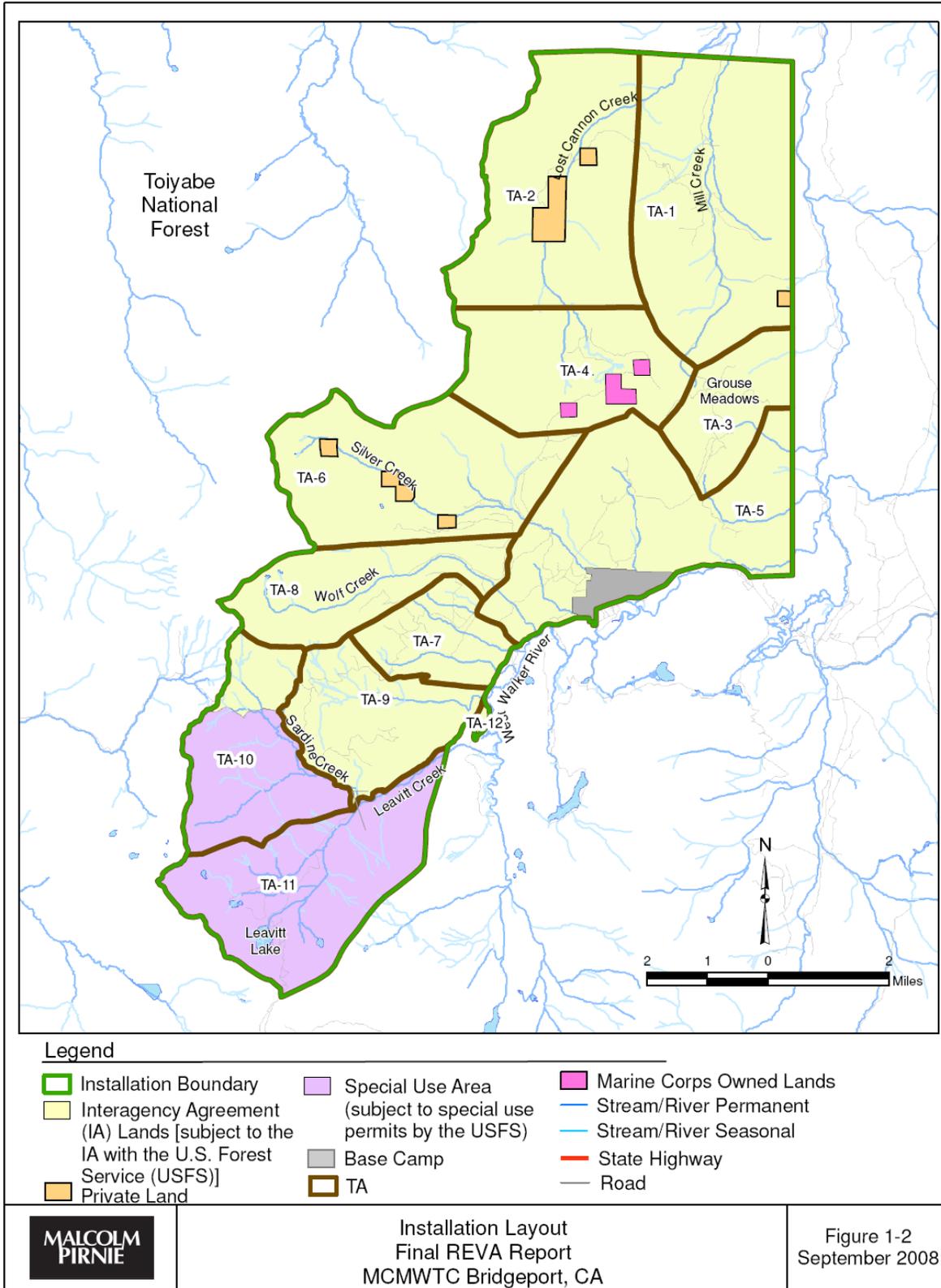
P:\6285\024\GIS\Bridgeport\030-June08_Fig 1-1.mxd



Headquarters Marine Corps
Range Environmental Vulnerability Assessment
4418024



Figure 1-2: Installation Layout



**MALCOLM
PIRNIE**

Installation Layout
Final REVA Report
MCMWTC Bridgeport, CA

Figure 1-2
September 2008

P:\6285\024\GIS\Bridgeport\026-June08_Fig 1-2.mxd

**MALCOLM
PIRNIE**

Headquarters Marine Corps
Range Environmental Vulnerability Assessment
4418024



The REVA process considers the potential for range vulnerabilities related to MC potentially deposited, or loaded, on the land as a result of the use of military munitions on operational ranges and TAs. The indicator MC typically assessed in REVA include trinitrotoluene (TNT); octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX); hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX); lead; and perchlorate. Data on site-specific environmental conditions are compiled, if available, and MC loading rates and areas are estimated. A conceptual site model (CSM) is developed to describe the potential MC transport pathways and receptors.

The REVA process included an analysis of the types of military munitions used at MCMWTC Bridgeport. The primary munitions activities conducted at MCMWTC Bridgeport involve the use of small arms. MC associated with small arms ammunition commonly used at operational ranges include lead, antimony, copper, and zinc. REVA focuses on lead as the indicator MC for SARs because lead is the most prevalent (by weight) potentially hazardous constituent associated with small arms ammunition.

No specific quantitative conclusions can be made regarding the fate and transport of lead since it is unlike any other MC. Lead is geochemically specific regarding its mobility in the environment. Site-specific conditions (i.e., geochemical properties) must be known in order to quantitatively assess lead migration. Site-specific geochemical properties cannot be predicted accurately and can be characterized only via sampling. Unlike the other indicator MC in REVA, without site-specific physical and chemical characterization, lead cannot be modeled effectively using fate and transport modeling. The scientific community has established that metallic lead (such as recently fired, unweathered bullets and shot) generally has low chemical reactivity and low solubility in water and is relatively inactive in the environment under most ambient or everyday conditions. However, a portion of lead deposited on a range may become environmentally active if the right combination of conditions exists. As a result, SARs at MCMWTC Bridgeport were qualitatively reviewed using the REVA SARAP.

The SARAP identifies factors that influence the potential for lead migration at the operational range boundary, including the range's design and layout, the physical and environmental conditions of the area, and current and past operation and maintenance practices. For operational ranges within this assessment, the amount of lead expected to have been loaded to the area was conservatively estimated.

The REVA process also identified some munitions other than small arms used at MCMWTC Bridgeport demonstration areas. It was determined that potentially deposited amounts of TNT, HMX, RDX, and perchlorate associated with the use of demonstration areas are minimal and did not require further assessment. The Sweetwater Flight Strip in Nevada, identified in Figure 1-1, has no operational ranges or munitions use; therefore, no further assessment of the flight strip was needed.

This report presents the analysis of:

- data collected during the REVA site visit to the installation conducted from 17 through 21 July 2006 and
- supplemental data sources, as described in Section 2.

Additional information regarding the steps and methods used in the complete assessment process are outlined in the *REVA Reference Manual* (former *Draft REVA User's Guide*) (HQMC, 2006).

As noted, this REVA report serves as a baseline environmental operational range assessment report. This document presents the conditions of the operational ranges at the time the assessment was conducted. The baseline environmental operational range assessment is based on available Marine Corps data, site observations, and information obtained while conducting personnel interviews. It is supplemented with referenced information from external sources, including reports and databases.

1.3. Report Organization

This REVA baseline environmental operational range assessment report for MCMWTC Bridgeport is organized into the following sections:

- Section 1 – Introduction
- Section 2 – Summary of Data Collection Effort
- Section 3 – Conceptual Site Model
- Section 4 – Munitions Constituents Loading Rates and Assumptions
- Section 5 – Small Arms Range Assessments
- Section 6 – References

2. Summary of Data Collection Effort

Data required for the operational range assessments were obtained from:

- Headquarters Marine Corps (HQMC),
- MCMWTC Bridgeport (during the site visit by the REVA team and in follow-up requests), and
- external data sources.

Data obtained from HQMC and the installation include various documents and reports for studies conducted for the installation. Examples include available training records and munitions use (expenditure data), available lead sampling data at MCMWTC Bridgeport, the Marine Corps Section 366 Report (which lists operational ranges at MCMWTC Bridgeport), Installation Restoration Program reports, natural and cultural resources surveys, maps, on-installation well data, historical agreements with the U.S. Department of Agriculture (USDA) and the U.S. Forest Service (USFS), and available geographic information system (GIS) data. External data sources include report and Internet searches at organizations such as the U.S. Geological Survey (USGS), the USDA Soil Conservation Service, the USFS, the California Department of Fish and Game (CDFG), and the Lahontan Regional Water Quality Control Board (RWQCB). References for collected data are presented in Section 6 of this REVA report.

A site visit was conducted by the REVA assessment team from 17 through 21 July 2006. The REVA team was accompanied by HQMC and Training and Education Command personnel during the site visit (DON, 29 June 2006). The installation site visit involved a review of various data repositories and interviews with installation personnel from the following offices:

- Environmental Office
- Facilities Maintenance
- Logistics (S-4)
- Natural Resources / Cultural Resources Branch Head, Environmental Office
- Operations (S-3, including Range Safety Officer)

At the time of the 2006 REVA site visit, there was not a centralized Range Control, Training and Operations Office, or Public Affairs Office at MCMWTC Bridgeport. The Range Safety Officer and S-4 have maintained records associated with training activities and munitions expenditures. Since the 2006 REVA site visit, MCMWTC Bridgeport has begun to establish a Range Control Center, which will improve data collection regarding range usage and munitions expenditure records.

3. Conceptual Site Model

The REVA team developed a CSM to characterize the dynamics at MCMWTC Bridgeport that can affect MC migration from operational ranges. The CSM was developed using information obtained during the REVA site visit and from environmental documents obtained from the installation and local geologic studies. Where details of site-specific characteristics and information did not exist, available regional information was used to estimate site-specific characteristics. The CSM was used in conjunction with additional range-specific environmental data to apply the SARAP to produce the SAR Assessments, presented in Section 5 and Appendix B.

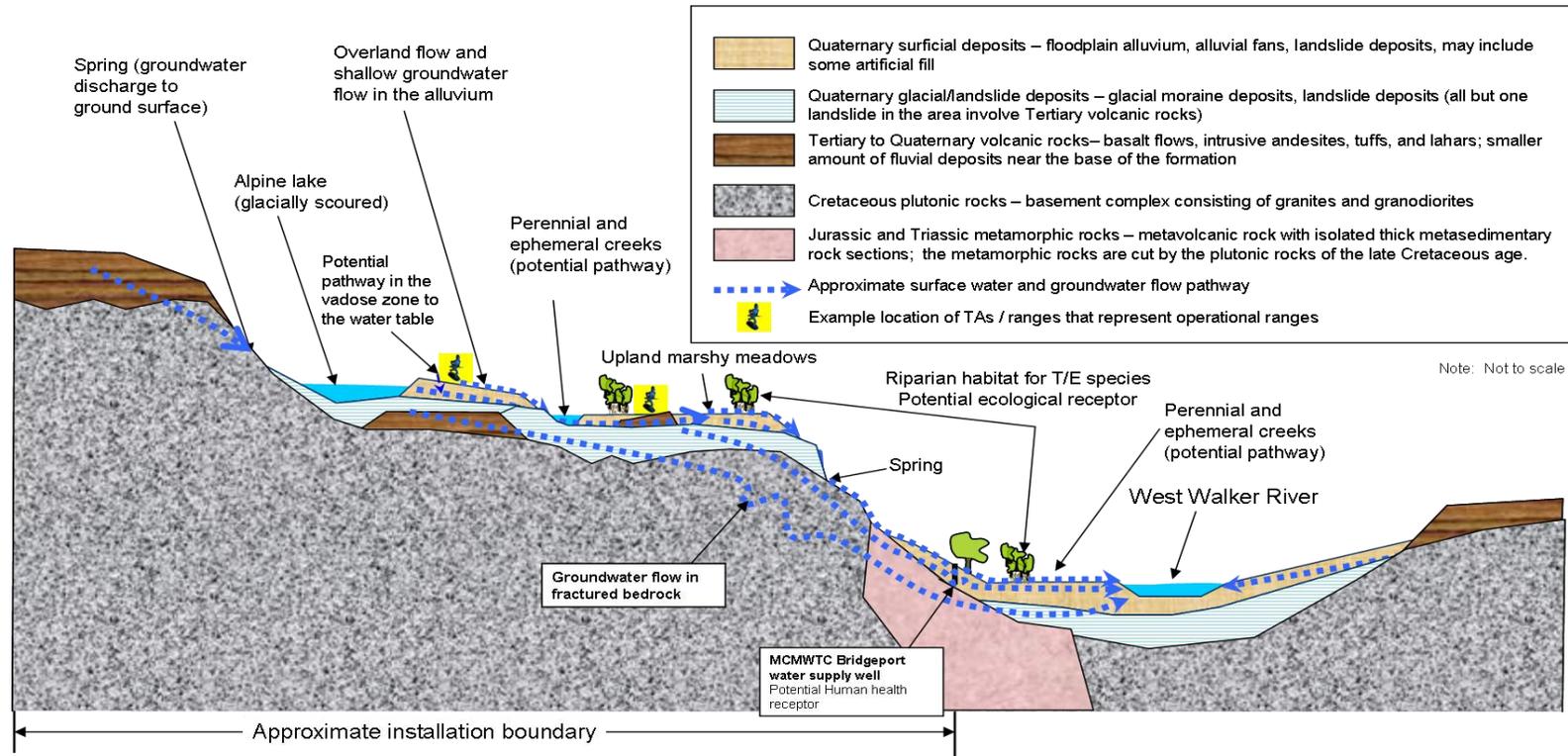
The CSM presented in this section includes:

- installation background, geography, and topography;
- the geologic, hydrologic, and environmental setting of the site;
- a discussion of primary receptors, if present; and
- a discussion of potential MC migration pathways.

Primary receptors are human beings and animal and plant species that are exposed, or that may be exposed, to MC potentially released from an operational range. Potential MC migration pathways evaluated under REVA are defined as the transport mechanisms by which MC could move off range and reach a receptor through surface water or groundwater flow. As part of the MCMWTC Bridgeport CSM, potential receptors (e.g., drinking water wells, sensitive species) were identified. Assessing the potential for off-range migration of MC includes an evaluation of potential MC migration pathways to determine if a potential pathway/receptor interaction exists.

The following sections describe the site characteristics reviewed and the general CSM developed for MCMWTC Bridgeport. Figure 3-1 is a schematic diagram of the site conditions addressed in this CSM. Figure 3-2 shows the general locations of the operational ranges and TAs at MCMWTC Bridgeport with respect to watersheds and streams. The general surface and subsurface geologic conditions of the installation are shown relative to MC loading areas, the range boundaries, groundwater and surface water flow pathways, and potential receptors.

Figure 3-1: CSM of the Geology and Hydrogeology: MCMWTC Bridgeport, CA



Notes:

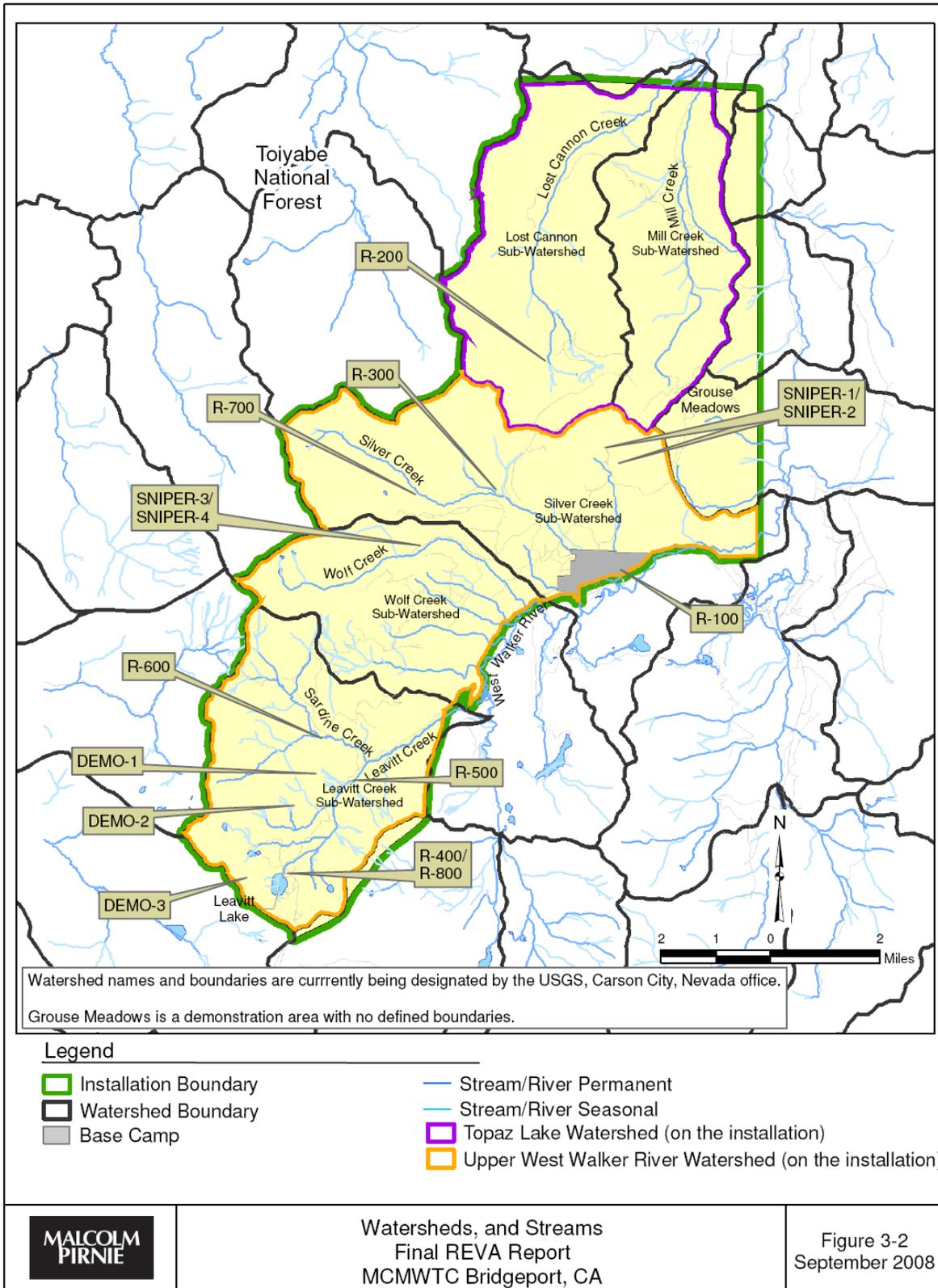
The cross section is based on a basic distribution of types of geological units and features. The graphic represents the general conceptual model for the surface and groundwater flow on the installation. The features present a typical representation of drainage basins relative to general surface water and groundwater pathways and not as a geologic cross section with accurate subsurface contacts and surficial outcrops.

Four major processes control the potential movement of groundwater and surface water from loading areas:

1. Surface water transport within ranges to the range boundary, including runoff to the creeks within or adjacent to the range, as well as surface water flow to the West Walker River and the underlying unconsolidated quaternary deposits
2. Shallow groundwater flow to discharge points in ephemeral creeks or springs
3. Infiltration water through the vadose zone through soil in the ranges to shallow groundwater
4. Groundwater flow in deeper fractured bedrock groundwater systems; site conditions suggest that groundwater eventually will be discharged into the West Walker River or underlying unconsolidated deposits.

Geology modified from Guisso, 1981.

Figure 3-2: Watersheds and Streams



P:\6285\024\GIS\Bridgeport\027-June08_Fig 3-2.mxd

3.1. Installation Overview

This portion of the CSM discusses the installation background and layout.

3.1.1. Installation Background

The operational ranges and TAs at MCMWTC Bridgeport, CA, were established in late 1951 (MCMWTC, n.d.). Current MCMWTC Bridgeport activities are spread over approximately 53,000 acres in the Toiyabe National Forest in the eastern Sierra Nevada Mountains. Approximately 46,000 acres are used under an Interagency Agreement (IA) with the USFS. An additional 7,000 acres used for training are subject to special use permits with the USFS (see Section 3.2). The Sweetwater Flight Strip in Nevada is part of MCMWTC Bridgeport, but is not included in this acreage (Figure 1-1). According to HQMC, the Sweetwater Flight Strip is used for “touch-and-go” landings, but it is not used for ordnance delivery or use (MCMWTC, n.d.).

According to the 2003 Section 366 Report prepared by the Marine Corps, MCMWTC Bridgeport

...conducts individual, small unit, and battalion level training in summer and winter mountain operations. The training emphasizes individual and unit mountain skills that enhance overall combat capability. Summer mountain operations include mountain safety, military rock climbing, fixed rope navigation, mountain navigation, rappelling, and planning/coordinating unit movements along rugged terrain. Winter mountain operations include cold weather safety, individual survival, cold weather bivouacs, route selection, over-the-snow mobility techniques, and avalanche safety.

3.1.2. Installation Layout

As noted previously, the location of MCMWTC Bridgeport is shown in Figure 1-1, and the layout of the installation is shown in Figure 1-2. MCMWTC Bridgeport training activities occur on 12 TAs, which include 12 operational live-fire fixed ranges and four demonstration areas (HQMC, 2003). Live fire is limited to SARs, and demonstration areas are for anti-personnel obstacle creation exercises (i.e., avalanche initiation and tree removal). Live fire is not the primary focus of the overall MCMWTC Bridgeport training program. As noted above, MCMWTC Bridgeport programs focus on mobility, orienteering, and survival in cold weather and mountainous terrain. Therefore, operational range usage, specifically MC loading (see Section 4), is generally lower at MCMWTC Bridgeport than at other Marine Corp installations.

The following SARs or range complexes were identified:

- R-100
- R-200
- R-300
- R-400/R-800, including the unnamed biathlon range
- R-500
- R-600
- R-700
- Sniper-1/Sniper-2
- Sniper-3/Sniper-4

Four demonstration areas were identified:

- Demo-1
- Demo-2
- Demo-3
- Grouse Meadows

Two ranges were identified as other than operational ranges and, therefore, excluded from REVA because they are addressed under the Military Munitions Response Program:

- R-201
- R-202

Table 3-1 identifies the TAs where these operational and other than operational ranges are located. Upper and lower Base Camps, which include the Expeditionary Airfield and Cantonment, are located along California State Highway (Hwy) 108 at Pickel Meadows in TA-5.

3.2. Land Ownership, Use, and IAs

The area encompassed by MCMWTC Bridgeport is predominately publicly owned land in the Toiyabe National Forest in California's Eastern Sierras and in the Sweetwater Range in Nevada. The Marine Corps owns approximately 200 acres of land in TA-4 within the Silver Creek watershed (Figure 1-2). Private land parcels within the installation boundary total 440 acres (MCMWTC Bridgeport personnel; DON et al., 2006). Three parcels are located just upstream and one parcel is located just downstream of R-700 in TA-6. Two parcels are located on Lost Cannon Creek in TA-2. Two other than operational ranges (historical ranges R-201 and R-202) are located at Summit Meadow, approximately 3 miles upstream of the parcels in TA-6.

In 1951, the Marine Corps initiated cold weather training on a 20-acre parcel at Pickel Meadows through a USFS special use permit. Over three decades, a series of IAs were signed; in 1982, the area designated for training included 46,000 acres. This IA area

Table 3-1: Range Summary

TA Name	Fixed Range	Use	Size (acres) ^a	Notes / Action Items
TA-1		TA	6,930	
TA-2		TA	5,941	
TA-3 ^b		TA	1,617	
TA-4		TA	3,717	
	R-200	SAR		Summit Meadows Ambush Site with multiple firing points
	R-201 ^c	SAR		Historical munitions use, currently part of maneuver area
	R-202 ^c	SAR		Historical munitions use, currently part of maneuver area
TA-5		TA	6,560	
	R-100	SAR		Pistol, shotgun, and M16 range
	Sniper-1/Sniper-2	SAR		Aspen Bowl; each a single static firing point for snipers
TA-6		TA	5,447	
	R-300	SAR		Silver Creek Range with multiple firing points
	R-700	SAR		Shepherd's Cabin Range with multiple firing points
TA-7		TA	1,555	
TA-8		TA	2,791	
	Sniper-3/Sniper-4	SAR		Wolf Creek; each a single static firing point for snipers
TA-9		TA	2,729	
TA-10 ^e		TA	3,100	
	R-600	SAR		Sardine Biathlon Range with multiple firing points
	Demo-1	Demonstration area		Anti-personnel obstacle demonstration (snow avalanche)
TA-11 ^e		TA	4,830	
	Demo-2	Demonstration area		Anti-personnel obstacle demonstration (snow avalanche)
	Demo-3	Demonstration area		Anti-personnel obstacle demonstration (snow avalanche)
	R-400/R-800 ^f	SAR		Leavitt Lake Ambush Site and Live Fire and Maneuver
	R-500	SAR		Leavitt Mountain Leader Ambush Range with multiple firing points
TA-12	Climbing area	Climbing area	N/A	

Total Operational Range Area
45,217^g

Notes:

N/A = not applicable

^a Total TA acreages are based on the 2003 Section 366 Report; however, acreages are not consistent with IA per MCMWTC Bridgeport and USFS liaison. Approximately 46,000 acres are included in the IA north of Hwy 108. The IA does not include TA-11 or portions of TA-10 located south of Hwy 108. As a result, acreages listed for individual TAs may be incorrect. Surface danger zones for individual ranges within training areas are found in the MCMWTC Range Regulations (2001).

^b Grouse Meadows, located in TA-3, is noted to be a location where anti-personnel demonstrations (tree fall) or "demos" are performed; there is no formally recognized fixed physical location for this activity.

^c Known ranges with historical use (R-201 and R-202) are noted in this table, though not the associated figure.

^d C4 is composed of 96% RDX, a REVA indicator MC. Source: MCMWTC Range Regulations (2001), Section 4009, Demolitions, Booby Traps, and Pyrotechnics.

^e TA-11 and portions of TA-10 south of Hwy 108 are used by MCMWTC Bridgeport through an annual special use permit from the USFS for winter use only.

^f Ranges R-400 and R-800 are located adjacent to Leavitt Lake. It is also noted that a biathlon course used by MCMWTC Bridgeport is in this area. Very limited munitions use is associated with this course, involving firing small arms into the southern side of the bowl surrounding Leavitt Lake. The area is not formally recognized in the MCMWTC Range Regulations (2001).

^g The total area is presented as shown in the 366 Report and is correct for the total area covered north of Hwy 108. It is also noted that an additional 7,000 acres south of Hwy 108 are used under annual permit from the USFS, including portions of TA-10 and all of TA-11. There are also 480 acres in Nevada at Sweetwater Strip, but no ordinance use or delivery occurs there. The sum of these three areas used by MCMWTC Bridgeport is approximately 53,000 acres (IA area, Special Use area, and Sweetwater Strip).



corresponds to TA-1 through TA-9, TA-12, and the portion of TA-10 north of Hwy 108 (Figure 1-2). An additional 480 acres in the nearby Sweetwater Mountains of Nevada are used as a landing strip (Sweetwater Flight Strip). Approximately 7,000 acres to the south of Hwy 108 are also used by MCMWTC Bridgeport, including the remainder of TA-10 and all of TA-11. The USFS issues an annual special use permit for these non-IA acres. The permit for 2007 was up for renewal in December 2007.

An agreement for a land interchange is underway between the DoD and the USFS to convey the Marine Corps' acreage in the Silver Creek watershed to the USFS in exchange for approximately 300 acres at MCMWTC Bridgeport Base Camp. The interchange effectively would restrict public use of the Base Camp at Pickel Meadows and bring it under Marine Corps control. This land interchange would bring R-100 into the Base Camp parcel (DON et al., 2006).

Other IAs and permits reviewed in MCMWTC Bridgeport's files include:

- procedures for establishing military activities on USFS lands, including the conformity with applicable forest plans and compatibility with other uses and
- cooperation and coordination agreements, including conservation programs, planning, law enforcement, and road construction.

Because of its location in Toiyabe National Forest, MCMWTC Bridgeport is part of an area popular for public recreational activities, including fishing, hunting, and camping (USFS, 2001). However, residential, commercial, or farming areas do not exist within the boundary of the installation. West Walker River is a popular trout fishing location. Based on interviews and observations, Leavitt Lake is noted to be a relatively popular public camping area. The area is also used for mule deer hunting. The USFS opens up the area around the Leavitt Lake bowl to "over-snow vehicles" each winter season through April 15 as a result of the West Hoover Travel Management Decision in 2005 (USDA, 2005a). According to the Humboldt-Toiyabe National Forest Web site, the end date for snowmobile use can vary at the discretion of the Bridgeport Ranger Station District Ranger (USFS, 2007).

The California Wild Heritage Act of 2007, S. 493 (109th Congress), is one of the bills introduced to the U.S. Congress in the last few years that proposes to set aside lands near Leavitt Lake as USFS wilderness. If passed as currently written, this law would not restrict Marine Corps activities in those areas. According to information available in July 2007, the bill was introduced by California's Senator Boxer in February 2007, is identical to H.R. 860 in the House of Representatives, and has been referred to the Senate Energy and Natural Resources Committee (GovTrack.us, 2007). No further action has been recorded. Figure 3-3 shows a map of proposed wilderness planning areas, as well as their relationship to MCMWTC Bridgeport TAs; the map was obtained from Marine Corps Installation West Government Affairs in 2007.

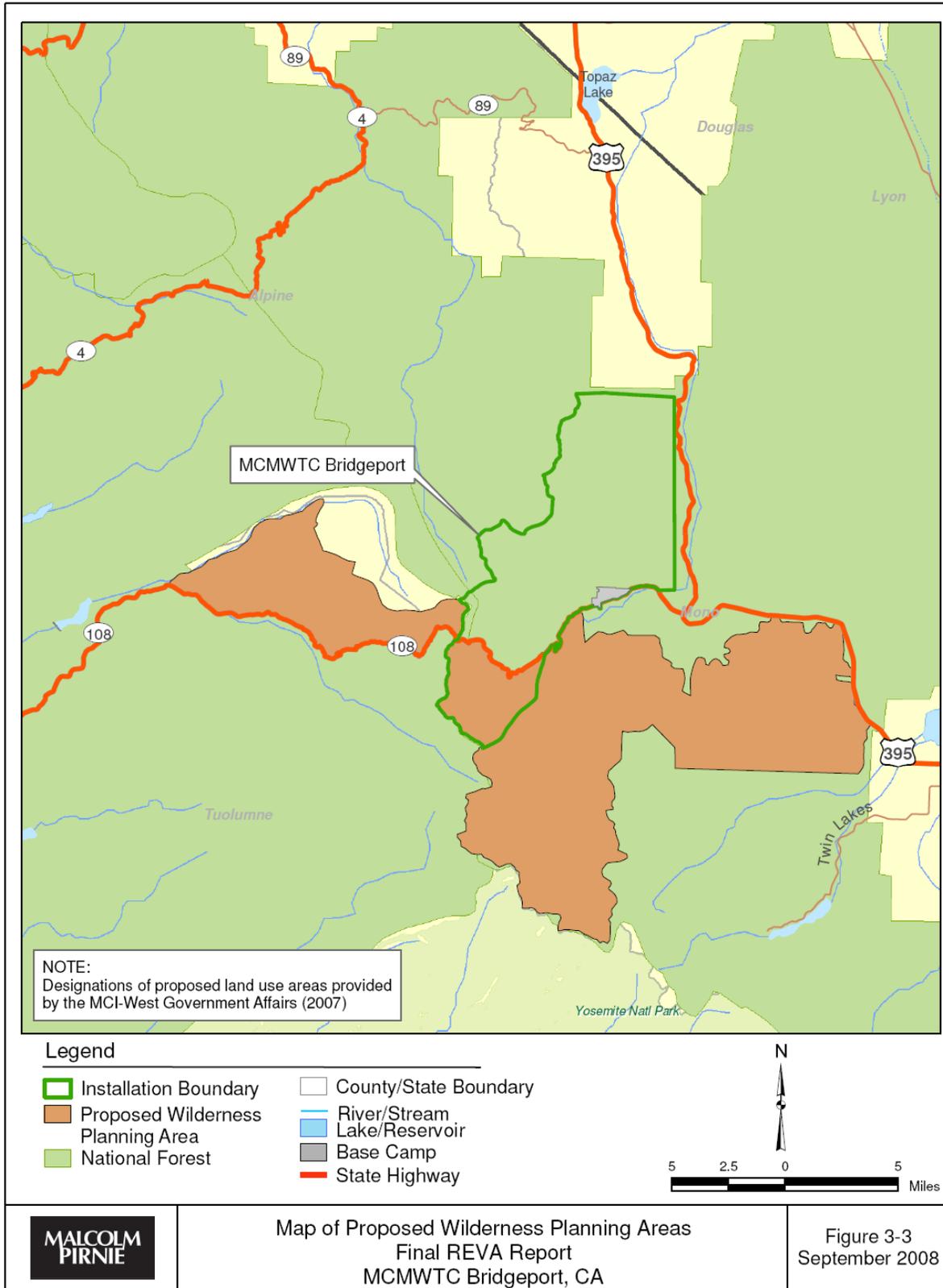
Seasonal livestock grazing also occurs on some portions of the area. According to a 2003 natural and cultural resources report prepared for the Marine Corps, three active grazing allotments and one inactive grazing allotment occur within MCMWTC Bridgeport (PHE, 2003). The allotment areas total 15,819 acres and include:

- Silver Creek sheep and goat allotment (inactive since the early 1990s, but reopened for use in the summer of 2007);
- Mill Canyon sheep and goat allotment (for grazing during the month of June);
- Lost Cannon cattle and horse allotment (for grazing from mid-July through September); and
- Sardine cattle and horse allotment (for grazing from mid-July through September).

According to MCMWTC Bridgeport environmental personnel, the Silver Creek allotment was reopened during the summer of 2007 and will be active for an indefinite period of time due to conflicts with the Sierra bighorn sheep in southern Mono County.

The natural and cultural resources report states that the USFS issues annual operating instructions for the active allotments (PHE, 2003). The instructions include preventing stream bank disturbance and avoiding areas known to contain federally listed or candidate threatened and endangered species (see Sections 3.7.3). Installation Range Regulations require notification of the Range Control Officer in the event that livestock are grazing in a TA. If grazing interferes with training activities, the Marines wait until the livestock move from the area before continuing an exercise (USMC, 2001).

Figure 3-3: Map of Proposed Wilderness Planning Areas



P:\6285\024\GIS\Bridgeport\025-June08_Fig 3-3.mxd



Wildfires, usually attributed to lightening strikes according to installation personnel, are a relatively common occurrence in the Toiyabe National Forest within the boundaries of the installation (USDA, 2005b; USFWS, 2005). MCMWTC Bridgeport has implemented rules and procedures (e.g., no use of tracers, controlled use of explosives, casing and dud recovery practices) to minimize fires attributable to military activities.

3.3. Physical Features of the Study Area

MCMWTC Bridgeport lies on the eastern side of the Sierra Nevada Mountains, which are oriented southeast to northwest, with the east side steepest and the west side tilted at a relatively gentle slope. The entrance and Base Camp for MCMWTC Bridgeport are located on the northern flank of Pickel Meadow, approximately 4 miles east of the junction with U.S. Route 395 on Hwy 108 (Figure 1-1) (NIMA, 2001). The Base Camp area is located on an elevated terrace above the West Walker River near the entrance of the installation. The Base Camp covers an area of approximately 532 acres. The elevation of MCMWTC Bridgeport is 6,762 feet at Base Camp; elevations rise to 11,459 feet in the TAs. The installation is bounded on two sides by federal wilderness areas and is approximately 11 miles northeast of Yosemite National Park (HQMC, 2003). Figure 3-2 shows the general locations of the operational ranges and TAs at MCMWTC Bridgeport with respect to watersheds and streams.

3.4. Surface Hydrology

The MCMWTC Bridgeport Base Camp is located approximately 1 mile north of the West Walker River. The installation boundary crosses the river in TA-5. The major streams located within the MCMWTC Bridgeport boundaries include Leavitt Creek, Wolf Creek, Silver Creek, Sardine Creek, Lost Cannon Creek, and Mill Creek (USGS, 2007). These streams and additional smaller creeks are part of watersheds and subwatersheds that drain the installation and discharge into the West Walker River (Anderson et al., 2000).

Figure 3-2 shows these watersheds as they relate to the general locations of operational ranges and TAs at MCMWTC Bridgeport. The watersheds include the following:

- Upper West Walker watershed
 - Leavitt Creek and Leavitt Lake subwatershed
 - Wolf Creek subwatershed
 - Silver Creek subwatershed
 - Sardine Creek subwatershed
- Topaz Lake watershed
 - Mill Creek subwatershed
 - Lost Cannon subwatershed

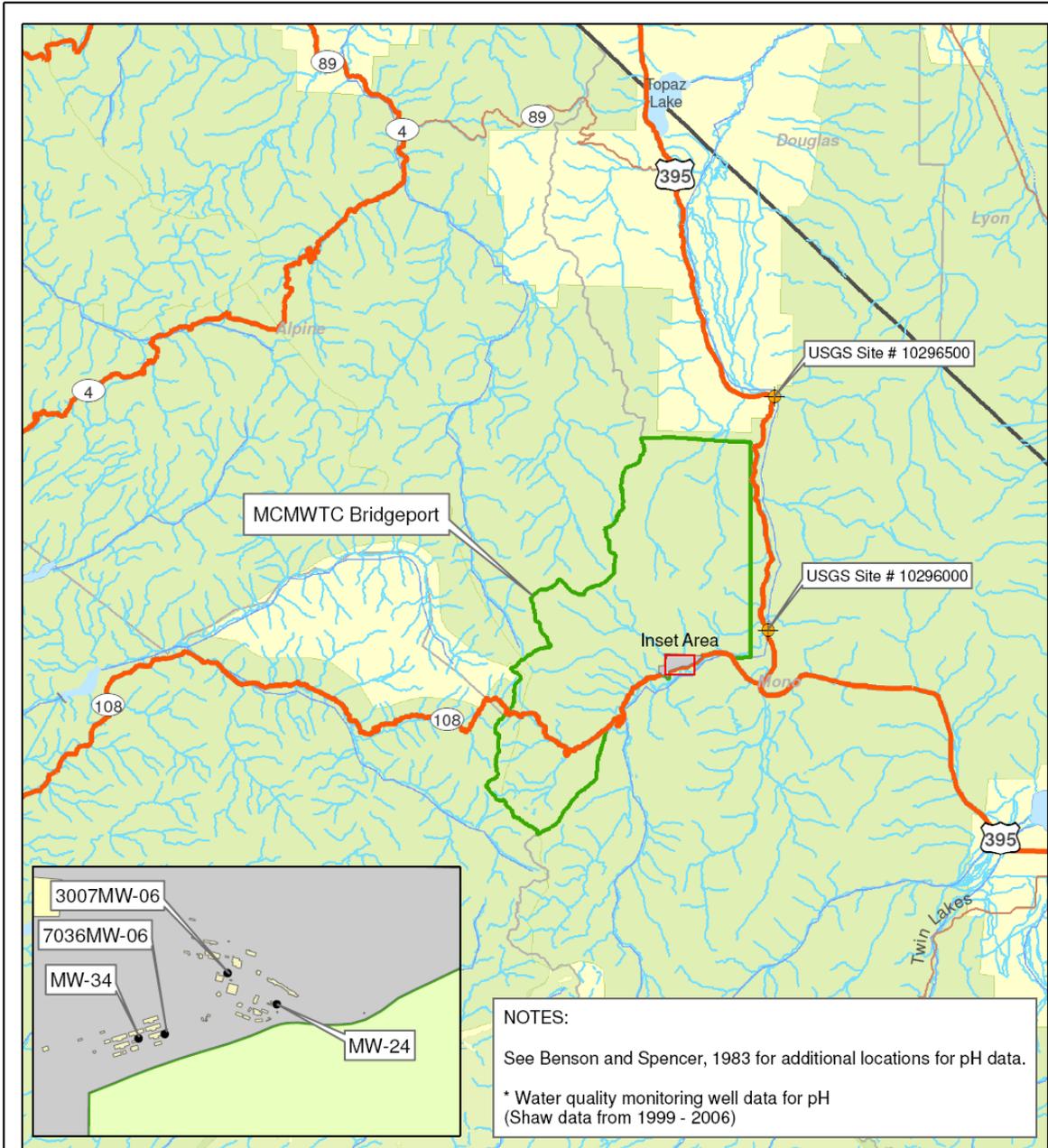
Surface water at MCMWTC Bridgeport is derived from the runoff predominantly of snowmelt and rainfall. Surface water bodies within the MCMWTC Bridgeport boundary consist of freshwater alpine lakes and intermittent and perennial creeks. Discontinuous and narrow Quaternary glacial and alluvial surficial deposits along streams are located within and adjacent to the ranges. These surficial deposits may either gain water or lose water to the streams depending on several factors, including topographic features and seasonal changes in water table elevation. Small springs occur in many locations within TAs, but the spring water typically infiltrates back into the groundwater in the higher elevations up gradient of the MCMWTC Bridgeport Base Camp (Kleinfelder, 2001).

The steep topography, soil characteristics, fire frequency, and climatic variability (heavy snowfall) can produce locally high erosion rates on the installation, although erosion was not visually observed at most operational ranges during the July 2006 REVA site visit (minimal erosion was observed at R-100). According to the natural and cultural resources report, areas prone to erosion include stream banks and areas heavily used by Marines during training exercises (PHE, 2003). A proposal is in place for CDFG and the U.S. Fish and Wildlife Service (USFWS) to work in conjunction with MCMWTC Bridgeport to install erosion control measures. For each range, a summary of the parameters associated with topography, soil characteristics, and climate data are included in Section 5 and the SAR Assessments (Appendix B).

3.4.1. Regional Climate Data

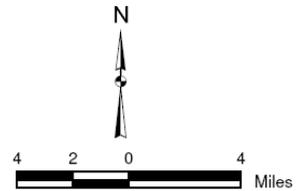
Due to seasonal climatic changes, including precipitation and temperature changes affecting snowmelt, streamflows are highest in the spring months and lowest during late summer and fall (Rockwell et al., n.d.; Smithson et al., n.d.). Based on monthly median streamflow data from 1938 to 2004 for USGS gauging station 10296000 (Figure 3-4), the median flow rate cfs was 302, 772, and 941 cubic feet per second (cfs) in April, May, and June, respectively, whereas the median flow rate was 60, 48, and 50 cfs in September, October, and November, respectively. This seasonal range of flows underscores the relationship between seasonal precipitation and surface water flows. Yearly precipitation ranges from 15 to 55 inches of rain, based on the Soil Survey Geographic Database (SSURGO). Operational ranges at MCMWTC Bridgeport are located at higher elevations than the city of Coleville, CA, located approximately 5 miles north of MCMWTC Bridgeport (Figure 1-1). Regionally related data for Coleville, CA, show the seasonal variability of temperature based on the monthly average temperatures: January (28 degrees Fahrenheit [°F]), February (30°F), March (34°F), April (39°F), May (46°F), June (54°F), July (59°F), August (59°F), September (52°F), October (44°F), November (34°F), and December (28°F) (Accuweather, 2007). The operational ranges at MCMWTC Bridgeport have generally has colder temperatures than listed above, typically producing snowfall during winter precipitation events.

Figure 3-4: Water Quality Evaluation Locations



Legend

- Installation Boundary
- National Forest
- County/State Boundary
- River/Stream
- Lake/Reservoir
- Base Camp
- State Highway
- ◆ USGS Gauging Station With Applicable Water Quality Data
- Monitoring Well*



MALCOLM PIRNIE	Water Quality Evaluation Locations Final REVA Report MCMWTC Bridgeport, CA	Figure 3-4 September 2008
---------------------------	--	------------------------------

P:\6285\024\GIS\Bridgeport\029-June08_Fig 3-4.mxd



3.4.2. Designated Beneficial Uses of Surface Waters

California's State Water Resources Control Board places MCMWTC Bridgeport into the North Lahontan Basin for the purpose of managing water use and quality. According to the *Water Quality Control Plan for the Lahontan Region, North and South Basins* (Basin Plan), the major hydrologic unit within the MCMWTC Bridgeport boundary is the West Walker River Hydrologic Unit (California RWQCB, 1994). This unit contains the two hydrologic areas (HA) applicable to the REVA program at MCMWTC Bridgeport: the Upper West Walker River HA and the Antelope Valley (Topaz Lake) HA. Within the Upper West Walker River HA, the surface waters and wetlands specified in the Basin Plan with "Beneficial Uses of Surface Waters" applicable to REVA include:

- West Walker River,
- Mill Creek,
- Lost Cannon Creek,
- Silver Creek,
- Pickel Meadows Wetlands, and
- Leavitt Meadows Wetlands.

MCMWTC Bridgeport ranges are located within and/or directly adjacent to these hydrologic subunits, and the named wetlands are downstream of the installation. Diverse beneficial uses are assigned to these perennial streams and wetlands as a result of their locations in the Eastern Sierra Mountains. The designated uses common to all the surface waters named above include municipal water supply; groundwater replenishment; contact and noncontact recreation; commercial and sport fishing; cold freshwater habitat; wildlife habitat support; and spawning, reproduction, and development of aquatic habitat. The wetlands named do not carry the commercial and sport fishing use.

In addition to the designations listed above:

- Upper West Walker River carries the designation for navigation, migration of aquatic organisms, and freshwater replenishment;
- Upper West Walker River and Silver Creek carry designations for agricultural supply;
- Silver Creek, Mill Creek, and Lost Cannon Creek carry the "RARE" designation for sensitive, threatened, and endangered species; and
- the listed wetlands carry the designated uses of water quality enhancement and floodwater storage.

The Basin Plan includes designated uses for unnamed "minor surface waters" and "minor wetlands" within these HAs. In general, the uses for minor surface waters are the same

as for Silver Creek. The uses for minor wetlands are the same as for named wetlands, with the additions of the “RARE” designation; spawning, reproduction, and development of aquatic habitat; and warm freshwater habitat support (California RWQCB, 1994).

3.4.3. U.S. Environmental Protection Agency Section 303(d) Water Quality Limited Segments

A 49-mile stretch of the West Walker River is listed on the U.S. Environmental Protection Agency’s (USEPA’s) 2002 Clean Water Act Section 303(d) List of Water Quality Limited Segments (also known as impaired water bodies) (SWRCB, 2003; USMC, n.d.). It is listed as a low priority for development of total maximum daily levels (TMDLs) for sedimentation¹. The list does not include a map of the segment; however, the Marine Corps Section 366 Report (2003) identifies the segment of the river within TA-5 as a part of this segment. This area may be potentially downstream of MCMWTC Bridgeport activities.

3.5. Base Lithology

According to Kleinfelder (1997), the four dominant lithologic units mapped on the MCMWTC Bridgeport include Tertiary volcanics, Quaternary glacial deposits, Quaternary alluvium, and artificial fill. These lithologic units are found in the Base Camp area, but other lithologies are found in the TAs based on previous geologic mapping of the area (Guisso, 1981). Cretaceous granitic basement rock and, to a lesser extent, Jurassic metamorphic rock are mapped extensively on the base. These rocks underlie the volcanic rocks and younger glacial and alluvial surficial deposits (Guisso, 1981). Surficial deposits of Tertiary-aged volcanic andesite, rhyolite, and basalt overlie intrusive granitic rock. The volcanic bedrock at the installation is dense, brown to dark black andesite previously interpreted to be flow deposits belonging to the Relief Peak Formation (Kleinfelder, 1997).

The Quaternary glacial till deposits are composed of granitic and volcanic boulders, cobbles, sand, silt, and clay (Kleinfelder, 2001). The till overlies the volcanic bedrock and is found throughout most of the installation. The Quaternary alluvium is composed of reworked and stratified glacial till and contains a high percentage of silty sand. The alluvium generally is present as terraces formed along the West Walker River. The alluvium overlies glacial till deposits and volcanic bedrock.

Artificial fill is predominantly reworked glacial till or alluvium that has been regraded in place or transported from other locations and can be difficult to distinguish from the underlying natural units. The fill is found primarily in the Base Camp area and was

¹ A TMDL is the total maximum daily amount of a pollutant that can be introduced to a water body from all sources and have the water body still meet water quality standards.

encountered to a maximum depth of 4 feet, as noted in borehole soil samples (Kleinfelder, 2001).

The geology and hydrostratigraphy within MCMWTC Bridgeport is complex and highly variable across the installation. The following description of the hydrogeology is based on general site conditions and previously mapped geologic structures.

3.6. Hydrostratigraphic Units and Groundwater Flow

Hydrostratigraphic units are geologic deposits with continuous lateral extent, with similar hydraulic conductivity and porosity (ability to allow water flow), and which define a distinct hydrologic system. Hydrostratigraphic units are not well-defined across the entire installation due to a lack of specific aquifer characteristic data and laterally discontinuous geologic units. Specific hydrogeologic data are available for portions of the Base Camp based on previous investigations. Groundwater recharge occurs through infiltration of snowmelt, rainfall, sheet flow, and discharge from some sections of intermittent and perennial creeks.

Based on observed site conditions and documentation for the Base Camp, groundwater generally flows in the following media:

- Alluvium and glacial deposits along intermittent and perennial surface streams
- Unconfined groundwater flowing hydraulically down gradient through glacial deposits, alluvium, and fractured bedrock (primarily volcanic rocks and plutonic rocks)

Alluvium and glacial deposits overlie Cretaceous intrusive rocks within and near ranges containing potential MC loading areas. Seasonal climatic changes impact the volume of and mechanisms for water infiltrating into shallow groundwater. Stream discharge could be a groundwater recharge mechanism to alluvium and glacial till deposits in the creek beds and to the shallow aquifer in the West Walker River basin. However, the perennial streams are generally gaining streams; therefore, groundwater is discharging primarily to the streams.

The following hydrogeologic data previously collected on the installation are from the upper and lower Base Camp areas (Jacobs Engineering Group, 1995 from Kleinfelder, 2001). Water levels within the installation fluctuate between 5 and 50 feet below ground surface (bgs), with the highest occurring in spring and summer (during periods of high snowmelt and runoff) and the lowest occurring in fall and winter (Kleinfelder, 2001). Past assessments at MCMWTC Bridgeport lower Base Camp reported groundwater encountered from approximately 3 to 54 feet bgs (Cory and Costa, 1995 from Kleinfelder, 1997). Groundwater generally is unconfined, but perched zones and

confined zones have been noted at areas within the Base Camp. Historical groundwater potentiometric maps suggest groundwater flows from north to south, with an average hydraulic gradient at the Base Camp of 0.05 feet/foot. Groundwater primarily flows in the surficial glacial deposits (Kleinfelder, 1997). More recent data show depth to groundwater at the lower Base Camp ranging from 10 to 68 feet bgs and at the upper Base Camp ranging from 15 to 26 feet bgs (Kleinfelder, 2001).

Previous investigations have suggested significant variability in the permeability of the water-bearing glacial till, creating variations in the hydraulic gradient (slope of the water table in unconfined aquifers). At Base Camp, hydraulic gradients range from 0.011 to 0.182 and hydraulic conductivity values are above 7.0×10^{-4} centimeters per second (Kleinfelder, 1997).

3.7. Receptors

As part of the goals for REVA, operational ranges are assessed to determine if there is off-range migration or the substantial potential for off-range migration of MC. Potential exposure pathways discussed in the CSM are surface water and groundwater. Potential receptors are identified in the sections below. A consideration at MCMWTC Bridgeport is that most of the land area is owned by the USFS and used under an IA or by special use permit (Section 3.2). Until the land interchange is approved, public access and use can occur throughout the installation.

3.7.1. Surface Water

As noted in Section 3.4.2, the streams within and downstream of MCMWTC Bridgeport carry diverse beneficial use designations, including drinking water. The streams normally are not used for drinking water on or off the installation, but recreational use of the streams and other water bodies occurs (such as fishing and swimming). The Naval Energy and Environmental Support Activity indicated in 1988 that surface water was not used for drinking water within 10 miles of the Base Camp area (NEESA, 1988 from Kleinfelder, 2001).

The immediate receptors of surface water runoff are perennial and ephemeral creeks, alpine lakes, wetlands, and marshlands. The creeks provide aquatic habitat during wet periods of the year and flow through potential habitat areas for a variety of wildlife. Sensitive, threatened, and endangered species, such as Lahontan cutthroat trout (LCT), consume surface water and shallow groundwater in habitat areas along creeks, in alpine lakes, in wetland areas, and in the West Walker River (Section 3.7.3). Livestock also graze the meadows along the West Walker River downstream of MCMWTC Bridgeport and may use grazing allotments.

3.7.2. Groundwater

According to MCMWTC Bridgeport personnel, the installation derives its water supply from groundwater on base. Two installation water supply wells are located at Base Camp, but the installation only uses one for water supply. According to MCMWTC Bridgeport personnel, analytical results for lead in drinking water samples have not exceeded the California Department of Health Services (DHS) action level of 0.015 milligrams per liter (mg/L). Lead concentrations consistently below regulatory levels may have contributed to historical pH values above 6.5 in groundwater (Section 3.8.2.1), promoting site conditions where lead is not readily mobile in groundwater. The other well has been taken out of operation due to high levels of manganese believed to be the result of leaching from natural deposits. Manganese is more soluble than lead at neutral pH, which allows for elevated levels of manganese without elevated levels of lead.

According to MCMWTC Bridgeport personnel, no wells are located on the parcels of private land within the perimeter of the installation. No other water supply wells have been identified within a 2-mile radius of Base Camp (EDR, 2002).

3.7.3. Endangered/Threatened Species

The USFS, the CDFG, and the Marine Corps included the area encompassed by MCMWTC Bridgeport in a number of assessments to identify federally endangered, threatened, and proposed species, species of concern, and their habitats. The REVA process included a review of information pertaining to amphibian and fish species that could be off-range ecological receptors in aquatic, riparian, and meadow environments (Ballard et al., 2005; USFS, 2003, 2004a through 2004d).

The natural and cultural resources report identifies the following federally listed or candidate species observed or likely to be present at MCMWTC Bridgeport due to suitable habitat in the area (PHE, 2003; USFS, 2003). This information was verified by a review of species lists on Web sites for the CDFG (2007) and the USFWS (2007):

- Yosemite toad (*Bufo canorus*) or YT, candidate species for federal listing (Federal Register, 2002)
- Mountain yellow-legged frog (*Rana muscosa*) or MYLF, a candidate species for federal listing (Federal Register, 2003; USFWS, 2003a)
- Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) or LCT, federally listed as threatened (USFWS, 2003b)

The CDFG has reintroduced LCT in Silver, Mill, and Wolf creeks (Coffin et al., 1995; USFWS, 2003b; PHE, 2003). In addition, the REVA team observed LCT in streams at Summit Meadow (Lost Cannon Creek) during the 2006 REVA site visit. Although the *Sierra Nevada Forest Plan Amendment (SNFPA) Final Supplemental Environmental Impact Statement (FSEIS)* identifies Paiute cutthroat trout (PCT) in the Humboldt-

Toiyabe National Forest (USFS, 2003 and 2004a through 2004d), environmental staff at MCMWTC Bridgeport clarified that PCT were reintroduced to the north and outside of the installation.

Critical Aquatic Refuges (CARs) were established by the USFS in “an effort to identify and protect populations” of MYLF, YT, and LCT. However, the CAR designation “does not regulate use within the area” (PHE, 2003, pg. 38). The natural and cultural resources report states that the following areas are set aside as CARs²:

- 5,100 acres at Summit Meadows for MYLF. Summit Meadows is the location of MCMWTC Bridgeport’s R-200 in TA-4.
- 6,400 acres in Mill Canyon for LCT (stream segment not confirmed, potentially includes TA-1)
- 6,000 acres in the Chango Lake / Silver Creek area for MYLF and LCT. This area is located near/upstream of R-700 in TA-6. Adults and tadpoles were present in the area in 1999.
- 3,200 acres near Wolf Creek Lake in TA-8 for MYLF, YT, and LCT. The lake is a few miles upstream of Sniper-3/Sniper-4.
- 2,000 acres near Koenig Lake and Leavitt Lake and their associated drainages. Populations of YT were found at three springs surrounding Leavitt Lake. This location is near R-400, R-500, and R-800 in TA-11 (PHE, 2003).

The natural and cultural resources report documents a concern on the part of the CDFG with respect to MCMWTC Bridgeport operations in meadows or the vicinity of water bodies and their potential to affect YT and MYLF populations. No data were provided to assess the potential impact (PHE, 2003). In addition, CDFG has imposed fishing restrictions on Wolf Creek, Mill Creek, and Silver Creek due to LCT reintroduction (PHE, 2003; MCMWTC Bridgeport environmental personnel). MCMWTC Bridgeport environmental personnel also note that taking of fish and game during survival training exercises is not authorized.

3.7.4. Cultural Resources

The presence of cultural resources has been documented within the boundaries of the installation, although a relatively small portion of the base has been surveyed. Evidence of cultural resources includes numerous prehistoric artifacts, as well as aspen stands with historic arborglyphs. The arborglyphs are carvings primarily made by Basque sheepherders who immigrated to the area (Mallea-Olaetxe, 2005). Over 25,000 carvings have been identified in aspen stands in the Grouse Meadows area of TA-3 (PHE, 2003; e2M, 2005 and 2006). The natural and cultural resources report does not identify any properties listed on the National Register of Historic Places (NRHP) or the California

² Maps of the CARs are found in the SNFPA FSEIS (USFS, 2001).

Register of Historic Resources (PHE, 2003). Cultural resource surveys are ongoing at MCMWTC Bridgeport to increase coverage, determine prehistoric land-use patterns, and draw conclusions regarding NRHP nomination eligibility for these resources.

3.8. Additional Installation Information

This section provides available site and regional analytical information on lead, pH, and perchlorate. The information is included in the SAR Assessments in Section 5 and Appendix B. Information for other MC was not available.

3.8.1. Historical Lead Study Results

Sampling at R-100 was conducted in 1997 to evaluate the presence, extent, potential for migration, and potential exposure conditions related to lead and copper. According to the report, analytical results of 20 soil samples show that copper is not present at levels that require action or special attention. Elevated concentrations of lead were detected in the area where bullets directly impact the soil in and behind the target berm. The report notes that some of the soil samples had lead concentrations exceeding soluble and total hazardous levels in California. A cleanup of this soil typically is not required unless the site ceases operation or changes use, unacceptable health impacts occur, or a release from the site is documented in excess of allowable concentrations to surface water, groundwater, air, or soil. Accordingly, further action (e.g., cleanup, additional sampling) was not recommended (Kleinfelder, 1997).

Soil samples collected outside of the high impact zone area in this 1997 study did not have high enough lead concentrations for the soil to be considered hazardous waste, if planned to be removed or disposed. Two shallow soil samples (0–6 inches bgs) located approximately 50 feet down gradient of the range contained total lead concentrations between 16 and 17 milligrams per kilogram (mg/kg). The results from the down gradient soil samples are below the October 2004 Region 9 Residential Preliminary Remediation Goal for lead of 400 mg/kg (USEPA, 2004). The study concluded that the difference between the on-base background concentrations and the SAR-specific background concentrations for lead was most likely due to natural variation in the soil and not due to migration of soluble lead (Kleinfelder, 1997).

3.8.2. Water Quality Considerations

In addition to the beneficial uses identified by the Lahontan RWQCB and described in the CSM, a number of water quality considerations were identified through the MCMWTC Bridgeport REVA process and are discussed below.

3.8.2.1. Site and Regional pH Evaluation

Available sources for pH data include historical documents, installation underground storage tank (UST) monitoring data, installation water supply well data, and USGS gauging stations. Site and regional pH data for surface water and groundwater are presented in Table 3-2, and some of the data locations are shown in Figure 3-4. The pH is above 6.5 for all surface water measurements and most groundwater measurements, excluding a few measurements in one shallow monitoring well with median pH values of 7.4. The solubility of lead is 10 parts per billion (ppb) above pH 8; below pH 6.5, solubility can approach or exceed 100 ppb (Malcolm Pirnie, 2006). The pH above 6.5 suggests site conditions at which lead will not dissolve and is not readily mobile in surface water or groundwater.

Localized dissolution of lead may occur in areas where the soil pH is less than 6.5. Lead potentially dissolved in low pH soil should precipitate back out when it reaches the groundwater due to the buffering capacity of the groundwater. Available groundwater data with neutral pH and low to nondetect lead concentrations support the conclusion of limited lead migration for lead potentially dissolved due to acidic soils on some of the operational ranges. Lead has low mobility and extremely high soil affinity (Malcolm Pirnie, 2006). The extremely high soil interaction affinity indicates that the vadose zone is a permanent repository for lead. Slow migration to groundwater may occur with increased speed as soil within the water plume becomes saturated. In addition, soil acts as a filter for particulate lead.

3.8.2.2. USGS Gauging Station Lead Results

Several USGS surface water gauging stations are located down gradient of the installation on the West Walker River. For two of these gauging stations, a limited number of samples and the analytical results are summarized in Table 3-3 and the locations are shown in Figure 3-4. Lead was not detected in any of the surface water samples analyzed. The sampling locations are several miles down gradient from the ranges, but the data suggest that surface water is not impacted by potential lead sources located up gradient of these gauging stations (USGS, 2007).

3.8.2.3. Installation Water Supply Well Lead Results

Based on the Consumer Confidence report for 2004 and communication with the installation, concentrations of lead have not exceeded the DHS action level for lead (0.015 mg/L) for the water supply for the installation (MCMWTC, 2005). The source of raw water for the installation is groundwater extracted from the one operational installation water supply well (Section 3.7.2).

Table 3-2: Installation and Regional pH Data

Medium	Sample Location Description	pH values	Data Source
Groundwater			
	Installation water supply well	6.9-7.7	pH data from 2004 to 2006 for groundwater samples collected up to 10 times per month.
	Lower Base Camp water table monitoring well MW-34 located up gradient of UST 07007E (used for monitoring UST sites)	Median = 7.13 (range = 6.7-8.4)	pH data from 1999 to 2006 as part of UST monitoring by Shaw Environmental, Inc. for Southwest Division (SWDIV)
	Lower Base Camp water table monitoring well 7036MW-6 located up gradient of UST 07036E (used for monitoring UST sites)	Median = 7.4 (range = 6.26-8.5)	pH data from 1999 to 2006 as part of UST monitoring by Shaw Environmental, Inc. for SWDIV
	Upper Base Camp water table monitoring well 3007MW-6 located up gradient of Site 03007E (used for monitoring UST sites)	Median = 7.4 (range = 6.52-9.2)	pH data from 1999 to 2006 as part of UST monitoring by Shaw Environmental, Inc. for SWDIV
	Upper Base Camp water table monitoring well MW-24 located up gradient well in Site 4	Median = 7.1 (range = 6.9-7.2)	pH data from 1994 to 1995 as part of UST monitoring by Shaw Environmental, Inc. for SWDIV
Surface Water			
	Silver Creek	6.77	Benson and Spencer, 1983 (sample date June 25, 1975)
	West Walker (at junction of Wolf Creek and stream from Poore Lake)	6.72 and 7.49	Benson and Spencer, 1983 (sample date June 25, 1975 and August 27, 1975)
	Wolf Creek	6.75	Benson and Spencer, 1983 (sample date June 25, 1975)
	Lower Leavitt Creek	6.83	Benson and Spencer, 1983 (sample date June 25, 1975)
	West Walker (between Wolf Creek and Leavitt Creek)	6.65 and 7.3	Benson and Spencer, 1983 (sample date June 25, 1975 and August 27, 1975)
	Leavitt Creek on lower fork	7.05	Benson and Spencer, 1983 (sample date June 25, 1975)
	Lost Cannon Creek (approximately 6 miles down gradient of R-200)	6.93	Benson and Spencer, 1983 (sample date June 25, 1975)
	McKay Creek (tributary to Leavitt Creek)	6.68	Benson and Spencer, 1983 (sample date June 25, 1975)
	West Walker River (3 miles down gradient of Base Camp) (USGS 10296000)	Median = 7.9 (range = 7.2-8.7)	USGS, 2007 (sampled quarterly to semi-annually from October 1960 to June 1995)
	West Walker River near Coleville, CA (USGS 10296500)	Median = 8.0 (range = 7.3-8.7)	USGS, 2007 (sampled from May 1994 to August 2005)
Spring			
	Approximately 2 miles north of Leavitt Lake. Based on a large scale map, the spring discharges into the Leavitt Creek	6.62	Benson and Spencer, 1983 (sample date June 18, 1975)

Table 3-3: Installation and Regional Lead Data

Media	Sample Location Description	Lead Results	Data Source
Groundwater			
	Installation water supply well	Below DHS action level of 0.015 mg/L. (Note: Analytical results could be nondetect, but analytical data are not available.)	Well description and lead results from 2004-2006 Consumer Confidence reports.
Surface Water			
	West Walker River (3 miles down gradient of Base Camp) (USGS 10296000)	Lead concentrations are nondetect. Laboratory reporting limit ranges between 1 and 5 micrograms per liter ($\mu\text{g/L}$).	http://waterdata.usgs.gov/ca (Sampled quarterly to semiannually from 1987 to June 1995, with a data gap between
	West Walker River near Coleville, CA (USGS 10296500)	Lead concentrations are nondetect. Laboratory detection limit is 1 $\mu\text{g/L}$.	http://waterdata.usgs.gov/ca (Sampled quarterly from May 1994 to June 1995)

3.8.2.4. Perchlorate

In accordance with the requirements of the Unregulated Contaminant Monitoring Regulation program, groundwater samples were collected from the one on-base operational water supply well and the nonoperational supply well in July 2005 and analyzed for perchlorate. In July 2006, these two wells were resampled, and three additional wells located several miles down gradient of the site near Coleville, CA, were sampled and analyzed for perchlorate.

Groundwater samples collected in July 2005 were analyzed using USEPA Method 314.0 with a method reporting limit of 4 $\mu\text{g/L}$. The analytical results for the July 2005 sampling event were nondetect. Groundwater samples collected in July 2006 were analyzed using USEPA Method 331.0 with a method reporting limit of 0.050 $\mu\text{g/L}$. Perchlorate was detected in four of the five samples collected at concentrations below the REVA trigger value (0.98 $\mu\text{g/L}$) and regulatory compliance criterion (HQMC, 2006). Notably, the one operational water supply well had a detection of 0.062 $\mu\text{g/L}$, an order of magnitude lower than the REVA trigger value.

The use of perchlorate at MCMWTC Bridgeport is limited, and the trace detections may be false positives or could be caused by other sources. In addition, the highest detection of perchlorate (0.59 $\mu\text{g/L}$) occurred in the base housing area located several miles down gradient of the installation along Hwy 395.

Recent studies by the USGS have indicated possible perchlorate background concentrations in the range of 0.1 to 10 mg/L in the western United States, with some localized areas containing background concentrations that are much greater (Orris, 2006). Although sufficient data are not yet available, it appears that perchlorate can occur naturally. The mechanism is not fully understood, but it is believed to occur when

chloride reacts with ozone in the atmosphere. The resulting perchlorate then dissolves in falling precipitation. There are some indications that lightning plays a role in the creation of perchlorate. Further, in arid environments where there is less precipitation to remove the perchlorate from the atmosphere, perchlorate can be incorporated into certain geologic formations. Study is ongoing to better understand the mechanisms behind naturally occurring perchlorate, as well as the geographic range of perchlorate contamination in groundwater (ITRC, 2005; Jackson, 2006).

4. Munitions Constituents Loading Rates and Assumptions

The amount of indicator MC deposited on operational ranges, referred to as MC loading, must be estimated to evaluate the potential for an off-range release from defined MC loading areas. The general locations of operational ranges at MCMWTC Bridgeport are shown in Figure 1-2. The following operational range-specific information regarding military munitions typically is required to calculate the potential MC loading for each operational SAR:

- Expenditure data (type and quantity of munitions fired or used)
- Quantity of REVA indicator MC in each military munition expended
- Estimation of the physical area across which the REVA indicator MC are distributed on the operational range (MC loading area)
- Activities potentially decreasing the MC loading rate (e.g., range maintenance)

This estimating process was conducted for MCMWTC Bridgeport as part of REVA; however, the methodology was modified appropriately from that defined in the *REVA Reference Manual* due to the nature of the training activities and data limitations at MCMWTC Bridgeport. For example, historical and current munitions use has been limited to the locations of MCMWTC Bridgeport operations within the Toiyabe National Forest.

A centralized Range Control organization does not exist at MCMWTC Bridgeport, so reliable expenditure records were limited. Since the 2006 REVA site visit, MCMWTC Bridgeport has begun to establish a Range Control Center, which will improve data collection regarding range usage and munitions expenditure records. Records of training activities in recent years, a review of installation Range Regulations, and interviews with Range Safety and Logistics personnel were required to produce a reasonable estimate of munitions used. Severe restrictions on the use of tracers, pyrotechnics, and non-small-arms munitions are in place to promote public and fire safety. The sections below describe the factors and methods used at MCMWTC Bridgeport to provide a reasonable and conservative estimate of MC loading on the operational ranges.

4.1. Indicator MC

Based on information compiled during the REVA site visit, the overwhelming majority of munitions training conducted at the installation involves the use of small arms. MC associated with small arms ammunition used by the Marine Corps include lead, antimony, copper, and zinc. REVA focuses on lead as the MC indicator for SARs because lead is the most prevalent (by weight) potentially hazardous constituent associated with small arms ammunition. Military munitions that contain TNT, HMX, RDX, and perchlorate are infrequently used at the MCMWTC Bridgeport demonstration areas. With the limited sporadic use of these types of munitions and the fact that the majority of the MC are consumed when the item is expended due to the activities of the demonstration areas, the potential for MC loading to be present at levels that may have the potential to result in an off-range release is considered negligible. Therefore, the primary REVA indicator MC of concern addressed within this assessment at MCMWTC Bridgeport is lead.

4.2. Munitions Expenditure Records

Operational range-specific munitions expenditure records (detailing munitions type and quantity) typically represent an ideal data source upon which to calculate potential MC loading from each range. During the visit by the REVA team, MCMWTC Bridgeport provided intermittent munitions expenditure reports for a five-year period (from 2002 to 2006), as well as written records summarizing the number of units and personnel training for the same time period. The expenditure reports document munitions issued to personnel at MCMWTC Bridgeport, while the training records track units and personnel visiting or participating in activities within the boundary of the installation.

Some limitations are associated with these data sources. Written records documenting units and personnel training are incomplete, although they involve a recent and reasonable timeframe. Installation personnel noted that there is no centralized Range Control, and written expenditure reports were not maintained consistently at MCMWTC Bridgeport until recently. As a result, the reports for earlier years may not accurately account for all munitions use at the installation. Additionally, although the expenditure forms document the firing point or TA where the munitions were intended to be used, this information was not always provided on the form. The nomenclature used to refer to actual TAs was not consistent, nor did the location provided necessarily correspond to ranges where munitions were actually used (although such an anomaly is assumed to have occurred on a limited basis). Installation personnel noted that units and personnel would sometimes expend munitions on the ranges that were issued outside of MCMWTC Bridgeport inventory (e.g., brought by visiting battalions or units), although this practice

was terminated. The expenditure reports do not document instances where munitions not issued from the MCMWTC Bridgeport inventory were used.

Interviews with previous and current installation personnel provided information that characterized general training and munitions use at the installation. Because of the limitations associated with the expenditure records, information from these interviews serves as the basis for conservatively estimating small arms munitions loading at MCMWTC Bridgeport. The expenditure and training records were used in a supporting manner to develop appropriate assumptions where information gaps from interviews existed. The method for estimating non-small-arms munitions loading for the operational ranges is discussed in Section 4.5.

4.3. Loading Areas

MC loading areas typically are defined locations on operational ranges or impact areas where the most significant portion of MC is deposited from historical and/or current military munitions usage. MC loading areas are identified, in part, through interviews with Range Control personnel or Range Safety offices at the installation.

As noted previously, information compiled during the REVA site visit indicates that the overwhelming majority of munitions training conducted at MCMWTC Bridgeport involves the use of small arms. Almost all operational ranges lack definable structures or impact berms. Consequently, these ranges also lack concentrated impact areas. With respect to SARs at MCMWTC Bridgeport, MC loading locations may correspond more closely to the area within the range fan—depending on the location, design, and use of the range—than would typically be expected when considering a wider range of munitions use at an installation. For the purposes of applying the SARAP at MCMWTC Bridgeport, the sizes of the loading areas were not estimated. Instead, it was assumed that the estimated MC loading occurred over the area approximately covered by the range itself³. This assumption was applied to MC loading on demonstration areas as well.

4.4. SAR Assumptions and Lead Loading Estimates

A number of assumptions are made throughout the MC loading estimation process. These assumptions may be based upon information from interviews and documentation, or where information sources are not readily available, reasonable conservative assumptions are made to allow for calculation of loading rates. The method used to estimate lead loading at SARs is based on the principles in the *REVA Reference Manual* but the MC Loading Calculator method described in the manual could not be applied to

³ Areas listed in Table 3-1 are estimated sizes of the entire TAs and not the individual ranges.

MCMWTC Bridgeport due to data limitations described in this section (HQMC, 2006). The existing expenditure data did not appear to match the level of training described during the REVA site visit. As a result, the conservative method used to estimate lead loading included the following:

- Assumptions on how many battalions/personnel trained per year by type of course (2002–2006)
- Assumptions regarding the quantity and type of munitions used in each course (estimated expenditures)
- Dispersion of quantity and type of courses and munitions by MCMWTC Bridgeport ranges
- Use of lead weight conversion factors for specific munitions
- Development of lead loading estimates by range

In addition, the lead estimation method for MCMWTC Bridgeport essentially reflects current use with no training factors applied that would reflect increases or decreases in usage over time. Historical data are either unavailable or insufficient to draw any conclusion. Therefore, the application of the SARAP assumes that current annual estimates equal historical annual uses. Loading estimates of small arms munitions are based upon live rounds. Blank, inert, or practice military munitions are not included in calculations because of the relatively small lead component present compared to live rounds. Reportedly, the majority of munitions used at the installation consist of blanks; tracers are no longer used at the installation due to potential fire risk.

Furthermore, the expenditure reports show regular instances where munitions issued at MCMWTC Bridgeport were used at Hawthorne Army Depot. According to installation personnel, this Army installation is used often for exercises by units and personnel engaged in training at MCMWTC Bridgeport. Based on this information, expenditure reports documenting munitions issued for use at Hawthorne Army Depot were not considered in developing loading estimates. Based on the expenditure reports, no munitions larger than .50-caliber were issued for use at MCMWTC Bridgeport.

4.4.1. Assumptions Based on Type of Training Exercise

For calculation purposes, it was assumed that small arms use currently conducted at MCMWTC Bridgeport may be broken into five categories of training exercises:

1. Unit Operations Training or Battalion Exercises
2. Specialized Training Exercises
3. Pistol Practice and Qualification

4. Mountain Scout/Sniper Course (MSSC)
5. Winter Mountain Leader Course (WMLC)

4.4.2. Estimated Lead Loading Rates for Training Activities

Conservative estimates of current annual expenditures were used to arrive at an estimate of lead loading by type of training exercise conducted at a range. Table 4-1 provides the estimated loading rate per range by training activity. Each SAR on MCMWTC Bridgeport is correlated to a type of training activity, so these loading rates were used in the SAR Assessments in Section 5 and Appendix B. Loading estimates were developed in pounds of lead per year per range for the SARs, rather than kilogram per square meter as is typical for REVA. Nevertheless, the loading estimates are useful for the SARAP and are critical in identifying an appropriate ranking for each range.

Table 4-1: Estimated Lead Loading Rates for Training Activities

Training Activity	Current Lead Loading (lb/year [yr])
Unit operations training	924.25
Specialized training	68.46
Pistol qualification/practice	250.02
MSSC	154.78
WMLC	8.28

4.5. Demonstration Area Evaluation

Demonstration areas are used to train personnel in the creation and use of anti-personnel obstacles, specifically tree falls and snow avalanches. They include Demo-1, Demo-2, Demo-3, and Grouse Meadows. Three of the demonstration areas at MCMWTC Bridgeport (Demo-1, Demo-2, and Demo-3) are very similar. All unused or unexploded explosives are recovered by personnel and returned to the Base Camp per standard operating procedures (SOPs). Interviews with installation personnel indicate a very low volume of explosives used over time.

In addition, as previously stated, severe restrictions on the use of tracers, pyrotechnics, and non-small-arms munitions are in place throughout MWMWTC Bridgeport to promote public and fire safety. A limited amount of smoke grenades and illumination devices is also issued for use at MCMWTC Bridgeport; some of these munitions contain the indicator MC discussed in Section 4.1. However, the devices do not represent a major source of lead, as installation personnel stated that expended devices and duds are recovered immediately after exercises to alleviate explosive safety concerns. There is the

potential that some MC may be released to the environment when the items are expended. However, with the limited sporadic use of these munitions and the fact that the majority of the MC are consumed when the items are expended, the potential for MC loading to be present at levels that may have the potential to result in an off-range release is considered negligible.

Due to the nature of the demonstration areas, all munitions are expected to be fully expended, and because they are operating in publicly accessible areas, MCMWTC Bridgeport also performs used casing and dud collection procedures after every exercise in the event they occur. SOPs at MCMWTC Bridgeport require removal of all duds. Since there is minimal MC residue remaining from these sporadically used munitions, estimated loading rates do not present a potential concern. Estimated loading rates may be calculated for planning purposes for future REVA efforts to indicate what loading rates could occur if dud recovery practices are not implemented. After reviewing the information associated with other MC, none of these demonstration areas were assessed further under REVA.

5. Small Arms Range Assessments

The purpose of REVA is to identify whether there has been a release or there is a substantial threat of a release of MC of concern from the operational range or range complex areas to off-range areas. The SARAP (Appendix A) was developed as a qualitative approach to identify and assess factors that influence the potential for lead to migrate from an operational range. These factors include the following:

- Range design and layout
- Physical and chemical characteristics of the area
- Past and present operation and maintenance practices

In addition, potential receptors and pathways are identified relative to the SAR being assessed. The potential for an identified receptor to be impacted by MC migration through an identified pathway is evaluated.

5.1. Summary of the SARAP

The SARAP is to be used for:

- 1) identifying the SARs within the Marine Corps that have the greatest potential for environmental concern (i.e., potential for lead migration to impact identified receptors) and
- 2) assessing the need for implementing further actions. Recommended further actions may include, but are not limited to, the following:
 - Sampling surface water, groundwater, and/or soil
 - Conducting additional studies
 - Identifying/implementing best management practices

The qualitative assessment process for a SAR involves describing and documenting its physical and environmental conditions, as well as how the range is utilized and maintained (including dates of use and types and amounts of small arms ammunition expended). The SAR data collection form within Section 3 of the *REVA Reference Manual* is a guide to collecting and documenting the necessary information used to complete the evaluation forms in this protocol (Tables 1 through 6 in Appendix A). The data collection form includes a comprehensive list of data elements that are useful in establishing the historical and current physical and environmental conditions, as well as capturing the types of information on conditions that influence lead's potential to migrate

from the range. The data collection form is organized by the following major topics or information areas associated with the operational range:

- Basic range information
- Current range layout
- Current range operations
- Historical range operations
- Amount of lead potentially deposited
- Environmental characteristics
- Potential receptors
- Surrounding land use
- Environmental activities conducted on the range

The data collection form in the *REVA Reference Manual* was used in the field to collect pertinent data on the major factors that potentially can influence lead's ability to migrate from each SAR. The assessment process involves identifying and evaluating these possible factors that can influence the potential for lead to migrate off range. The protocol produces two scores: the sum of surface water elements and the sum of groundwater elements. These scores are used to identify the appropriate evaluation ranking (high, moderate, minimal) for surface water and groundwater.

The surface water concern evaluation ranking and the groundwater concern evaluation ranking identify the potential for off-range lead migration for each of those pathways at the SAR. The ranking designations and their descriptions follow:

- High (50–65 points) = The SAR most likely has the potential for lead migration and environmental concern, creating the greatest level of environmental concern and requiring additional action(s).
- Moderate (30–49 points) = The SAR may have the potential for lead migration and environmental concern, most likely indicating that there is no immediate environmental concern, but actions may be necessary to prevent a greater or future concern.
- Minimal (0–29 points) = The SAR has minimal or no potential for lead migration and environmental concern, indicating minimal threat of environmental concern. No further action currently is required, but actions may be considered to maintain a minimal ranking.

The environmental concern evaluation rankings can be used to evaluate if further actions should be performed, based on the general guidelines for recommended actions (Appendix A, Table 7). Additional documentation describing the purpose, requirements,

and supporting drivers for the performance of the SAR Assessments is provided with the range-specific assessments in Appendix B, which contains nine assessments evaluating the 12 operational SARs. Due to the proximity of the range fans and MC loading areas, three pairs of ranges (R-400/R-800, Sniper-1/Sniper-2, and Sniper-3/Sniper-4) were assessed together.

A map showing the general locations of the ranges is presented in Figure 5-1, and a summary of the SAR Assessment results is provided in Table 5-1. The results show that most of the SARs were characterized as minimal to moderate or moderate environmental concern based on the score ranges defined above. Conservative assumptions applied to unknown or uncertain evaluation characteristics in the SARAP caused some of the environmental concern evaluation rankings to be higher than the actual potential for off-range migration of lead.

Table 5-1: Summary of SAR Assessment Results

Range Number/Name	Surface Water Environmental Concern	Groundwater Environmental Concern
R-100	Minimal to moderate	Minimal to moderate
R-200	Minimal to moderate	Moderate
R-300	Minimal to moderate	Moderate
R-400/R-800	Moderate	Moderate
R-500	Minimal to moderate	Minimal to moderate
R-600	Minimal to moderate	Minimal to moderate
R-700	Minimal to moderate	Moderate
Sniper-1/Sniper-2	Minimal ^a	Minimal ^b
Sniper-3/Sniper-4	Minimal ^b	Minimal ^b

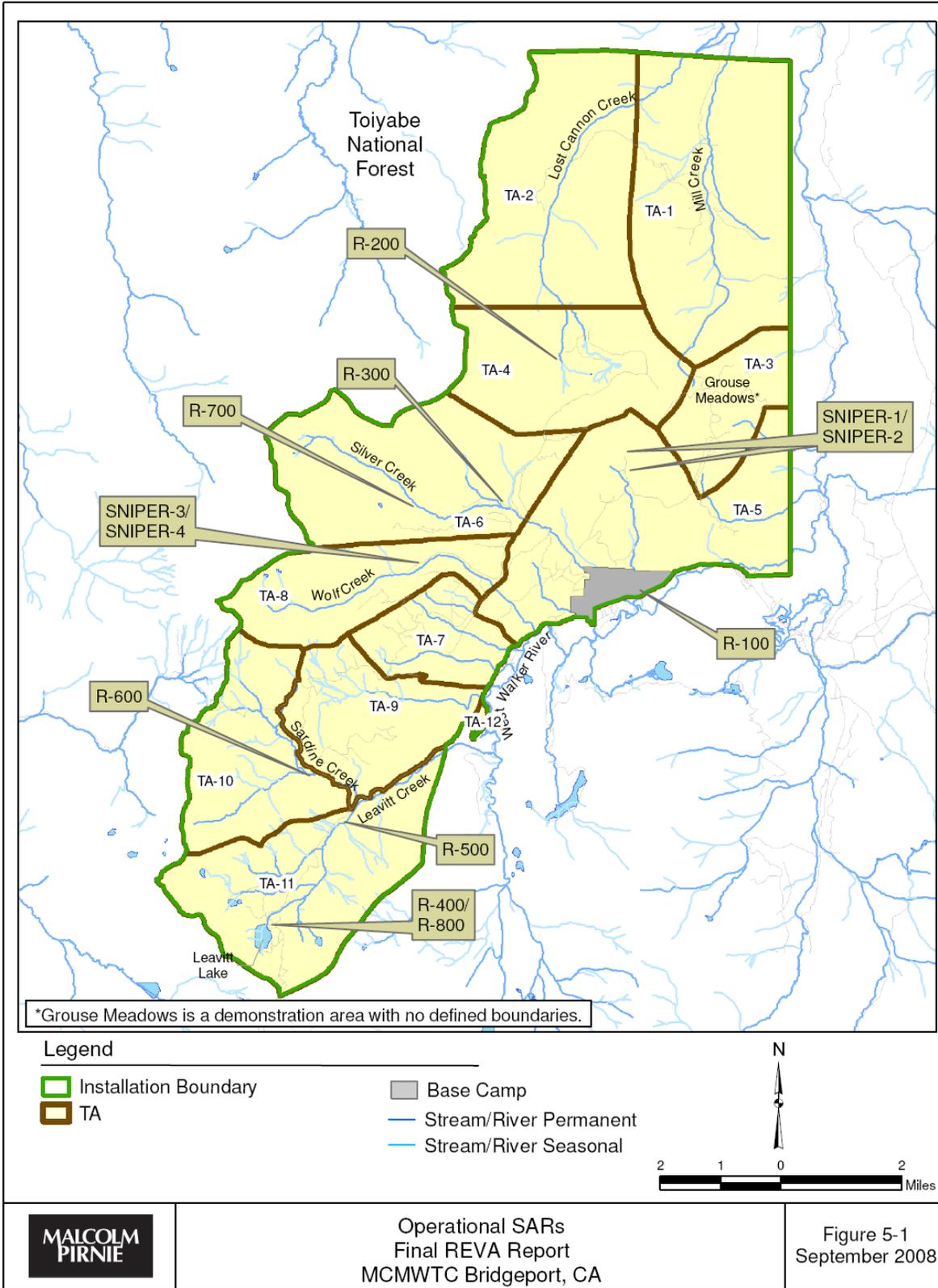
^a Original protocol environmental concern evaluation ranking was minimal to moderate; the ranking was adjusted based on professional judgment.

^b Original protocol environmental concern evaluation ranking was moderate; the ranking was adjusted based on professional judgment.

The evaluation suggests that many of these SARs do not require further actions. This judgment follows from certain site conditions and existing range management practices, including:

- low or projected decreased use of live-fire munitions,
- regional and site-specific values of pH suggesting lead is not mobile,
- regionally related USGS data showing no lead detections in streams sampled,
- results of the lead study conducted at R-100 (Kleinfelder, 1997), and

Figure 5-1: Operational SARs



P:\6285\024\GIS\Bridgeport\028-June08_Fig 5-1.mxd



Headquarters Marine Corps
Range Environmental Vulnerability Assessment
4418024



- MCMWTC Bridgeport water supply data with concentrations below the California DHS action level for lead.

The table notes for Table 5-1 denote ranges where the environmental concern evaluation ranking has been lowered due to site conditions and a projected decrease in live-fire munitions use to begin in 2007. The following sections provide range-specific information to address (1) factors considered in assessing the ranking of environmental concern and (2) recommended actions. The summary section for each SAR includes an explanation of the professional judgment applied in the assessment process.

5.2. R-100

5.2.1. Site Background

R-100 is used for pistol practice and qualification by the Marines stationed at MCMWTC Bridgeport. It is located in TA-5 just east of the main Base Camp, north of Pickel Meadow (Figure 5-1). The range extends from south to north, where a hay-covered backstop is in place. The range has eight mechanically operated targets with firing lines at 7, 15, and 25 meters (m). The annual lead loading at this range is conservatively estimated to be 250 lb/yr. No formal lead removal practices or bullet capturing technologies are used. A previous site investigation, described in Section 3.8.1, does not suggest off-range lead migration based on distribution of lead in shallow soil samples (Kleinfelder, 1997).

Many of the site-specific parameters for this range, presented in the assessment in Appendix B, were extracted from the SSURGO database, including precipitation, surface slope, vegetation, runoff conditions, soil pH, soil type, infiltration conditions, depth to water in soil profile, and clay content in soil (USDA NRCS, n.d.). Other data sources used to score some of the evaluation characteristics in the SARAP include field observations, historical documents, USGS monitoring data, Marine Corps GIS databases, and the *Water Quality Control Plan for the Lahontan Region*.

Minimal vegetation was observed during the REVA site visit in the area between the firing lines and the impact area (hay bales). However, vegetation was observed surrounding the immediate firing lines and impact area. In addition, the SSURGO database reports 60%–90% vegetation. Erosion was not observed in the target area or the firing lines. However, the SSURGO database reports very high runoff for the soil type associated with the range, and erosion was observed approximately 100 feet down gradient of the target area near the edge of the terrace where the range is located. Erosion engineering controls for runoff are not present.

Surface runoff generated during precipitation events flows toward Silver Creek, which drains to the West Walker River. Surface water and groundwater receptors for the

installation are identified and described in Section 3.7. Additional site-specific conditions related to surface water and groundwater receptors, including drinking water usage, other beneficial uses, and the presence of sensitive species, are presented for R-100 in Section 3 and Appendix B.

Historical lead data from USGS gauging stations and the installation drinking water supply well are presented in Section 3.8.2.2 and Section 3.8.2.3, respectively. These data do not show levels of lead above the detection limit or the DHS action level for drinking water. Based on pH data from installation and regional data, as described in Section 3.8.2.1, the pH of surface water and groundwater within the boundaries of the installation and at locations down gradient of the installation is above 6.5. The pH above 6.5 suggests that lead is not mobile, which is consistent with the analytical results for lead.

5.2.2. Assessment Results

Surface Water

The surface water environmental concern evaluation ranking for R-100 ranges from minimal to moderate (score: 24–42 points). On the basis of the SAR Assessment for R-100 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. However, based on the chemical conditions at the site (i.e., documented pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

Groundwater

The groundwater environmental concern evaluation ranking for R-100 ranges from minimal to moderate (score: 29–40 points). On the basis of the SAR Assessment for R-100 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. However, based on the chemical conditions at the site (i.e., documented pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

5.3. R-200

5.3.1. Site Background

R-200 is one of the primary ranges used for small arms exercises conducted by visiting battalions. It is located in TA-4 at Summit Meadow (Figure 5-1). The range is oriented from the eastern firing line to the mountains backing its western end; during its summer 2006 visit, the REVA team observed the vegetated ground across much of the range to be

saturated with drainage from the mountains . There are no established firing lines, and the target range may vary from 25 to 200 m. Both stationary and moving targets are used at this range. The annual lead loading at this range is conservatively estimated to be 925 lb/yr.

Munitions at R-200 are fired into targets with no construction, such as berms or bullet traps, to catch expenditures. The public nature and use of the land where this range is located prohibit the presence of such constructions. No formal lead removal activities are performed. Consequently, expenditures at these ranges are expected to be spread across the mountainous area behind the target areas identified in the MCMWTC Bridgeport Range Regulations for R-200 (USMC, 2001).

Many of the site-specific parameters for this range, presented in the assessment in Appendix B, were extracted from the SSURGO database, including precipitation, surface slope, vegetation, runoff conditions, soil pH, soil type, infiltration conditions, depth to water in soil profile, and clay content in soil (USDA NRCS, n.d.). Other data sources used to score some of the evaluation characteristics in the SARAP include field observations, historical documents, USGS monitoring data, Marine Corps GIS databases, and the *Water Quality Control Plan for the Lahontan Region*.

Abundant vegetation was observed in the projected range fan area, and the SSURGO database reports 85% vegetation. Erosion was not observed, and the SSURGO database reports a range of low to very high runoff for the soil type associated with the range. Erosion engineering controls for runoff are not present. Although no wells are present on the range, shallow groundwater is assumed based on the perennial Lost Cannon Creek and saturated meadows, both located within the range fan.

Surface runoff generated during precipitation events flows toward Lost Cannon Creek, which drains to the West Walker River. Surface water and groundwater receptors for the installation are identified and described in Section 3.7. Additional site-specific conditions related to surface water and groundwater receptors, including drinking water usage, other beneficial uses, and the presence of sensitive and federally listed species, are presented for R-200 in Section 3 and Appendix B.

Historical lead data from USGS gauging stations and the installation drinking water supply well are presented in Section 3.8.2.2 and Section 3.8.2.3, respectively. These data do not show levels of lead above the detection limit or DHS action level for drinking water. Based on pH data from installation and regional data, as described in Section 3.8.2.1, the pH of surface water and groundwater within the boundaries of installation and at locations down gradient of the installation is above 6.5. The pH above 6.5 suggests that lead is not mobile, which is consistent with the regionally related data for lead.

5.3.2. Assessment Results

Surface Water

The surface water environmental concern evaluation ranking for R-200 ranges from minimal to moderate (score: 28–45 points). On the basis of the SAR Assessment for R-200 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. However, based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

Groundwater

The groundwater environmental concern evaluation ranking for R-200 is in the moderate range (score: 35–47 points). On the basis of the SAR Assessment for R-200 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. However, based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

5.4. R-300

5.4.1. Site Background

R-300 is one of the primary ranges used for small arms exercises conducted by visiting battalions. It is located in TA-6 just north of Silver Creek (Figure 5-1). The range is oriented generally from the southern firing line to the mountains backing its northern end. The target distance may vary from 25 to 200 m; stationary targets are used at this range. The annual lead loading at this range is conservatively estimated to be 925 lb/yr. Munitions at R-300 are fired into targets with no construction, such as berms or bullet traps, to catch expenditures. The public nature and use of the land where the range is located prohibit the presence of such constructions.

Many of the site-specific parameters for this range, presented in the assessment in Appendix B, were extracted from the SSURGO database, including precipitation, surface slope, vegetation, runoff conditions, soil pH, soil type, infiltration conditions, depth to water in soil profile, and clay content in soil (USDA NRCS, n.d.). Other data sources used to score some of the evaluation characteristics in the SARAP include field observations, historical documents, USGS monitoring data, Marine Corps GIS databases, and the *Water Quality Control Plan for the Lahontan Region*.

Dense to sparse vegetation cover was observed in the projected range fan area, and the SSURGO database reports 85% vegetation. Erosion was not observed, and the SSURGO

database reports a range of low to medium runoff for the soil type associated with the range. Erosion engineering controls for runoff are not present. Although no wells are present on the range, shallow groundwater is assumed based on Silver Creek and a small tributary located within 200 feet of the range fan.

Surface runoff generated during precipitation events flows toward Silver Creek, which drains to the West Walker River. Surface water and groundwater receptors for the installation are identified and described in Section 3.7. Additional site-specific conditions related to surface water and groundwater receptors, including drinking water usage, other beneficial uses, and the presence of sensitive and federally listed species, are presented for R-300 in Section 3 and Appendix B.

Historical lead data from USGS gauging stations and the installation drinking water supply well are presented in Section 3.8.2.2 and Section 3.8.2.3, respectively. These data do not show levels of lead above the detection limit or DHS action level for drinking water. Based on pH data from installation and regional data, as described in Section 3.8.2.1, the pH of surface water and groundwater within the boundaries of the installation and at locations down gradient of the installation is above 6.5. The pH above 6.5 suggests that lead is not mobile, which is consistent with the regionally related data for lead.

5.4.2. Assessment Results

Surface Water

The surface water environmental concern evaluation ranking for R-300 ranges from minimal to moderate (score: 28–43 points). On the basis of the SAR Assessment for R-300 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

Groundwater

The groundwater environmental concern evaluation ranking for R-300 is in the moderate range (score: 33–47 points). On the basis of the SAR Assessment for R-300 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related data for lead, the evaluation does not suggest off-range migration of lead.

5.5. R-400/R-800

5.5.1. Site Background

The Leavitt Lake area (R-400/R-800) is one of the primary ranges used for small arms exercises conducted by visiting battalions; it is also used for the WMLC. It is located at the southern end of the installation in TA-11 (Figure 5-1). The range fans are oriented in an east-west direction facing each other over Leavitt Creek, which flows out of Leavitt Lake; training exercises may be conducted in either direction. Moving and stationary targets may be used; the mountain wall used during the biathlon course is located at the southern end of Leavitt Lake. The annual lead loading at this range, including expenditures for the WMLC, is conservatively estimated to be 930 lb/yr. MCMWTC Bridgeport personnel suggest this area has been a popular TA for many years, and installation records indicate that the area has been used as far back as 1955.

Munitions at R-400/R-800 are fired into targets with no construction, such as berms or bullet traps, to catch expenditures. The public nature and use of the land where these ranges are located prohibit the presence of such constructions. No formal lead removal activities have been or are performed at the ranges. Consequently, expenditures at these ranges are expected to be spread across the mountainous area behind the target areas.

Many of the site-specific parameters for these ranges, presented in the assessment in Appendix B, were extracted from the SSURGO database, including precipitation, surface slope, vegetation, runoff conditions, soil pH, soil type, infiltration conditions, depth to water in soil profile, and clay content in soil (USDA NRCS, n.d.). Other data sources used to score some of the evaluation characteristics in the SARAP include field observations, historical documents, USGS monitoring data, Marine Corps GIS databases, and the *Water Quality Control Plan for the Lahontan Region*.

Variable vegetation cover was observed in the projected range fan areas, and the SSURGO database reports 75% vegetation. Erosion was not observed during the site visit, and the SSURGO database reports very high runoff for the soil type associated with the range. Erosion engineering controls for runoff are not present. Although no wells are present on the range, shallow groundwater is assumed based on the proximity of Leavitt Lake and Leavitt Creek.

Surface runoff generated during precipitation events flows toward Leavitt Lake and Leavitt Creek, which drains to the West Walker River. Surface water and groundwater receptors for the installation are identified and described in Section 3.7. Additional site-specific conditions related to surface water and groundwater receptors, including drinking water usage, other beneficial uses, and the presence of sensitive and federally listed species, are presented for R-400/R-800 in Section 3 and Appendix B.

Historical lead data from USGS gauging stations and the installation drinking water supply well are presented in Section 3.8.2.2 and Section 3.8.2.3, respectively. These data do not show levels of lead above the detection limit or DHS action level for drinking water. Based on pH data from installation and regional data, as described in Section 3.8.2.1, the pH of surface water and groundwater within the boundaries of the installation and at locations down gradient of the installation is above 6.5. The pH above 6.5 suggests that lead is not mobile, which is consistent with the regionally related data for lead.

5.5.2. Assessment Results

Surface Water

The surface water environmental concern evaluation ranking for R-400/R-800 is in the moderate range (score: 30–45 points). On the basis of the SAR Assessment for R-400/R-800 in Appendix B, the potential for lead transport in surface water exists. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the ranges may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. However, the ranges are located in a high public use area, and additional actions may be warranted to eliminate or reduce potential exposure to nearby receptors.

Groundwater

The groundwater environmental concern evaluation ranking for R-400/R-800 is in the moderate range (score: 31–43 points). On the basis of the SAR Assessment for R-400/R-800 in Appendix B, the potential for lead transport in groundwater exists. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related data for lead, the ranges may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. However, the ranges are located in a high public use area, and additional actions may be warranted to eliminate or reduce potential exposure to nearby receptors.

5.6. R-500

5.6.1. Site Background

R-500 is one of three ranges utilized for specialized training activities by select members of visiting battalions. It is located in TA-11 near Leavitt Creek (Figure 5-1). The range is oriented generally from the northwestern firing line to the mountains backing its southeastern end. The target distance may vary from 50 to 200 m; moving and stationary targets are used at this range. The annual lead loading at this range is conservatively estimated to be 70 lb/yr. The range is conservatively assumed to have been operational

for over 30 years. Munitions at R-500 are fired into targets with no construction, such as berms or bullet traps, to catch expenditures. The public nature and use of the land where this range is located prohibit the presence of such constructions. No formal lead removal activities are performed at this site.

Many of the site-specific parameters for this range, presented in the assessment in Appendix B, were extracted from the SSURGO database, including precipitation, surface slope, vegetation, runoff conditions, soil pH, soil type, infiltration conditions, depth to water in soil profile, and clay content in soil (USDA NRCS, n.d.). Other data sources used to score some of the evaluation characteristics in the SARAP include field observations, historical documents, USGS monitoring data, Marine Corps GIS databases, and the *Water Quality Control Plan for the Lahontan Region*.

Dense vegetation cover was observed in the projected range fan area, and the SSURGO database reports 80%–95% vegetation. The SSURGO database reports very high runoff for the soil type associated with the range. Erosion engineering controls for runoff are not present. Although no wells are present on the range, shallow groundwater is assumed based on Leavitt Creek being located within the range fan.

Surface runoff generated during precipitation events flows toward Leavitt Creek, which drains to the West Walker River. Surface water and groundwater receptors for the installation are identified and described in Section 3.7. Additional site-specific conditions related to surface water and groundwater receptors, including drinking water usage, other beneficial uses, and the presence of sensitive and federally listed species, are presented for R-500 in Section 3 and Appendix B.

Historical lead data from USGS gauging stations and the installation drinking water supply well are presented in Section 3.8.2.2 and Section 3.8.2.3, respectively. These data do not show levels of lead above the detection limit or DHS action level for drinking water. Based on pH data from installation and regional data, as described in Section 3.8.2.1, the pH of surface water and groundwater within the boundaries of the installation and at locations down gradient of the installation is above 6.5. The pH above 6.5 suggests that lead is not mobile, which is consistent with the regionally related data for lead.

5.6.2. Assessment Results

Surface Water

The surface water environmental concern evaluation ranking for R-500 ranges from minimal to moderate (score: 28–43 points). On the basis of the SAR Assessment for R-500 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate

environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

Groundwater

The groundwater environmental concern evaluation ranking for R-500 ranges from minimal to moderate (score: 27–41 points). On the basis of the SAR Assessment for R-500 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

5.7. R-600

5.7.1. Site Background

R-600 is one of three ranges utilized for specialized training activities by select members of visiting battalions. It is located in TA-10 and oriented from northeast to southwest; the firing line sits immediately adjacent to Sardine Creek (Figure 5-1). The target distance may vary from 25 to 200 m; stationary targets are used at this range. The annual lead loading at this range is conservatively estimated to be 70 lb/yr. The range is conservatively assumed to have been operational for over 30 years. Munitions at R-600 are fired into targets with no construction, such as berms or bullet traps, to catch expenditures. The public nature and use of the land where this range is located prohibit the presence of such constructions. No formal lead removal activities are performed at this site.

Many of the site-specific parameters for this range, presented in the assessment in Appendix B, were extracted from the SSURGO database, including precipitation, surface slope, vegetation, runoff conditions, soil pH, soil type, infiltration conditions, depth to water in soil profile, and clay content in soil (USDA NRCS, n.d.). Other data sources used to score some of the evaluation characteristics in the SARAP include historical documents, USGS monitoring data, Marine Corps GIS databases, and the *Water Quality Control Plan for the Lahontan Region*.

Vegetation cover is approximately 90%–95%, and runoff conditions are designated as very high for the soil type associated with the range based on the SSURGO data. Erosion engineering controls for runoff are not present. Although no wells are present on the range, shallow groundwater is assumed based on Sardine Creek being located within the range fan.

Surface runoff generated during precipitation events flows toward Sardine Creek, which drains to Leavitt Creek, which drains to the West Walker River. Surface water and groundwater receptors for the installation are identified and described in Section 3.7. Additional site-specific conditions related to surface water and groundwater receptors, including drinking water usage, other beneficial uses, and the presence of sensitive and federally listed species, are presented for R-600 in Section 3 and Appendix B.

Historical lead data from USGS gauging stations and the installation drinking water supply well are presented in Section 3.8.2.2 and Section 3.8.2.3, respectively. These data do not show levels of lead above the detection limit or DHS action level for drinking water. Based on pH data from installation and regional data, as described in Section 3.8.2.1, the pH of surface water and groundwater within the boundaries of the installation and at locations down gradient of the installation is above 6.5. The pH above 6.5 suggests that lead is not mobile, which is consistent with the regionally related data for lead.

5.7.2. Assessment Results

Surface Water

The surface water environmental concern evaluation ranking for R-600 ranges from minimal to moderate (score: 24–39 points). On the basis of the SAR Assessment for R-600 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

Groundwater

The groundwater environmental concern evaluation ranking for R-600 ranges from the minimal to moderate range (score: 29–41 points). On the basis of the SAR Assessment for R-600 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

5.8. R-700

5.8.1. Site Background

R-700 is one of three ranges utilized for specialized training activities by select members of visiting battalions. It is located in TA-6 and oriented from southeast to northwest along a creek, which drains the Silver Creek Meadows (Figure 5-1). This range accommodates multiple firing points, though the firing line is limited to 30 m across. Stationary targets are used at distances between 25 and 200 m. The annual lead loading at this range is conservatively estimated to be 70 lb/yr. The range is conservatively assumed to have been operational for over 30 years. Munitions at R-700 are fired into targets with no construction, such as berms or bullet traps, to catch expenditures. The public nature and use of the land where this range is located prohibit the presence of such constructions. No formal lead removal activities are performed at this site.

Many of the site-specific parameters for this range, presented in the assessment in Appendix B, were extracted from the SSURGO database, including precipitation, surface slope, vegetation, runoff conditions, soil pH, soil type, infiltration conditions, depth to water in soil profile, and clay content in soil (USDA NRCS, n.d.). Other data sources used to score some of the evaluation characteristics in the SARAP include field observations, historical documents, USGS monitoring data, Marine Corps GIS databases, and the *Water Quality Control Plan for the Lahontan Region*.

Vegetation cover is approximately 90%–95%, and runoff conditions are designated as very high for the soil type associated with the range based on the SSURGO data. Erosion engineering controls for runoff are not present. Although no wells are present on the range, shallow groundwater is assumed based on the Silver Creek Meadows being located within the range fan.

Surface runoff generated during precipitation events drains the Silver Creek Meadows, which drains to the West Walker River. Surface water and groundwater receptors for the installation are identified and described in Section 3.7. Additional site-specific conditions related to surface water and groundwater receptors, including drinking water usage, other beneficial uses, and the presence of sensitive and federally listed species, are presented for R-700 in Section 3 and Appendix B.

Historical lead data from USGS gauging stations and the installation drinking water supply well are presented in Section 3.8.2.2 and Section 3.8.2.3, respectively. These data do not show levels of lead above the detection limit or DHS action level for drinking water. Based on pH data from installation and regional data, as described in Section 3.8.2.1, the pH of surface water and groundwater within the boundaries of the installation and at locations down gradient of the installation is above 6.5. The pH above 6.5

suggests that lead is not mobile, which is consistent with the regionally related data for lead.

5.8.2. Assessment Results

Surface Water

The surface water environmental concern evaluation ranking for R-700 ranges from minimal to moderate (score: 26–43 points). On the basis of the SAR Assessment for R-700 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

Groundwater

The groundwater environmental concern evaluation ranking for R-700 is in the moderate range (score: 31–45 points). On the basis of the SAR Assessment for R-700 in Appendix B, the range may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead.

5.9. Sniper-1/Sniper-2

5.9.1. Site Background

Sniper-1/Sniper-2 is one of two pairs of ranges utilized during the MSSC. Each range represents a single firing point that is oriented around Aspen Bowl (Figure 5-1). Stationary, unfixed targets (i.e., foam dummies) are placed by instructors within 15 m of a target marker located at the bottom of the bowl. The annual total lead loading from these ranges is conservatively estimated to be 155 lb/yr. MCMWTC Bridgeport does not intend to conduct live munitions exercises at these ranges, though it intends to maintain these ranges for other (nonmunitions) training exercises. Small arms ammunition used at Sniper-1/Sniper-2 is fired into targets with no construction, such as berms or bullet traps, to catch expenditures. The public nature and use of the land where these ranges are located prohibit the presence of such constructions. No formal lead removal activities are performed at this site.

Many of the site-specific parameters for these ranges, presented in the assessment in Appendix B, were extracted from the SSURGO database, including precipitation, surface slope, vegetation, runoff conditions, soil pH, soil type, infiltration conditions, depth to

water in soil profile, and clay content in soil (USDA NRCS, n.d.). Other data sources used to score some of the evaluation characteristics in the SARAP include historical documents, USGS monitoring data, Marine Corps GIS databases, and the *Water Quality Control Plan for the Lahontan Region*.

Dense vegetation cover was observed in the projected range fan area, and the SSURGO database reports 85%–100% vegetation. The SSURGO database reports a range of high to very high runoff for the soil type associated with the range. Erosion engineering controls for runoff are not present. Although no wells are present on the range, shallow groundwater is assumed based on an unnamed intermittent creek located within the range fan.

Surface runoff generated during precipitation events flows toward the West Walker River. Surface water and groundwater receptors for the installation are identified and described in Section 3.7. Additional site-specific conditions related to surface water and groundwater receptors, including drinking water usage, other beneficial uses, and the presence of sensitive and federally listed species, are presented for Sniper-1/Sniper-2 in Section 3 and Appendix B.

Historical lead data from USGS gauging stations and the installation drinking water supply well are presented in Section 3.8.2.2 and Section 3.8.2.3, respectively. These data do not show levels of lead above the detection limit or DHS action level for drinking water. Based on pH data from installation and regional data, as described in Section 3.8.2.1, the pH of surface water and groundwater within the boundaries of the installation and at locations down gradient of the installation is above 6.5. The pH above 6.5 suggests that lead is not mobile, which is consistent with the regionally related data for lead.

5.9.2. Assessment Results

Surface Water

The surface water environmental concern evaluation ranking for Sniper-1/Sniper-2 ranges from minimal to moderate (score: 22–40 points). On the basis of the SAR Assessment for Sniper-1/Sniper-2 in Appendix B, the ranges may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead. Starting in 2007, MCMWTC Bridgeport does not intend to conduct live munitions exercises at these ranges, though it does intend to maintain these ranges for other (nonmunitions) training exercises. Therefore, it is the professional judgment of the REVA team that the overall concern for lead migration and exposure to surface water receptors is more accurately categorized as a minimal level. The evaluation

ranking for surface water has been modified to minimal based on the SAR assessment, low historical munitions use, and the projected future elimination of live-fire munitions use at Sniper-1/Sniper-2.

Groundwater

The groundwater environmental concern evaluation ranking for Sniper-1/Sniper-2 is in the moderate range (score: 31–42 points). On the basis of the SAR Assessment for Sniper-1/Sniper-2 in Appendix B, the ranges may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead. The installation no longer intends to conduct live munitions exercises at these ranges, though it intends to maintain these ranges for other (nonmunitions) training exercises. Therefore, it is the professional judgment of the REVA team that the overall concern for lead migration and exposure to potential groundwater receptors is more accurately categorized as a minimal level. The evaluation ranking for groundwater has been modified to minimal based on the SAR assessment, low historical munitions use, and the projected future elimination of live-fire munitions use at Sniper-1/Sniper-2.

5.10. Sniper-3/Sniper-4

5.10.1. Site Background

Sniper-3/Sniper-4 is one of two pairs of ranges utilized during the MSSC. Each range represents a single firing point that is oriented around Wolf Creek in a general north-south orientation (Figure 5-1). Stationary, unfixed targets (i.e., foam dummies) are placed by instructors within 40 feet of a target marker located near the creek. The annual total lead loading from these ranges is conservatively estimated to be 155 lb/yr. Starting in 2007, MCMWTC Bridgeport does not intend to conduct live munitions exercises at these ranges, though it does intend to maintain these ranges for other (nonmunitions) training exercises. Munitions at Sniper-3/Sniper-4 are fired into targets with no construction, such as berms or bullet traps, to catch expenditures. The public nature and use of the land where these ranges are located prohibit the presence of such constructions. No formal lead removal activities are performed at this site.

Many of the site-specific parameters for these ranges, presented in the assessment in Appendix B, were extracted from the SSURGO database, including precipitation, surface slope, vegetation, runoff conditions, soil pH, soil type, infiltration conditions, depth to water in soil profile, and clay content in soil (USDA NRCS, n.d.). Other data sources used to score some of the evaluation characteristics in the SARAP include historical

documents, USGS monitoring data, Marine Corps GIS databases, and the *Water Quality Control Plan for the Lahontan Region*.

Dense vegetation cover was observed in the projected range fan area, and the SSURGO database reports 90%–100% vegetation. The SSURGO database reports a range of medium to very high runoff for the soil type associated with the range. Erosion engineering controls for runoff are not present. Although no wells are present on the range, shallow groundwater is assumed based on Wolf Creek located within the range fan.

Surface runoff generated during precipitation events flows toward the West Walker River. Surface water and groundwater receptors for the installation are identified and described in Section 3.7. Additional site-specific conditions related to surface water and groundwater receptors, including drinking water usage, other beneficial uses, and the presence of sensitive and federally listed species, are presented for Sniper-3/Sniper-4 in Section 3 and Appendix B.

Historical lead data from USGS gauging stations and the installation drinking water supply well are presented in Section 3.8.2.2 and Section 3.8.2.3, respectively. These data do not show levels of lead above the detection limit or DHS action level for drinking water. Based on pH data from installation and regional data, as described in Section 3.8.2.1, the pH of surface water and groundwater within the boundaries of the installation and at locations down gradient of the installation is above 6.5. The pH above 6.5 suggests that lead is not mobile, which is consistent with the regionally related data for lead.

5.10.2. Assessment Results

Surface Water

The surface water environmental concern evaluation ranking for Sniper-3/Sniper-4 is moderate (score: 30–43 points). On the basis of the SAR Assessment for Sniper-3/Sniper-4 in Appendix B, the ranges may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead. Starting in 2007, MCMWTC Bridgeport does not intend to conduct live munitions exercises at these ranges, though it does intend to maintain these ranges for other (nonmunitions) training exercises. Therefore, it is the professional judgment of the REVA team that the overall concern for lead migration and exposure to surface water receptors is more accurately categorized as a minimal level. The evaluation ranking for surface water has been modified to minimal based on the SAR assessment, low historical

munitions use, and the projected future elimination of live-fire munitions use at Sniper-3/Sniper-4.

Groundwater

The groundwater environmental concern evaluation ranking for Sniper-3/Sniper-4 is moderate (score: 33–46 points). On the basis of the SAR Assessment for Sniper-3/Sniper-4 in Appendix B, the ranges may have the potential for lead migration and environmental concern, but the assessment most likely indicates no immediate environmental concern. Based on the chemical conditions at the site (i.e., pH > 6.5) and the regionally related analytical lead results, the evaluation does not suggest off-range migration of lead. The installation no longer intends to conduct live munitions exercises at these ranges, though it does intend to maintain these ranges for other (nonmunitions) training exercises. Therefore, it is the professional judgment of the REVA team that the overall concern for lead migration and exposure to groundwater receptors is more accurately categorized as a minimal level. The evaluation ranking for groundwater has been modified to minimal based on the SAR assessment, low historical munitions use, and the projected future elimination of live-fire munitions use at Sniper-3/Sniper-4.

6. References

- AccuWeather.com. 2007. Historical Monthly Temperature Data for Coleville, CA. <http://www.accuweather.com/>. (Accessed October 2007).
- Anderson, S.W., J.R. Smithson, L.A. Freeman, and G.L. Rockwell. 2000. *Water Resources Data California Water Year 2000. Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River*.
- Ballard, Grant and Sacha K. Heath. 2005. *Riparian Bird Monitoring and Habitat Assessment in the Upper East and West Walker River Watersheds 1998-2003 Final Report*. PRBO Conservation Science.
- Benson, L.V. and R.J. Spencer. 1983. *A Hydrochemical Reconnaissance Study of the Walker River Basin, California and Nevada*. USGS Open-file Report 83-740, 53 pp. <http://pubs.er.usgs.gov/usgspubs/ofr/ofr83740>.
- California Department of Fish and Game (CDFG), Habitat Conservation and Planning Branch. 2007. Plant and Animal Species Lists. <http://www.dfg.ca.gov/hcpb/species/lists.shtml>. (Accessed July 2007).
- California Regional Water Quality Control Board (RWQCB), Lahontan Region. 1994. *Water Quality Control Plan for the Lahontan Region, North and South Basins*.
- Coffin, Patrick D. and William F. Cowan. 1995. *Lahontan Cutthroat Trout (Oncorhynchus clarki henshawi) Recovery Plan*.
- Department of Defense (DoD). 2004. Department of Defense Directive 4715.11 *Environmental and Explosive Safety Management on Operational Ranges Within the United States*.
- . 2005. Department of Defense Instruction 4715.14. *Operational Range Assessments*.
- Department of the Navy (DON), Commandant of the Marine Corps to Commanding Officer, Marine Corps Mountain Warfare Training Center, Bridgeport, CA. 11 April 2006. Memorandum. *Marine Corps Perchlorate Sampling and Management Policy*.
- . 29 June 2006. Letter. *Range Environmental Vulnerability Assessment (REVA) at Marine Corps Mountain Warfare Training Center, Bridgeport, CA*.
- Department of the Navy, United States Marine Corps, and United States Department of Agriculture, Forest Service. 2006. Draft Memorandum of Understanding. Relating to a Land Interchange between the MCMWTC, California, and the Humboldt-Toiyabe National Forest.
- Engineering Environmental Management, Inc. (e2M). 2005. *Cultural Resources Survey Report for the U.S. Marine Corps Mountain Warfare Training Center. Season I:*

- Silver Creek Watershed Reconnaissance, Cantonment, Leavitt Meadows, Grouse Meadows, and Selected Training Areas.*
- . 2006. *Draft Cultural Resources Survey Report for the U.S. Marine Corps Mountain Warfare Training Camp. Season II: Survey and Eligibility Evaluations.*
- Environmental Data Resources, Inc. (EDR). 2002. *The EDR Radius Map with GeoCheck® for Mountain Warfare Training Center, Highway 108, Bridgeport, California, 96107.*
- Fabian, Gene and Kimberly Watts. 2005. *Army Small Arms Training Range Environmental Best Management Practices (BMPs) Manual.* United States Army Environmental Center.
- Federal Register 67, no. 237 (10 December 2002) Proposed Rules. *Department of the Interior. Fish and Wildlife Service. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition to List the Yosemite Toad.*
- Federal Register 68, no. 11 (January 2003) Proposed Rules. *Department of the Interior. Fish and Wildlife Service. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition To List the Sierra Nevada Distinct Population Segment of the Mountain Yellow-legged Frog (Rana muscosa).*
- GovTrack.us. 2007. S. 493 [110th]: The California Wild Heritage Act of 2007. <http://www.govtrack.us/congress/bill.xpd?bill=s110-493>.
- Guisso, J. R. 1981. Preliminary geologic map of the Sonora Pass 15 minute quadrangle, California. United States Geological Survey, 1:62,500, Open-File Report OF-81-1170.
- Headquarters, United States Marine Corps (HQMC). 2003. *Mountain Warfare Training Center, Bridgeport, CA - General information.*
- . 2006. *Final REVA Reference Manual.*
- Interstate Technology and Regulatory Council (ITRC) Perchlorate Team. 2005. Perchlorate: Overview of Issues, Status, and Remedial Options. <http://www.itrcweb.org>. (Accessed July 2007).
- Interstate Technology and Regulatory Council (ITRC) Small Arms Firing Range Team. 2003. *Characterization and Remediation of Soils at Closed Small Arms Firing Ranges.* Technical/Regulatory Guidelines.
- . 2005. *Environmental Management at Operating Outdoor Small Arms Firing Ranges.* Technical Guideline.
- Jackson, W.A. 2006. "Occurrence of Atmospherically Generated Perchlorate in Arid and Semi-Arid Regions of North America." Presentation to the 16th Symposium of the Groundwater Resources Association of California.

- Kleinfelder, Inc. 1997. *Final Site Assessment Report, Small Arms Range – Lead Study, Marine Corps Mountain Warfare Training Center, Bridgeport, California.*
- . 2001. *Report for Site Assessment USTs 3007E and 7036E, United States Marine Corps Mountain Warfare Training Center Bridgeport, California.*
- Mallea-Olaetxe, Joxe. 2005. *Recording Basque Aspen Carvings at Grouse Meadows Toiyabe National Forest, California.* A report and evaluation on the research conducted in 2005 (11 two-hour Digital Video Discs with video data already submitted).
- Headquarters Marine Corps. 2006. *Final REVA Reference Manual.*
- Marine Corps Installations West, Government Affairs. 2007. Map of Proposed Wilderness Planning Areas (provided by MCMWTC Bridgeport personnel).
- Marine Corps Mountain Warfare Training Center Bridgeport (MCMWTC). 2005. *2004 Consumer Confidence Report.*
- National Imagery and Mapping Agency (NIMA). 2001. Military Installation Map (MIM). Limited Distribution, Marine Corps Mountain Warfare Training Center V795S, Edition 1-NIMA.
- Orris, G.J. 2006. “Natural Perchlorate in Soils and Plants of the Western U.S.” United States Geological Survey Presentation to the 16th Symposium of the Groundwater Resources Association of California.
- Potomac-Hudson Engineering, Inc. (PHE). 2003. *United States Marine Corps, Mountain Warfare Training Center, Bridgeport, California, Final Report National and Cultural Resources and Associated Support.*
- Rockwell, G.L., S.W. Anderson, J.R. Smithson, and L.A. Freeman. n.d. *Water Resources Data—California, Water Year 1999 Volume 3—Southern Central Valley Basins and the Great Basin From Walder River to Truckee River.*
- Shaw Environmental, Inc. 2003. *Final Site Closure Report, Installation Restoration Program Site 5—Large Fuel Spill, Marine Corps Mountain Warfare Training Center, Bridgeport, California.*
- . 2006. Data files. Groundwater pH, 1994–1995 and 1999–2006, Underground Storage Tank Monitoring Program at MCTMWTC Bridgeport. (Obtained from MCMWTC Bridgeport Environmental for REVA process).
- Smithson, J.R., L.A. Freeman, G.L. Rockwell, S.W. Anderson, and G.L. Pope. n.d. *Water Resources Data California Water Year 2001. Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River.*

- State Water Resources Control Board (SWRCB). 2003. *Resolution No. 2003-0009, Approval of the 2002 Federal Clean Water Act Section 303(d) List of Water Quality Limited Segments.*
- United States Department of Agriculture Natural Resources Conservation Service Soil Survey Staff (USDA NRCS). n.d. Soil Survey Geographic (SSURGO) Database for Toiyabe National Forest Area, California. <http://soildatamart.nrcs.usda.gov>. (Accessed 15 September 2006).
- United States Environmental Protection Agency (USEPA). 2004. Region 9 Preliminary Remediation Goal (PRG) Table. <http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf>. (Accessed September 2007).
- United States Fish and Wildlife Service (USFWS). 2002. *Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition to List Yosemite Toad.*
- . 2003a. *Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition to List the Sierra Nevada Distinct Population Segment of the Mountain Yellow-Legged Frog.*
- . 2003b. *Short-Term Action Plan for Lahontan Cutthroat Trout (Oncorhynchus clarki henshawi) in the Walker Basin.*
- . 2004. *Revised Recovery Plan for the Paiute Cutthroat Trout (Oncorhynchus clarki seleniris).*
- . 2005. *Biological Opinion for the Mill Canyon Fuels Reduction Project, Mono County, California.*
- . 2007. Species Information Threatened and Endangered Plants and Animals. <http://www.fws.gov/endangered/wildlife.html>. (Accessed July 2007).
- United States Forest Service (USFS). 2001. *Sierra Nevada Forest Plan Amendment, Supplemental Environmental Impact Statement, 2001; Volume 4, Appendix I, Aquatic and Riparian Habitat Information.* http://www.fs.fed.us/r5/snfpa/library/archives/feis/vol_4/appn_i.pdf.
- . 2003. *Biological Assessment for SNFPA SEIS Final.* <http://www.fs.fed.us/r5/snfpa/final-seis/biological-documents/BA/I/1.htm>.
- . 2004a. *2004 Fish & Habitat Survey Report, Mill Creek, Mono County, California.* Bridgeport Ranger District, Humboldt-Toiyabe National Forest.
- . 2004b. *2004 Fish & Habitat Survey Report, Silver Creek, Mono County, California.* Bridgeport Ranger District, Humboldt-Toiyabe National Forest.
- . 2004c. *2004 Fish & Habitat Survey Report, Wolf Creek, Mono County, California.* Bridgeport Ranger District, Humboldt-Toiyabe National Forest.

- 2004d. *Sierra Nevada Forest Plan Amendment, Final Supplemental Environmental Impact Statement*. <http://www.fs.fed.us/r5/snfpa/final-seis/index.html>.
- 2007. Humboldt-Toiyabe National Forest: Leavitt Lake Snowmobile Area. www.fs.fed.us/r4/htnf/recreation/motorized/osv/leavitt_osv.shtml. (Accessed July 2007).
- United States Geological Survey (USGS). 2003. Map. Surface Features of the Water River Basin, California and Nevada.
- 2007. Hydrology of the Walker River Basin–Surface-Water Data for West Walker River. http://nevada.usgs.gov/walker/swdata_westwalker.htm. (Accessed March 2007).
- 2007. Water Data for the Nation. <http://waterdata.usgs.gov/ca> (Accessed March 2007).
- United States Marine Corps (USMC). 2001. *MCMWTC Range Regulations*.
- 2003. *Section 366 Report (MCMWTC)*.
- n.d. Clean Water Act and Range Strategy Survey Complex Summary. <http://usmc.cwasurvey.com>. (Accessed 12 October 2004; Hard copy obtained from MCMWTC Bridgeport during REVA site visit).
- n.d. Range and Training Areas Information Questionnaire. <http://usmcrangeinventory.com>. (Hard Copy obtained from MCMWTC Bridgeport during REVA site visit; Accessed 12 October 2004 by MCMWTC; URL inactive 4 August 2007).

Appendix A

Small Arms Range Assessment Protocol

SMALL ARMS RANGE ASSESSMENT PROTOCOL

Introduction

The purpose of the Range Environmental Vulnerability Assessment (REVA) is to identify whether there has been a release or there is a substantial threat of a release of munitions constituents (MC) of concern from the operational range or range complex areas to off-range areas. This is accomplished through the use of fate and transport modeling and analysis of the REVA indicator MC based upon site-specific environmental conditions at the operational ranges and training areas at an installation.

MC associated with small arms ammunition commonly used at operational ranges includes lead, antimony, copper, and zinc. REVA focuses on lead as the MC indicator for small arms ranges because lead is the most prevalent (by weight) potentially hazardous constituent associated with small arms ammunition. No specific quantitative conclusions can be made regarding the fate and transport of lead since it is unlike any other MC. Lead is geochemically specific regarding its mobility in the environment. Site-specific conditions must be known (i.e., geochemical properties) in order to quantitatively assess lead migration. Site-specific geochemical properties are only identified via sampling and cannot be observed physically. Without site-specific physical and chemical characterization, lead cannot effectively be modeled using fate and transport modeling like the other indicator MC in REVA. The scientific community has established that metallic lead (such as recently fired, unweathered bullets and shot) generally has low chemical reactivity and low solubility in water and is relatively inactive in the environment under most ambient or everyday conditions. However, a portion of lead deposited on a range may become environmentally active if the right combination of conditions exists.

For small arms ranges, the fate and transport parameters are based entirely on site-specific geochemical properties, which cannot be determined solely by physical observation. Therefore, small arms ranges associated with the installation are qualitatively reviewed and assessed to identify factors that influence the potential for lead migration at the operational range, including:

- design and layout,
- the physical and chemical characteristics of the area, and
- current and past operation and maintenance practices.

In addition, potential receptors and pathways must be identified relative to the small arms range being assessed. The potential for an identified receptor to be impacted by MC migration through an identified pathway will be evaluated.

This Small Arms Range Assessment Protocol was developed in lieu of collecting site-specific information for every small arms range. The protocol will help to determine which ranges necessitate data collection of site-specific geochemical properties or further assessment based the range's overall prioritization regarding the potential for an identified receptor to be impacted by potential lead migration through an identified pathway.

Purpose

This Small Arms Range Assessment Protocol outlines a qualitative approach to assess the small arms ranges in the REVA process in lieu of collecting site-specific geochemical properties at every range. This qualitative approach helps to identify and assess factors that influence the potential for lead to migrate at an operational range.

This protocol is to be used for:

- 1) Identifying the small arms ranges within the Marine Corps that have the greatest potential for environmental concern (i.e., potential for lead migration to impact identified receptors) and
- 2) Assessing the need for implementing further actions. Recommended further actions may include, but are not limited to, the following:
 - Sampling surface water, groundwater, and/or soil
 - Conducting additional studies
 - Implementing best management practices (BMPs)

Data Collection and Documentation

The qualitative assessment process for a small arms range involves first capturing and documenting its physical and environmental conditions, as well as how the range is utilized and maintained (including dates of use and types and amounts of small arms ammunition expended). The small arms range data collection form within Section 3 of the REVA Reference Manual is a guide to collecting and documenting the necessary information in order to complete the evaluation forms presented later in this protocol (Tables 1 through 6). It includes a comprehensive list of data elements that are useful in establishing the historical and current

physical and environmental conditions, as well as capturing the types of information on conditions that influence lead's potential to migrate from the range. The data collection form is organized by major topics or information areas associated with the operational range, including the following:

- Basic range information
- Current range layout
- Current range operations
- Historical range operations
- Amount of lead potentially deposited
- Environmental Characteristics
- Potential receptors
- Surrounding land use
- Environmental activities conducted on the range
- Summary

The data collection form in the REVA Reference Manual can be modified, where needed, to fully capture the major factors that can potentially influence lead's ability to migrate from each specific small arms range.

Qualitative Assessment

The small arms range can be qualitatively assessed once the conditions of the range have been fully understood and documented. The assessment process involves a discussion of possible factors that can influence the potential for lead to migrate off range. Several of these factors are listed below, followed by a detailed discussion:

- Range use and range management (source)
- Surface water
- Groundwater and soil
- Pathways
- Receptors

Range Use and Range Management (Source)

The amount of lead and other MC deposited on a range is a combination of the following factors:

- Duration of use
- Current and historical frequency of range usage
- Amount and types of small arms ammunition expended on the range
- Scope and frequency of any range maintenance activities involving the removal of lead from the range
- Presence and duration of bullet-capturing technologies

Surface Water

Under specific pH conditions, lead from shot or bullets can slowly dissolve in water. Runoff and groundwater recharge could transport this dissolved lead off range. The primary factors influencing the potential for dissolved lead to migrate via surface water include, but are not limited to, the following:

- pH of the water
- Duration of water contact with the lead
- Intensity and frequency of rainfall
- Steepness of the slope containing lead
- Amount and type of vegetation on the slope
- Infiltration rate of surface soils
- Presence of engineering controls or BMPs to modify or control surface water runoff

Groundwater and Soil

The amount of lead that dissolves in water is primarily influenced by the pH of the water and the duration of water contact with the lead. Once lead is dissolved in water, the amount of lead that attaches to the soil and/or enters the groundwater is determined by several factors, including the following:

- Organic carbon content of the soil
- pH of the soil
- Properties of the soil, including porosity, irreducible water content, and hydraulic conductivity
- Amount of recharge percolating through the vadose zone

- Clay content of the soil (lead attaches to clay minerals more than other soil fractions)
- Depth to groundwater

Pathways

The REVA Small Arms Range Assessment involves developing a conceptual site model (CSM) for the range to identify the range's physical and environmental conditions. The CSM's purpose is to identify if a potential for source-receptor-pathway interaction may exist. Factors that influence the potential for a source-receptor-pathway interaction (e.g., heavy range use, potable water supply wells in proximity to the range), as well as factors that decrease the potential for such interactions, should be discussed in the assessment.

Potential pathways include:

- groundwater used as a source of potable or agricultural water,
- the use of surface water downstream of a range as a source of potable or agricultural water, and
- the use of the soil, surface water, or groundwater by sensitive species.

Receptors

Receptors in REVA can include on-range and off-range personnel and sensitive species and ecosystem areas. Factors considered when assessing the potential complete exposure pathway for receptors include, but are not limited to, the following:

- The number and proximity of water supply wells relative to the range
- The characteristics of nearby water supply wells (e.g., depth to groundwater, well construction details)
- The uses of the surface water or groundwater (e.g., agriculture, drinking water)
- The locations of nearby sensitive species areas, such as endangered species habitats (i.e., within proximity to the range)

Small Arms Range Assessment Protocol

This Small Arms Range Assessment Protocol is based on evaluating the potential environmental concerns posed by MC. Environmental concern evaluation rankings for surface water and groundwater conditions are established for each small arms range. The rankings range between High (indicating the highest potential environmental concern) and MINIMAL (indicating the

lowest potential environmental concern). Sites for which there is insufficient information to complete the evaluation are placed into an Evaluation Pending ranking. Possible recommended actions are based on the relative environmental concern evaluation rankings assigned by the protocol. High rankings necessitate further actions. Further actions may included sampling, additional site-specific studies, and/or BMPs. These actions will be evaluated based on site specific conditions for each range.

Protocol Instructions

1. For Tables 1 through 5:
 - a. Enter the appropriate score for each criteria in the site score column. Use the highest (i.e., most conservative) value if no information is known to complete the score. Professional judgment may be used at any time to override a designated score. If professional judgment is used, mark the score column appropriately (*) and fill in the notes section at the bottom of the table with text detailing why professional judgment was used and how it impacted the scores.
 - b. Sum the site scores in the last row.
2. Transfer the scores from Tables 1 through 5 onto Table 6 in the appropriate rows.
3. Use the scores in Table 6 to determine the surface water and groundwater environmental concern evaluation rankings.

Evaluation Ranking Designation

Once Table 6 is complete, the protocol finishes with two scores: the sum of surface water elements and the sum of groundwater elements. These scores are used to identify the appropriate evaluation ranking (High, Moderate, Minimal) for surface water and groundwater (as mentioned in step 3 of the protocol instructions).

The surface water concern evaluation ranking and the groundwater concern evaluation ranking identify the potential impact for lead migration for each of those pathways at the small arms range. The ranking designations and their descriptions follow:

- High = Small arms range most likely has the potential for lead migration creating the greatest level of environmental concern and requiring additional action(s).
- Moderate = Small arms range may have the potential for lead migration and most likely indicating that there is no immediate environmental concern, but actions may be necessary to prevent a greater concern.

- Minimal = Small arms range has minimal or no potential for lead migration indicating minimal threat of environmental concern, but actions may be necessary to ensure that the no concerns elevate.

These rankings are used to determine whether additional actions are appropriate. The highest environmental concern evaluation ranking (surface water or groundwater), as determined in Table 6, is used to evaluate if further actions are suggested, based on the guidelines for recommended actions (Table 7).

The overall range evaluation rankings should be compared to each range within the installation and to the overall rankings of all ranges across the Marine Corps. These rankings will assist in determining how funding should best be allocated across the Marine Corps to prevent environmental concerns due to small arms ranges.

Assessment Report

Once the Small Arms Range Assessment Protocol has been completed and appropriate actions have been designated and implemented, the assessment should be written into a report that describes the process taken, details the information used to score Tables 1 through 5, outlines the scores and evaluation rankings, and identifies the additional actions taken. The report should detail whether an identified receptor is or is not impacted by lead migration through the identified pathway(s). The completed protocol tables should be included as an appendix to the report.

Best Management Practices for Small Arms Ranges

BMPs are important for all ranges and should be used appropriately to maintain the sustainability of operational ranges. However, this protocol prioritizes which small arms ranges may need BMPs to address specific possibilities of lead migration.

Following the Small Arms Range Assessment, BMPs may be recommended based on the environmental concern evaluation ranking. Prior to selecting and implementing BMPs, the management objectives must be established. Depending on the range-specific site conditions and the management objectives, the following BMPs should be considered:

- Bullet and shot containment techniques (e.g., berms, backstops, traps)
- Prevention of soil erosion from berms, aprons, and other range areas

- Soil amendments
- Recovery and/or recycling of lead

Negative impacts of implementation should also be considered when selecting a BMP. For example, using soil amendments may affect water quality of nearby water bodies or modifying surface water runoff may impact nearby habitats.

The prevention of soil erosion can be achieved by implementing one or several of the following practices:

- Maintaining vegetation on berms and drainageways
- Reducing runoff rates by adjusting site drainage patterns
- Providing sediment traps such as a vegetated detention basin or infiltration area
- Preventing the creation of a “point source”

Soil amendments may be an effective BMP by implementing one or both of the following practices:

- Increasing the retentive capacity of soil by adding organic matter, fertilizer, and/or lime
- Maintaining a pH range between 6 and 8 by adding triple superphosphate, bone meal, or other applicable additives

The recovery and recycling of lead from operational ranges should be considered as a way to control the migration of lead. The following should be considered when implementing recovery and recycling practices:

- Focus on safety as the primary concern of the proposed activities
- Avoid practices that appear as treatment activities (e.g. acid leaching, fixation, etc.)
- Dispose lead by using a lead recycler or smelter
- Use residual soil for the original purpose (e.g. berm/target area soil) following lead recovery practices.

TABLES

Table 1: Range Use and Range Management (Source) Element

Table 2: Surface Water Pathways Characteristics Element

Table 3: Groundwater Pathways Characteristics Element

Table 4: Surface Water Receptors Element

Table 5: Groundwater Receptors Element

Table 6: Relative Environmental Concern Evaluation

Table 7: Guidelines for Recommended Actions

Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Evaluation Characteristics	Score Criteria	Site Score
Duration of Range Use	Length of time the range has been used	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	
Bullet-Capturing Technology	The presence and duration of bullet-capturing technologies Compare the duration of the range use to the duration of bullet-capturing technologies.	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	
MC Loading Rates	The amount and types of small arms ammunition expended on the range Estimate the MC loading by using a time weighted average of MC loading rates	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	
Range Maintenance	Frequency of any range maintenance activities involving the removal of lead from the ranges	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	
Source Element Score			
Notes:			

Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Evaluation Characteristics	Score Criteria	Site Score
pH of Water	pH below 6.5 increases the rate of lead dissolution. pH above 8.5 slightly increases the rate of dissolution for lead.	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	
Precipitation	Intensity and frequency of precipitation	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	
Slope of Range	The amount of deviation from the horizontal for the berm / target area	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	
Vegetation	Approximate vegetation cover within and directly downslope of the surface danger zone	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	
Soil Type/Runoff Conditions	Soil with a higher porosity (sands/gravels) has more infiltration and less runoff compared to soil with low porosity (silts/clays).	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand/gravel	
Runoff/ Erosion Engineering Controls	The presence of engineering controls or BMPs to modify or control surface water runoff and erosion Partial engineering controls include using erosion controls such as a proper groundcover or use of berms or backstops. Using a combination of multiple partial engineering controls may create an effective engineering control. Other effective engineering controls include bullet containment technologies.	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	
Surface Water Pathway Score			
Notes:			

Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Evaluation Characteristics	Score Criteria	Site Score
Depth to Groundwater	The potential for impact to the groundwater decreases with an increasing depth to the water table.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	
Precipitation	Intensity and frequency of precipitation	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	
pH of Water	pH below 6.5 increases the rate of lead dissolution. pH above 8.5 slightly increases the rate of dissolution for lead.	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	
pH of Soil	Lead tends to sorb to soils with neutral pH. Acidic pH promotes dissolution into water; basic pH does as well, though amounts and rates are typically less than acidic pH	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	
Soil Type/Infiltration Conditions	Soil with a higher porosity (sands/gravels) has more infiltration and less runoff compared to soil with low porosity (silts/clays).	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	
Clay Content in Soil	Amount of clay in the soil Lead attaches to clay soil more readily than any other soil types.	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	
Groundwater Pathway Score			
Notes:			

Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Evaluation Characteristics	Score Criteria	Site Score
Drinking Water Usage	Identify if nearby surface water bodies are used as a drinking water source.	10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown 5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown 2 if low possibility for contamination in the media to be present at or migrate to a point of exposure	
Agricultural or Other Beneficial Usage	Identify if nearby surface water bodies are used as an agricultural or other beneficial use, such as recreational (excluding drinking water).	5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably. 1 if low possibility for contamination in the media to be present at or migrate to a point of exposure	
Sensitive Species Habitat and Threatened or Endangered Species	Identify if nearby surface water bodies are downgradient of or nearby any sensitive species habitat or threatened or endangered species.	10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary 5 if potential for receptors to have access to possibly contaminated media 1 if little or no potential for receptors to have access to possible contaminated media	
Surface Water Receptor Score			
Notes:			

Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Evaluation Characteristics	Score Criteria	Site Score
Wells Identified as Potable Water Sources	Number and location of potable water or potable water supply wells relative to the location of the range Evaluate well construction / radius of influence data and hydrogeologic setting to assess if wells are potential receptors.	10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown 5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure	
Wells Identified for Agricultural or Other Beneficial Usage	Number and location of agricultural wells relative to the location of the range Evaluate well construction / radius of influence data and hydrogeologic setting to assess if wells are potential receptors.	5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure	
Sensitive Species Habitat and Threatened and Endangered Species	Evaluate of groundwater discharge or usage near areas of sensitive species habitat or areas where threatened and endangered species are located within proximity of the range	5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources	
Groundwater Receptor Score			
Notes:			

Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)										
Surface Water										
Element	Table	Score								
Range Use and Range Management (Source)	1									
Surface Water Pathways	2									
Surface Water Receptors	4									
Sum of Surface Water Element Scores										
Groundwater										
Element	Table	Score								
Range Use and Range Management (Source)	1									
Groundwater Pathways	3									
Groundwater Receptors	5									
Sum of Groundwater Element Scores										
The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media:										
<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black; padding: 5px;">Environmental Concern Evaluation Ranking*</th> <th style="text-align: left; border-bottom: 1px solid black; padding: 5px;">Score Range</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">High</td> <td style="padding: 5px;">50-65</td> </tr> <tr> <td style="padding: 5px;">Moderate</td> <td style="padding: 5px;">30-49</td> </tr> <tr> <td style="padding: 5px;">Minimal</td> <td style="padding: 5px;">0-29</td> </tr> </tbody> </table>		Environmental Concern Evaluation Ranking*	Score Range	High	50-65	Moderate	30-49	Minimal	0-29	
Environmental Concern Evaluation Ranking*	Score Range									
High	50-65									
Moderate	30-49									
Minimal	0-29									
*Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.										
Surface Water Environmental Concern Evaluation Ranking										
Groundwater Environmental Concern Evaluation Ranking										
Notes:										

Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions	
Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.

Appendix B

Small Arms Range Assessments

Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Duration of Range Use	Interviews indicated use only since 2000, though the lead study was conducted in 1997. It is possible that the range has been operational for more than 30 years, based on the center being established in 1951.	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	5
Bullet-Capturing Technology	No bullet capturing technology; small arms are fired towards hay bales in front of a hill/berm.	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	0
MC Loading Rates	Approximately 250 lbs/yr based on conservative assumptions and recent expenditure data and interviews. MC loading calculations are in the MCMWTC Bridgeport REVA report, Section 4.	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	3
Range Maintenance	No formal lead removal; possible that periodic hay replacement may result in a fraction of lead being removed from the range.	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	5
Source Element Score			13
Notes:			

SARAP R-100

Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
pH of Water	6.5 ≤ median pH ≤ 8.5 for surface water (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
Precipitation	Yearly precipitation ranges from 16-24 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	1-3
Slope of Range	SSURGO data for the soil type in this area suggests slopes from 15-50%. However, the range was located on a nearly horizontal terrace based on field observations.	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	1-5
Vegetation	Minimal Vegetation cover observed on the range in field. 60-90% rangeland total cover identified in SSURGO data.	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	1-5
Soil Type/Runoff Conditions	Field observations- Minimal to no erosion near the targets and firing locations. Erosion was observed approximately 100 feet downgradient near the edge of the terrace where the range is located. SSURGO data: grain size distribution for three soils is approximately 67.4% sand; 19.6% silt; 13% Clay SSURGO data: very high runoff	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand/gravel	3-5
Runoff/ Erosion Engineering Controls	No engineering controls	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	0
Surface Water Pathway Score			7-19
Notes: Precipitation on the installation is typically snowfall.			

SARAP R-100

Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Depth to Groundwater	SSURGO database: no water in soil profile. Historical water levels near basecamp range from 5-50 ft below ground surface.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	3-5
Precipitation	Yearly precipitation ranges from 16-24 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	1-3
pH of Water	6.5 ≤ median pH ≤ 8.5 for groundwater (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
pH of Soil	pH range of 6.1 to 7.3 based on the SSURGO database	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1-5
Soil Type/Infiltration Conditions	SSURGO data: very high runoff SSURGO data: grain size distribution for three soils is approximately 67.4% sand; 19.6% silt; 13% Clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Clay Content in Soil	SSURGO data: grain size distribution for three soils is approximately 67.4% sand; 19.6% silt; 13% Clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Groundwater Pathway Score			12-20
Notes: Precipitation on the installation is typically snowfall.			

SARAP R-100

Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Drinking Water Usage*	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.*</p> <p>A previous on-site investigation (Kleinfelder, 1997) suggests minimal to no lead migration based on distribution of lead in shallow soil samples.</p>	<p>10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>2 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	2
Agricultural or Other Beneficial Usage*	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.*</p> <p>A previous on-site investigation (SWDIC, 1997) suggests minimal to no lead migration based on distribution of lead in shallow soil samples.</p>	<p>5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown</p> <p>3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably.</p> <p>1 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	1-3
Sensitive Species Habitat or Threatened and Endangered Species	<p>The GIS database did not identify nearby sensitive habitat or species. However, the potential for receptors exposed downgradient of the range exists.</p>	<p>10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary</p> <p>5 if potential for receptors to have access to possibly contaminated media</p> <p>1 if little or no potential for receptors to have access to possible contaminated media</p>	1-5
Surface Water Receptor Score			4-10
<p>Notes: *Surface water bodies (Silver Creek and West Walker River) have beneficial uses including Municipal and Domestic Supply (drinking water supply), Agricultural Supply, and other usage according to the Water Quality Control Plan for the Lahontan Region (Basin Plan). However, these waters are not expected to be impacted by the operational range based on Range Use and Surface Water Pathways (Tables 1 and 2). In particular, the pH > 6.5 for surface water suggests lead will not dissolve and is not readily mobile.</p>			

SARAP R-100

Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/ Source	Score Criteria	Site Score
Wells Identified as Potable Water Sources	One on-base drinking water well present, but not hydraulically downgradient of the range. Analytical results do not show elevated concentrations of lead above regulatory Action Levels. No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002).	10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown 5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure	2
Wells Identified for Agricultural or Other Beneficial Usage	No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002)	5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure	1
Sensitive Species Habitat or Threatened and Endangered Species	The GIS database did not identify nearby sensitive habitat or species. However, the potential for receptors exposed downgradient of the range exists (i.e. groundwater discharge to riparian areas).	5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources	1-3
Groundwater Receptor Score			4-7
Notes: *Water supply wells may be present over 2 miles downgradient of the installation. However, the pH of groundwater above 6.5 suggests lead will not dissolve and is not readily mobile.			

SARAP R-100

Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)		
Surface Water		
Element	Table	Score
Range Use and Range Management (Source)	1	13
Surface Water Pathways	2	7-19
Surface Water Receptors	4	4-10
Sum of Surface Water Element Scores		24-42
Groundwater		
Element	Table	Score
Range Use and Range Management (Source)	1	13
Groundwater Pathways	3	12-20
Groundwater Receptors	5	4-7
Sum of Groundwater Element Scores		29-40
The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media:		
<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>	
High	50-65	
Moderate	30-49	
Minimal	0-29	
*Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.		
Surface Water Environmental Concern Evaluation Ranking		Minimal to Moderate
Groundwater Environmental Concern Evaluation Ranking		Minimal to Moderate
Notes:		

Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions

Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.
<p>Notes:</p> <p>The process of Implementing BMPs includes identifying and evaluating appropriate BMPs prior to implementation.</p> <p>In cases where federal or state listed threatened and endangered species or species of special concern are identified, the following actions are recommended depending on the Environmental Concern Evaluation Ranking:</p> <p>High Ranking: Conduct appropriate scientific literature review to assess potential impacts.</p> <p>Moderate Ranking: Consider conducting appropriate scientific literature review to assess potential impacts.</p>	

SARAP R-200

Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Duration of Range Use	Interviews indicate the range may have been used since 1952.	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	5
Bullet-Capturing Technology	No bullet capturing technology; munitions are fired over a meadow containing a small stream (Lost Cannon Creek) and shallow groundwater. The documented range fan and installation personnel confirmed that munitions are fired in the general direction of mountainside (Lost Cannon Peak).	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	0
MC Loading Rates	Approximately 925 lbs/yr based on conservative assumptions and recent expenditure data and interviews. MC loading calculations are in the MCMWTC Bridgeport REVA report, Section 4.	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	3
Range Maintenance	No lead removal activities are performed.	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	5
Source Element Score			13
Notes:			

SARAP R-200

Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
pH of Water	6.5 ≤ median pH ≤ 8.5 for surface water (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
Precipitation	Yearly precipitation ranges from 30-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
Slope of Range	SSURGO data for the soil type in this area suggests slopes from 0-4% for soil type 626022 and 4-30% for soil type 779347. To be conservative, a higher score for slope is used due to Lost Cannon Creek running through the range.	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	1-5
Vegetation	Estimated over 80% Vegetation cover observed on the range in field (see photos). 85% rangeland total cover identified in SSURGO data.	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	1
Soil Type/Runoff Conditions	SSURGO data: low to very high runoff, Using SSURGO data the grain size distribution ranges from: 62.7-91.1% sand; 3.9-23.3% silt; 5-14% clay	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand / gravel	1-5
Runoff/ Erosion Engineering Controls	No engineering controls Field observations-No erosion observed, minimal erosion possible	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	0
Surface Water Pathway Score			7-17
Notes: Precipitation on the installation is typically snowfall. Lost Cannon creek runs through east side of range. Meadows within the range fan were saturated during the July 2006 site visit.			

SARAP R-200

Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Depth to Groundwater	SSURGO database: 5-45 inches. Shallow groundwater expected based on 1) historical water levels near basecamp ranging from 5-50 ft below ground surface and 2) Lost Cannon creek runs through east side of range.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	5
Precipitation	Yearly precipitation ranges from 30-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
pH of Water	6.5 ≤ median pH ≤ 8.5 for groundwater (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
pH of Soil	pH range of Soil (pH=5.6-6.5) based on the SSURGO database	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1-5
Soil Type/Infiltration Conditions	Using SSURGO data the grain size distribution ranges from: 62.7-91.1% sand; 3.9-23.3% silt; 5-14% clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3-5
Clay Content in Soil	Using SSURGO data the grain size distribution ranges from: 62.7-91.1% sand; 3.9-23.3% silt; 5-14% clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3-5
Groundwater Pathway Score			16-26
Notes: Precipitation on the installation is typically snowfall.			

SARAP R-200

Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Drinking Water Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.</p> <p>Creeks are designated for drinking water use, but no known sources of domestic water supply, other than the potential limited use during training activities, are located on the installation. R-200 is located over 6 miles upgradient from the installation boundary.*</p>	<p>10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>2 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	2
Agricultural or Other Beneficial Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.</p> <p>Surface water bodies potentially used for Agricultural/Beneficial Usage are located downgradient.*</p>	<p>5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown</p> <p>3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably</p> <p>1 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	1-3
Sensitive Species Habitat or Threatened and Endangered Species	<p>The GIS database and USFWS website identified nearby sensitive habitat or species (such as Mountain Yellow Legged Frog: a candidate for federal listing as endangered).</p>	<p>10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary</p> <p>5 if potential for receptors to have access to possibly contaminated media</p> <p>1 if little or no potential for receptors to have access to possible contaminated media</p>	5-10
Surface Water Receptor Score			8-15
<p>Notes: * Lost Cannon Creek has beneficial uses including Municipal and Domestic Supply (drinking water supply), Agricultural Supply, and other usage according to the Water Quality Control Plan for the Lahontan Region (Basin Plan). However, these waters are not expected to be impacted by the operational range based on Range Use and Surface Water Pathways (Tables 1 and 2). In particular, the pH > 6.5 for surface water suggests lead will not dissolve and is not readily mobile.</p> <p>According to a 2003 natural resources study at MCMWTC, a grazing allotment is identified in vicinity of the Lost Cannon Creek (cattle and horse) from mid-July through September.</p>			

Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/ Source	Score Criteria	Site Score
Wells Identified as Potable Water Sources	One on-base drinking water well present near basecamp, but not downgradient of the range. No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002).	10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown 5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure	2
Wells Identified for Agricultural or Other Beneficial Usage	No other water supply wells identified within 2 miles of basecamp* (EDR, 2002).	5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure	1
Sensitive Species Habitat or Threatened and Endangered Species	The GIS database and USFWS website identified nearby sensitive habitat or species (such as Mountain Yellow Legged Frog). The potential for receptors exposed downgradient of the range exists.	5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources	3-5
Groundwater Receptor Score			6-8
Notes: *Water supply wells may be present in Walker, CA located over 2 miles downgradient of the installation boundary at Lost Cannon Creek and over 8 miles downgradient of R-200. In addition, the pH of groundwater above 6.5 suggests lead will not dissolve and is not readily mobile.			

Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)										
Surface Water										
Element	Table	Score								
Range Use and Range Management (Source)	1	13								
Surface Water Pathways	2	7-17								
Surface Water Receptors	4	8-15								
Sum of Surface Water Element Scores		28-45								
Groundwater										
Element	Table	Score								
Range Use and Range Management (Source)	1	13								
Groundwater Pathways	3	16-26								
Groundwater Receptors	5	6-8								
Sum of Groundwater Element Scores		35-47								
<p>The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media:</p> <table border="0" style="margin-left: 40px;"> <thead> <tr> <th style="text-align: left;"><u>Environmental Concern Evaluation Ranking*</u></th> <th style="text-align: left;"><u>Score Range</u></th> </tr> </thead> <tbody> <tr> <td>High</td> <td>50-65</td> </tr> <tr> <td>Moderate</td> <td>30-49</td> </tr> <tr> <td>Minimal</td> <td>0-29</td> </tr> </tbody> </table> <p>*Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.</p>		<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>	High	50-65	Moderate	30-49	Minimal	0-29	
<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>									
High	50-65									
Moderate	30-49									
Minimal	0-29									
Surface Water Environmental Concern Evaluation Ranking		Minimal to Moderate								
Groundwater Environmental Concern Evaluation Ranking		Moderate								
Notes:										

Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions

Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.
<p>Notes:</p> <p>The process of Implementing BMPs includes identifying and evaluating appropriate BMPs prior to implementation.</p> <p>In cases where federal or state listed threatened and endangered species or species of special concern are identified, the following actions are recommended depending on the Environmental Concern Evaluation Ranking:</p> <p>High Ranking: Conduct appropriate scientific literature review to assess potential impacts.</p> <p>Moderate Ranking: Consider conducting appropriate scientific literature review to assess potential impacts.</p>	

SARAP R-300

Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Duration of Range Use	Conservative estimate. Supporting data not available. It is possible that the range has been operational for more than 30 years, based on the center being established in 1951.	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	5
Bullet-Capturing Technology	No bullet capturing technology; targets are placed in front of a hill (no berms)	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	0
MC Loading Rates	Approximately 925 lbs/yr based on conservative assumptions and recent expenditure data and interviews. MC loading calculations are in the MCMWTC Bridgeport REVA report, Section 4.	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	3
Range Maintenance	No formal lead removal.	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	5
Source Element Score			13
Notes:			

SARAP R-300

Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
pH of Water	6.5 ≤ median pH ≤ 8.5 for surface water (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
Precipitation	Yearly precipitation ranges from 35-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
Slope of Range	SSURGO data for the soil type in this area suggests slopes from 4-30%.	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	1-5
Vegetation	85% rangeland total cover identified in SSURGO data for R-300.	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	1
Soil Type/Runoff Conditions	SSURGO data: Low to medium runoff; Using SSURGO data the grain size distribution for three soils is approximately: 85% sand; 10% silt; 5% Clay	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand/gravel	1-3
Runoff/ Erosion Engineering Controls	No engineering controls	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	0
Surface Water Pathway Score			7-15
Notes: Precipitation on the installation is typically snowfall. Silver Creek and a small tributary run less than 200 feet downgradient of the range.			

SARAP R-300

Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Depth to Groundwater	SSURGO database: no water in soil profile. Proximity to creek and shallow groundwater on the installation suggests depth to groundwater is less than 100 feet.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	3-5
Precipitation	Yearly precipitation ranges from 35-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
pH of Water	6.5 ≤ median pH ≤ 8.5 for groundwater (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
pH of Soil	pH range of 4.5 to 7.3 based on the SSURGO database	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1-5
Soil Type/Infiltration Conditions	Using SSURGO data the grain size distribution for three soils is approximately: 85% sand; 10% silt; 5% Clay	5 if soil type is sand / gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3-5
Clay Content in Soil	Using SSURGO data the grain size distribution for three soils is approximately: 85% sand; 10% silt; 5% Clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3-5
Groundwater Pathway Score			14-26
Notes: Precipitation on the installation is typically snowfall. Silver Creek and a small tributary are located less than 200 feet downgradient of the range.			

SARAP R-300

Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Drinking Water Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.</p> <p>Creeks are designated for drinking water use, but no known sources of domestic water supply, other than the potential limited use during training activities, are located on the installation. R-300 is located over 2 miles upgradient from the installation boundary.*</p>	<p>10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>2 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	2
Agricultural or Other Beneficial Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2. Surface water bodies potentially used for Agricultural/ Beneficial Usage are located downgradient.*</p>	<p>5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown</p> <p>3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably.</p> <p>1 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	1-3
Sensitive Species Habitat or Threatened and Endangered Species	<p>The GIS database and USFWS website identified nearby sensitive habitat or species (such as Mountain Yellow Legged Frog Critical Aquatic Refuge and Lahontan Cutthroat Trout.)</p>	<p>10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary</p> <p>5 if potential for receptors to have access to possibly contaminated media</p> <p>1 if little or no potential for receptors to have access to possible contaminated media</p>	5-10
Surface Water Receptor Score			8-15
<p>Notes: *Surface water bodies (Silver Creek and West Walker River) have beneficial uses including Municipal and Domestic Supply (drinking water supply), Agricultural Supply, and other usage according to the Water Quality Control Plan for the Lahontan Region (Basin Plan). However, these waters are not expected to be impacted by the operational range based on Range Use and Surface Water Pathways (Tables 1 and 2). In particular, the pH > 6.5 for surface water suggests lead will not dissolve and is not readily mobile.</p> <p>Mountain Yellow Legged Frog is a candidate species for federal listing as endangered and Lahontan Cutthroat Trout is federally listed as threatened.</p>			

Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/ Source	Score Criteria	Site Score
Wells Identified as Potable Water Sources	One on-base drinking water well present, but not hydraulically downgradient of the range. Analytical results from the installation water supply well do not show elevated concentrations of lead above regulatory Action Levels. No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002).	<p>10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown</p> <p>5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably</p> <p>2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure</p>	2
Wells Identified for Agricultural or Other Beneficial Usage	No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002)	<p>5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown</p> <p>3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably</p> <p>1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure</p>	1
Sensitive Species Habitat and Threatened and Endangered Species	The GIS database and USFWS website identified nearby sensitive habitat or species (such as Mountain Yellow Legged Frog Critical Aquatic Refuge and Lahontan Cutthroat Trout).	<p>5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources</p> <p>3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources</p> <p>1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources</p>	3-5
Groundwater Receptor Score			6-8
Notes: *Water supply wells may be present over 2 miles downgradient of the installation. However, the pH of groundwater above 6.5 suggests lead will not dissolve and is not readily mobile.			

Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)										
Surface Water										
Element	Table	Score								
Range Use and Range Management (Source)	1	13								
Surface Water Pathways	2	7-15								
Surface Water Receptors	4	8-15								
Sum of Surface Water Element Scores		28-43								
Groundwater										
Element	Table	Score								
Range Use and Range Management (Source)	1	13								
Groundwater Pathways	3	14-26								
Groundwater Receptors	5	6-8								
Sum of Groundwater Element Scores		33-47								
<p>The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media:</p> <table style="margin-left: 40px; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><u>Environmental Concern Evaluation Ranking*</u></th> <th style="text-align: left;"><u>Score Range</u></th> </tr> </thead> <tbody> <tr> <td>High</td> <td>50-65</td> </tr> <tr> <td>Moderate</td> <td>30-49</td> </tr> <tr> <td>Minimal</td> <td>0-29</td> </tr> </tbody> </table> <p>*Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.</p>		<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>	High	50-65	Moderate	30-49	Minimal	0-29	
<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>									
High	50-65									
Moderate	30-49									
Minimal	0-29									
Surface Water Environmental Concern Evaluation Ranking		Minimal to Moderate								
Groundwater Environmental Concern Evaluation Ranking		Moderate								
Notes:										

Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions

Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.
<p>Notes:</p> <p>The process of Implementing BMPs includes identifying and evaluating appropriate BMPs prior to implementation.</p> <p>In cases where federal or state listed threatened and endangered species or species of special concern are identified, the following actions are recommended depending on the Environmental Concern Evaluation Ranking:</p> <p>High Ranking: Conduct appropriate scientific literature review to assess potential impacts.</p> <p>Moderate Ranking: Consider conducting appropriate scientific literature review to assess potential impacts.</p>	

SARAP R-400/R-800

Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Duration of Range Use	Interviews suggest that the area has long served as a popular training location, and communication notes indicate use as far back as 1955.	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	5
Bullet-Capturing Technology	No bullet capturing technology, with the exception of a very small set of exercises. Most munitions are fired in E-W direction, while munitions used in the biathlon training course are fired in the southern wall of the bowl surrounding Leavitt Lake.	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	0
MC Loading Rates	Approximately 930 lbs/yr based on conservative assumptions and recent expenditure data and interviews. MC loading calculations are in the MCMWTC Bridgeport REVA report, Section 4.	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	3
Range Maintenance	No lead removal activities are performed.	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	5
Source Element Score			13
Notes: The remote Leavitt Lake bowl is also used for recreation (winter sports, backpacking, camping, and fishing) and is located near the Hoover Wilderness Area in Inyo and Humboldt-Toiyabe National Forests.			

SARAP R-400/R-800

Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
pH of Water	6.5 ≤ median pH ≤ 8.5 for surface water (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
Precipitation	Yearly precipitation ranges from 35-55 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
Slope of Range	SSURGO data for the soil type in this area suggests slopes from 8-75%.	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	3-5
Vegetation	75% rangeland total cover identified in SSURGO data for R-400/R-800.	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	1
Soil Type/Runoff Conditions	SSURGO data: Very High runoff. SSURGO data: The grain size distribution for three soils is approximately: 66.8% sand; 19.2% silt; 14% Clay	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand/gravel	1-5
Runoff/Erosion Engineering Controls	No engineering controls	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	0
Surface Water Pathway Score			9-17
Notes: Precipitation on the installation is typically snowfall. Leavitt Creek runs through R-400.			

SARAP R-400/R-800

Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Depth to Groundwater	SSURGO database: no water in soil profile. Proximity to Leavitt Lake and Leavitt Creek suggests depth to groundwater is less than 100 feet.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	3-5
Precipitation	Yearly precipitation ranges from 35-55 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
pH of Water	6.5 ≤ median pH ≤ 8.5 for groundwater (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
pH of Soil	pH range of 4.5 to 7.3 based on the SSURGO database	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1-5
Soil Type/Infiltration Conditions	SSURGO data: Very High runoff; Using SSURGO data the grain size distribution for three soils is approximately: 66.8% sand; 19.2% silt; 14% Clay.	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	1-3
Clay Content in Soil	Using SSURGO data the grain size distribution for three soils is approximately: 66.8% sand; 19.2% silt; 14% Clay.	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Groundwater Pathway Score			12-22
Notes: Precipitation on the installation is typically snowfall.			

SARAP R-400/R-800

Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element			
(These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Drinking Water Usage	A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2. Creeks are designated for drinking water use, but no known sources of domestic water supply, other than the potential limited use during training or recreational activities, occur in this area. R-400/R-800 is located over 4 miles upgradient from the training areas used by MCMWTC Bridgeport.*	<p>10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>2 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	2
Agricultural or Other Beneficial Usage	A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2. Surface water bodies potentially used for Agricultural/ Beneficial Usage are located downgradient.*	<p>5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown</p> <p>3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably.</p> <p>1 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	1-3
Sensitive Species Habitat or Threatened and Endangered Species	The GIS database and USFWS website identified nearby sensitive habitat or species (such as Yosemite Toad Critical Aquatic Refuge). The potential for receptors exposed downgradient of the range exists.	<p>10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary</p> <p>5 if potential for receptors to have access to possibly contaminated media</p> <p>1 if little or no potential for receptors to have access to possible contaminated media</p>	5-10
Surface Water Receptor Score			8-15
<p>Notes: * Leavitt Meadows Wetlands and the West Walker River have beneficial uses including Municipal and Domestic Supply (drinking water supply), Agricultural Supply, and other usage according to the Water Quality Control Plan for the Lahontan Region (Basin Plan). However, these waters are not expected to be impacted by the operational range based on Range Use and Surface Water Pathways (Tables 1 and 2). In particular, the pH > 6.5 for surface water suggests lead will not dissolve and is not readily mobile.</p>			

SARAP R-400/R-800

Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Wells Identified as Potable Water Sources	One on-base drinking water well present, but not hydraulically downgradient of the range. Analytical results from the installation water supply well do not show elevated concentrations of lead above regulatory Action Levels. No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002).	10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown 5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure	2
Wells Identified for Agricultural or Other Beneficial Usage	No other water supply wells identified within 2 miles of basecamp* (EDR, 2002)	5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure	1
Sensitive Species Habitat or Threatened and Endangered Species	The GIS database and USFWS website identified nearby sensitive habitat or species (such as Yosemite Toad Critical Aquatic Refuge). The potential for receptors exposed downgradient of the range exists.	5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources	3-5
Groundwater Receptor Score			6-8
Notes: *Water supply wells may be present over 2 miles downgradient. However, the pH of groundwater above 6.5 suggests lead will not dissolve and is not readily mobile.			

SARAP R-400/R-800

Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)		
Surface Water		
Element	Table	Score
Range Use and Range Management (Source)	1	13
Surface Water Pathways	2	9-17
Surface Water Receptors	4	8-15
Sum of Surface Water Element Scores		30-45
Groundwater		
Element	Table	Score
Range Use and Range Management (Source)	1	13
Groundwater Pathways	3	12-22
Groundwater Receptors	5	6-8
Sum of Groundwater Element Scores		31-43
The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media:		
<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>	
High	50-65	
Moderate	30-49	
Minimal	0-29	
*Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.		
Surface Water Environmental Concern Evaluation Ranking		Moderate
Groundwater Environmental Concern Evaluation Ranking		Moderate
Notes:		

SARAP R-400/R-800

Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions

Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.
<p>Notes:</p> <p>The process of Implementing BMPs includes identifying and evaluating appropriate BMPs prior to implementation.</p> <p>In cases where federal or state listed threatened and endangered species or species of special concern are identified, the following actions are recommended depending on the Environmental Concern Evaluation Ranking:</p> <p>High Ranking: Conduct appropriate scientific literature review to assess potential impacts.</p> <p>Moderate Ranking: Consider conducting appropriate scientific literature review to assess potential impacts.</p>	

SARAP R-500

Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Duration of Range Use	Unknown; expenditure data only supports use from 2001, though information believed to be incomplete. It is possible that the range has been operational for more than 30 years, based on the center being established in 1951.	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	3-5
Bullet-Capturing Technology	No bullet capturing technology	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	0
MC Loading Rates	Approximately 70 lbs/yr based on conservative assumptions and recent expenditure data and interviews. MC loading calculations are in the MCMWTC Bridgeport REVA report, Section 4. Infrequent (and low munitions use) sniper exercises may be conducted; sniper courses involving munitions use are expected to reduce significantly this year.	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	1
Range Maintenance	No lead removal activities are performed.	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	5
Source Element Score			9-11
Notes:			

SARAP R-500

Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
pH of Water	6.5 ≤ median pH ≤ 8.5 for surface water (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
Precipitation	Yearly precipitation ranges from 35-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
Slope of Range	SSURGO data for the soil type in this area suggests slopes from 30-75%. However, field conditions observed suggest nearly a nearly horizontal slope directly downgradient of the range	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	5
Vegetation	80-95% rangeland total cover identified in SSURGO data for R-500.	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	1
Soil Type/Runoff Conditions	SSURGO data: Very High runoff; Using SSURGO data the grain size distribution for three soils is approximately: 67.4-66.8% sand; 19.2-19.6% silt; 10-18% Clay	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand/gravel	1-5
Runoff/Erosion Engineering Controls	SSURGO data: Very High runoff No engineering controls	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	0
Surface Water Pathway Score			11-17
Notes: Precipitation on the installation is typically snowfall. Leavitt Creek runs through the range. Meadows within the range fan were saturated during the July 2006 site visit.			

SARAP R-500

Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Depth to Groundwater	SSURGO database: no water in soil profile. 100 feet from Leavitt Creek and shallow groundwater on the installation suggests depth to groundwater is less than 100 feet.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	3-5
Precipitation	Yearly precipitation ranges from 35-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
pH of Water	6.5 ≤ median pH ≤ 8.5 for groundwater (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
pH of Soil	pH range of 6.1 to 7.3 based on the SSURGO database	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1-5
Soil Type/Infiltration Conditions	SSURGO data: Very High runoff; Using SSURGO data the grain size distribution for three soils is approximately: 67.4-66.8% sand; 19.2-19.6% silt; 10-18% Clay. Score of 1-3 based on a designation of "High Runoff" in the SSURGO data.	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	1-3
Clay Content in Soil	Using SSURGO data the grain size distribution for three soils is approximately: 67.4-66.8% sand; 19.2-19.6% silt; 10-18% Clay.	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Groundwater Pathway Score			12-22
Notes: Precipitation on the installation is typically snowfall.			

SARAP R-500

Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Drinking Water Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.</p> <p>Creeks are designated for drinking water use, but no known sources of domestic water supply, other than the potential limited use during training activities, are located on the installation. R-500 is located over 2 miles upgradient from the training areas used by MCMWTC.*</p>	<p>10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>2 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	2
Agricultural or Other Beneficial Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.</p> <p>Surface water bodies potentially used Agricultural/Beneficial Usage are located downgradient.*</p>	<p>5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown</p> <p>3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably.</p> <p>1 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	1-3
Sensitive Species Habitat or Threatened and Endangered Species	<p>Leavitt Creek is located approximately 100 feet downgradient. The USFWS website identifies the Yosemite Toad in the Leavitt Creek Area.</p>	<p>10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary</p> <p>5 if potential for receptors to have access to possibly contaminated media</p> <p>1 if little or no potential for receptors to have access to possible contaminated media</p>	5-10
Surface Water Receptor Score			8-15
<p>Notes: Notes: * Leavitt Meadows Wetlands and the West Walker River have beneficial uses including Municipal and Domestic Supply (drinking water supply), Agricultural Supply, and other usage according to the Water Quality Control Plan for the Lahontan Region (Basin Plan). However, these waters are not expected to be impacted by the operational range based on Range Use and Surface Water Pathways (Tables 1 and 2). In particular, the pH > 6.5 for surface water suggests lead will not dissolve and is not readily mobile.</p> <p>The Yosemite Toad is a candidate for federal listing. The drainage of Leavitt Lake (Leavitt Creek) is part of Critical Aquatic Refuge for this species, according to a 2003 natural and cultural resources study encompassing MCMWTC.</p>			

SARAP R-500

Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Wells Identified as Potable Water Sources	One on-base drinking water well present, but not hydraulically downgradient of the range. Analytical results from the installation water supply well do not show elevated concentrations of lead above regulatory Action Levels. No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002).	10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown 5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure	2
Wells Identified for Agricultural or Other Beneficial Usage	No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002)	5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure	1
Sensitive Species Habitat or Threatened and Endangered Species	Leavitt Creek is located approximately 100 feet downgradient and the USFWS website identifies the Yosemite Toad. The potential for receptors exposed downgradient of the range exists.	5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources	3-5
Groundwater Receptor Score			6-8
Notes: *Water supply wells may be present over 2 miles downgradient of the installation. However, the pH of groundwater above 6.5 suggests lead will not dissolve and is not readily mobile.			

SARAP R-500

Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)		
Surface Water		
Element	Table	Score
Range Use and Range Management (Source)	1	9-11
Surface Water Pathways	2	11-17
Surface Water Receptors	4	8-15
Sum of Surface Water Element Scores		28-43
Groundwater		
Element	Table	Score
Range Use and Range Management (Source)	1	9-11
Groundwater Pathways	3	12-22
Groundwater Receptors	5	6-8
Sum of Groundwater Element Scores		27-41
The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media:		
<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>	
High	50-65	
Moderate	30-49	
Minimal	0-29	
*Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.		
Surface Water Environmental Concern Evaluation Ranking		Minimal to Moderate
Groundwater Environmental Concern Evaluation Ranking		Minimal to Moderate
Notes:		

SARAP R-500

Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions

Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.
<p>Notes:</p> <p>The process of Implementing BMPs includes identifying and evaluating appropriate BMPs prior to implementation.</p> <p>In cases where federal or state listed threatened and endangered species or species of special concern are identified, the following actions are recommended depending on the Environmental Concern Evaluation Ranking:</p> <p>High Ranking: Conduct appropriate scientific literature review to assess potential impacts.</p> <p>Moderate Ranking: Consider conducting appropriate scientific literature review to assess potential impacts.</p>	

Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Duration of Range Use	Unknown; expenditure data only supports use from 2001, though information believed to be incomplete. It is possible that the range has been operational for more than 30 years, based on the center being established in 1951.	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	3-5
Bullet-Capturing Technology	No bullet capturing technology; munitions fired into hill/mountainside.	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	0
MC Loading Rates	Approximately 70 lbs/yr based on conservative assumptions and recent expenditure data and interviews. MC loading calculations are in the MCMWTC Bridgeport REVA report, Section 4.	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	1
Range Maintenance	No lead removal activities are performed.	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	5
Source Element Score			9-11
Notes:			

SARAP R-600

Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
pH of Water	6.5 ≤ median pH ≤ 8.5 for surface water (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
Precipitation	Yearly precipitation ranges from 30-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
Slope of Range	SSURGO data for the soil type in this area suggests slopes from 0-4%.	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	1
Vegetation	90-95% rangeland total cover identified in SSURGO data	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	1
Soil Type/Runoff Conditions	SSURGO data: very high runoff, Using SSURGO data the grain size distribution ranges from: 62.7-67.1-% sand; 18.9-23.3% silt; 14% Clay	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand/gravel	1-5
Runoff/Erosion Engineering Controls	No engineering controls	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	0
Surface Water Pathway Score			7-13
Notes: Precipitation on the installation is typically snowfall. Sardine Creek runs through the range. No direct field observations. Minimal erosion possible based on topography and observation at other operational ranges.			

SARAP R-600

Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Depth to Groundwater	SSURGO database: 5-45 inches. Shallow groundwater expected based on 1) historical water levels near base camp ranging from 5-50 ft below ground surface and 2) Sardine creek running through east side of range.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	3-5
Precipitation	Yearly precipitation ranges from 30-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
pH of Water	6.5 ≤ median pH ≤ 8.5 for groundwater (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
pH of Soil	pH range of Soil (pH=5.6-6.5) based on the SSURGO database	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1-5
Soil Type/Infiltration Conditions	Using SSURGO data the grain size distribution ranges from: 62.7-67.1-% sand; 18.9-23.3% silt; 14% Clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Clay Content in Soil	Using SSURGO data the grain size distribution ranges from: 62.7-67.1-% sand; 18.9-23.3% silt; 14% Clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Groundwater Pathway Score			14-22
Notes: Precipitation on the installation is typically snowfall.			

SARAP R-600

Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Drinking Water Usage	A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2. Creeks are designated for drinking water use, but no known sources of domestic water supply, other than the potential limited use during training activities, are located on the installation. R-600 is located over 2 miles upgradient from the training areas used by MCMWTC Bridgeport.*	10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown 5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown 2 if low possibility for contamination in the media to be present at or migrate to a point of exposure	2
Agricultural or Other Beneficial Usage	A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2. Surface water bodies potentially used for Agricultural/ Beneficial Usage are located downgradient.*	5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably. 1 if low possibility for contamination in the media to be present at or migrate to a point of exposure	1-3
Sensitive Species Habitat or Threatened and Endangered Species	The GIS database and the USFWS website identified nearby sensitive habitat or species (such as Yosemite Toad). The potential for receptors exposed downgradient of the range exists.	10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary 5 if potential for receptors to have access to possibly contaminated media 1 if little or no potential for receptors to have access to possible contaminated media	5-10
Surface Water Receptor Score			8-15
Notes: * Leavitt Meadows Wetlands and the West Walker River (both downgradient of Sardine Creek) have beneficial uses including Municipal and Domestic Supply (drinking water supply), Agricultural Supply, and other usage according to the Water Quality Control Plan for the Lahontan Region (Basin Plan). However, these waters are not expected to be impacted by the operational range based on Range Use and Surface Water Pathways (Tables 1 and 2). In particular, the pH > 6.5 for surface water suggests lead will not dissolve and is not readily mobile. According to a 2003 natural resources study at MCMWTC Bridgeport, there is a grazing allotment in vicinity of the Sardine Creek (cattle and horse) from mid-July through September.			

SARAP R-600

Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Wells Identified as Potable Water Sources	One on-base drinking water well present, but not hydraulically downgradient of the range. Analytical results from the installation water supply well do not show elevated concentrations of lead above regulatory Action Levels. No other drinking water supply wells identified within 2 miles of base camp* (EDR, 2002).	10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown 5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure	2
Wells Identified for Agricultural or Other Beneficial Usage	No other drinking water supply wells identified within 2 miles of base camp* (EDR, 2002)	5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure	1
Sensitive Species Habitat or Threatened and Endangered Species	The GIS database and the USFWS website identified nearby sensitive habitat or species (such as Yosemite Toad).	5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources	3-5
Groundwater Receptor Score			6-8
Notes: *Water supply wells may be present over 2 miles downgradient of the installation. However, the pH of groundwater above 6.5 suggests lead will not dissolve and is not readily mobile.			

SARAP R-600

Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)		
Surface Water		
Element	Table	Score
Range Use and Range Management (Source)	1	9-11
Surface Water Pathways	2	7-13
Surface Water Receptors	4	8-15
Sum of Surface Water Element Scores		24-39
Groundwater		
Element	Table	Score
Range Use and Range Management (Source)	1	9-11
Groundwater Pathways	3	14-22
Groundwater Receptors	5	6-8
Sum of Groundwater Element Scores		29-41
The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media:		
<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>	
High	50-65	
Moderate	30-49	
Minimal	0-29	
*Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.		
Surface Water Environmental Concern Evaluation Ranking		Minimal to Moderate
Groundwater Environmental Concern Evaluation Ranking		Minimal to Moderate
Notes:		

Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions

Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.
<p>Notes:</p> <p>The process of Implementing BMPs includes identifying and evaluating appropriate BMPs prior to implementation.</p> <p>In cases where federal or state listed threatened and endangered species or species of special concern are identified, the following actions are recommended depending on the Environmental Concern Evaluation Ranking:</p> <p>High Ranking: Conduct appropriate scientific literature review to assess potential impacts.</p> <p>Moderate Ranking: Consider conducting appropriate scientific literature review to assess potential impacts.</p>	

Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Duration of Range Use	Unknown; expenditure data supports use from 2001, though information believed to be incomplete. It is possible that the range has been operational for more than 30 years, based on the center being established in 1951.	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	3-5
Bullet-Capturing Technology	No bullet capturing technology; munitions fired along stream in Silver Creek Meadows.	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	0
MC Loading Rates	Approximately 70 lbs/yr based on conservative assumptions and recent expenditure data and interviews. MC loading calculations are in the MCMWTC Bridgeport REVA report, Section 4.	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	1
Range Maintenance	No lead removal activities are performed.	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	5
Source Element Score			9-11
Notes: Precipitation on the installation is typically snowfall.			

SARAP R-700

Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
pH of Water	6.5 ≤ median pH ≤ 8.5 for surface water (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
Precipitation	Yearly precipitation ranges from 30-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
Slope of Range	SSURGO data for the soil type in this area suggests slopes from 0-4%. To be conservative, a higher score for slope is used due to Silver Creek running through the range.	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	1-5
Vegetation	90-95% rangeland total cover identified in SSURGO data	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	1
Soil Type/Runoff Conditions	SSURGO data: very high runoff. Using SSURGO data the grain size distribution ranges from: 62.7-67.1-% sand; 18.9-23.3% silt; 14% clay	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand/gravel	3-5
Runoff/Erosion Engineering Controls	No engineering controls	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	0
Surface Water Pathway Score			9-17
Notes: Silver Creek flows through east side of range. Precipitation on the installation is typically snowfall.			

SARAP R-700

Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Depth to Groundwater	SSURGO database: 5-45 inches. Shallow groundwater expected based on 1) historical water levels near basecamp ranging from 5-50 ft below ground surface and 2) Silver creek running through east side of range.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	5
Precipitation	Yearly precipitation ranges from 30-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
pH of Water	6.5 ≤ median pH ≤ 8.5 for groundwater (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
pH of Soil	pH range of Soil (pH=5.6-6.5) based on the SSURGO database	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1-5
Soil Type/Infiltration Conditions	Using SSURGO data the grain size distribution ranges from: 62.7-67.1-% sand; 18.9-23.3% silt; 14% Clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3-5
Clay Content in Soil	Using SSURGO data the grain size distribution ranges from: 62.7-67.1-% sand; 18.9-23.3% silt; 14% Clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3-5
Groundwater Pathway Score			16-26
Notes: Precipitation on the installation is typically snowfall.			

SARAP R-700

Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element			
(These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Drinking Water Usage*	A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2. Creeks are designated for drinking water use, but no known sources of domestic water supply, other than the potential limited use during training activities, are located on the installation. R-700 is located over 3 miles upgradient from the installation boundary.*	10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown 5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown 2 if low possibility for contamination in the media to be present at or migrate to a point of exposure	2
Agricultural or Other Beneficial Usage*	A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2. Surface water bodies potentially used for Agricultural/Beneficial Usage are located downgradient.*	5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably. 1 if low possibility for contamination in the media to be present at or migrate to a point of exposure	1-3
Sensitive Species Habitat or Threatened and Endangered Species	The GIS database and USFWS website identified nearby sensitive habitat or species (such as Mountain Yellow Legged Frog Critical Aquatic Refuge, a candidate species for federal listing as endangered, and Lahontan Cutthroat Trout, federally listed as threatened).	10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary 5 if potential for receptors to have access to possibly contaminated media 1 if little or no potential for receptors to have access to possible contaminated media	5-10
Surface Water Receptor Score			8-15
Notes: *Surface water bodies (Silver Creek and West Walker River) have beneficial uses including Municipal and Domestic Supply (drinking water supply), Agricultural Supply, and other usage according to the Water Quality Control Plan for the Lahontan Region (Basin Plan). However, these waters are not expected to be impacted by the operational range based on Range Use and Surface Water Pathways (Tables 1 and 2). In particular, the pH > 6.5 for surface water suggests lead will not dissolve and is not readily mobile.			

Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Wells Identified as Potable Water Sources	One on-base drinking water well present, but not hydraulically downgradient of the range. Analytical results do not show elevated concentrations of lead above regulatory Action Levels. No other drinking water supply wells identified within 2 miles of base camp* (EDR, 2002).	10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown 5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure	2
Wells Identified for Agricultural or Other Beneficial Usage	No other water supply wells identified within 2 miles of the base camp (EDR, 2002)	5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure	1
Sensitive Species Habitat or Threatened and Endangered Species	The GIS database and USFWS website identified nearby sensitive habitat or species (such as Mountain Yellow Legged Frog Critical Aquatic Refuge and Lahontan Cutthroat Trout).	5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources	3-5
Groundwater Receptor Score			6-8
Notes: *Water supply wells may be present over 2 miles downgradient of the installation. However, the pH of groundwater above 6.5 suggests lead will not dissolve and is not readily mobile.			

SARAP R-700

Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)		
Surface Water		
Element	Table	Score
Range Use and Range Management (Source)	1	9-11
Surface Water Pathways	2	9-17
Surface Water Receptors	4	8-15
Sum of Surface Water Element Scores		26-43
Groundwater		
Element	Table	Score
Range Use and Range Management (Source)	1	9-11
Groundwater Pathways	3	16-26
Groundwater Receptors	5	6-8
Sum of Groundwater Element Scores		31-45
The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media:		
<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>	
High	50-65	
Moderate	30-49	
Minimal	0-29	
*Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.		
Surface Water Environmental Concern Evaluation Ranking		Minimal to Moderate
Groundwater Environmental Concern Evaluation Ranking		Moderate
Notes:		

Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions

Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.
<p>Notes:</p> <p>The process of Implementing BMPs includes identifying and evaluating appropriate BMPs prior to implementation.</p> <p>In cases where federal or state listed threatened and endangered species or species of special concern are identified, the following actions are recommended depending on the Environmental Concern Evaluation Ranking:</p> <p>High Ranking: Conduct appropriate scientific literature review to assess potential impacts.</p> <p>Moderate Ranking: Consider conducting appropriate scientific literature review to assess potential impacts.</p>	

SARAP Sniper-1/Sniper-2
Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Duration of Range Use	Unknown; interviews suggest sniper courses have been operated for many years, though timeframe is unspecified. It is possible that the range has been operational for more than 30 years, based on the center being established in 1951.	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	5
Bullet-Capturing Technology	No bullet capturing technology, though use of foam dummies may result in limited capture and removal. Munitions fired into a small area.	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	0
MC Loading Rates	Approximately 155 lbs/yr based on conservative assumptions and recent expenditure data and interviews. MC loading calculations are in the MCMWTC Bridgeport REVA report, Section 4. Interviews stress training focuses on movement, not weapons use, so munitions use at this area has always been very low. Sniper courses involving munitions use are expected to reduce significantly starting 2007.	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	1-3
Range Maintenance	No lead removal activities are performed.	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	5
Source Element Score			11-13
Notes:			

SARAP Sniper-1/Sniper-2 Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
pH of Water	6.5 ≤ median pH ≤ 8.5 for surface water (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
Precipitation	Yearly precipitation ranges from 35-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
Slope of Range	SSURGO data for the soil type in this area suggests slopes from 15-50%. However, field conditions observed suggest a nearly horizontal slope in the target area and directly downgradient of the range for 10's of feet.	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	1-5
Vegetation	85-100% rangeland total cover identified in SSURGO data.	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	1
Soil Type/Runoff Conditions	SSURGO data: high to very high runoff, Using SSURGO data the grain size distribution ranges from: 67.1-67.4% sand; 18.9-19.6% silt; 13-14% Clay	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand/gravel	1-5
Runoff/ Erosion Engineering Controls	No engineering controls	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	0
Surface Water Pathway Score			7-17
Notes: Precipitation on the installation is typically snowfall. An unnamed intermittent creek runs through the range.			

SARAP Sniper-1/Sniper-2 Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Depth to Groundwater	SSURGO database: no groundwater in the soil profile. Shallow groundwater expected based on 1) historical water levels near basecamp ranging from 5-50 ft below ground surface and 2) unnamed intermittent creek located on the range.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	5
Precipitation	Yearly precipitation ranges from 35-45 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
pH of Water	6.5 ≤ median pH ≤ 8.5 for groundwater (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
pH of Soil	pH range of Soil (pH=5.6-7.3) based on the SSURGO database	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1-5
Soil Type/Infiltration Conditions	Using SSURGO data the grain size distribution ranges from: 67.1-67.4% sand; 18.9-19.6% silt; 13-14% Clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Clay Content in Soil	Using SSURGO data the grain size distribution ranges from: 67.1-67.4% sand; 18.9-19.6% silt; 13-14% Clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Groundwater Pathway Score			16-22
Notes: Precipitation on the installation is typically snowfall.			

SARAP Sniper-1/Sniper-2 Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element			
(These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Drinking Water Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.</p> <p>Creeks are designated for drinking water use, but no known sources of domestic water supply, other than the potential limited use during training activities, are located on the installation. Range is located over 2 miles upgradient from the installation boundary.*</p>	<p>10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>2 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	2
Agricultural or Other Beneficial Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2. Surface water bodies potentially used for Agricultural/ Beneficial Usage are located downgradient.*</p>	<p>5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown</p> <p>3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably.</p> <p>1 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	1-3
Sensitive Species Habitat or Threatened and Endangered Species	<p>The GIS database does not identify specific nearby sensitive habitat or species. The potential for receptors exposed downgradient of the range exists.</p>	<p>10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary</p> <p>5 if potential for receptors to have access to possibly contaminated media</p> <p>1 if little or no potential for receptors to have access to possible contaminated media</p>	1-5
Surface Water Receptor Score			4-10
<p>Notes: * The West Walker River (downgradient of the unnamed intermittent creek) has beneficial uses including Municipal and Domestic Supply (drinking water supply), Agricultural Supply, and other usage according to the Water Quality Control Plan for the Lahontan Region (Basin Plan). However, these waters are not expected to be impacted by the operational range based on Range Use and Surface Water Pathways (Tables 1 and 2). In particular, the pH > 6.5 for surface water suggests lead will not dissolve and is not readily mobile.</p>			

SARAP Sniper-1/Sniper-2 Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/ Source	Score Criteria	Site Score
Wells Identified as Potable Water Sources	One on-base drinking water well present, but not hydraulically downgradient of the range. Analytical results from the installation water supply well do not show elevated concentrations of lead above regulatory Action Levels. No other drinking water supply wells identified within 2 miles of base camp* (EDR, 2002).	10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown 5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure	2-5
Wells Identified for Agricultural or Other Beneficial Usage	No other drinking water supply wells identified within 2 miles of base camp* (EDR, 2002)	5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown 3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably 1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure	1
Sensitive Species Habitat or Threatened and Endangered Species	The GIS database does not identify specific nearby sensitive habitat or species. However, an unnamed intermittent creek is on the range.	5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources 1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources	1
Groundwater Receptor Score			4-7
Notes: *Water supply wells may be present over 2 miles downgradient of the installation. However, the pH of groundwater above 6.5 suggests lead will not dissolve and is not readily mobile.			

SARAP Sniper-1/Sniper-2
 Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)		
Surface Water		
Element	Table	Score
Range Use and Range Management (Source)	1	11-13
Surface Water Pathways	2	7-17
Surface Water Receptors	4	4-10
Sum of Surface Water Element Scores		22-40
Groundwater		
Element	Table	Score
Range Use and Range Management (Source)	1	11-13
Groundwater Pathways	3	16-22
Groundwater Receptors	5	4-7
Sum of Groundwater Element Scores		31-42
The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media:		
<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>	
High	50-65	
Moderate	30-49	
Minimal	0-29	
*Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.		
Surface Water Environmental Concern Evaluation Ranking		Minimal to Moderate
Groundwater Environmental Concern Evaluation Ranking		Moderate
Notes:		

SARAP Sniper-1/Sniper-2
 Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions

Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.
<p>Notes:</p> <p>The process of Implementing BMPs includes identifying and evaluating appropriate BMPs prior to implementation.</p> <p>In cases where federal or state listed threatened and endangered species or species of special concern are identified, the following actions are recommended depending on the Environmental Concern Evaluation Ranking:</p> <p>High Ranking: Conduct appropriate scientific literature review to assess potential impacts.</p> <p>Moderate Ranking: Consider conducting appropriate scientific literature review to assess potential impacts.</p>	

SARAP Sniper-3/Sniper-4
 Small Arms Range Protocol Evaluation Forms

Table 1: Range Use and Range Management (Source) Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Duration of Range Use	Unknown; interviews suggest sniper course have been operated for many years, though timeframe unspecified. It is possible that the range has been operational for more than 30 years, based on the center being established in 1951.	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	5
Bullet-Capturing Technology	No bullet capturing technology, though use of dummy targets may result in limited capture and removal. Munitions fired into a small area around Wolf Creek.	If [range usage duration = bullet capture duration], then apply a negative score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a negative score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	0
MC Loading Rates	Approximately 155 lbs/yr based on conservative assumptions and recent expenditure data and interviews. MC loading calculations are in the MCMWTC Bridgeport REVA report, Section 4. Interviews stress training focuses on movement, not weapons use, so munitions use at this area has always been very low. Sniper courses involving munitions use are expected to reduce significantly starting 2007.	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	3
Range Maintenance	No lead removal activities are performed.	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	5
Source Element Score			13
Notes:			

SARAP Sniper-3/Sniper-4 Small Arms Range Protocol Evaluation Forms

Table 2: Surface Water Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
pH of Water	6.5 ≤ median pH ≤ 8.5 for surface water (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
Precipitation	Yearly precipitation ranges from 30-50 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
Slope of Range	SSURGO data for the soil type in this area suggests slopes from 2-50%. However, field conditions observed suggest nearly a nearly horizontal slope directly downgradient of the range.	5 if slope > 10% 3 if slope = 5% to 10% 1 if slope < 5%	1-5
Vegetation	90-100% rangeland total cover identified in SSURGO data.	5 if vegetation cover < 20% 3 if vegetation cover = 20% to 50% 1 if vegetation cover > 50%	1
Soil Type/Runoff Conditions	SSURGO data: medium to very high runoff, Using SSURGO data the grain size distribution ranges from: 44-66.6% sand; 21.9-23% silt; 10-18% Clay	5 if soil type is clay / silty clay 3 if soil type is clayey sand / silt 1 if soil type is sand/gravel	3
Runoff/ Erosion Engineering Controls	No engineering controls. Minimal erosion possible based on topography and observation at other operational ranges.	0 if no engineering controls -5 if partial engineering controls -10 if effective engineering controls	0
Surface Water Pathway Score			9-15
Notes: Precipitation on the installation is typically snowfall. Wolf Creek runs through the range.			

SARAP Sniper-3/Sniper-4 Small Arms Range Protocol Evaluation Forms

Table 3: Groundwater Pathways Characteristics Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Depth to Groundwater	SSURGO database: 5-30 inches. Shallow groundwater expected based on 1) historical water levels near base camp ranging from 5-50 ft below ground surface and 2) the Wolf Creek bisects the range.	5 if depth to groundwater < 20 feet 3 if depth to groundwater = 20-99 feet 1 if depth to groundwater = 100-300 feet 0 if depth to groundwater >300 feet	5
Precipitation	Yearly precipitation ranges from 30-50 inches per year (SSURGO database)	5 if precipitation > 40 inches/year 3 if precipitation = 20-40 inches/year 1 if precipitation < 20 inches/year	3-5
pH of Water	6.5 ≤ median pH ≤ 8.5 for groundwater (REVA report Table 3.3)	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1
pH of Soil	pH range of Soil (pH=5.1-6.5) based on the SSURGO database	5 if pH < 6.5 3 if pH > 8.5 1 if 6.5 ≤ pH ≤ 8.5	1-5
Soil Type/Infiltration Conditions	SSURGO data: grain size distribution ranges from: 44-66.6% sand; 21.9-23% silt; 10-18% clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Clay Content in Soil	SSURGO data: grain size distribution ranges from: 44-66.6% sand; 21.9-23% silt; 10-18% clay	5 if soil type is sand/gravel 3 if soil type is clayey sand / silt 1 if soil type is clay / silty clay	3
Groundwater Pathway Score			16-22
Notes: Precipitation on the installation is typically snowfall.			

SARAP Sniper-3/Sniper-4 Small Arms Range Protocol Evaluation Forms

Table 4: Surface Water Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Drinking Water Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.</p> <p>Creeks are designated for drinking water use, but no known sources of domestic water supply, other than the potential limited use during training or recreational activities. Range is located over 2 miles upgradient from the installation boundary.*</p>	<p>10 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has a reasonable potential to move toward a surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>5 if contamination in the media has moved or is expected to move only slightly beyond the source (tens of feet) or could move, but is not moving appreciably, toward surface water body used as a potable water supply or if a designation as a potable water source is unknown</p> <p>2 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	2
Agricultural or Other Beneficial Usage	<p>A low possibility of lead contamination or migration is present based on range conditions presented in Tables 1 and 2.</p> <p>Surface water bodies potentially used for Agricultural/Beneficial Usage are located downgradient.*</p>	<p>5 if analytical data or observable evidence indicates that contamination in the media is present at, is moving toward, or has moved to a point of exposure or if a designation as agricultural or other beneficial usage is unknown</p> <p>3 if contamination in the media has moved only slightly beyond the source (tens of feet) or could move but is not moving appreciably.</p> <p>1 if low possibility for contamination in the media to be present at or migrate to a point of exposure</p>	1-3
Sensitive Species Habitat and Threatened or Endangered Species	<p>The 2003 MCMWTC Bridgeport Natural and Cultural Resources Report and the USFWS identified nearby sensitive habitat or species (such as Lahontan Cutthroat Trout). The potential for receptors exposed downgradient of the range exists.</p>	<p>10 if identified receptors have access to possibly contaminated media and/or are located adjacent to the range boundary</p> <p>5 if potential for receptors to have access to possibly contaminated media</p> <p>1 if little or no potential for receptors to have access to possible contaminated media</p>	5-10
Surface Water Receptor Score			8-15
Notes: * Wolf Creek and the West Walker River have beneficial uses including Municipal and Domestic Supply (drinking water supply), Agricultural Supply, and other usage according to the Water Quality Control Plan for the Lahontan Region (Basin Plan). However, these waters are not expected to be impacted by the operational range based on Range Use and Surface Water Pathways (Tables 1 and 2). In particular, the pH > 6.5 for surface water suggests lead will not dissolve and is not readily mobile.			

SARAP Sniper-3/Sniper-4 Small Arms Range Protocol Evaluation Forms

Table 5: Groundwater Receptors Element (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)			
Criteria	Justification/Source	Score Criteria	Site Score
Wells Identified as Potable Water Sources	One on-base drinking water well present, but not hydraulically downgradient of the range. Analytical results from the installation water supply well do not show elevated concentrations of lead above regulatory Action Levels. No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002).	<p>10 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as a potable water source is unknown</p> <p>5 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably</p> <p>2 if low possibility for MC to be present at or migrate to within a reasonable radius of influence or point of exposure</p>	2-5
Wells Identified for Agricultural or Other Beneficial Usage	No other drinking water supply wells identified within 2 miles of basecamp* (EDR, 2002)	<p>5 if analytical data or observable evidence or site conditions indicate that MC may be within or moving toward a reasonable radius of influence of a well or other point of exposure or if a designation as agricultural or other beneficial usage is unknown</p> <p>3 if analytical data or observable evidence or site conditions indicate that MC have moved only slightly beyond the source (tens of feet) or could move toward a reasonable radius of influence of a well or other point of exposure, but are not moving appreciably</p> <p>1 if low possibility for MC to be present at or migrate to within a reasonable radius of influence of a well or point of exposure</p>	1
Sensitive Species Habitat and Threatened and Endangered Species	The 2003 MCMWTC Bridgeport Natural and Cultural Resources Report and the USFWS identified nearby sensitive habitat or species (such as Lahontan Cutthroat Trout). The potential for receptors exposed downgradient of the range exists.	<p>5 if identified receptors exposed to potentially MC-impacted water from groundwater or groundwater sources</p> <p>3 if potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources</p> <p>1 if little or no potential for receptors exposed to potentially MC-impacted water from groundwater or groundwater sources</p>	1-5
Groundwater Receptor Score			4-11
Notes: *Water supply wells may be present over 2 miles downgradient of the installation. However, the pH of groundwater above 6.5 suggests lead will not dissolve and is not readily mobile.			

SARAP Sniper-3/Sniper-4
 Small Arms Range Protocol Evaluation Forms

Table 6: Relative Environmental Concern Evaluation (These definitions only apply for the purposes of the Small Arms Range Assessment Protocol.)										
Surface Water										
Element	Table	Score								
Range Use and Range Management (Source)	1	13								
Surface Water Pathways	2	9-15								
Surface Water Receptors	4	8-15								
Sum of Surface Water Element Scores		30-43								
Groundwater										
Element	Table	Score								
Range Use and Range Management (Source)	1	13								
Groundwater Pathways	3	16-22								
Groundwater Receptors	5	4-11								
Sum of Groundwater Element Scores		33-46								
The relative environmental concern evaluation ranking for each media is determined by selecting the appropriate score based on the data elements for that media: <table style="margin-left: 40px;"> <thead> <tr> <th style="text-align: left;"><u>Environmental Concern Evaluation Ranking*</u></th> <th style="text-align: left;"><u>Score Range</u></th> </tr> </thead> <tbody> <tr> <td>High</td> <td>50-65</td> </tr> <tr> <td>Moderate</td> <td>30-49</td> </tr> <tr> <td>Minimal</td> <td>0-29</td> </tr> </tbody> </table> *Use the Environmental Concern Evaluation Ranking to determine if further actions are warranted based on the guidelines for recommended actions, as defined in Table 7.		<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>	High	50-65	Moderate	30-49	Minimal	0-29	
<u>Environmental Concern Evaluation Ranking*</u>	<u>Score Range</u>									
High	50-65									
Moderate	30-49									
Minimal	0-29									
Surface Water Environmental Concern Evaluation Ranking		Moderate								
Groundwater Environmental Concern Evaluation Ranking		Moderate								
Notes:										

SARAP Sniper-3/Sniper-4
 Small Arms Range Protocol Evaluation Forms

Table 7: Guidelines for Recommended Actions

Environmental Concern Evaluation Ranking	Recommended Action
High	Action required. 1) Sample appropriate media (groundwater, surface water, and/or soil). 2) Implement BMPs.
Moderate	1) Implement BMPs. 2) Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal	1) No further action needed. 2) Consider implementing BMPs.
<p>Notes:</p> <p>The process of Implementing BMPs includes identifying and evaluating appropriate BMPs prior to implementation.</p> <p>In cases where federal or state listed threatened and endangered species or species of special concern are identified, the following actions are recommended depending on the Environmental Concern Evaluation Ranking:</p> <p>High Ranking: Conduct appropriate scientific literature review to assess potential impacts.</p> <p>Moderate Ranking: Consider conducting appropriate scientific literature review to assess potential impacts.</p>	