



FINAL ANNUAL STATE OF THE RESERVATION REPORT

TRAINING YEAR 2019

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PREFACE

The *Annual State of the Reservation Report* describes the nature and extent of military training and other activities taking place in the Camp Edwards Training Area/Upper Cape Water Supply Reserve and the status of the Massachusetts Army National Guard's compliance with environmental laws, regulations and the Environmental Performance Standards, a set of 19 standards established in Chapter 47 of the Acts of 2002 guiding military and civilian usage of the Camp Edwards Training Area/Upper Cape Water Supply Reserve. Ultimately, the goal of the Annual Report is to illustrate that military training can occur in the Camp Edwards Training Area/Upper Cape Water Supply Reserve in a manner that is compatible with the Environmental Performance Standards.

The *Annual State of the Reservation Report* covers the Massachusetts National Guard's Training Year 2019, which ran from October 1, 2018 to September 30, 2019; therefore, information provided in this report generally encompasses an individual training year rather than calendar year. The report's primary focus is the review of the Massachusetts Army National Guard's environmental programs relative to environmental compliance. Each year, the report provides information on military training levels, range area usage, resource management activities, environmental indicators for training activities, and coordination among other activities and projects, such as the regional water supply and the remediation program activities. Cape Cod Air Force Station and the US Coast Guard Communications Station are both located within the boundary of the Upper Cape Water Supply Reserve; however, they are not subject to Chapter 47 of the Acts of 2002 and the Environmental Performance Standards (Chapter 47 of the Acts of 2002, Section 15).

The report also provides information on environmental reviews for proposed Massachusetts National Guard and other projects within the Upper Cape Water Supply Reserve.

This report, established by the Massachusetts Environmental Policy Act process and required by state law (Chapter 47 of the Acts of 2002), is the result of many years of environmental reviews and submissions by the Massachusetts Army National Guard.

The Annual Report is structured as follows:

Section 1, Introduction, discusses the structure of Joint Base Cape Cod and the environmental management structure pertaining to activities in the northern training areas of Camp Edwards.

Section 2, Small Arms Ranges and Military Training Activities, provides an update on the return to live fire at the Small Arms Ranges at Camp Edwards and associated activities. This section also provides information on military training that occurred in the Reserve during Training Year 2019. Data is provided on the levels of training in the various training areas in the Reserve and range usage, as well as at the various training support area facilities in the Cantonment Area on Camp Edwards.

Section 3, Environmental Program Management, focuses on environmental management programs operated by the Massachusetts Army National Guard in the Reserve and program compliance with the Environmental Performance Standards for the Reserve for the training year.

Section 4, Remediation Program Activities, provides a summary of remediation activities undertaken in the Reserve during the training year by the Installation Restoration Program and the Impact Area Groundwater Study Program.

Section 5, Miscellaneous Military and Civilian Activities and Environmental Program Priorities, provides information on major activities undertaken during Training Year 2019 that may not be directly related to a

Massachusetts Army National Guard environmental management program, actions in the Reserve, or specific Environmental Performance Standards for the Reserve.

The Annual Report is the culmination of a year-long effort by the military and civilian employees of the Massachusetts Army National Guard, Training Site Camp Edwards, the Environmental & Readiness Center, the Natural Resource Program, and the Environmental Management Commission to provide valuable information on the state of the Reserve to interested stakeholders and the community at large.

Annual State of the Reservation Report Key Terms

Upper Cape Water Supply Reserve

The Upper Cape Water Supply Reserve was established by Chapter 47 of the Acts of 2002 as public conservation land dedicated to three primary purposes: water supply and wildlife habitat protection; the development and construction of public water supply systems, and, the use and training of the military forces of the commonwealth; provided that, such military use and training is compatible with the natural resource purposes of water supply and wildlife habitat protection. It comprises—and for the purposes of this report, may be synonymous with—Camp Edwards’ 14,886-acre northern training area. Cape Cod Air Force Station and US Coast Guard Communications Station Boston are both located within the boundary of the Upper Cape Water Supply Reserve; however, they are not subject to the Environmental Performance Standards.

Camp Edwards Training Area

The Massachusetts Army National Guard Camp Edwards Training Site (Camp Edwards Training Area) is the major training area for Army National Guard soldiers in the Northeast. It is approximately 14,886 acres located on the northern portion of Joint Base Cape Cod. At Camp Edwards, soldiers practice maneuvering exercises, bivouacking, and use the small arms ranges. The Upper Cape Water Supply Reserve also is located on the 14,886 acres of Camp Edwards. It comprises—and for the purposes of this report, may be synonymous with—Camp Edwards’ 14,886-acre northern training area.

Environmental Performance Standards

The Environmental Performance Standards (Appendix A) are a list of requirements, or standards for performance, that guide both military and other users in the protection of Camp Edwards’ natural and cultural resources and the groundwater beneath the Reserve. The Environmental Performance Standards are based in large part on existing federal, state, and Department of Defense regulations. In some cases, the protections offered by the performance standards are more stringent than those offered by other regulations. These standards apply to the Camp Edwards Training Area at Joint Base Cape Cod. Although Cape Cod Air Force Station and the US Coast Guard Communications Station are located within the boundary of the Upper Cape Water Supply Reserve, the Environmental Performance Standards do not apply to them as they were excluded by Chapter 47 of the Acts of 2002.

Training Year

A training year runs from October 1 to September 30 and is based on the federal fiscal year. Information found in the annual *State of the Reservation Report* is compiled by training year. This *Annual State of the Reservation Report* is for Training Year 2019 (October 1, 2018 – September 30, 2019).

Training Support Area

There are separate facilities and equipment that can simulate live military training; these are grouped under the Training Support Area. The majority of the training activities associated with these facilities are conducted in the Cantonment Area of Camp Edwards. Training Support Areas include Kelley Tactical Training Base, the Calero Mobile Military Operations on Urban Terrain Site, the Engagement Skills Trainer and the Virtual Convoy Operations Trainer.

Small Arms Ranges

Small arms ranges allow live-fire qualification training with weapons of a small caliber, i.e. handgun, rifle, shotgun, or machine gun. Small arms training is designed to train a soldier to be “qualified” in the use and maintenance of his or her assigned weapon. There are seven active small arms ranges on Camp Edwards, which the Massachusetts Army National Guard uses for weapons familiarization, weapons zeroing (essentially customizing it to give the soldier a more accurate shot) and qualification.

Impact Area

The 2,200 acre Impact Area is located in the center of the Upper Cape Water Supply Reserve/Camp Edwards Training Site. All the small arms ranges are focused around the perimeter of the Impact Area, and all small arms range firing is pointed towards the Impact Area. The 330-acre Central Impact Area is located within the Impact Area; it was the primary target area for artillery, mortar and other firing activities from the early 1900s until firing ceased in 1997. The Central Impact Area contains critical habitat for several state-listed species.

Cantonment Area

The southern 7,200-acre, developed area of Joint Base Cape Cod with roads, utilities, office and classroom buildings, training support areas, and housing. There are numerous federal, state and county entities located there.

Environmental Protection Agency Administrative Orders

In February 1997, the Environmental Protection Agency utilized its powers under the Safe Drinking Water Act to issue the first Administrative Order concerning Camp Edwards. There are four administrative orders in total; Administrative Order #2 was issued in April 1997 to the National Guard Bureau and the Massachusetts National Guard. It required that certain training activities (artillery and mortar firing) cease pending the completion of environmental investigations at the training ranges and Impact Area.

Referenced Documents

The *Annual State of the Reservation* report encompasses a large amount of information and makes reference to many letters, reports and other documents that were developed over the course of Training Year 2019. Many of these are available on-line and any letter, document or report referenced in the *Annual State of the Reservation Report* is available by contacting Emily Kelly, Community Involvement Specialist, Massachusetts National Guard Environmental & Readiness Center, 339-202-9341, emily.d.kelly2.nfg@mail.mil.

TABLE OF CONTENTS

PREFACE	I
TABLE OF CONTENTS	IV
LIST OF TABLES	VI
LIST OF FIGURES	VII
LIST OF GRAPHS	VIII
ACRONYMS	IX
SECTION 1 INTRODUCTION	1
1.0 INTRODUCTION.....	1
1.1 JOINT BASE CAPE COD STRUCTURE.....	1
1.2 ENVIRONMENTAL MANAGEMENT STRUCTURE	3
SECTION 2 SMALL ARMS RANGES AND MILITARY TRAINING ACTIVITIES	5
2.0 Introduction.....	5
2.1 Camp Edwards Training Area/Upper Cape Water Supply Reserve	5
2.2 Range Update	13
2.3 Science Advisory Ad Hoc Committee	14
2.4 Tango, Juliet and Kilo Ranges.....	14
2.5 Sierra and India Ranges.....	15
2.6 Lima Range	18
2.7 Echo Range.....	18
2.8 Range Usage Data.....	19
2.9 Off-Site Training.....	26
2.10 Simulated Munitions.....	27
2.11 Pyrotechnics.....	27
2.12 M69 Hand Grenade Simulator	28
2.13 Soldier Validation Lane.....	29
2.14 EPS 15.3.3 Field Refueling.....	30
2.15 Multi-Purpose Machine Gun Range	33
2.16 Combined Arms Exercise	33
SECTION 3 ENVIRONMENTAL PROGRAM MANAGEMENT	35
3.0 Introduction.....	35
3.1 Groundwater Resources Management	35
3.2 Wetlands and Surface Water Management.....	40
3.3 Rare Species Management.....	41
3.4 Soil Conservation Management	48
3.5 Vegetation, Habitat and Wildlife Management.....	48
3.6 Fire Management.....	54
3.7 Pest Management	56
3.8 Air Quality Management	56
3.9 Noise Management	57
3.10 Stormwater Management.....	57
3.11 Wastewater Management.....	57
3.12 Solid Waste Management.....	58

TABLE OF CONTENTS

3.13	Hazardous Materials Management.....	58
3.14	Hazardous Waste Management	59
3.15	Vehicle Management	59
3.16	General Use and Access Management	59
3.17	Cultural Resources Management.....	60
3.18	EPS Violations	60
3.19	Mitigation	61
SECTION 4 REMEDIATION PROGRAM ACTIVITIES.....		65
4.0	Introduction.....	65
4.1	Investigation And Remediation Programs	65
4.2	Installation Restoration Program Activities in the Reserve	67
4.3	Impact Area Groundwater Study Program Activities.....	67
SECTION 5 MISCELLANEOUS MILITARY AND CIVILIAN ACTIVITIES AND ENVIRONMENTAL PROGRAM PRIORITIES.....		69
5.0	Miscellaneous Military Activities.....	69
5.1	Projects at Camp Edwards.....	69
5.2	Joint Base Cape Cod Executive Director.....	70
5.3	Miscellaneous Civilian Activities	70
5.4	Environmental Program Priorities.....	72
APPENDIX A ENVIRONMENTAL PERFORMANCE STANDARDS		75
APPENDIX B LIST OF CONTACTS.....		89
APPENDIX C FIRING RANGE AND SOLDIER VALIDATION LANE INFORMATION.....		93
APPENDIX D ENVIRONMENTAL LAWS AND REGULATIONS.....		143
APPENDIX E WATER SUPPLY INFORMATION.....		149
APPENDIX F RARE SPECIES REPORTED TO NATURAL HERITAGE AND ENDANGERED SPECIES PROGRAM.....		184
APPENDIX G ENVIRONMENTAL PERFORMANCE STANDARDS VIOLATIONS HISTORY		190

LIST OF TABLES

Table 2-1 Overview of Training Use - TY 2019	6
Table 2-2 Training Use History	13
Table 2-3 Training Area Use - TY 2019	23
Table 2-4 Training Area Use History	24
Table 2-5 Training Support Area Use - TY 2019	25
Table 2-6 Training Support Area Use History	26
Table 3-1 List of Rare Species Reported To NHESP	43

LIST OF FIGURES

Figure 1-1 Map of Joint Base Cape Cod.....	2
Figure 1-2 Utility Easements and Leases	4
Figure 2-1 Camp Edwards Training Area and Ranges	6
Figure 2-2 Personnel Usage by Training Area in the Reserve, TY 2010 – TY 2019	8
Figure 2-3 Ten Year Personnel Use by Training Area in the Reserve, TY 2010 – TY 2019.....	9
Figure 2-4 Daily Usage Per Training Area in the Reserve, TY 2010 – TY 2019.....	10
Figure 2-5 Ten Year Daily Usage by Training Area in the Reserve, TY 2010 – TY 2019.....	11
Figure 2-6 SVL Objective Locations.....	31
Figure 3-1 Well Locations.....	39
Figure 3-2 Training Areas C-13 And C-14 Mowing	54
Figure 3-3 Grassland Management Areas	63
Figure 4-1 JBCC Groundwater Plume Map	66
Figure 4-2 lagwsp Wells Installed During TY 2019.....	68
Figure 5-1 Eversource Switching Station Area.....	71

LIST OF GRAPHS

Graph 2-1 Average Personnel Use by Training Area for TY 2010 to TY 2019	12
Graph 2-2 Average Days Used By Training Area, TY 2010 to TY 2019	13
Graph 2-3 STAPP™ System Water Pumping.....	16
Graph 2-4 Lead Ammunition Use – Tango, Juliet and Kilo Ranges.....	20
Graph 2-5 Copper Ammunition Use – Sierra and India Ranges	21
Graph 2-6 M781 40mm Training Round Use – Lima Range	22
Graph 2-7 Simulated Munitions Use	27
Graph 2-8 Pyrotechnics Use in the Reserve History	28
Graph 2-9 M69 Hand Grenade Simulator Use	29
Graph 2-10 Soldier Validation Lane Use.....	30
Graph 3-1 Precipitation Recorded	36
Graph 3-2 U.S. Geological Survey Monitoring Well.....	37
Graph 3-3 Daily Water Withdrawal, J-Well and Water Cooperative.....	38
Graph 3-4 Camp Edwards Deer Harvest.....	52
Graph 3-5 Camp Edwards Turkey Harvest.....	53
Graph 3-6 Prescribed Fire Accomplishment within the Reserve	55
Graph 3-7 Wastewater Treatment Plant Discharge	58
Graph 3-8 Hazardous Waste Disposal – Camp Edwards.....	59

ACRONYMS

AFCEC	Air Force Civil Engineer Center
AFS	Air Force Station
ANGB	Air National Guard Base
AR	Army Regulation
ATV	All Terrain Vehicle
BMP	Best Management Practice
BP	Battle Position
CAA	Clean Air Act
CAC	Community Advisory Council
CAX	Combined Arms Exercise
CER	Camp Edwards Regulation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CIA	Central Impact Area
CMP	Conservation and Management Plan
CMR	Code of Massachusetts Regulations
CPQC	Combat Pistol Qualification Course
CS	Chemical Spill
CSE	Comprehensive Site Evaluation
DCR	Department of Conservation and Recreation
DFG	Department of Fish and Game
DFW	Division of Fisheries and Wildlife
DNA	Deoxyribonucleic acid
DoD	Department of Defense
E&RC	Environmental & Readiness Center
EMC	Environmental Management Commission
EPA	Environmental Protection Agency
EPS	Environmental Performance Standard
FAA	Federal Aviation Administration
FS	Fuel Spill
HMMWV	High Mobility Multipurpose Wheeled Vehicle
IAGWSP	Impact Area Groundwater Study Program
IED	Improvised Explosive Device
IMT	Individual Movement Techniques
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
ISWM	Integrated Solid Waste Management Site
ITAM	Integrated Training Area Management

Acronyms, continued

JBCC	Joint Base Cape Cod
JLUS	Joint Land Use Study
LQG	Large Quantity Generator
MANG	Massachusetts National Guard
MAANG	Massachusetts Air National Guard
MAARNG	Massachusetts Army National Guard
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
MA SHPO	Massachusetts State Historic Preservation Office
MCP	Massachusetts Contingency Plan
MEC	Munitions and Explosives of Concern
MEPA	Massachusetts Environmental Policy Act
MESA	Massachusetts Endangered Species Act
MGL	Massachusetts General Law
MIPAG	Massachusetts Invasive Plants Advisory Group
mm	millimeter
MMR	Massachusetts Military Reservation
MMRP	Military Munitions Response Program
MPMG	Multipurpose Machine Gun Range
NBC	Nuclear-Biological-Chemical
NEPA	National Environmental Policy Act
NHESP	Natural Heritage and Endangered Species Program
NLEB	Northern Long-eared Bat
OB/OD	Open Burning/Open Detonation
OEA	Office of Economic Adjustment
OMMP	Operation, Maintenance and Monitoring Plan
P2	Pollution Prevention
PAVE PAWS	Precision Acquisition Vehicle Entry – Phased Array Warning System
ppb	parts per billion
ppm	parts per million
PAN	Percussion Actuated Neutralizer
PFAS	Per- and polyfluoroalkyl substances
RDX	Royal Demolition Explosive
REC	Record of Environmental Consideration
RI/FS	Remedial Investigation/Feasibility Study
ROA	Record of Action
ROTC	Reserve Officers Training Corps
RTI	Regional Training Institute

Acronyms, continued

SAC	Science Advisory Council
SEMASS RRF	Southeastern Massachusetts Resource Recovery Facility
SPVS	Solar Photovoltaic System
SR/ES	Source Registration/Emissions Statement
SVL	Soldier Validation Lane
TSA	Training Support Area
TTB	Tactical Training Base
TY	Training Year
UAS	Unmanned Aerial System
URI	University of Rhode Island
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTES	Unit Training and Equipment Site
UTM	Ultimate Training Munition
WPA	Wetlands Protection Act
WWTP	Waste Water Treatment Plant
XRF	X-Ray Fluorescence

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SECTION 1

INTRODUCTION

1.0 INTRODUCTION

This section of the *Annual State of the Reservation Report* (Annual Report) provides information on Joint Base Cape Cod (JBCC) and the environmental management structure overseeing activities in the approximately 14,886 acre Camp Edwards Training Area/Upper Cape Water Supply Reserve (Reserve).

1.1 JOINT BASE CAPE COD STRUCTURE

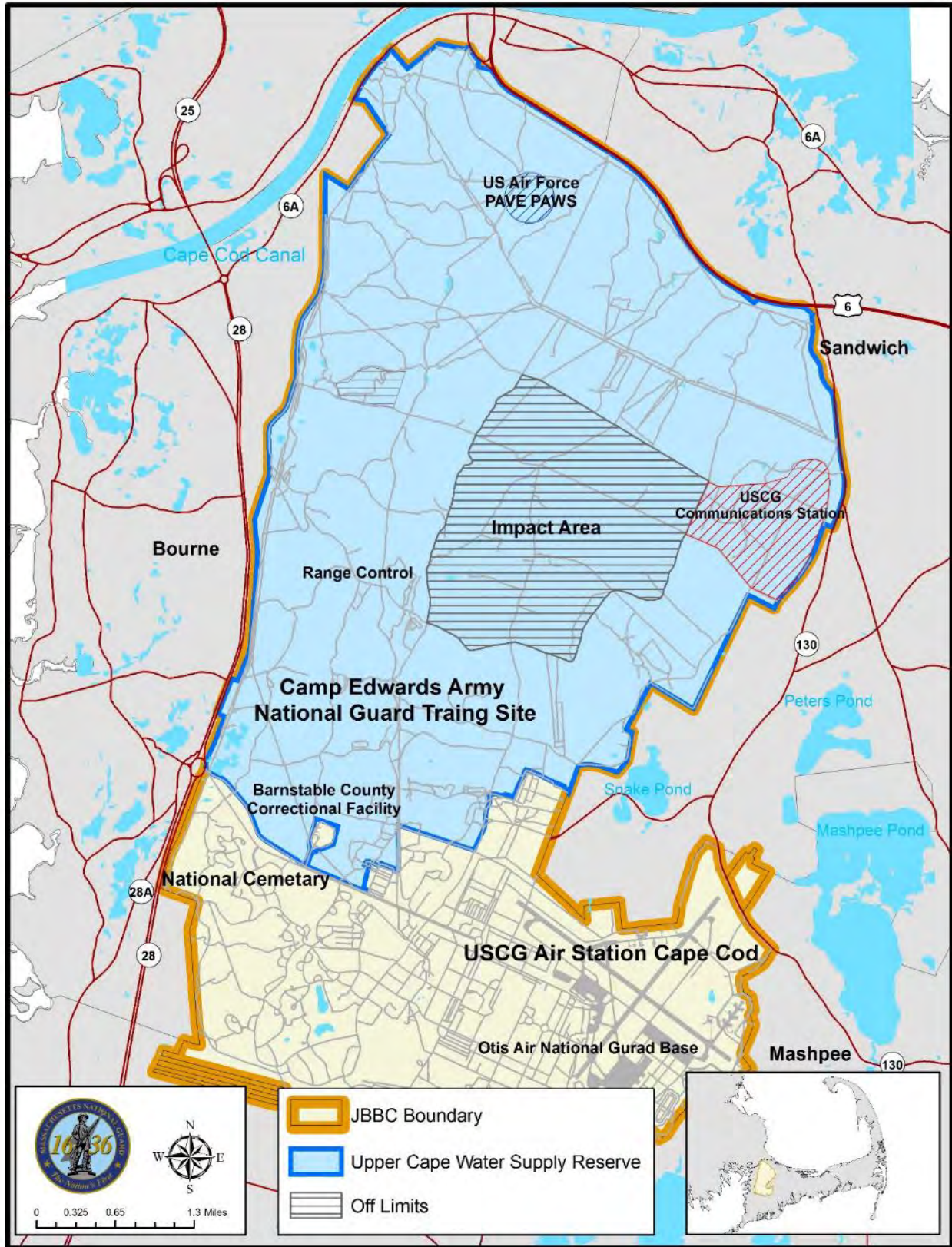
Joint Base Cape Cod is a multi-service military installation and is home to the Massachusetts Air National Guard's (MAANG) Otis Air National Guard Base (ANGB), the United States Coast Guard's (USCG) Base Cape Cod, the U.S. Air Force's Cape Cod Air Force Station (AFS), the Massachusetts Army National Guard's (MAARNG) Camp Edwards, and the Department of Veterans Affairs Cemetery. Joint Base Cape Cod is located in the upper western portion of Cape Cod, immediately south of the Cape Cod Canal in Barnstable County, Massachusetts. It includes parts of the towns of Bourne, Mashpee and Sandwich, and abuts the Town of Falmouth. Joint Base Cape Cod covers nearly 21,000 acres – approximately 30 square miles (Figure 1-1).

The Massachusetts Army National Guard's components of JBCC comprise two primary land use zones. The Camp Edwards Training Area comprises approximately 14,400 acres of the Reserve. The remaining Camp Edwards military-controlled area of JBCC lies in the southern portion, or Cantonment Area.

The MAARNG and MAANG are part of the Commonwealth of Massachusetts Military Division. However, federal law largely dictates their activities, make-up, training, and functions. For example, most of the day-to-day activities conducted at JBCC by the National Guard, including annual and weekend training, are federal military activities funded by the federal government. In conducting federal military activities, the National Guard is required by federal law to follow Department of Defense (DoD) regulations, Army regulations, Air Force instructions, and applicable federal and state laws and regulations.

There are three major facilities in the northern portion of JBCC that are not on land under the operational control of the Massachusetts National Guard. Cape Cod AFS, which includes the PAVE PAWS ballistic missile early warning radar system, is located on an 87-acre parcel of land on the northwest corner of the Reserve. The USCG's Communications Station is located on a 542-acre parcel along the northeastern side of the Reserve. A Barnstable County Correctional Facility that opened in 2004 is located on a 29-acre parcel of land just north of Connery Avenue, just outside the southern edge of the Reserve. The locations of these facilities are shown in Figure 1-1. Because these facilities are located on land not under the control of the Massachusetts National Guard, and because the Environmental Performance Standards (EPSs) (see Appendix A) established through Chapter 47 of the Acts of 2002 do not apply to these organizations and facilities, detailed information concerning activities at these facilities is not included in the Annual Report. Questions pertaining to activities at Cape Cod AFS, the Coast Guard Communications Station, and the Barnstable County Correctional Facility should be addressed to the persons listed in Appendix B of this report.

Figure 1-1 Map of Joint Base Cape Cod



The Commonwealth of Massachusetts has issued three utility easements on its state-owned property in the Reserve: an electrical power line easement (Eversource), a natural gas pipeline easement (National Grid), and a natural gas pipeline easement (Algonquin - that partially overlays the National Grid easement). Additionally, there are easements issued to the Upper Cape Regional Water Supply Cooperative and to the Bourne Water District. The locations of the utilities and facilities are shown in Figure 1-2.

1.2 ENVIRONMENTAL MANAGEMENT STRUCTURE

1.2.1 Environmental Management Commission

Chapter 47 of the Acts of 2002 established the Environmental Management Commission (EMC), consisting of the Commissioner of the Department of Fish and Game (DFG), the Commissioner of the Massachusetts Department of Environmental Protection (MassDEP), and the Commissioner of the Department of Conservation and Recreation (DCR). The EMC oversees compliance with and enforcement of the EPSs in the Reserve, coordinates the actions of environmental agencies of the Commonwealth in the enforcement of environmental laws and regulations in the Reserve, as appropriate, and facilitates an open and public review of all activities in the Reserve. The legislation also states that the environmental agencies on the EMC retain all their respective, independent enforcement authority.

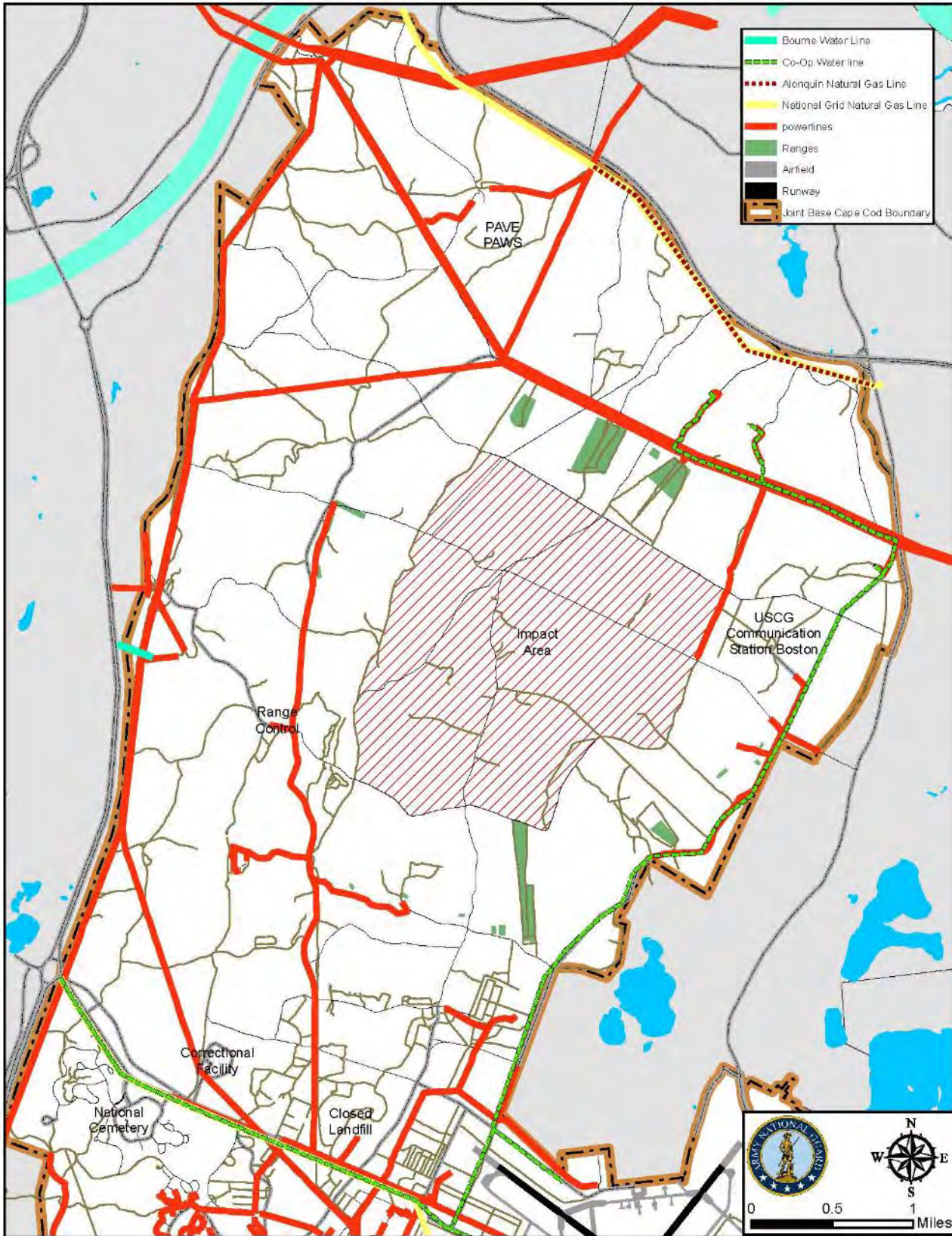
Chapter 47 of the Acts of 2002 also directed that the EMC be assisted by two advisory councils. The Community Advisory Council (CAC), consisting of 15 members, assists the EMC by providing advice on issues related to the protection of the water supply and wildlife habitat within the Reserve. The Science Advisory Council (SAC), consisting of up to nine members, assists the EMC by providing scientific and technical advice relating to the protection of the drinking water supply and wildlife habitat within the Reserve.

Chapter 47 of the Acts of 2002 also established an Environmental Officer for the Reserve. Mr. Leonard Pinaud of MassDEP is the Environmental Officer. In this capacity, he provides monitoring of military and civilian activities on and uses of the Reserve and the impact of those activities and uses on the water supply and wildlife habitats. Working directly for the EMC, the Environmental Officer has unrestricted access to all data and information from the various environmental and management programs in the Reserve. He has full access to all points in the Reserve and conducts inspections at any time in order to monitor, oversee, evaluate, and report to the EMC on the environmental impact of military training and other activities. His on-site monitoring occurs prior to, during, and immediately following training and other activities. The Environmental Officer's monitoring activities include but are not limited to: training sites, pollution prevention and habitat protection activities for both military and military contractors in the Reserve, as well as coordinating with and consulting with the Massachusetts National Guard Environmental & Readiness Center (E&RC) on various projects, initiatives and issues.

The Environmental Officer acts as a liaison between the EMC, SAC, CAC, military, general public, and various state agencies. He identifies and monitors ongoing issues regarding training procedures and the environment in the Reserve and keeps the EMC, SAC and CAC apprised of the progress of these issues in addition to bringing issues to the E&RC for resolution. He also participates in community outreach activities with the E&RC and facilitates the EMC, SAC and CAC public meetings under the legislation.

The EMC, SAC and CAC met a total of seven times during Training Year (TY) 2019. The groups discussed a number of topics, all of which are covered in this report. In November 2017, an Ad Hoc Committee to the Science Advisory Council was established. Please see Section 2.3 for further discussion. Minutes from the meetings may be found at www.massnationalguard.org/ERC/emc.html.

Figure 1-2 Utility Easements and Leases



SECTION 2

SMALL ARMS RANGES AND MILITARY TRAINING ACTIVITIES

2.0 INTRODUCTION

Section 2 of the Annual Report provides an update on actions associated with active small arms ranges in the Reserve including range maintenance, environmental sampling and levels of military and civilian use of the ranges.

This section also provides information on the use of Training Areas, Training Support Areas (TSA) in the Cantonment Area of Camp Edwards, information on simulated munitions, the Soldier Validation Lane (SVL), and off-site training during TY 2019.

The Massachusetts National Guard (MANG) reports on some Cantonment Area training activities to provide context for why soldiers then move into the Reserve/Training Area to conduct the most realistic training possible to provide for trained and ready soldiers. In the words of the MAARNG trainers, soldiers are provided training in a “crawl, walk, run” scenario. The crawl phase is in the classroom where they learn theory and the basics of the training they are about to undertake; the walk phase is where soldiers can literally walk through the training event in a classroom setting, use simulators, or go in to the field and walk through a scenario. Finally, the run phase is where the crawl and the walk phase are put into the most realistic field setting possible in the Reserve/Training Area.

2.1 CAMP EDWARDS TRAINING AREA/UPPER CAPE WATER SUPPLY RESERVE

2.1.1 Military and Civilian Use

The MAARNG has approximately 5,960 soldiers who train on average one weekend per month and one two-week cycle during a training year. Units start planning their training several years in advance of the year in which they actually conduct their training. The unit leadership assesses the strengths and limitations of its personnel and begins to schedule training sites and resources to best support the training their units require. During the year prior (TY 2018) to the year of execution (TY 2019) units confirm geographical areas and training sites within the Reserve.

Military training activities in the Reserve are tracked by Range Control based on individual training area use and the number of personnel participating in this use. This method records the number of times each training area is utilized and the number of personnel and vehicles utilizing the areas for each event. Figure 2-1 shows the locations of the major training areas and firing ranges in the Reserve.

Camp Edwards Range Control manages and tracks training area use. For example, Table 2-1 shows the overall utilization of the ranges, training areas and training support areas during TY 2019, while Table 2-2 shows their utilization for each of the past ten training years. For specific training area use for TY 2019 see Table 2-3 and for the ten year totals for training area use see Table 2-4. Range Control is operational 24 hours per day when units are training and, during the course of a training day, personnel from Range Control will observe units at various locations to ensure that they are following range and safety regulations.

Military training activities in the Reserve are tracked by the number of times each training area is utilized per day and by the number of personnel and vehicles utilizing the areas for each use. In many cases personnel and vehicles utilize more than one training area per day. Figure 2-2 shows a color-coded personnel use by training area for each of the past ten training years. Figure 2-3 provides a color-coded ten year personnel use by training for the past ten training years. Figure 2-4 shows a color-coded daily usage by training area for each of the past ten training years with Figure 2-5 providing a color-coded ten year daily usage by training area for the past ten training years. For example, as seen in Figure 2-5, training areas B-8 and B-9 were not used, and area B-11 shows a dramatic increase in use; this is a result of the closing and opening of these training areas due to the proximity to the Monument Beach Sportsman's Club's (Club) firing range. These training areas are within the surface danger zone for the rifle range and therefore are closed when the club's range is operational. The MAARNG and the Club coordinate schedules to ensure safety of Soldiers and Club members. Graph 2-1 shows the average personnel use by training area for TY 2010 to TY 2019; Graph 2-2 shows the average days used by training area for TY 2010 to TY 2019. As units become aware that the ranges and other training venues at Camp Edwards meet qualification standards, the use of the areas were these venues are located will increase. Fluctuations in training usage is also largely influenced by deployment cycles and changes to training doctrine and directives. In addition, over the past two decades, cleanup activities in the Reserve have resulted in small arms ranges and other training venues being unavailable for use. As the cleanup comes to completion, it is likely that there will be greater training opportunities at Camp Edwards. So with new ranges, training venues, and eventual completion of the cleanup program, Training Area use and numbers will fluctuate accordingly.

In the Table 2-1 and Table 2-2, civilian use includes use of the ranges and training areas in the Reserve and the Training Support Areas in the Cantonment Area; civilian use ranges from unmanned aircraft systems ground operations and flight testing, to practicing land navigation, to training in the Calero Mobile Military Operations on Urban Terrain Site, to use of classrooms and other facilities. In addition, there were also deer and turkey hunting seasons during TY 2019. Information on these activities is provided in Sections 3.5.4 and 3.5.5 of this report. Fluctuations in training days and event numbers from year to year is a result of differing unit training requirements, combined training needs, and deployment cycles. During TY 2019, civilian use numbers are higher than in past years due to the Cape Cod Police Academy's use of facilities in the Cantonment Area as well as a Federal Emergency Management Agency training that took place.

TABLE 2-1 OVERVIEW OF TRAINING USE - TY 2019

Area	Training Days/Events	PERSONNEL	
		Military Personnel	Civilian Personnel
Ranges	225	5,370	271
Training Areas	702	49,716	1,920
Training Support Areas	1,554	39,888	10,233
TOTAL	2,481	94,974	12,424

Figure 2-1 Camp Edwards Training Area and Ranges

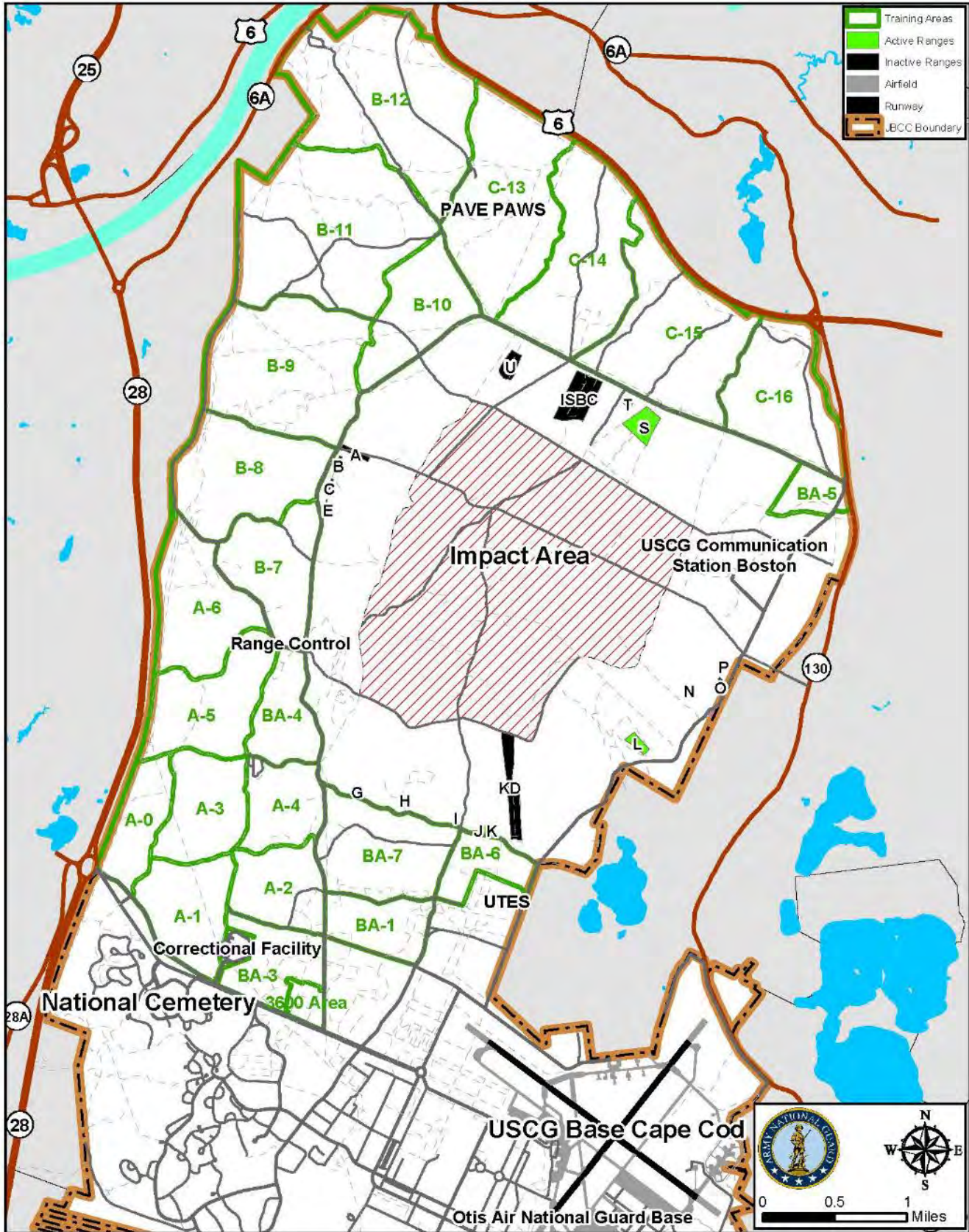
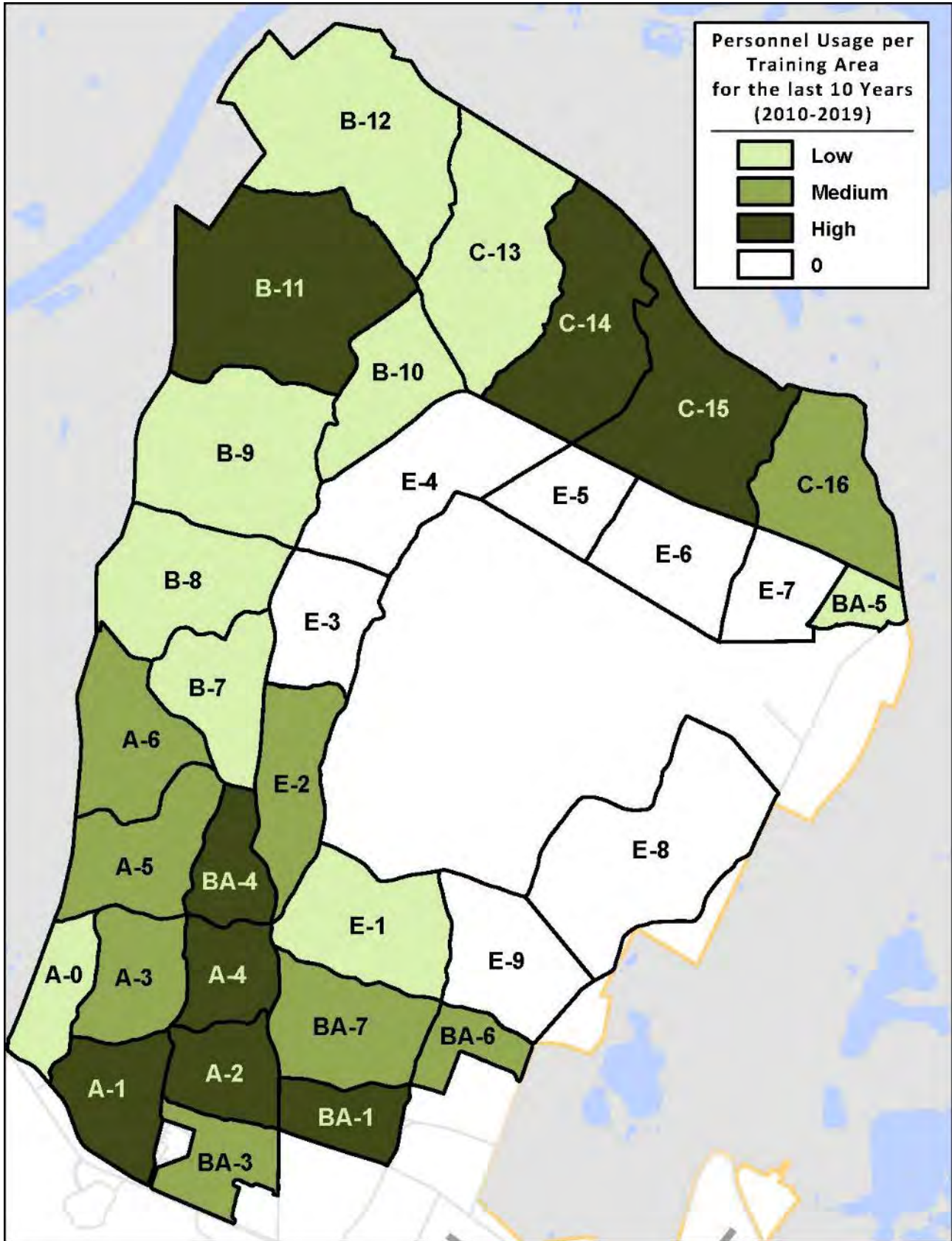
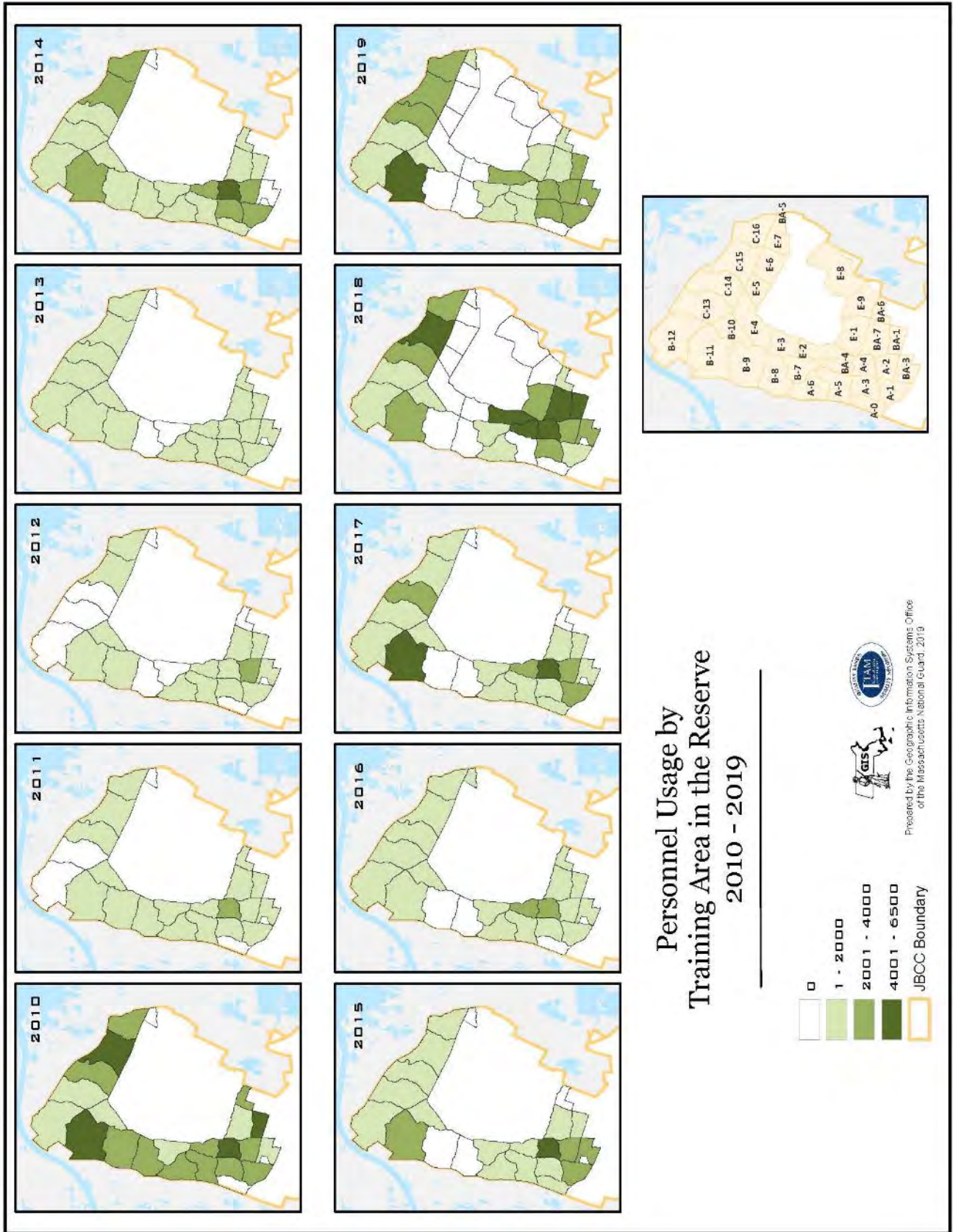


Figure 2-2 Personnel Usage by Training Area in the Reserve, TY 2010 – TY 2019



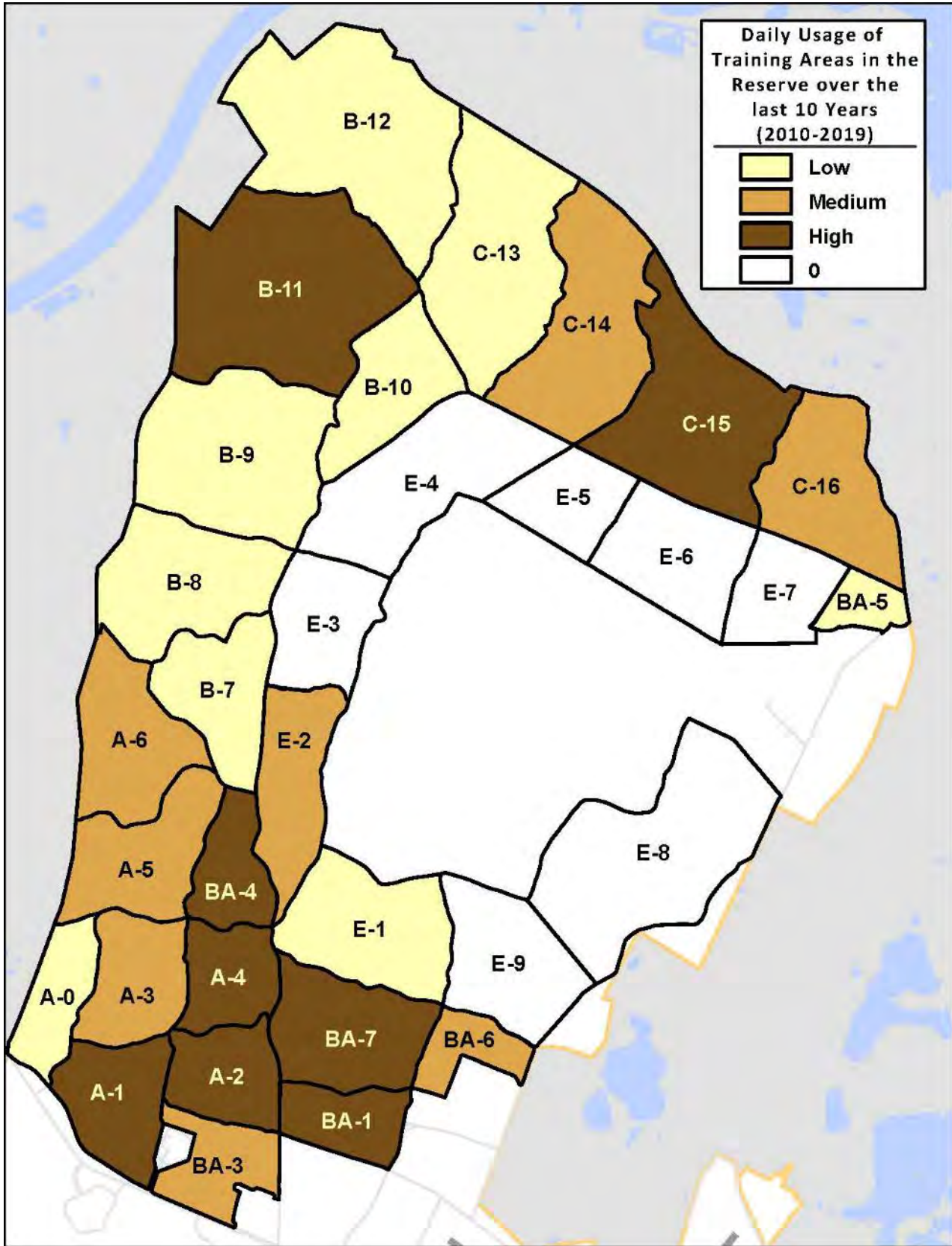
Low=1-5,879 personell; Medium=5,880-16,177 personell; High=16,178-36,103 personell

Figure 2-3 Ten Year Personnel Use by Training Area in the Reserve, TY 2010 – TY 2019



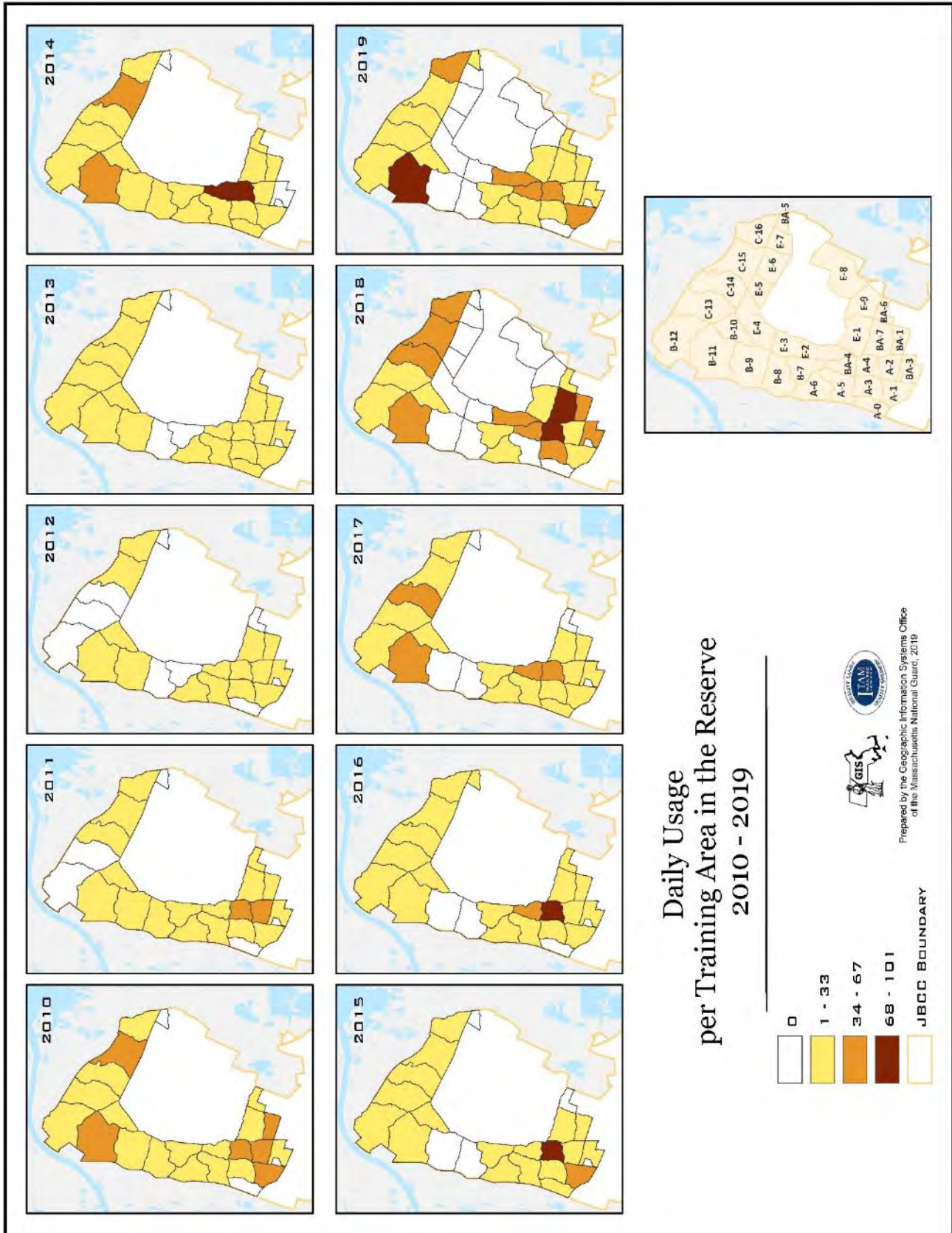
Note: Prior to 2018, the E training areas were not available for use and are not delineated in the 2010 to 2017 graphics.

Figure 2-4 Daily Usage per Training Area in the Reserve, TY 2010 – TY 2019



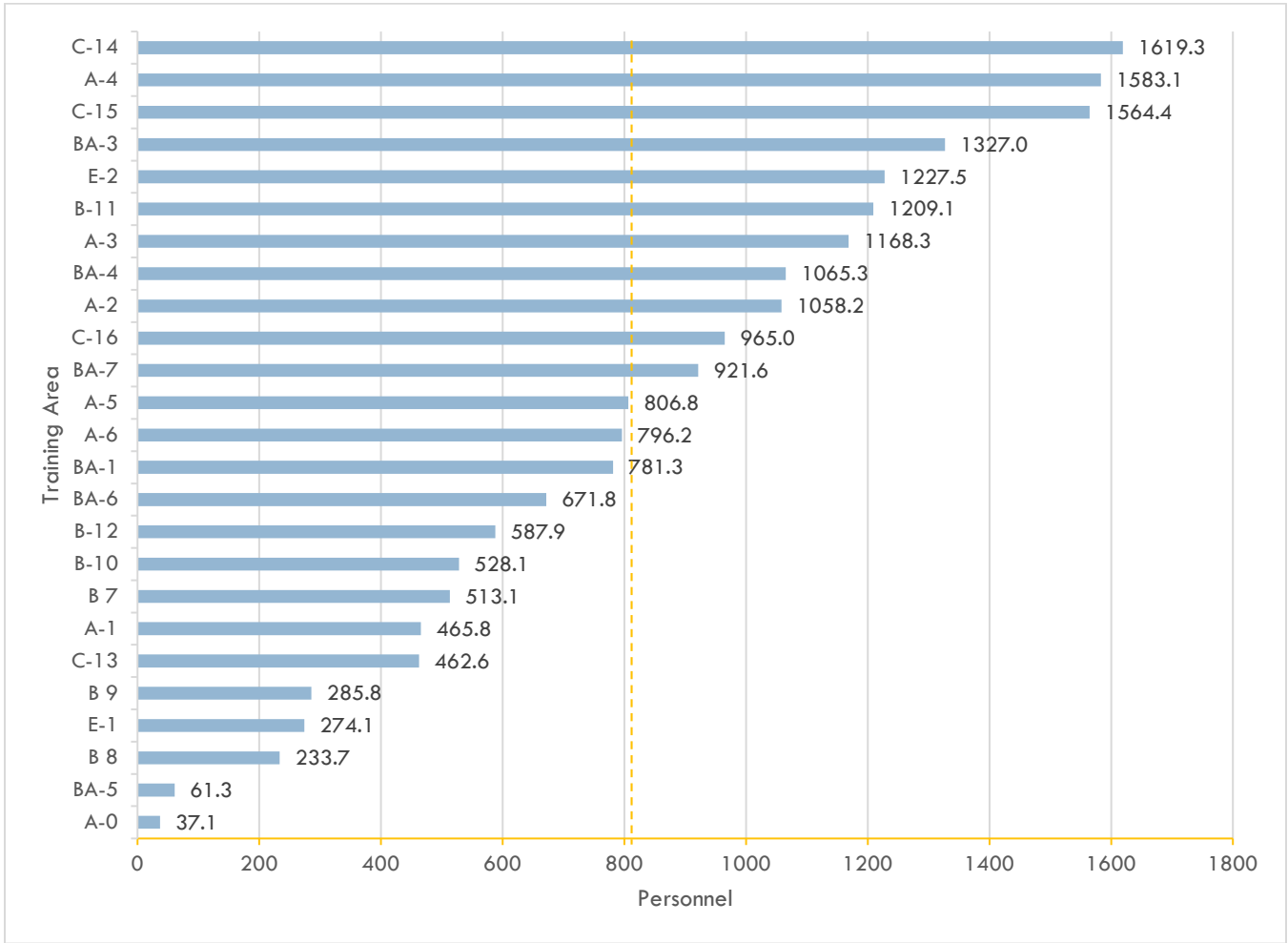
Low=1-76 days; Medium=77-225 days; High=226 to 529 days

Figure 2-5 Ten Year Daily Usage by Training Area in the Reserve, TY 2010 – TY 2019



Note: Prior to 2018, the E training areas were not available for use and are not delineated in the 2010 to 2017 graphics.

Graph 2-1 Average Personnel Use by Training Area for TY 2010 to TY 2019



Graph 2-2 Average Days Used by Training Area, TY 2010 to TY 2019

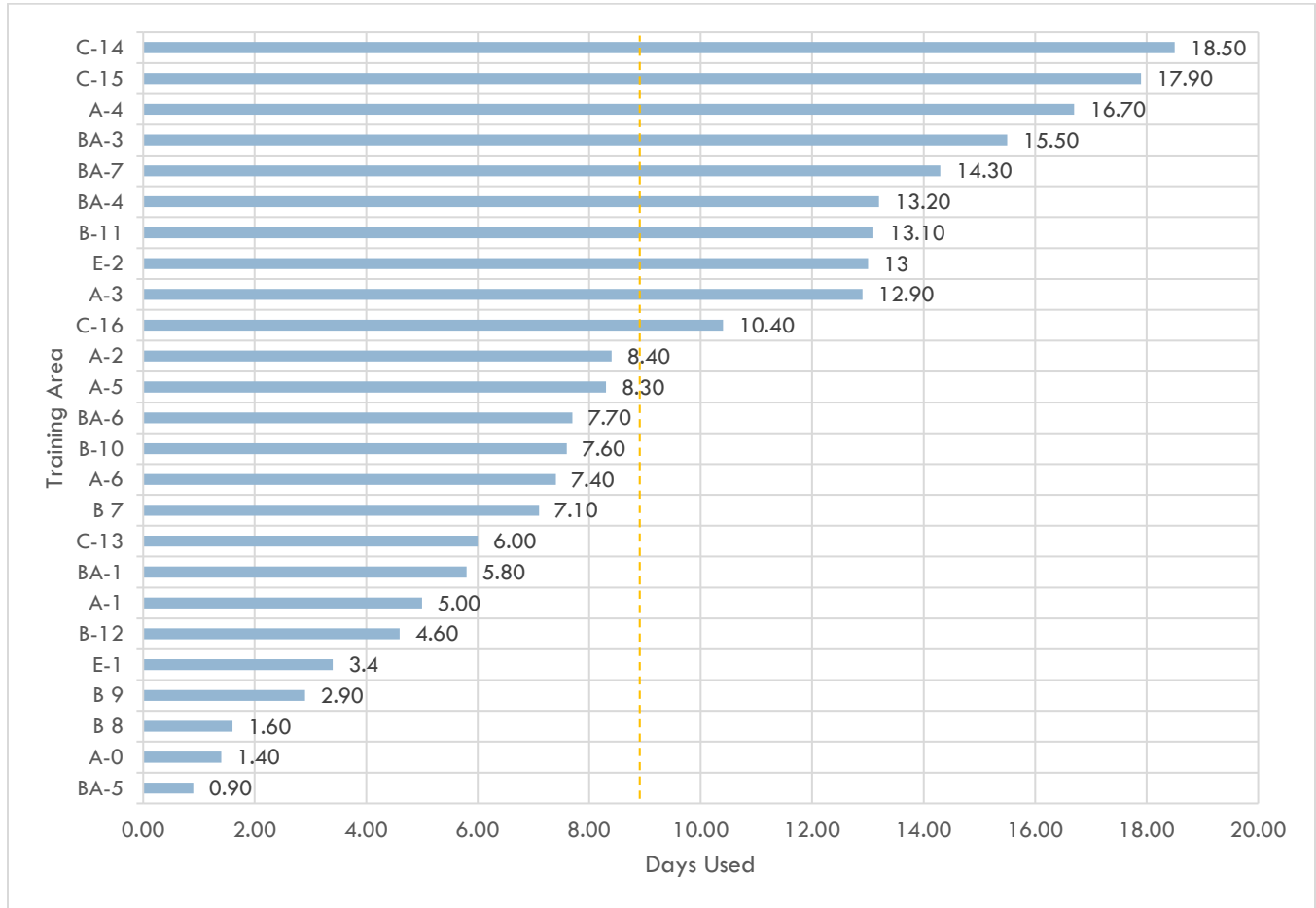


TABLE 2-2 TRAINING USE HISTORY

Training Year	Training Days/Events	Military Personnel	Civilian Personnel
TY 2019	2,481	94,974	12,424
TY 2018	2,118	103,864	1,673
TY 2017	2,268	144,671	3,450
TY 2016	2,065	92,083	2,271
TY 2015	2,105	122,645	2,691
TY 2014	1,845	121,740	2,050
TY 2013	1,052	46,361	1,650
TY 2012	1,117	78,745	866
TY 2011	1,232	71,707	819
TY 2010	1,721	156,425	6,945
TOTAL	18,004	1,033,215	34,839

2.2 RANGE UPDATE

The current active small arms ranges on Camp Edwards are Juliet, Kilo, Sierra, India, Lima, and Echo ranges. Tango Range is currently inactive as its STAPP™ system was dismantled in Fall 2017 (see Section 2.3.2). The locations of these ranges are shown in Figure 2-1.

2.3 SCIENCE ADVISORY AD HOC COMMITTEE

On November 2, 2017, the EMC formed an Ad Hoc Committee to the SAC to review current small arms range environmental monitoring process and aide in developing the most appropriate monitoring processes for those ranges. Committee members are SAC members Phil Gschwend and Jack Duggan, both geochemists, SAC member Denis LeBlanc, US Geological Survey, and Jay Clausen from the US Army Corps of Engineers Cold Regions Research and Engineering Laboratory, who is a metals mobility expert. The committee had a sunset clause of two years, however based on the effectiveness of the body and emerging issues, such as pyrotechnics, the EMC voted to allow the Ad Hoc committee to continue.

The committee met on July 17, 2019 and discussed the need for the MAARNG to conduct further work to research the movement of antimony in soil. That work has been and will be conducted by the Cold Regions Research Lab. The work conducted will help determine the type or species of antimony present in soil this can then lead to what the source of antimony may be on the range and if any management actions are needed.

It was also determined that the MAARNG will conduct two seasonal baseline samplings at the Small Arms Ranges, before and after the training season. In addition to metals, the baseline sampling will include those constituents that may make metals mobile in soil. Once these baselines are established, range monitoring will occur every three years.

The Ad Hoc Committee also discussed pyrotechnic use for the Combined Arms Exercise (CAX) (see Section 2.16); they received results of tests, for potassium perchlorate, conducted earlier in June 2019 at TTB Kelley and concurred with their use during the CAX exercise.

2.4 TANGO, JULIET AND KILO RANGES

Live fire with lead ammunition resumed at Tango Range in August 2007, Kilo Range in March 2009, and Juliet Range in August 2009. The Tango Range STAPP™ system was dismantled in November 2017 and will be reconfigured as a copper ammunition only range in 2020 (see Section 2.4.2).

2.4.1 Range Maintenance and Sampling

Camp Edwards personnel conducted inspections of Juliet and Kilo ranges during TY 2019 in accordance with the provisions of the OMMP.

Maintenance activities conducted at Juliet and Kilo ranges during TY 2019 included: securing the tarp cover after severe weather, disposing of water from the internal reservoir, repairing tears and seam failures in the top cover, and patching bullet pockets.

A list of the inspection and maintenance activities at these ranges in TY 2019 is included in Appendix C.

In October 2019, surface soil, porewater, and groundwater samples were collected from the ranges per the OMMP. The samples were analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen where appropriate for the media being sampled. Results (see Appendix C) of the surface soil and groundwater analyses continue to show no trends or significant concentrations when compared to the Action Levels specified in the OMMPs. The porewater results indicate the presence of antimony in several lysimeters on these ranges, and the concentrations exceeded the Action Level (6 parts per billion [ppb]) for antimony in porewater at each of these locations. Figures showing lysimeter locations, data and graphs are in Appendix C. Antimony is in lead alloy bullets and in bullet primers.

There are several potential causes of increased antimony in porewater:

- STAPP™ system water reservoir leak resulting in metals possibly being released to the range floor
- legacy range soils, where lead-antimony bullets were fired, were used for berm and range construction at Julie, Kilo, and Tango ranges;
- phosphates added to range soils (1998-1999) to immobilize lead in legacy soils; and
- pH levels of soil and porewater.

To address the issue of antimony and other metals movements through soils, the MAARNG, along with members of the SAC Ad-Hoc Committee (see Section 2.3) added the sampling of substances that can cause metals to be mobile in soil (see above paragraph). The first round of this amended sampling was completed in October 2019 and the second round is scheduled for April 2020.

Another finding of the Ad-Hoc Committee through lab studies at the Cold Regions Research Lab in New Hampshire is that antimony is not threatening the groundwater (see Section 2.3). The Tango, Juliet and Kilo Ranges sampling results for TY 2019 are available in Appendix C.

An estimated 8,830 gallons of water were pumped from the STAPP™ systems on Juliet and Kilo ranges during TY 2019: 3,075 gallons at Juliet and 5,755 gallons at Kilo. The water pumped is the result of incidental seepage of rain water, as well as condensation within the systems. This water has been tested at various times since the systems were installed for constituents that would reasonably be expected to be found on active ranges, particularly metals. The water is managed as a non-hazardous waste water and disposed of accordingly.

Graph 2-3 reflects the amount of water pumped from the STAPP™ systems from TY 2010 to TY 2019. Gallons pumped are estimated figures based on measurements of water in containment areas by dip stick as water pumped from multiple systems can be accumulated in the same disposal drum. With these large-scale rain events, the wind has blown the tarp covers off the STAPP™ Systems there by allowing more rainwater to enter the system. Camp Edwards will be anchoring the tarps for the upcoming winter season hoping to reduce STAPP™ water volumes. The MAARNG is no longer using lead ammunition for rifles; as funding becomes available, the two STAPP™ systems will be removed from the ranges.

2.4.2 Tango Range Dismantling

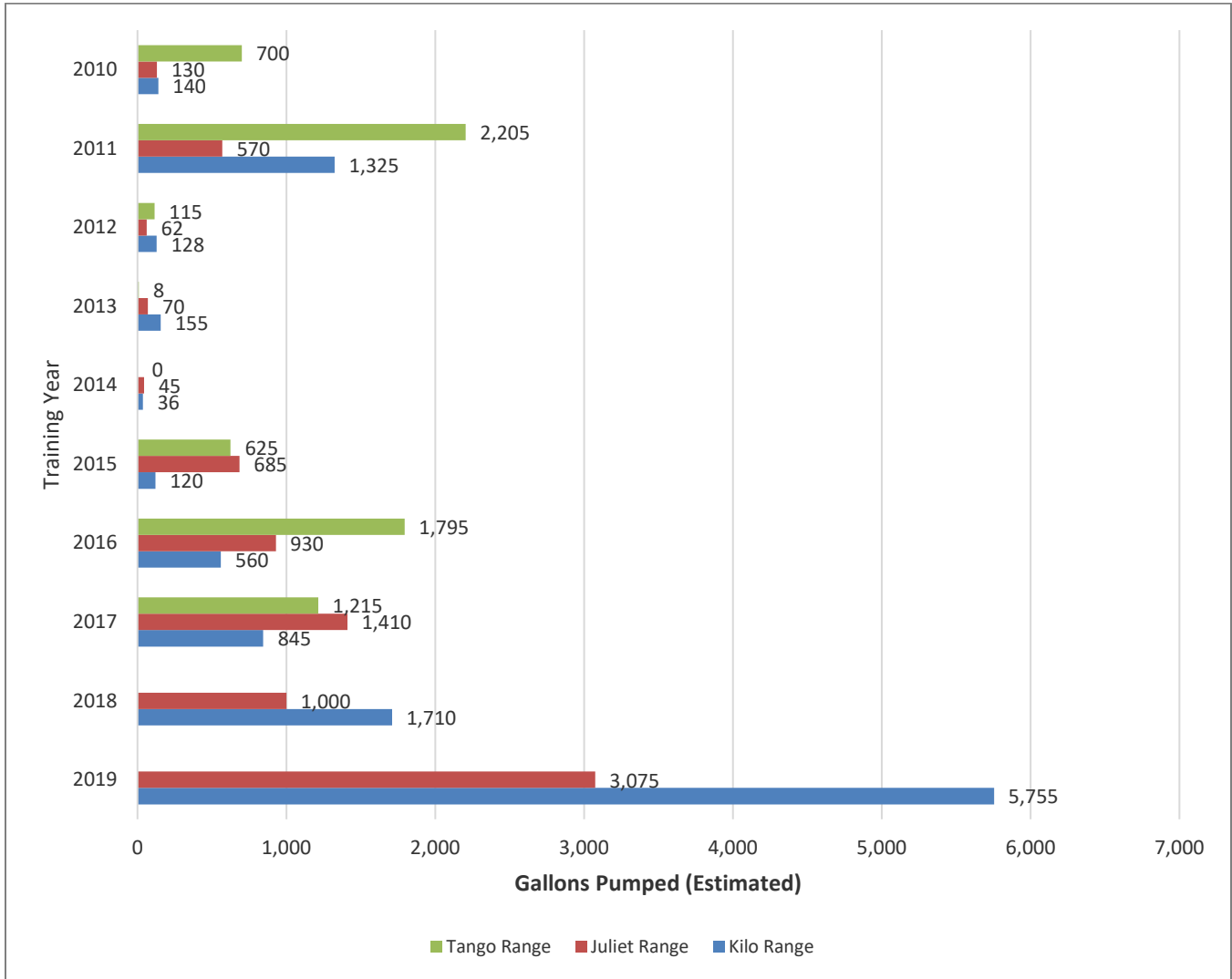
Camp Edwards decommissioned and removed the STAPP™ system from Tango Range in November 2017. The range will be converted to a 32 lane zeroing range for copper ammunition. Soldiers will be able to zero their weapons at Tango Range and then move to the adjacent Sierra Range to conduct weapons qualification. To safely use Tango Range, the target and firing lines will be moved 25 meters north to move them out of the Surface Danger Zone of the adjoining Sierra Range, such that both ranges can be used simultaneously. The range design is at 95 percent.

2.5 SIERRA AND INDIA RANGES

Sierra Range is an automated 300 meter pop-up modified record of fire range using copper ammunition only and is used to qualify soldiers in marksmanship proficiency. The firing line is 200 meters long with 10 firing positions. There are nine stationary, pop-up targets in each firing lane. The targets are located at 50, 100, 150, 200, 250, and 300 meters, with two targets at the 50 meter distance and one each at the other distances.

India Range is a basic 25-meter firing range using copper ammunition to train soldiers on the skills necessary to align the sights on their weapons and practice basic marksmanship techniques against stationary targets. It has 20 firing positions with one target in each firing lane. The range is also used for short-range marksmanship training and qualification.

Graph 2-3 STAPP™ System Water Pumping



The EMC approved use of Sierra Range for copper ammunition for a two-year pilot program period in June 2012; India Range was approved for copper ammunition in May 2013. Firing of copper ammunition commenced at Sierra Range in July 2012 and at India Range in September 2013. At its meeting on July 24, 2014, the EMC extended the pilot program period for both ranges through December 31, 2016. In December 2016, the MAARNG requested and was granted EMC approval of an extension of the pilot program period for both ranges through December 31, 2017. The Pilot Period was extended so that further soil, porewater and groundwater monitoring data could be gathered to evaluate environmental impacts of utilizing these ranges and to allow time for the presentation of environmental monitoring data to the SAC, CAC and the EMC. At its November 2, 2017, meeting, the EMC voted to authorize the Acting Environmental Officer to close out the Pilot Period for India and Sierra Ranges and allow the MAARNG to continue to operate the ranges in accordance with the EPSs and the OMMPs.

The MAARNG sent a letter of request to end the Pilot Period on Sierra and India ranges to the EMC’s Environmental Officer on November 11, 2017. In a letter dated December 29, 2017, the EMC’s Environmental Officer stated that after a compliance review, it was determined that the MAARNG was not in compliance “with one more laws, regulations, orders, licenses, permits or approvals enforced by the EMC and that additional actions are necessary for compliance with the requirements of Chapter 47 of the Acts of 2002 (Chapter 47), the Environmental Performance Standards (revised April 6, 2017; the EPSs) and the range specific SOP and Range

Maintenance Plans. Compliance issues identified included lack of completed Detailed Inspection Forms and Range Maintenance Forms; degradation and erosion on the backstop berm at India Range, in the frontal Station Infantry Target berms at the 50 meter targets, and in the 50 and 100 meter backstop berms on Sierra Range. The MAARNG was required to perform maintenance on those ranges prior to any utilization.

The EMC reinspected India and Sierra ranges and found the MAARNG to be in compliance with the OMMP for the range and authorized their use. The Pilot Period for Sierra and India Ranges was extended until December 31, 2018. In a letter dated November 2, 2018, the MAARNG sent a letter of request to end the Pilot Period for Sierra and India Ranges to the EMC's Environmental Officer. On December 12, the EMC's Environmental Officer, along with representatives from Camp Edwards, conducted a compliance inspection at India and Sierra ranges. The ranges were found to be in compliance. In a letter dated December 27, 2018, the EMC's Environmental Officer terminated the Pilot Period for Sierra and India ranges.

2.5.1 Range Maintenance and Sampling

During TY 2019, berms on Sierra and India Ranges were repaired using loam and sand. The repaired berms were also seeded with an approved seed mix as reviewed by the Natural Resources Office, Range Control, and Facilities Engineering.

The MAARNG, in coordination with the EMC's Environmental Officer, experimented with an alternative bullet-pocket management practice. The Camp Edwards Range Control staff utilized multiple bullet capturing blocks (Dura-Bloc™) to fill two bullet pockets on India Range. One pocket had the blocks placed in a stepped fashion and the other had the blocks placed in a flush fashion (See Photographs 2-1 and 2-2).



Photograph 2-1 and 2-2 Dura-Bloc™ installed on India Range as an alternative bullet pocket management.

A list of inspection activities at Sierra and India ranges in TY 2019 is included in Appendix C.

Groundwater, porewater, and surface soil samples were collected from Sierra Range and India Range as prescribed in the OMMP. The samples were analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen where appropriate for the media being sampled. Results of the soil and groundwater analyses continue to show no exceedance of the Action Levels specified in the OMMP.

2.6 LIMA RANGE

In 2012, EPA Region 1 and the EMC approved returning to live firing on Lima Range using the M781 40mm Training Round.

The M781 is a practice grenade that is fired as a projectile composed of a hollow plastic “windshield” filled with Day-Glo-Orange marking powder. The formula for the Day-Glo-Orange marking powder has not changed and as used is considered to be non-toxic to human health and the environment. The initial firing of the M781 40mm Training Round occurred in 2013.

Lima Range is used to train and test individual soldiers on the skills necessary to engage and defeat stationary target emplacements with the 40mm grenade launcher. The range has four self-contained stations and is 30-meters wide by 400-meters long. The stations consist of firing positions and targets of various types and distances, ranging from 100 to 350 meters.

2.6.1 Range Maintenance and Sampling

In October 2019, porewater and surface soil samples were collected from Lima Range and analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen, where appropriate for the media being sampled. There were no Action Level exceedances when samples were analyzed from Lima Range during the 2019 sampling effort. The Lima Range sampling results for TY 2019 are in Appendix C.

A list of the inspection activities at Lima Range in TY 2019 is included in Appendix C.

2.7 ECHO RANGE

Echo Range, a dual purpose range, is a Combat Pistol/Military Police Qualification Course, consisting of 15 firing lanes with seven pop-up targets per lane offset along the firing lanes at varying distances with one fixed Military Police target at the end of the lane. Shooters shift their pistol firing position to engage the targets at the varying distances. 9 mm pistol ammunition is fired at pop-up targets, passes through and strikes the backstop berm. The two courses of fire, on the same range, are referred to as an automated combat pistol/MP firearms qualification course.

Camp Edwards has constructed Echo Range to be a Combat Pistol Qualification Course. The backstop berm will be utilized as the primary projectile capture area. Single Individual Target frontal berms are the capture location for extreme low shot projectiles. The backstop berm was constructed on core material (native), landscape fabric as a demarcation line, a projectile capture medium that is 1/8th minus (road sand), and capped with top soil that slows projectiles and allows for vegetation and slope stabilization.

Over the last five training years, Camp Edwards staff has worked to finish upgrading Echo Range for use with lead ammunition, a process originally begun in 2006. Actions included conducting line of site analyses, test firing, and the development of a scope and contract for range design modification that is in compliance with regulatory requirements and be protective of the environment. In TY 2017, the EMC’s Environmental Officer approved the range design and OMMP for Echo Range. Camp Edwards Range Control brought out Megett

Target Company in TY 2018 to trouble shoot issues with the pop-up targets; those issues were fixed. Echo Range became operational in September 2019.

2.7.1 Range Maintenance and Sampling

In October 2019, groundwater and surface soil samples were collected from Echo Range and analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen, where appropriate for the media being sampled. There were no Action Level exceedances when samples were analyzed from Echo Range during the 2019 sampling effort.

A list of the inspection activities at Echo Range in TY 2019 is included in Appendix C.



Photograph 2-3 Soldiers firing on Echo Range on September 6, 2019.

2.7.1 Range Maintenance and Sampling

In October 2019, groundwater and surface soil samples were collected from Echo Range and analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen, where appropriate for the media being sampled. There were no Action Level exceedances when samples were analyzed from Echo Range during the 2019 sampling effort.

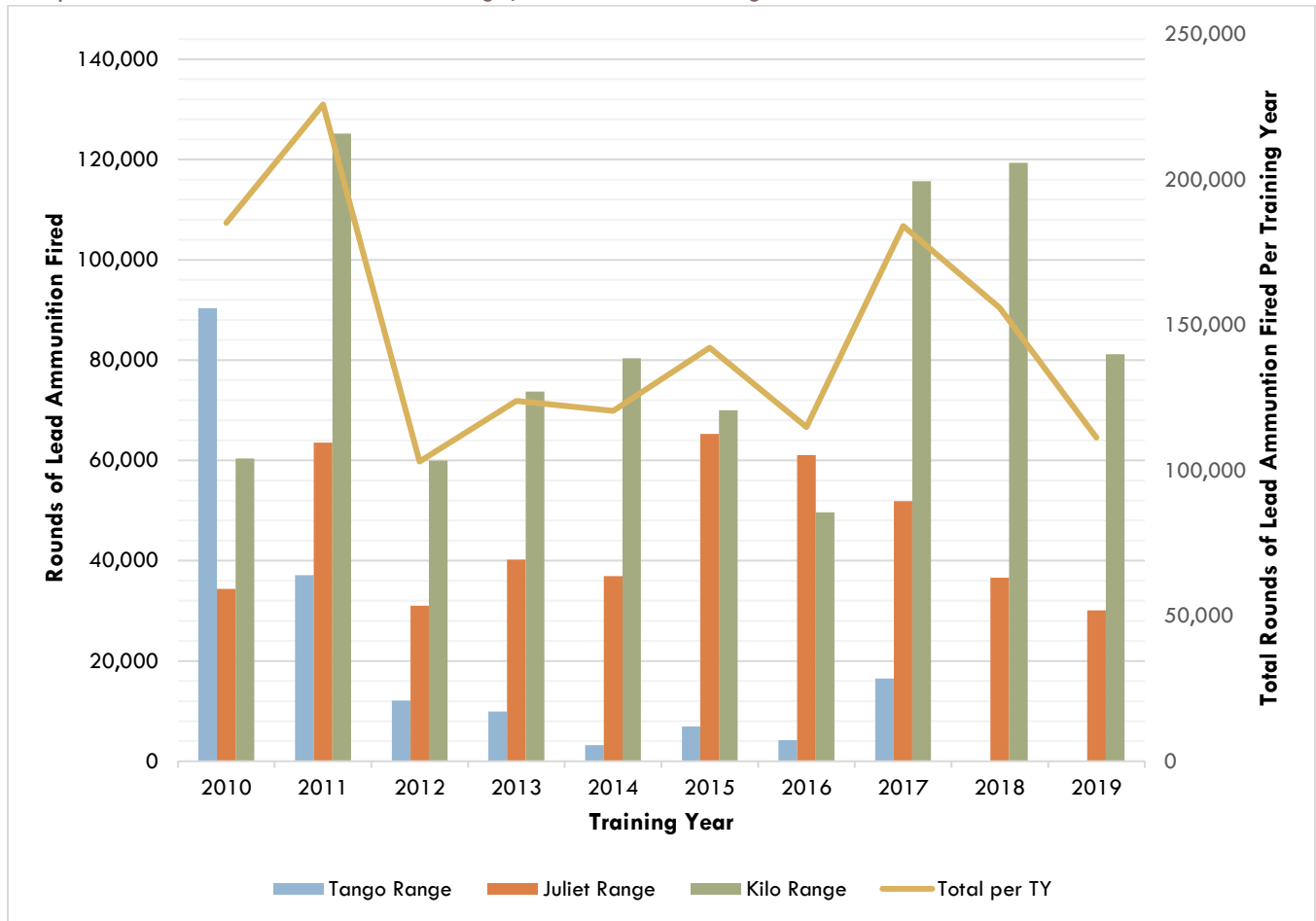
A list of the inspection activities at Echo Range in TY 2019 is included in Appendix C.

2.8 RANGE USAGE DATA

A total of 1,676,349 rounds of lead ammunition have been fired at Tango, Juliet and Kilo ranges since STAPP™ systems were installed (at Tango Range in 2006; and Juliet and Kilo Ranges in 2008) and their use approved: 467,220 at Juliet Range and 865,103 at Kilo Range. As of November 2017, the Tango Range STAPP™ system was dismantled; there is currently no firing on Tango Range. Graph 2-4 provides a summary of lead ammunition

rounds fired at Tango, Juliet and Kilo from TY 2010 to TY 2019. The graph shows a declining trend in usage of lead ammunition. Information on lead ammunition fired from TY 2010 through TY 2019, including amounts and types, is provided in Appendix C.

Graph 2-4 Lead Ammunition Use – Tango, Juliet and Kilo Ranges



*The Tango Range STAPP system was dismantled in November 2017. There is currently no firing on Tango Range.

A total of 960,255 rounds of copper ammunition have been fired at Sierra and India ranges since its use was approved: 555,213 at Sierra Range and 405,042 at India Range. Graph 2-5 provides a summary of copper ammunition fired at Sierra and India ranges since use of copper ammunition was approved at them. The graph shows an upward trend in copper ammunition use. As lead ammunition stocks across DoD and within the MAARNG are depleted, the MANG at Camp Edwards will transition to all copper-based ammunition with the exception of pistol ammunition at Echo Range Information on the number of copper ammunition fired on Sierra and India ranges each training year from 2012 through 2019 is provided in Appendix C.

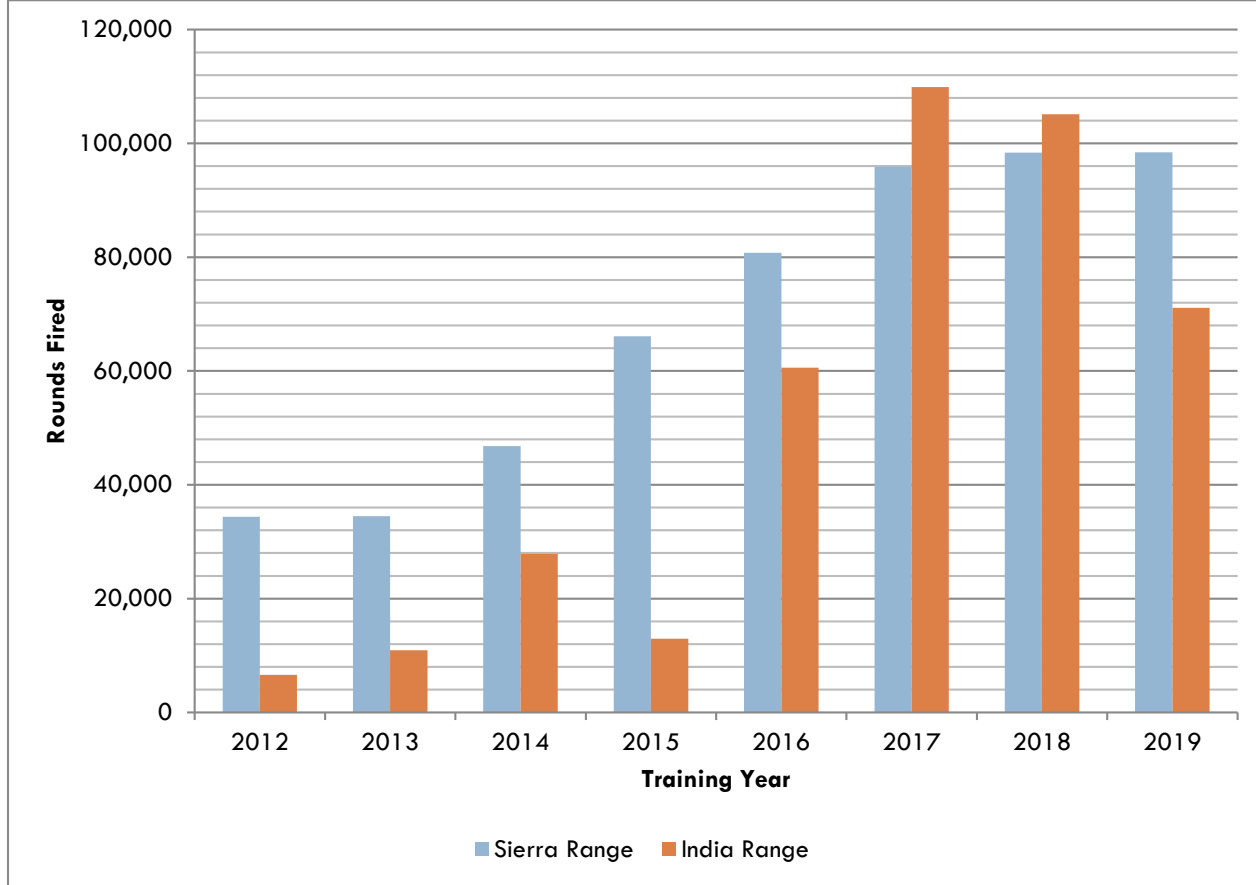
A total of 10,227 M781 40mm Training Rounds have been fired at Lima Range since its use was approved. Graph 2-6 provides information on the number of M781 40mm Training Rounds fired at Lima Range. The graph reflects the cyclic requirement for qualification for grenadiers. Units that have grenadiers only have one to two soldiers with that requirement in the unit; not every soldier uses this weapon.

A total of 4,350 rounds of 9mm lead ammunition has been fired at Echo Range since it became operational during TY 2019. Information on lead ammunition fired from TY 2010 through TY 2019, including amounts and types, is provided in Appendix C.

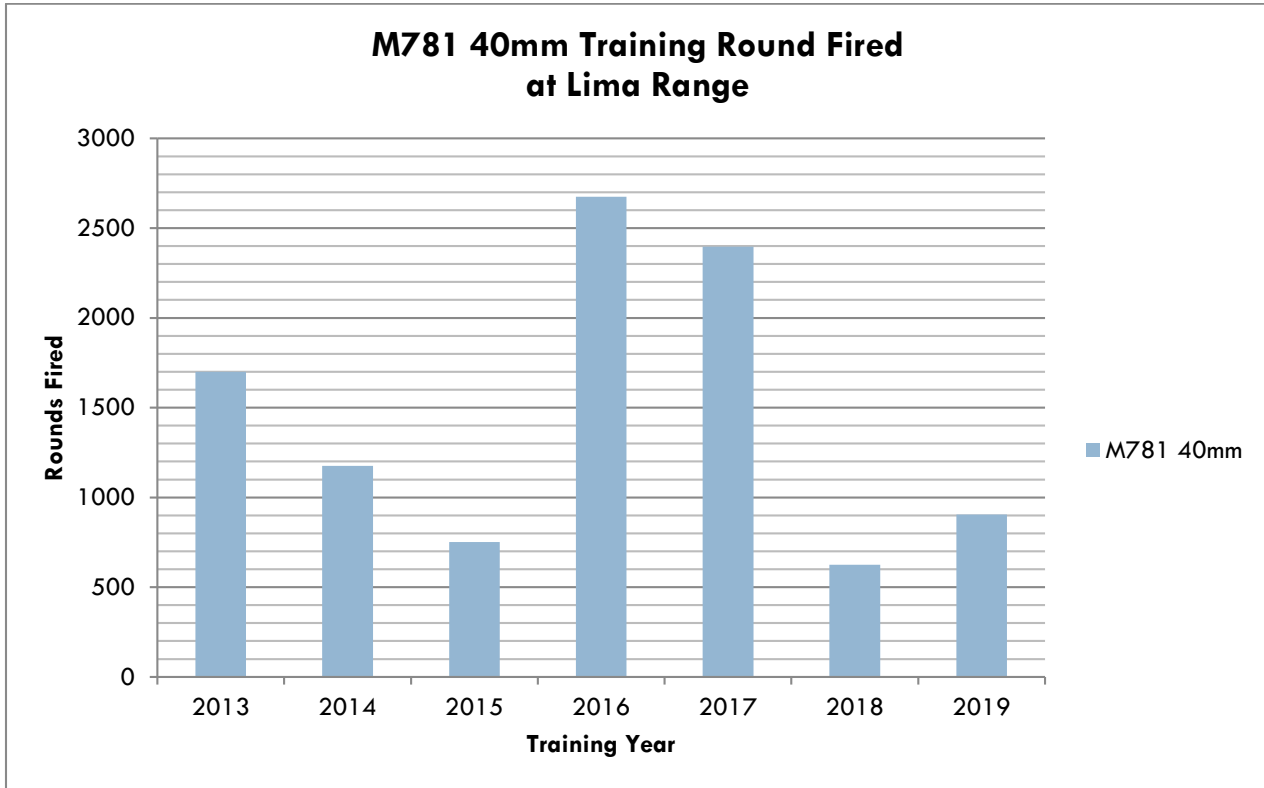
The only civilian use of the firing ranges during TY 2019 was by the US Postal Service Office of the Inspector General. They fired 4,250 9mm rounds of ammunition on Juliet Range and 8,700 5.56mm rounds of ammunition at Kilo Range on May 8, 2019. During TY 2019, some type of weapons firing was conducted on at least one of the ranges on 103 calendar days.

In accordance with the OMMP for each range, the MANG is required to capture, contain, and recover bullets/projectiles (copper and lead) to the greatest extent practical. The OMMPs define when this is required for each range. To date only Juliet Range has had bullets/projectiles removed from the STAPP™ system. Approximately 3,600 pounds of lead was removed from the STAPP™ system in 2017.

Graph 2-5 Copper Ammunition Use – Sierra and India Ranges



Graph 2-6 M781 40MM Training Round Use – Lima Range



2.8.1 Training Areas

Camp Edwards has numerous areas that support military training: Training Areas, battle positions, observation posts, training roads, etc. The Training Areas also support a variety of training activities including land navigation, bivouacs, Soldier Validation Lanes, meteorological data collection, engineer/infantry/artillery skills training, drivers (day and night) training, and Reserve Officer Training Corps (ROTC) training.

Information on utilization of the Training Areas and major locations within them during TY 2019 is provided in Table 2-3. Usage numbers generated by the two-week-long CAX exercise (see Section 2.16) are not included in Table 2-3. When the training areas were reserved through the MAARNG's Range Facility Management Support System, they were reserved in a block as if all 900 soldiers would be utilizing every training area every day of the exercise, which is not the case. The total overall utilization of the training areas for the past 10 training years is included in Table 2-4. The variations over the years in training days and personnel numbers is a result of differing unit training requirements, combined training needs, and deployment cycles. During TY 2019, some type of training was conducted in at least one of the training areas on 177 calendar days. The numbers in Tables 2-3 and 2-4 do not include employees and vehicles from the remediation programs and private contracting firms. Also, hunters using the Reserve during the deer and turkey seasons are not tracked as they move through the various training areas; please see Sections 3.5.4 and 3.5.5 for information about the deer and turkey hunting seasons.

Other military users of the Training Areas during TY 2019 included the Vermont ARNG, Connecticut ARNG, Maine ARNG, New Hampshire ARNG, Rhode Island ARNG, New York ARNG, and New Jersey ARNG, Massachusetts Air National Guard, the US Air Force, the US Army, the Army Reserve, the US Coast Guard, the Marine Corps Reserve, and the US Navy.

Civilian organizations using the Training Areas during TY 2019 included the Federal Emergency Management Agency, the Massachusetts Environmental Police, the Massachusetts Institute of Technology-Lincoln Lab, and environmental remediation contractors and environmental restoration contractors.

TABLE 2-3 TRAINING AREA USE - TY 2019

Training Area	Training Days	Personnel		Vehicles (Wheeled) #	Vehicles (Tracked) #
		Military	Civilian		
SVL-OBJ 1	25	1,497	0	0	0
SVL-OBJ 2	11	525	0	0	0
SVL-OBJ 3	4	394	0	0	0
OP 1	19	1,106	0	0	0
OP 2	5	494	0	0	0
OP 3	5	483	0	0	0
OP 4	5	498	0	0	0
BP 2	20	405	0	7	0
BP 7	3	194	0	0	0
BP 8	3	450	0	0	0
BP 12	5	425	0	83	0
BP 14	23	612	300	30	0
BP 16	23	568	300	30	0
BP 20	11	484	300	30	0
BP 24	7	546	0	30	0
BP 27	13	723	0	48	0
BP 28	9	297	0	0	0
NBC 1	7	182	0	0	0
Training Roads	35	6,350	0	72	0
A 1	15	1,585	0	0	0
A 2	12	1,717	0	0	0
A 3	17	1,746	0	0	0
A 4	12	1,617	0	0	0
A 5	12	1,264	20	0	0
A 6	12	1,024	0	0	0
B 7	11	902	20	0	0
B 10	12	967	0	30	0
B 11	20	1,434	0	44	0
B 12	12	967	0	0	0
BA 1	3	102	0	0	0
BA 3	22	2,014	0	28	0
BA 4	12	332	300	0	0
BA 5	6	472	0	2	0
BA 6	19	1,554	0	49	0
BA 7	16	971	0	25	0
C 13	12	1,223	0	22	0
C 14	32	2,819	300	33	0
C 15	23	2,353	300	9	0
C 16	18	1,856	0	19	0
Wheelock Hill	2	100	0	0	0
Land Nav 1	21	915	0	2	0

TABLE 2-3 TRAINING AREA USE - TY 2019, cont'd

Training Area	Training Days	Personnel		Vehicles (Wheeled) #	Vehicles (Tracked) #
		Military	Civilian		
Land Nav 2	15	1,129	0	5	0
Land Nav 3	20	1,151	0	0	0
Land Nav 4 Alpha	2	82	0	0	0
Land Nav 4 Bravo	11	397	0	0	0
Land Nav 4 Charlie	8	87	70	0	0
Dig Site 3	18	2,375	0	20	0
R-4101 Airspace	74	328	10	0	0
Total	702	49,716	1,920	618	0

TABLE 2-4 TRAINING AREA USE HISTORY

Training Year	Training Days/Events	Personnel		Vehicles (Wheeled)	Vehicles (Tracked)
		Military	Civilian		
TY 2019	702	49,716	1,920	618	0
TY 2018	893	69,652	238	530	12
TY 2017	688	42,478	1,344	1,244	12
TY 2016	551	24,344	1,858	2,805	0
TY 2015	681	33,219	1,909	2,198	0
TY 2014	642	39,137	370	4,129	0
TY 2013	247	11,164	181	1,484	7
TY 2012	232	13,532	122	2,037	5
TY 2011	298	16,591	132	2,232	2
TY 2010	614	63,379	488	5,627	3
TOTAL	4,846	313,496	6,642	22,286	41

2.8.2 Vehicle Use, Fueling and Maintenance

Vehicle use in the training areas during TY 2019 was 618 wheeled vehicles. No tracked vehicles were used. These numbers do not include vehicles from the Impact Area Groundwater Study Program (IAGWSP) program and contractors. Pumping fuel in the Reserve has been prohibited by the EPSs since 2002, however the MAARNG has proposed to modify the EPSs to allow refueling in the Reserve under certain conditions. Please see Section 2.14 for further discussion. Currently, the fuel point and the secondary containment pads in the Tactical Training Base (TTB) area represent the designated location for units to refuel and park and store tanker trucks at Camp Edwards.

The military does not conduct scheduled vehicle maintenance in the training areas. Personnel in the field are authorized only to check fluid levels, add small amounts, and repair flat tires or track sections that separate during training. Major repairs and other maintenance activities and training occur at the Unit Training Equipment Site (UTES) facility located in the Cantonment Area of Camp Edwards. The UTES facility is a vehicle and motor pool area; the Massachusetts National Guard has also designated the area as a Satellite Accumulation Point to store hazardous waste.

2.8.3 Training Support Areas (Simulators, Cantonment Area)

There are separate facilities and equipment that can simulate live military training; these are grouped under the Training Support Area (TSA). The majority of the training activities associated with these facilities are conducted in the Cantonment Area of Camp Edwards.

Table 2-5 presents the total number of training days/events and personnel that used each TSA during TY 2019. Overall historical use of the TSA for the past 10 training years is included in Table 2-6. Because unit commanders maximize training time by rotating personnel through several different events or exercises in a given training cycle, this again presents an inflated figure for training days compared to calendar days. For example, the Cape Cod Police Academy Cadets and Cadre are counted as using the facility and areas on a daily basis.

Civilian organizations using the Training Support Areas in the Cantonment Area of Camp Edwards during TY 2019 included Andrews International Group Security, Boy Scouts of America, the Barnstable County Sheriff's Department, SEMLEC-SWAT, FBI Boston, Yankee Division Veteran's Association of Cape Cod, the Massachusetts State Police, MIT, Lincoln Lab, the Massachusetts Environmental Police, Federal Emergency Management Agency, Region 1, the US Postal Service Inspector General, Southeastern Mass Technical Rescue Team, the Cape Cod Police Academy, Eversource, US Geological Survey, the Civil Air Patrol, and the Massachusetts Maritime Academy.

TABLE 2-5 TRAINING SUPPORT AREA USE - TY 2019

Training Support Area	Training Days/Events	Personnel	
		Military	Civilian
1100 Training Area (Drivers Tng)	25	3,560	0
1600 Training Area	1	0	14
3400 Training Area/Rail Load Ramp	2	100	0
APFT Running Track	36	4,374	0
Asymmetric Threat Classroom	13	481	0
Battle Simulation Ctr - Bldg 1206	118	7,084	670
Battle Simulation Ctr - Rear Offices	54	1,565	0
Battle Simulation - Bldg 1213, 1st Floor	14	355	380
Battle Simulation - Bldg 1213, 2nd Floor	35	1,065	380
Battle Simulation - TOC Pads	33	2,783	0
Call for Fire Trainer	65	1,784	15
VBS3 Classroom - Bldg 3494	30	1,076	0
Connery Field	8	180	60
Counter IED Visual Indicator Lane	7	162	0
Counter IED Search House (HME)/Site Exploitation	3	93	0
Engagement Skill Trainer 2000 - A	76	296	0
Engagement Skill Trainer 2000 - B	148	1,698	126
Engagement Skill Trainer 2000 - C	110	642	0
HEAT 1123	19	163	0
HEAT 1132	2	13	0
HEAT 1215	24	349	20
1243-High Risk Entry Facility-Control	12	1,100	230
1244-High Risk Entry Facility	12	1,100	230
Lee Field	10	600	1,800

TABLE 2-5 TRAINING SUPPORT AREA USE - TY 2019, cont'd

Training Support Area	Training Days/Events	Personnel	
		Military	Civilian
MRAP	25	438	0
ODS - Operator Driving System	8	16	0
Shaw Field	30	940	1,800
Vault 1 - TSC	128	584	0
Vault 2 - TSC	137	944	0
Vault 3 - TSC	66	345	0
Virtual Convoy Opns Trainer #43 (VCOT - TSC)	52	837	0
Virtual Convoy Opns Trainer #98 (VCOT - TSC)	45	900	20
Weapons Cleaning - Bldg 3498	52	2,090	0
Welcome Center	143	2,026	4,108
YD Memorial Park	11	145	380
TY 2019 total	1,554	39,888	10,233

TABLE 2-6 TRAINING SUPPORT AREA USE HISTORY

Training Year	Training Days/Events	Personnel		
		Military	Civilian	Total
TY 2019	1,554	39,888	10,223	51,665
TY 2018	1,061	39,619	4,285	43,904
TY 2017	1,299	96,783	1,150	97,933
TY 2016	1,224	50,463	282	50,745
TY 2015	1,313	73,678	627	75,618
TY 2014	1,132	77,516	1,541	79,057
TY 2013	742	42,654	1,404	44,058
TY 2012	824	63,210	691	63,901
TY 2011	852	52,225	574	52,799
TY 2010	1,052	90,439	6,116	96,555
TOTAL	11,053	626,475	26,893	656,235

2.9 OFF-SITE TRAINING

During TY 2019, the MAARNG had 94 units conduct their annual two-week training cycle. Of these, 34 units trained in Massachusetts, 20 of which trained solely at Camp Edwards. Thirty-two units trained in ten different states and eight countries; one in Connecticut, one in Alabama, one in Indiana, twelve in Pennsylvania, five in California, one in Maryland, one in Utah, four in Louisiana, one in New Hampshire and five in New Jersey, one unit in Paraguay, two units in Guatemala, two units in El Salvador, two units in Honduras, two units in Germany, one unit in Bulgaria, one unit in Canada and one unit in Tajikistan. Four units were mobilized and deployed in support of contingency operations; one unit deployed overseas and three units deployed to the continental United States.

The total number of Massachusetts soldiers trained during annual training for TY 2019 was 4,468 out of 5,820. Twenty units conducted year-round annual training consisting of 499 soldiers, while 195 returned from deployment, in lieu of annual training. The number of MAARNG soldiers that completed a two-week annual training cycle by general geographical locations is: 499 in Massachusetts, 3,424 in other states, and 545 outside of the continental United States.

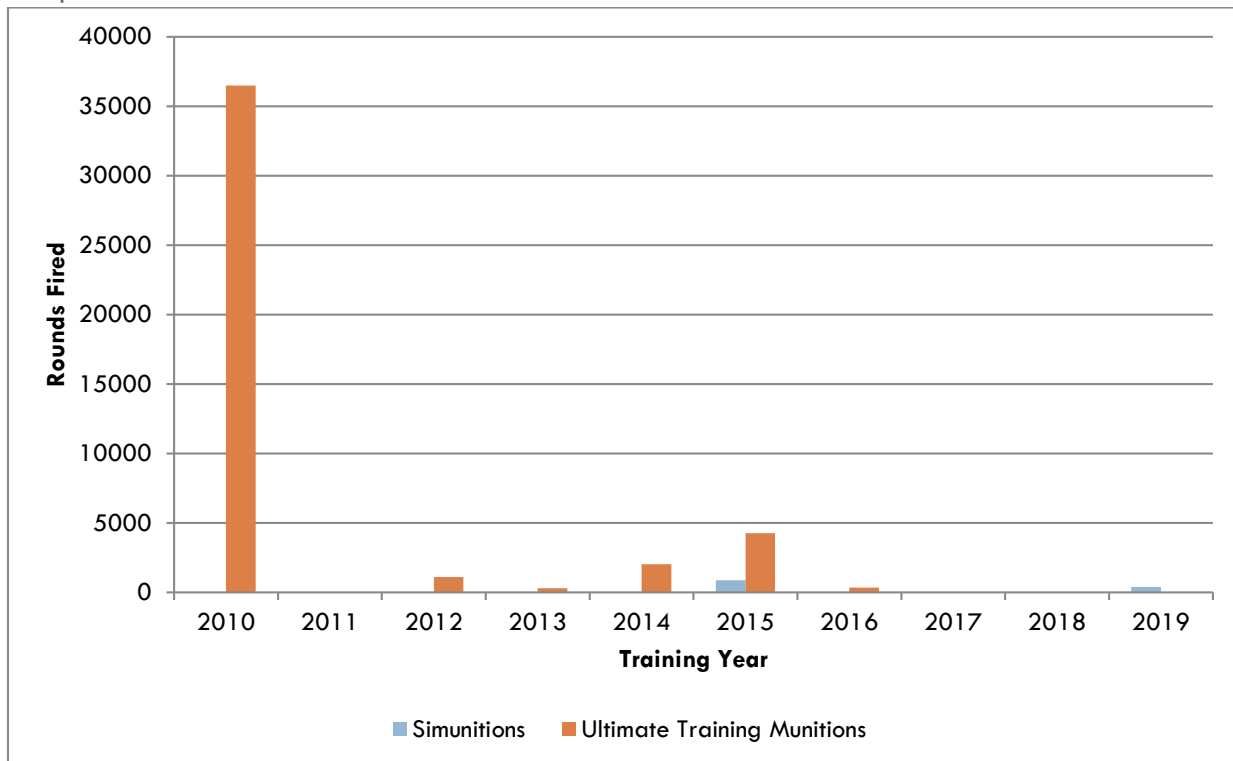
2.10 SIMULATED MUNITIONS

The MAARNG uses two types of simulated munitions at Camp Edwards: an Ultimate Training Munitions (UTM) Man Marker Round and a Simunitions FX Marking Round. The EMC required that the Annual Report include steps taken by the National Guard and progress associated with converting to the use of lead-free primer in simulated munitions. The Massachusetts National Guard monitors the activities of the U.S. Army Environmental Command in its efforts working with private industry development of alternate munitions; currently no new information has been provided. Simulated munitions are best used in concert with other simulators to be effective for most units; therefore their effective training use is currently limited. Graph 2-7 provides the number of UTM and Simunitions FX Marking Rounds fired in the Reserve since 2010. The higher numbers of UTM used in 2010 were due to units deploying.

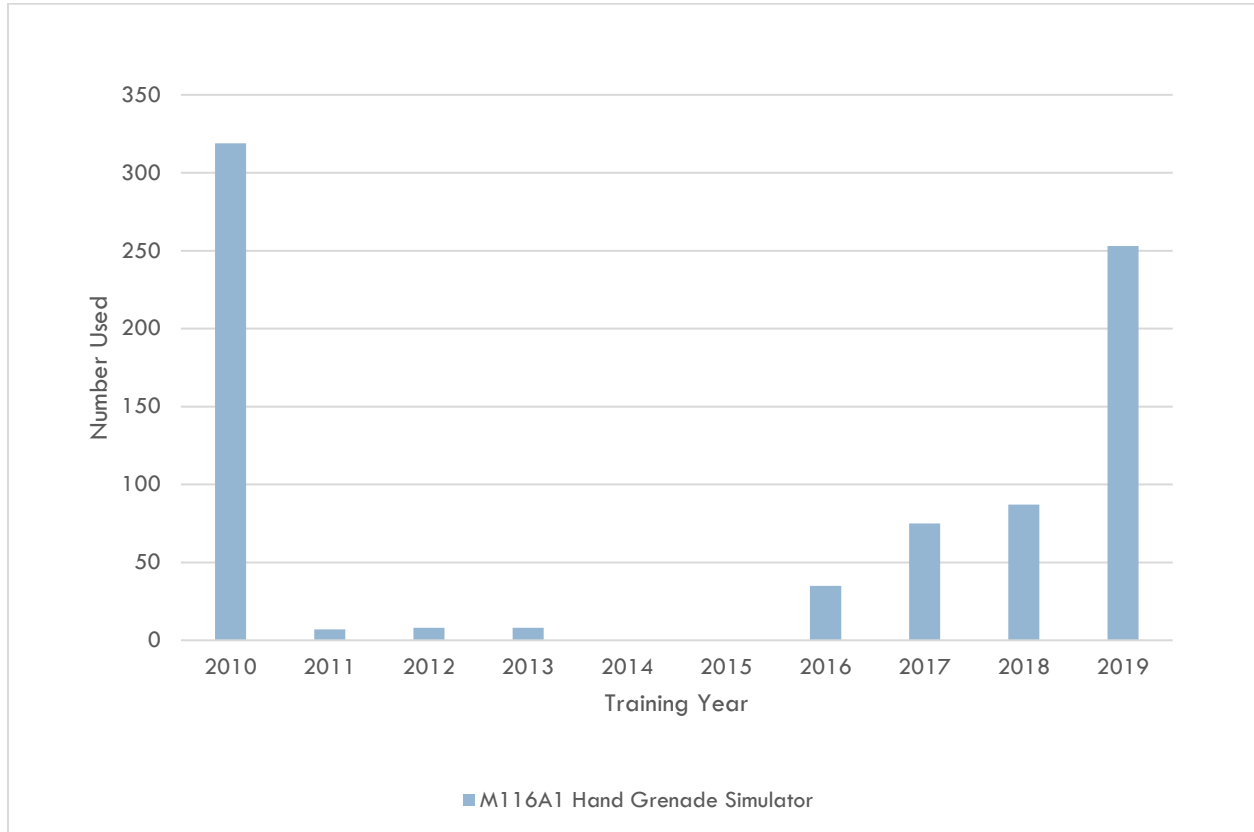
2.11 PYROTECHNICS

The M116A1 Hand Grenade Simulator was approved for use at Camp Edwards in March 2010. Two-hundred-fifty-three were used in the Reserve during TY 2019. Graph 2-8 shows the number used each training year since TY 2010. The graph shows an increase in usage in TY 2019; this was due to the large-scale CAX training which took place in July/August 2019 (see Section 2.16).

Graph 2-7 Simulated Munitions Use



Graph 2-8 Pyrotechnics Use in the Reserve History



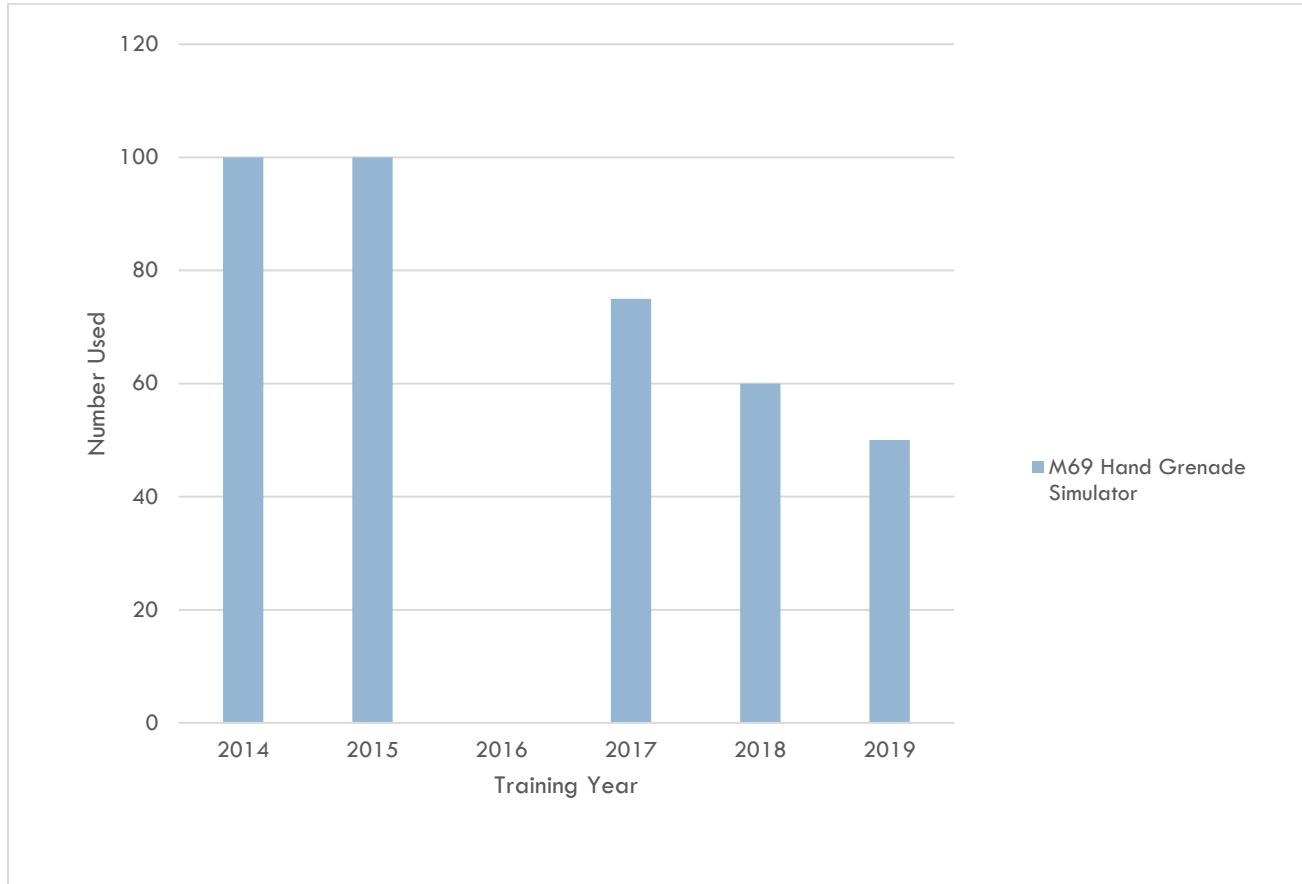
2.12 M69 HAND GRENADE SIMULATOR

In 2013, EPA Region 1 and the EMC approved the use of the M69 Hand Grenade Simulator on Camp Edwards.

The M69 provides realistic training and familiarizes soldiers with the functioning of a fragmentation hand grenade. The average soldier can throw the M69 approximately 40 meters (131 feet). After a delay of four to five seconds, the M69 emits a small puff of white smoke and makes a popping noise. The grenade bodies are reused repeatedly by replacing the fuse assembly.

Camp Edwards developed a Standard Operating Procedure and Course Management Plan for the M69 Hand Grenade Simulator, approved by the EMC in 2014. The plan allows for maximum effective use of the M69 Hand Grenade Simulator with the M288 Fuse in the Camp Edwards Training Areas and on the Hand Grenade Qualification Course while abiding by training and environmental guidelines. Use of the M69 Hand Grenade Simulator began in September 2014. Fifty were used in the Reserve in TY 2019. Graph 2-9 shows the number of M69 Hand Grenade Simulators used since TY 2014.

Graph 2-9 M69 Hand Grenade Simulator Use



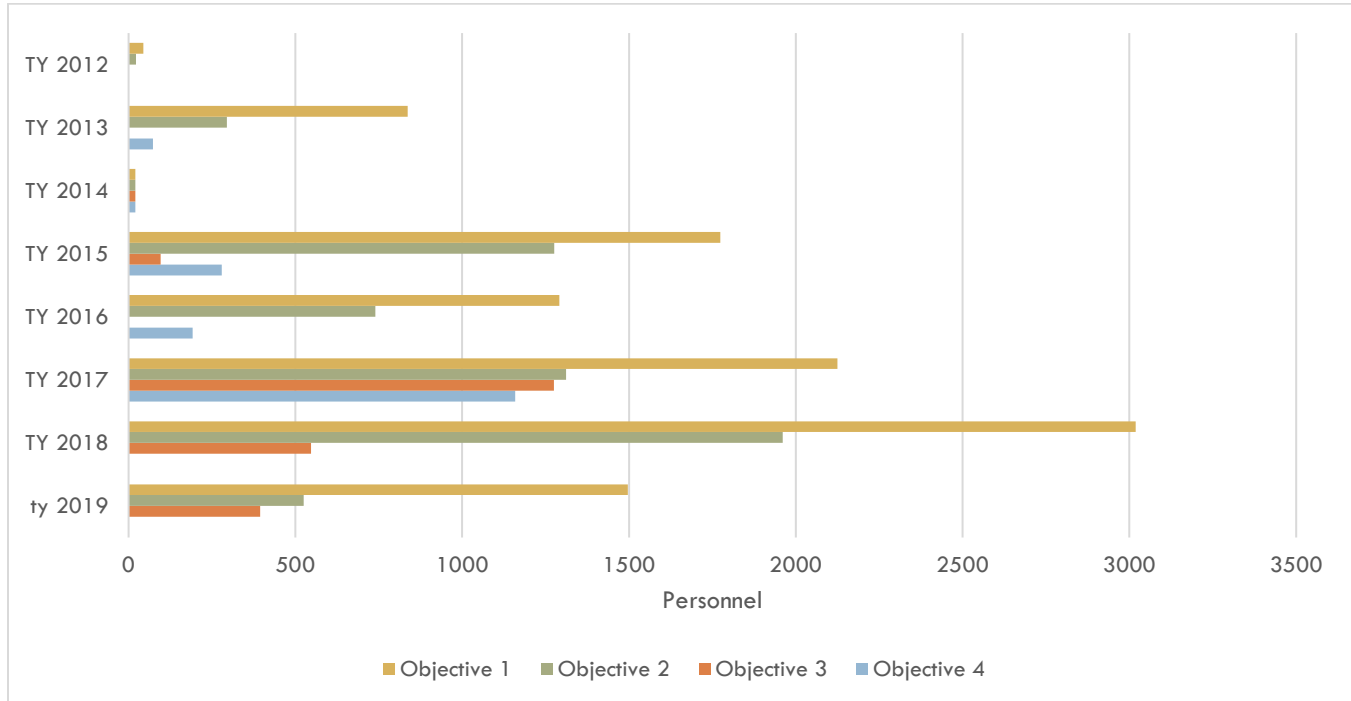
2.13 SOLDIER VALIDATION LANE

The SVL uses conex-like shipping containers as training aids, which can be reconfigured to mimic small villages and used for Improvised Explosive Device (IED) training. The containers are located in open or previously cleared, historically used training areas including training and bivouac sites within the Training Area. The ability to periodically reconfigure the portable training aids within the Training Area will critically enhance the ability to adapt scenarios to the most current combat situations, ultimately helping to save the lives of soldiers on the battlefield.

Three SVL locations (called objectives) were used during TY 2019 to meet military training needs: Objective 1 in Training Area A-4; Objective 2 in Training Area BA 4; and Objective 3 in Training Area B 11. Graph 2-10 shows the use of all four SVL Objectives since TY 2012. The locations of the SVL Objectives are shown in Figure 2-6.

The Natural Heritage and Endangered Species Program (NHESP) requires a yearly monitoring report be submitted documenting the locations and numbers of containers and the approximate dates of placement within these locations, as well as documenting any cutting of trees or leveling of sites that were required for container placement. The Soldier Validation Lane Annual Monitoring Report for TY 2019 is in Appendix C.

Graph 2-10 Soldier Validation Lane Use



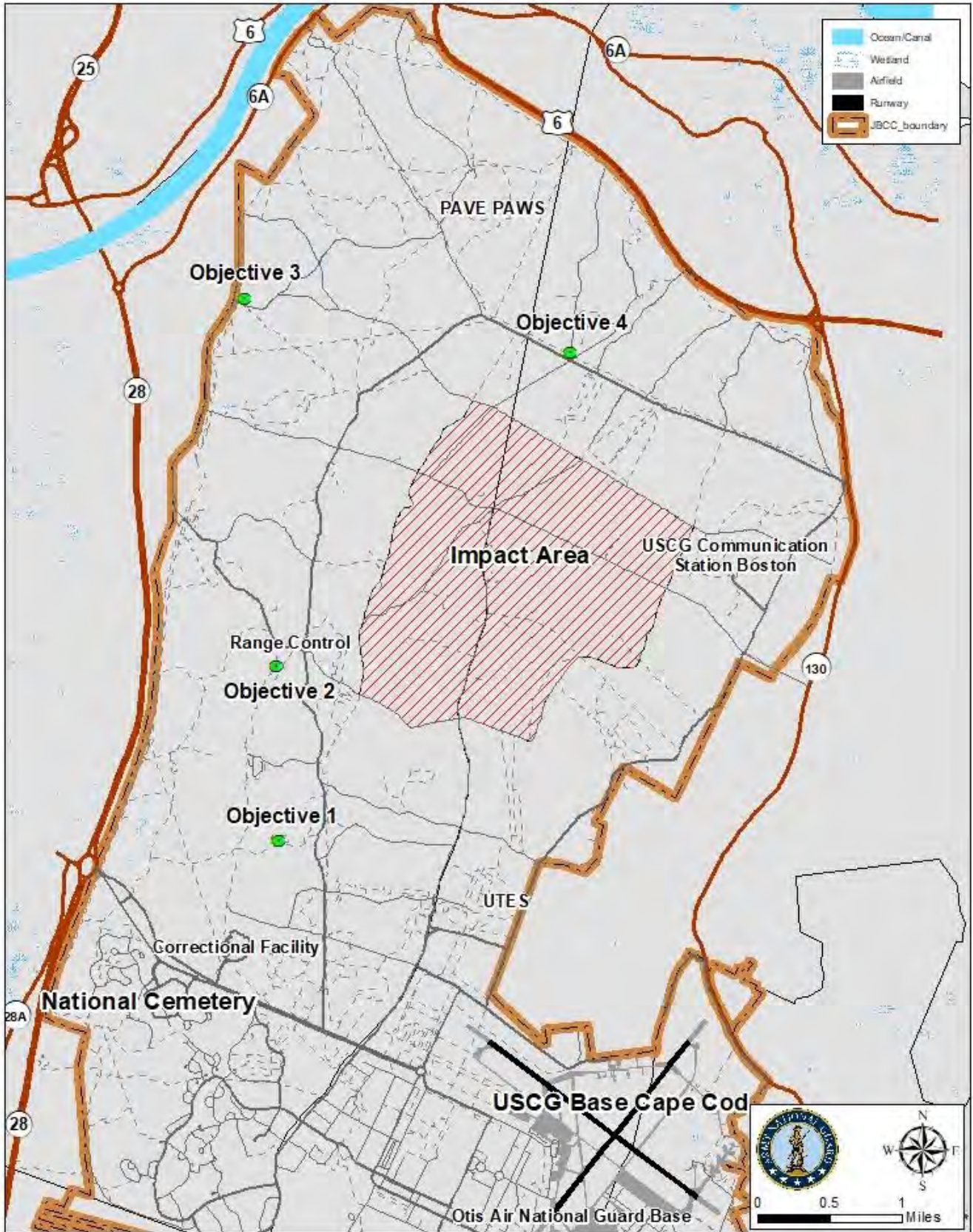
2.14 EPS 15.3.3 FIELD REFUELING

The MAARNG is proposing to modify EPS 15.3.3, Fuel Management, which states: “No storage or movement of fuels for supporting field activities, other than in vehicle fuel tanks, will be permitted except in approved containers no greater than five gallons in capacity.” The MAARNG is making a request of the EMC that vehicle refueling in the Reserve be allowed under certain conditions. Currently, exceptions to the standard are granted so that the MAARNG can complete critical remediation, construction and training area and habitat management in the most cost effective and efficient manner. In addition to the MAARNG’s need to refuel vehicles for remediation, range construction and training area and habitat management, there is a required need for MAARNG soldiers to be able to train effectively with refueling in a tactical, field training environment. The proposed adjustment is reflective of the many years of EPS implementation and continual improvement of training and environmental practices that allow for compatible military training at Camp Edwards.

In TY 2017, the MAARNG conducted its first Proof of Concept was conducted outside of the Reserve, within TTB Kelley, to illustrate that field refueling can be conducted in a safe and environmentally protective manner. During the Proof of Concept, MAARNG soldiers refueled a Blackhawk helicopter in a tactical environment, demonstrating their standard BMPs, which are protective of the environment. BMPs included large-capacity secondary containment under the fueler and secondary containment at connections in the fuel line. A second Proof of Concept was conducted during TY 2018 at Battle Position 2 that consisted of refueling HUMVEEs.

BMPs include secondary containment under the fueler and a drip pan on the ground under the nozzle (See Photograph 2-1). During TY 2019, the MAARNG requested, and was granted by the EMC Environmental Officer, an exception to the standard to allow refueling in the Reserve during the CAX (see Section 2.16). Refueling during the CAX was executed successfully. Photographs 2-4 and 2-5 show HEMTTs set up in the Reserve for refueling during the exercise. As requested by the EMC through guidance of the SAC and CAC, the MAARNG has drafted a Standard Operating Procedure for fueling in the Reserve along with a map that denotes areas for fueling vehicles and off-limits areas. The Standard Operating Procedure covers topics ranging from how

Figure 2-6 SVL Objective Locations



Soldiers fuel to criteria for closing and opening a newly requested fueling site. The MAARNG has also developed language for the proposed EPS change.

During the September 26, 2019 SAC meeting, it was determined that more information would be needed to review and provide input to the EMC to decide if this standard needs to be adjusted. Information requested included site descriptions, distance to sensitive receptors, depth to groundwater, site screening criteria, etc. The MAARNG plans to return to the both the SAC and CAC with the additional information prior to requesting the EPS change from the EMC during TY 2020.



Photograph 2-4 Refueling operations in the Reserve during the CAX.



Photograph 2-5 A HEMTT is set up for refueling operations in the Reserve during the CAX. The HEMTT sits on secondary containment to prevent the threat of a spill.

2.15 MULTI-PURPOSE MACHINE GUN RANGE

During TY 2015, the MAARNG was awarded a MILCON (Military Construction) project to construct a Multi-Purpose Machine Gun Range (MPMG) in 2020 on Camp Edwards at the current KD Range. An MPMG is where soldiers train and qualify with automatic weapons. KD Range is a 600-yard Known Distance Range that is currently divided into two subparts with two distinct firing line/target configurations and training uses.

The approximately \$11.5 million project consists of \$9.7 for range construction and \$1.8 million for targetry. Environmental contracting and review of the project began in May 2018, and includes review under both the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA). For the NEPA process, a draft Environmental Assessment was completed and provided to all involved agencies for comment. The Environmental Assessment will be completed during TY 2020 and a 30-day public comment period will be held. A pre-filing MEPA site visit was conducted on August 8, 2019. The visit included participants from MEPA, NHESP, the EMC and the MAARNG. A pre-filing MEPA meeting was held on August 26 with the same agencies participating. The next step in the MEPA process will be to submit a Notice of Project Change in TY 2020, complete a Supplemental Environmental Impact Report, if required, and hold a 30-day public comment period.

It is anticipated that construction will be awarded in March 2020 with project completion in March 2022.

As part of the preliminary planning process, Camp Edwards conducted a test fire at KD Range on August 14, 2015, to simulate noise from the proposed MPMG range. The results of the test fire showed noise levels did not exceed MassDEP levels for nuisance noise and met the Army's criteria for considering a range in this area. Other surveys included an Archeological Survey in 2016 (no "finds" reported); Flora/Fauna Planning/Impact Assessment Surveys; Federal species-Bats surveyed in 2015 and 2016 (project area); Frosted elfin surveyed in 2017, and the Rusty-patched bumble bee, which was surveyed in 2017; State species-Eastern Whip-poor-will surveyed annually, including adjacent to project area; updated base-wide Moth survey and then under the Migratory Bird Treaty Act, base-wide annual bird monitoring including in and near the project area.

Currently, the MPMG is in design and is at 100% completion. MEPA, NEPA, NHESP permitting and mitigation, and EMC requirements continue to be coordinated with the appropriate agencies. All these processes will be coordinated with the EMC's Environmental Officer. Once appropriate permitting and EMC approvals are in place, the MAARNG will advertise and award this project to be constructed. Construction is tentatively scheduled to begin in May 2020.

2.16 COMBINED ARMS EXERCISE

Since 2017, the MAARNG has been planning a Combined Arms Exercise (CAX) with joint elements at Camp Edwards with approximately 900 soldiers. The first iteration of this exercise was successfully conducted in 2018. During TY 2019, the MAARNG expanded on this training. The exercise is took place from July 27 to August 10, 2019 and included approximately 900 soldiers. The purpose of the exercise is to build ready Army units and organizational readiness to conduct Unified Land Operations and to demonstrate the capability to integrate National Defense requirements with Natural Resource protection at Camp Edwards.

In the 2019 iteration, the exercise involved combat support units. The primary areas of operation were Demo 2, BA-6, TTB Kelley, and Dig Site 3. The training involved a movement of troops hit with a simulated chemical attack with the troops pulling back to decontaminate. The primary goal of the exercise is to take collective units tasks and incorporate them into a training scenario to meet directed training requirements.

In preparation for the exercise, the MAARNG made four non-standard training requests: for the use of CS (tear gas) outside of the NBC chambers at several sites in the Reserve; for tactical refueling in the Reserve; to utilize

Sierra Range to replicate a base defense live-fire scenario; and for the use of training simulators. The training simulators the MAARNG requested included smoke grenades, Star Clusters and Parachute Flares/Smoke, and Ground Burst (Artillery) simulators. The devices are used to simulate battlefield conditions during training. The training simulators all contain a very small amount of potassium perchlorate. The MAARNG worked with the SAC Ad Hoc Committee (see Section 2.3) and the EMC Environmental Officer to design a testing regime to verify that these training simulators could be used without impacting the soil and groundwater of the Reserve. Soil samples taken after the test were non-detect for potassium perchlorate. After presenting that information to the SAC Ad Hoc Committee, the group concurred that these simulators could be used in the Reserve during the CAX.

The non-standard training requests were approved by the EMC's Environmental Officer prior to the CAX.



Photographs 2-6 and 2-7 Soldiers training during the CAX on Sierra Range.



SECTION 3

ENVIRONMENTAL PROGRAM MANAGEMENT

3.0 INTRODUCTION

Chapter 47 of the Acts of 2002 requires the Annual Report to contain information describing the range of resource management activities conducted by the MAARNG in the Reserve and to report on activities associated with the EPSs for the Reserve. Sections 3.1 through 3.16 include information for each EPS where there were associated activities. Section 3.17 provides similar information for the generic Cultural Resources EPS that also applies to MAARNG activities in the Reserve. In addition to meeting this requirement, Section 3 provides information on required mitigation measures undertaken by the MAARNG and information on any noncompliance with the EPSs or other laws and/or regulations.

Chapter 47 of the Acts of 2002 also requires the Annual Report to describe long-term trends in the major areas of resource management and activities. Data is provided in this report back through TY 2010, when available, or longer when appropriate to illustrate long-term trends. Additional information on environmental management activities performed in the Reserve can be found on the Publications page of the E&RC web site at: <https://www.massnationalguard.org/ERC/>.

During TY 2019, five Records of Environmental Consideration (RECs) were reviewed for natural and cultural resources for proposed actions in the Reserve. RECs are an internal environmental review document based on NEPA. The RECs reviewed were for: the Wheelock Overlook (Training Area A-5) Timber Harvest; mowing of Training Area C-13 and Training Area C-14 for fire break maintenance; and for the proposed demolition of the STAPP™ systems on Juliet and Kilo ranges.

Appendix D identifies the relevant federal, state, DoD, and U.S. Army environmental regulations governing MAARNG activities in the Reserve.

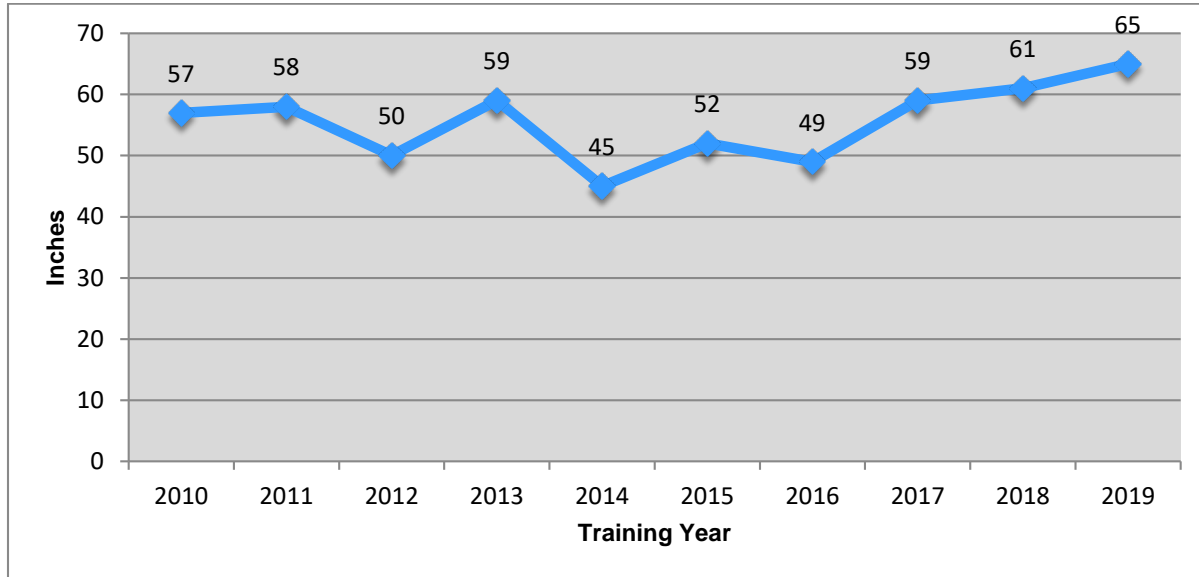
3.1 GROUNDWATER RESOURCES MANAGEMENT

The MAARNG complied with the Groundwater Environmental Performance Standard during TY 2019. Travel in Zone 1 Wellhead Protection Areas was limited to foot travel or to vehicles required for construction, operation or maintenance of wells. The Upper Cape Water Supply Cooperative continues to have fencing around its three water supply wells and appropriate signage around the wells' 400-foot radius in the Reserve. Both the Upper Cape Water Supply Cooperative and the 102nd Intelligence Wing operated within the water withdrawal limits of their respective MassDEP issued permit or registration. The Bourne Water District has a well in the Reserve that became operational in TY 2014 as part of its overall water supply system. The JBCC Groundwater Protection Policy is available on the Publications page of the E&RC website at: <https://www.massnationalguard.org/ERC/>.

3.1.1 Precipitation

Precipitation information included in the Annual Report is obtained from the Northeast Regional Climate Center at Cornell University in Ithaca, New York, based on recordings from a station in East Sandwich, Massachusetts. That station reported a total of 64.89 inches of precipitation for TY 2019 (Graph 3-1).

Graph 3-1 Precipitation Recorded



3.1.2 Groundwater Level

During the early part of TY 2005, the U.S. Geological Survey (USGS) installed a monitoring well (USGS number MA-SDW 537-0107) on Camp Edwards to record the altitude of the water table in the Cape Cod aquifer. The well is located west of Greenway Road on the J-1 Range of the Reserve and is about 107 feet deep. A recording device in the well electronically transmits a continuous record of the water level near the top of the water-table mound that forms the Sagamore groundwater-flow system on western Cape Cod. The well's location is shown in Figure 3-1 at the end of this section.

The pattern of water-level changes observed at the monitoring well is caused by natural seasonal and year-to-year variations in recharge from precipitation. Graph 3-2 shows the trend in the water-table altitude at the USGS monitoring well for the 2005-2019 training years. During TY 2019 (October 1, 2018, to September 30, 2019), the water-table altitude declined about 0.7 feet during October to January, rose about 1.8 feet during the next 7 months, and then declined about 0.3 feet to end the training year about 1 foot higher than the average water-table altitude for TY 2005-2019.

The well became operational in January 2005. The IAGWSP provides part of the funding for the installation and operation of the monitoring well because the water-level data are used in that program. Information about the well and the observed groundwater levels is publicly available on the following USGS website:

<http://groundwaterwatch.usgs.gov/AWLSites.asp?S=414159070310501&ncd=>

Graph 3-2 U.S. Geological Survey Monitoring Well



3.1.3 Water Supply Systems

Upper Cape Regional Water Supply Cooperative

The Upper Cape Regional Water Supply Cooperative provided 450,819,000 gallons of water (a daily average of 1,235,120) from its three wells to the six public water supply systems it services during TY 2019: Bourne Water District, Mashpee Water District, Sandwich Water District, the Town of Falmouth water system, the Barnstable County Correctional Facility, and the Otis ANGB water supply system. The Cooperative is authorized to withdraw up to 3.0 million gallons per day. Graph 3-3 shows the daily average pumping rate of the Cooperative since TY 2010. The locations of the Cooperative's three water supply wells (WS-1, WS-2, WS-3) and its seven sentry monitoring wells (C-1 through C-7) are shown in Figure 1 in Appendix E. The Cooperative's 2019 Long Term Monitoring Sentry Well Sampling Results are available in Appendix E.

In May 2018 the explosive compound RDX was detected in groundwater samples collected by the Upper Cape Regional Water Cooperative from sentry wells C-1S (0.43 $\mu\text{g/L}$) and C-4S (0.27 $\mu\text{g/L}$). The Massachusetts Contingency Plan Groundwater 1 standard for RDX is 1 $\mu\text{g/L}$ (ppb) and the EPA Health Advisory is 0.6 $\mu\text{g/L}$.

The IAGWSP resampled sentry wells C-1S and C-4S for explosives and perchlorate on August 1, 2018. No explosives were detected; however perchlorate was detected at low, estimated values in C-1S (0.043-J $\mu\text{g/L}$) and C-4S (0.018-J $\mu\text{g/L}$), below the Massachusetts Maximum Contaminant Level (MMCL) for perchlorate of 2 $\mu\text{g/L}$. Travel time from the sentinel wells to the water supply wells is approximately 3 years. The Cooperative water supply wells WS-1, WS-2 and WS-3 were sampled for explosives and perchlorate in August 2018 with no detections.

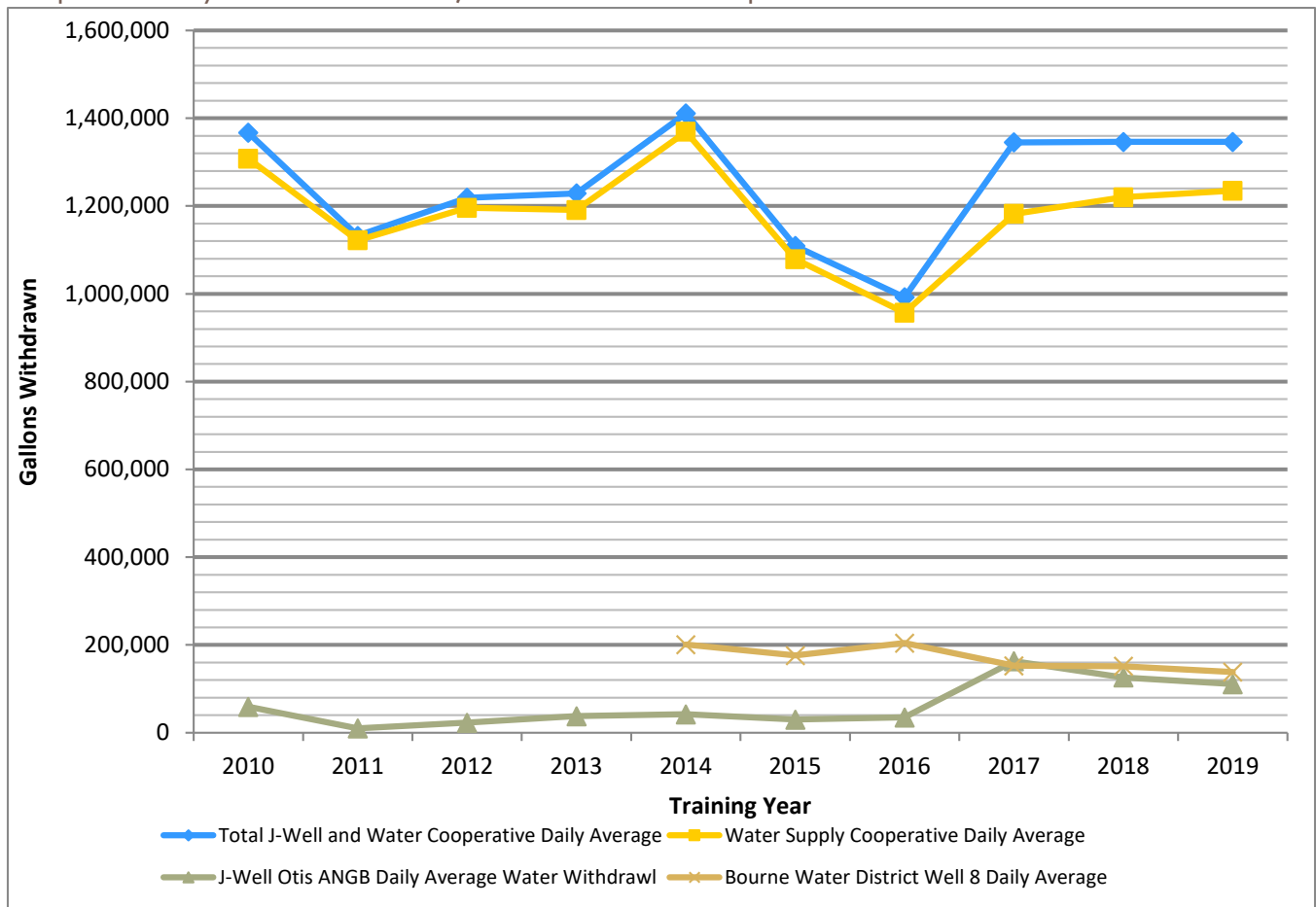
The IAGWSP has identified groundwater contaminated with RDX and perchlorate in areas upgradient of the Cooperative’s sentry wells. The J-2 Northern plume is upgradient of the C4-S sentry well and the J-2 eastern Plume is located upgradient of the C1-S sentry well.

The RDX and perchlorate in these plumes is being captured by multiple extraction wells and RDX has not been previously detected in monitoring wells downgradient of the extraction wells. Shallow and intermediate sentry wells were sampled for explosives and perchlorate in 2015 and the deep sentry wells were sampled for explosives and perchlorate in 2017 - none of these compounds were detected in any of the samples.

Environmental monitoring wells located upgradient of C-4S were sampled for explosives and perchlorate. Monitoring well 330 was nondetect for explosives/0.022 µg/L j for perchlorate and Monitoring Well 345 was nondetect for explosives and perchlorate.

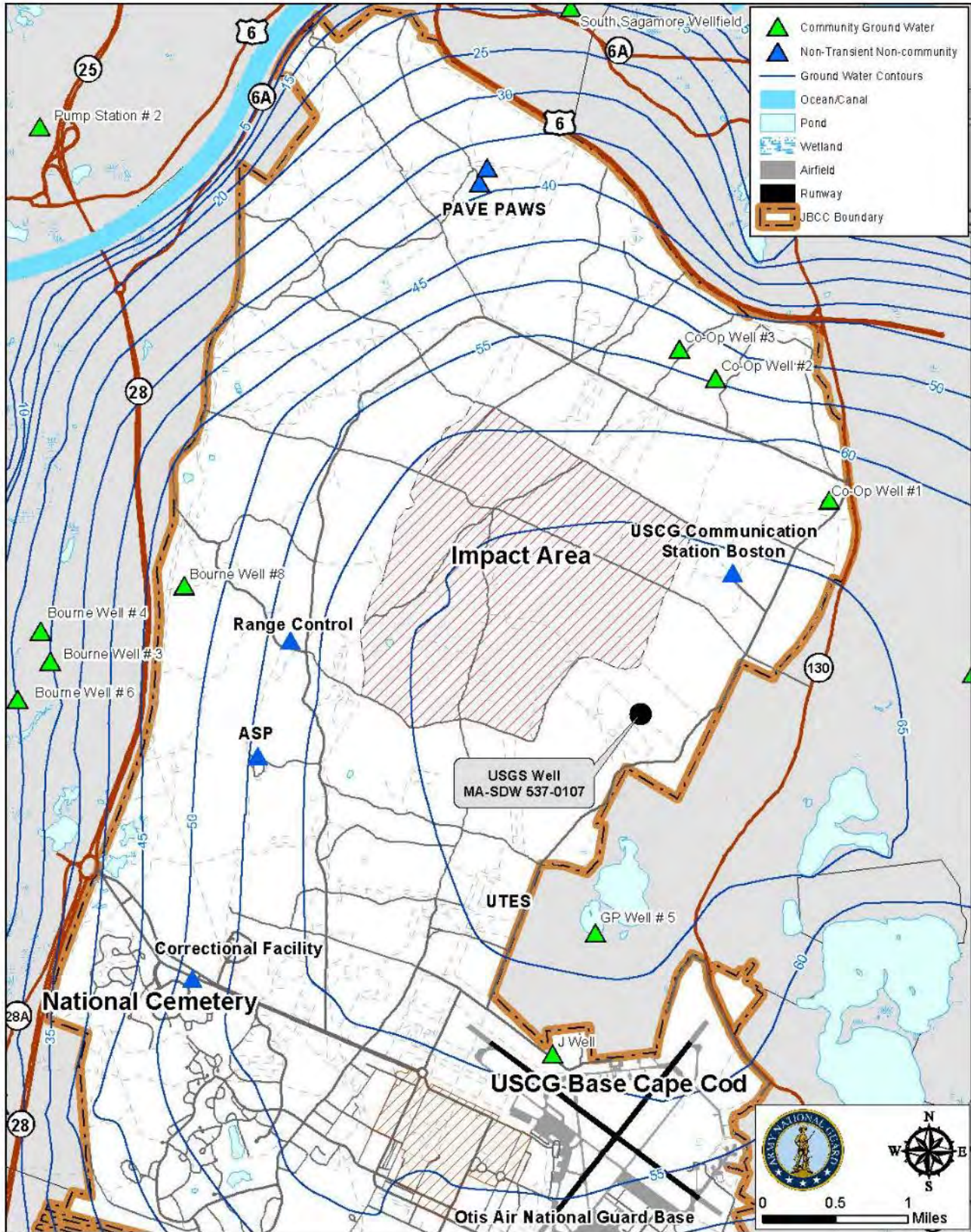
In June 2019, the IAGWSP did additional sampling on 29 well screens not currently in their monitoring program (due to historically low detections). Of those samples, 24 were non-detect for RDX and perchlorate, and the remaining results were below the Massachusetts Contingency Plan Groundwater 1 standard for RDX and perchlorate. Monitoring well results for RDX were: Monitoring Well 331M1/0.096 ppb; Monitoring Well 331M2/0.13 ppb. Monitoring well results for perchlorate were: Monitoring Well 330M1/0.81 ppb; Monitoring Well 63M2/0.029 ppb; Monitoring Well 63M3/0.034 ppb.

Graph 3-3 Daily Water Withdrawal, J-Well and Water Cooperative



Note: Bourne Water District Well 8 began production on May 30, 2014.

Figure 3-1 Well Locations



Otis ANGB Public Water Supply System

The Otis ANGB system pumped an average of 111,154 gallons of water per day and a total of 40,610,000 gallons of water from its well, known as J-Well (located in the Cantonment Area), during TY 2019. It also received 31,074,000 gallons from the Cooperative during TY 2019; a daily average of 85,134 gallons. Graph 3-3 shows the daily average pumping rate of the Otis system since TY 2010.

A copy of the calendar year 2018 Water Quality Report published by the 102nd Intelligence Wing in June 2019 is provided in Appendix E.

Bourne Water District Water Supply Well

Bourne Water District Well 8 became operational in May 2014. During TY 2019 a total of 50,498,800 gallons pumped, with a daily average of 138,353 gallons pumped. Graph 3-3 shows the daily average pumping rate of Well 8 for TY 2014 through TY 2019. The well's location is shown in Figure 3-1. A copy of the calendar year 2018 Bourne Water District's Water Quality Report is provided in Appendix E.

Other Water Wells

There are two water supply wells located within the boundary of the Reserve, which are not subject to Chapter 47 of the Acts of 2002 and the EPSs. These are located at Cape Cod AFS and the USCG Communications Station. Further information on these water supply wells is available by contacting the Massachusetts Department of Environmental Protection at 508-946-2760.

3.2 WETLANDS AND SURFACE WATER MANAGEMENT

The MAARNG did not take any actions during TY 2019 that resulted in the loss of any wetland resources or their 100-foot buffer areas. No new bivouac areas were created in the Reserve during the year within 500 feet of any wetland and no land alteration activities were conducted by the MAARNG within 100 feet of a certified vernal pool during the year. Representatives of the E&RC routinely attended numerous coordination meetings held by various parties (e.g., Camp Edwards, IAGWSP) to stay abreast of the activities in the Reserve and to ensure appropriate coordination occurred and impacts were avoided or permitted.

Two projects underwent coordination and review with the respective towns. The Natural Resources Office consulted with the Bourne Conservation Agent to ensure no negative impacts occurred to wetlands or buffer areas in training area A-0 as a result of renovation activities at the former Rod and Gun Club area to include trail repair in support of remediation activities and repair and maintenance at the building and grounds. Additionally, a wetland survey and delineation was contracted in support of the fuel point modernization, which is outside, but adjacent to the Reserve. The surveyors found there were no wetland resources within or near the project area and the findings were provided to the Sandwich Conservation Agent.

In TY 2019, work was completed to comply with the Conservation and Management Plan (CMP) for Agassiz's Clam Shrimp (*Eulimnadia agassizii*), a state listed endangered species, occurring in road way puddles. Details on this mitigation and monitoring are in Section 3.3.4 Agassiz's Clam Shrimp. In TY 2018, the Bourne Conservation Commission reviewed this project and made a negative determination, as reported in the TY 2018 annual report.

3.2.1 Vernal Pools

In TY 2019, the Natural Resources Office only monitored vernal pools and puddles for the existence of clam shrimp. Given little knowledge on clam shrimp use of vernal pools, the Racoon Swamp pools were surveyed for clam shrimp presence. These pools represent a diversity of conditions (differing hydrologies, vegetative communities, and aquatic fauna). No other vernal pools or puddles were monitored specifically for amphibian

activity. Monitoring of puddles followed the guidance agreed upon in the CMP for Agassiz's Clam Shrimp, which is in Section 3.3.4 along with monitoring results..

3.3 RARE SPECIES MANAGEMENT

The Natural Resources Office and their contractors observed and reported on floral and faunal species listed under the Massachusetts Endangered Species Act (MESA) on Camp Edwards in TY 2019. The office observed ten species and is reporting the sightings to NHESP in early TY 2020 (Table 3-1). Field crew members hired for TY 2019 were primarily involved in observing and reporting these rare floral and faunal species in the Reserve with supplementary observations from others. The Natural Resources Office is also reporting observations of three "Tracking List" species to NHESP as a standard condition of scientific collection permits for reptiles and amphibians.

The Natural Resources Office formally and informally reviewed proposed military and civilian activities in the Reserve to ensure that adverse impacts to natural resources (including state-listed endangered species) were avoided or mitigated. Multiple state and federal coordination processes were initiated or completed during TY 2019 for rare species. MESA coordination continued for future development of a MPMG range (Project #18-37434) with development of a Conservation Management Permit and incipient establishment of a "master planning" mitigation bank at Joint Base Cape Cod for state-listed species. Three individual projects, two of which are associated with the mitigation bank, were submitted to NHESP for review including modernization of the fuel point (no take and outside the Reserve), expansion of the physical fitness complex, and expansion of Tango Range. One streamlined consultation form was submitted to the US Fish and Wildlife Service (USFWS) New England Field Office for a project that was beyond the scope of our informal consultation, but met the criteria of the exemption for habitat and potential take under the Section 4(d) rule for the Northern Long-eared Bat. This was the Wheelock Overlook pine barrens restoration timber harvest, which was also reviewed and permitted by DCR and DFW.

Multiple contracts were developed or continued in TY 2019 for surveying and managing rare species. Tetra Tech, a contractor for the MAARNG, is currently vetting bat acoustic data from TY 2018 and TY 2019. Tetra Tech is also completing a report interpreting MAARNG bat call vetting results from 2016 and 2017. Michael Veit completed ten days of surveying for *Anthophora walshii*, a species proposed for state listing. This species' range is in the central US with Massachusetts having the only population east of Ohio. The species has only been documented in two Massachusetts locations, Martha's Vineyard and Camp Edwards, in the last 35 years. For this survey, sites with large populations of *Baptisia tinctoria*, the primary food plant for the species, were surveyed including areas in the Cantonnent area and the powerline right-of-way on Gibbs Road. *A. walshii* was documented at three grassland parcels owned by MAARNG, one parcel owned by the Coast Guard on Shelton Road, and on the powerline on Gibbs Road near Sierra Range. Both foraging and nesting activity was documented at all sites, except the on the powerline where no nesting activity was documented.

AECOM was contracted to complete five days of canine-assisted turtle surveys in C-14. Prescribed fire is planned for portions of C-14 within the next year. Turtle surveys were contracted to better ascertain turtle numbers in the area to be burned and the potential for turtle mortality during prescribed fires. Scott Egan and his team located 13 turtles in and around the target area and placed transmitters on all turtles, except for one turtle that was visibly underweight for its size. MAARNG staff brought this turtle to the Cummings School of Veterinary Medicine at Tufts University in Grafton, Massachusetts, where it is being treated for a possible respiratory infection, had fly larvae removed from a subcutaneous pocket in its leg, and will be fed through the winter in order to replace lost mass. Once recovery is complete, it will be released in the spring where it was found.

In Fiscal Year 2019, MAARNG Natural Resources continued coverboard surveys aimed at studying snake species distributions in the Reserve. TY 2019 coverboard surveys resulted in detection of seven snake species. The Natural Resources Office continued to coordinate with the State Herpetologist to better provide information on two species of interest, black racers (*Coluber constrictor*) and eastern hognose snakes (*Heterodon platirhinos*), currently proposed for state listing as special concern. Results from the TY 2018 DoD PARC Ophidiomycosis (snake fungal disease) survey indicate presence of the fungal disease at Camp Edwards. Of samples taken from 17 individuals in four species, 5 individuals in two species tested positive for Ophidiomycosis. It's unclear whether the disease will be problematic for any species in the Reserve, but continued snake monitoring will allow for detection of any major problems.

3.3.1 Rare Species Reporting

Table 3-1 identifies the rare species sightings reported to NHESP for the past five years. See Appendix F for sightings reported for the past 10 years. The fluctuation in numbers reported is attributed to a variety of factors, including but not limited to: the time and length of surveys, locations where surveys are conducted (the same locations are not necessarily visited each year), intensity of the surveys, the number and experience of summer field crew personnel, weather conditions during the times available for surveys, locations where soldiers may train during the training year, familiarity of individual soldiers and others utilizing the various training areas and training support areas on Camp Edwards with rare species, etc. With these limitations and the varied associated counting procedures and efforts, the numbers contained in Table 3-1 do not reflect changes or trends in populations. These are raw number counts that are reported to NHESP based on sightings.

Efforts are ongoing to collect rare species and management data in a way that allows for trends analysis that will better inform management decisions and meet the intent of Chapter 47 of the Acts of 2002. The data currently reported in the table are gross observations only and not interpretable for trends. State-listed species such as the Whip-poor-will lend themselves to data collection for trends analysis (annual point-count transects) and cooperation with statewide or national efforts. Likewise, grassland bird monitoring standardization will allow for long-term trends analysis and better integration with broader conservation initiatives. The Natural Resource Program staff are working with statewide and regional efforts to coordinate monitoring, including participating in the annual Northeastern Nightjar Survey.

Based on recommendations from the state botanist in 2016, a subset of rare plant sites are surveyed annually, and each site monitored every three years. Hence, the numbers presented in the tables cannot be evaluated as trends in the species. State-listed plants were surveyed at ten sites for *Ophioglossum pusillum* and *Triosteum perfoliatum* in TY 2019. *Ophioglossum pusillum* was found in low quantities at two sites. Surveys were performed later in the year to maximize ability to discern between *Triosteum* species, but this makes finding *Ophioglossum* difficult. Surveys in TY 2020 will occur earlier in the season and specifically target *Ophioglossum pusillum*. In addition, the Natural Resources-ITAM Office will survey every known extant *Ophioglossum* site in the Reserve in order to get an accurate assessment of the species' status. In TY 2019, five sites had *Triosteum perfoliatum* present. This species is difficult to tell from its congener, *Triosteum aurantiacum*, particularly when plants are in smaller growth stages or less than ideal conditions. In the Reserve, it appears that the two species grow in the same areas, adjacent to each other. This makes accurate counts difficult, and has prompted the Natural Resources-ITAM Office to look into the feasibility of studying the genetics of the two species. Late in TY 2019, Plant Conservation Volunteers from the Native Plant Trust (formerly New England Wildflower Society) visited the Reserve to survey several *Triosteum perfoliatum* sites with hopes of collecting seed for their regional conservation seed bank. Due to the condition of the *Triosteum* plants late in the season, it was not possible to find a sufficient population to collect from where species identification could be confirmed.

In TY 2019, acoustic monitoring for bats continued. Tetra Tech was contracted to perform manual vetting, and results will be received in FY20. Manual vetting involves expert evaluation of bat call acoustic data to determine

as possible the genus and/or species of bat recorded. Reported data is then recorded calls, not individuals, which can roughly be evaluated to levels of activity. Acoustic data is much more useful for evaluating patterns and levels of activity rather than relating to population information. Confirmed detections will be reported to NHESP.

Starting in TY 2019, grassland bird numbers represent individuals (not double counting the same bird) observed in a given year rather than the total number of birds observed throughout repeated surveys as was reported in past years. This will better represent the number of active territories in a given year. In 2019, there were 20 active Grasshopper Sparrow territories and 12 active Upland Sandpiper territories. There were no Vesper Sparrows observed in TY 2019. Annual bird surveys including focused state-listed species efforts were contracted and coordinated with MassWildlife.

The number of Whip-poor-wills reported reflects the lowest number (between two observers) heard per site during a single round of surveys to remain conservative in reporting, while keeping detections over negative site records (sites are only considered negative records if surveyors mark paired zeroes). It is of note that only a single Whip-poor-will survey night was completed due to assisting DFW on active netting of Whip-poor-wills for a migration study. A second attempt was made due to the survey night having less than ideal conditions, but conditions and results were poor, and the survey was aborted. In prior years, reported numbers have included multiple surveys, and likely repeated counts. The TY 2019 survey resulted in the second-least Whip-poor-wills of any year the Natural Resource Office has run the NHESP Northeast Nightjar Survey (53 individuals). However, the two lowest counts were separated by the highest number recorded (TY 2018). The survey also documented an Eastern Screech Owl and two Northern Saw-whet Owls. No other nightjar species were heard in 2019 during official surveys, but Chuck-will's-widows were heard in the area during mist-netting surveys with DFW. Harrier sightings were not counted as the species is constant and conspicuous throughout the non-breeding season with much uncertainty to individuals, and NHESP no longer accepts non-nesting reports of this and other raptor species.

See Section 3.3.4 for information regarding clam shrimp (*Branchiopoda: Spinicaudata*) observations, and Table 3.1 for reporting of the state-listed clam shrimp *Eulimnadia agassizii*.

TABLE 3-1 LIST OF RARE SPECIES REPORTED TO NHESP					
Individuals Reported					
Common/Scientific Names	TY 2015	TY 2016	TY 2017	TY 2018	TY 2019
BIRDS					
Grasshopper Sparrow ¹ (<i>Ammodramus savannarum</i>)	46 (23)	59 (16)	44 (15)	47 (16)	(20)
Northern Harrier ² (<i>Circus cyaneus</i>)	Wintering	Wintering	Wintering	Wintering	Wintering
Upland Sandpiper ¹ (<i>Bartramia longicauda</i>)	12 (7)	20 (6)	23 (8)	20 (7)	(12)
Sharp-shinned Hawk ² (<i>Accipiter striatus</i>)	1	0	0	0	0
Long-eared Owl ² (<i>Asio otus</i>)	0	0	0	0	0
Vesper Sparrow (<i>Pooecetes gramineus</i>)	0	0	0	0	0
Whip-poor-will ³ (<i>Antrastomus vociferous</i>)	96	87	52	110	53
Bald Eagle ² (<i>Haliaeetus leucocephalus</i>)	3	0	0	0	0

TABLE 3-1 LIST OF RARE SPECIES REPORTED TO NHESP, cont'd

Individuals Reported					
Common/Scientific Names	TY 2015	TY 2016	TY 2017	TY 2018	TY 2019
REPTILES and AMPHIBIANS					
Eastern Box Turtle (<i>Terrapene carolina carolina</i>)	13	38	42	43	58
ODONATES					
Comet Darner ⁴ (<i>Anax longipes</i>)	0	N/A	N/A	N/A	N/A
Spatterdock Darner ⁴ (<i>Aeshna mutata</i>)	0	N/A	N/A	N/A	N/A
PLANTS					
Adder's Tongue Fern ^{5,7} (<i>Ophioglossum pusillum</i>)	256	98	247	0	25
Broad Tinker's Weed ^{6,7} (<i>Triosteum perfoliatum</i>)	N/A	113	127	0	200
American Arborvitae ⁸ (<i>Thuja occidentalis</i>)	4	4	N/A	N/A	N/A
BUTTERFLIES and MOTHS⁹					
Barrens Buckmoth (<i>Hemileuca maia</i>)	13	90	95	0	4
Pine Barrens Speranza (<i>Speranza exonerata</i>)	0	44	13	0	0
Sandplain Euchlaena (<i>Euchlaena madusaria</i>)	0	3	7	0	0
Coastal Swamp Metarranthis (<i>Metarranthis pilosaria</i>)	0	1	1	0	0
Melsheimer's Sack Bearer (<i>Cicinnus melsheimeri</i>)	0	2	0	0	0
Gerhard's Underwing (<i>Catocala herodias</i>)	0	33	10	0	0
Pine Barrens Zale (<i>Zale lunifera</i>)	0	13	8	0	0
Barrens Dagger Moth (<i>Acronicta albarufa</i>)	0	1	0	0	0
Chain-dotted Geometer (<i>Cingilia catenaria</i>)	0	0	0	0	1
Drunk Apamea (<i>Apamea inebriata</i>)	0	1	0	0	0
Pink Sallow (<i>Psectraglaea carnosia</i>)	0	9	5	0	0
Pink Streak (<i>Dargida rubripennis</i>)	0	25	0	0	0
Unexpected Cycnia (<i>Cycnia inopinatus</i>)	0	0	1	0	11
Coastal Heathland Cutworm (<i>Abagrotis benjamini</i>)	0	0	1	0	0
Pine Barrens Lycia (<i>Lycia ypsilon</i>)	0	0	2	0	0

TABLE 3-1 LIST OF RARE SPECIES REPORTED TO NHESP, cont'd

Common/Scientific Names	Individuals Reported				
	TY 2015	TY 2016	TY 2017	TY 2018	TY 2019
BUTTERFLIES and MOTHS⁹					
Water-willow Stem Borer (<i>Papaipema sulphurata</i>)	0	0	1	0	0
Waxed Sallow Moth (<i>Chaetagnaea cerata</i>)	0	0	2	0	0
Frosted Elfin ¹⁰ (<i>Callophrys irus</i>)	0	5	5	5	TBD
CRUSTACEANS					
Agassiz's Clam Shrimp ¹¹ (<i>Eulimnadia agassizii</i>)	1	0	6	38	9
MAMMALS					
Northern Long-Eared Bat ^{12,13} (<i>Myotis septentrionalis</i>)	9 (2)	15 (1)	2	TBD	TBD
Little Brown Bat ¹² (<i>Myotis lucifugus</i>)	5	22	4	TBD	TBD
Tricolored Bat ¹² (<i>Perimyotis subflavus</i>)	3	7	3	TBD	TBD

¹ Starting TY 2019, numbers represent individuals observed in a given year rather than the total number of birds observed throughout repeated surveys as was reported in past years. The numbers in parentheses represent this new way of reporting individuals applied to past years' data. Also, the 2015 numbers reported in past annual reports included birds found on the Coast Guard airfield, which is not reported by MAARNG Natural Resources. Numbers in this version of Table 3-1 are accurate. ² NHESP is only accepting reports of nesting raptors, rather than opportunistic observations of individuals. Reports are provided as relevant, but common wintering birds or migrants are not individually tracked or reported (e.g., Northern Harrier). ³ As of TY 2016, quantities only reflect the results of annual survey routes during May, after totaling the minimum number (between two observers) heard at each site. In prior years, the number shown reflects the quantity reported to NHESP, which may include multiple survey windows and repeated counts. ⁴ Spatterdock Darner is no longer on NHESP's rare species list. Also, Odonate surveys were suspended after TY 2015. ⁵ Several known *Ophioglossum* sites could not be surveyed in TY 2016 due to a lack of cease-fire agreement with the off-base Monument Beach Shooting Club. 2019 numbers are likely underrepresentative, as surveys occurred late in the season. In 2020 *Ophioglossum* will be surveyed earlier in the year in order to get an accurate count. ⁶ Surveys performed in 2015 did not differentiate *Triosteum perfoliatum* from *T. aurantiacum*, greatly increasing the number of individuals counted. For this reason, *Triosteum perfoliatum* was not reported to NHESP in 2015. Actual 2019 numbers may be as few as 82, MAARNG staff is looking into the possibility of studying the genetics of *Triosteum perfoliatum* and *T. aurantiacum* due to difficulty in accurately differentiating the two species. ⁷ In 2018, only sites with historic records and no recent records were surveyed, and this should not be interpreted as a loss of rare plants between 2017 and 2018. ⁸ NHESP is not interested in tracking this population, as it is likely of anthropogenic origin (pers. comm. with State Botanist, Bob Wernerehl). ⁹ Moths were extensively surveyed under contract with the Lloyd Center for the Environment between 2016 and 2017. There were no surveys in 2018, and MAARNG staff is not recording flight records of Barrens Buckmoth, as they are ubiquitous around the reserve. 2019 quantities represent individuals or groups of individuals (a group of Barrens Buckmoth caterpillars on a single leaf is counted as one, as are a pair of Unexpected *Cynia* caterpillars sharing the same butterflyweed plant). ¹⁰ MAARNG staff did not perform surveys for *Callophrys irus* in 2019, but facilitated USFWS surveys. Results are pending, but USFWS staff found Frosted Elfins across a wider area than was previously known. ¹¹ Numbers represent only locations where species was found and ID confirmed by either NHESP Aquatic Ecologist or trained MAARNG staff. ¹² Acoustic monitoring collects "call sequence" data and the true number of individuals is unknown. Numbers in the table reflect the number of survey sites with acoustic detections confirmed through manual call vetting. Numbers are reported to NHESP, but not tracked by them due to current uncertainty in using acoustic identifications. TY 2015 numbers were lowered to reflect manual vetting results rather than acoustic classifier results. TY 2018-2019 data is still being processed, these numbers are to be determined at a later date (TBD). ¹³ Number in parentheses is captured individuals trackable by NHESP due to species identification confirmation versus acoustic data.

3.3.2 Northern Long-Eared Bat (NLEB)

The NLEB was federally listed as threatened in May 2015. The listing is primarily due to the severe population crashes (estimated greater than 95%) caused by white-nose syndrome. The extent of population loss drives concerns for impacts on individuals and maternal roost sites throughout the eastern United States. Recent survey efforts have suggested that NLEB are persisting better in coastal areas of the Northeast than any of the rest of their range. Because of this, there is a strong focus on surveys and conservation on Cape Cod and the Islands, Long Island, and coastal New Jersey. A NLEB was discovered on Martha's Vineyard in February 2016 with successively more found hibernating. Acoustic hits for NLEB on base in March and November suggest bats may be overwintering on Cape Cod, as well. If they are utilizing a different type of hibernacula than the caves utilized inland, it could have huge implications for the recovery of the species. Caves allow the spread and growth of white-nose, but a different type of hibernacula or less densely inhabited hibernacula may be allowing coastal bats to avoid white-nose syndrome leading to the greater numbers of bats in coastal areas.

In TY 2019, 19 sites were acoustically monitored, including three sites off-base where Natural Resource Program staff attempted to survey for NLEB hibernating on Cape. Two of these sites were chosen for long-term monitoring through the winter and into TY 2020, both of which have been recording since 2015. In TY 2019 program staff aimed to acoustically monitor the state listed species *Perimyotis subflavus* (also being considered for federal listing), as it is a high-flying species that requires different methods than those used to monitor NLEB. Two of the acoustic sites were set up above the forest canopy to survey specifically for them. Results will be ready once the data is qualitatively vetted. Currently, Tetra Tech is analyzing acoustic results from 2018 and 2019. Tetra Tech is also preparing reports on data from 2016 and 2017.

The Army National Guard completed a programmatic informal consultation for NLEB addressing small projects implemented by MAARNG at all managed locations to include actions less than 5 acres and incorporating conservation measures. The USFWS concurred with the Army National Guard determination on October 8, 2015 and small projects are kept within the scope of that agreement. Larger projects are scoped to avoid impacts to bats to the extent possible while utilizing the 4(d) rule exemption under the Endangered Species Act as appropriate for habitat management actions. A significant investment in equipment, personnel training, and collaboration continued in TY 2019 to address concerns both over avoiding impacts to bats and minimizing bat impacts on ongoing actions such as pine barrens habitat management.

The Air Force Civil Engineer Center (AFCEC) manages two 1.5 megawatt (MW) wind turbines in the Reserve. Turbine operation is curtailed for the NLEB from July 15 to October 15, 30 minutes before sunset to 30 minutes after sunrise for wind speeds less than 4.5 meters per second. There were no reported bat or bird strikes during TY 2019.

3.3.3 New England Cottontail Rabbit Study

The Natural Resources Office began a study in TY 2010 on the New England cottontail rabbit (*Sylvilagus transitionalis*), at the time a candidate species for federal listing. Original study objectives were to determine the home range and habitat preferences of the species. This information can be used regionally to influence effective management efforts for this species. Current and future efforts are transitioning more from research into population monitoring, though with a strong emphasis on evaluating the effects of habitat management on cottontails. New England cottontails occur throughout suitable scrub oak habitat across Camp Edwards.

On September 11, 2015, the USFWS announced a “not warranted” finding for the New England cottontail. This initiates a 12-month review period for the decision, at which point the species will be removed from the federal candidate list and not added to the Endangered Species List unless substantial new information is received. The finding is based upon the conservation implementation enacted and future commitments by the large regional

partnership, including MAARNG and Camp Edwards. Continued habitat management and monitoring are critical to New England cottontail success and keeping the species from being federally listed.

In TY 2016, the MAARNG contracted wildlife detection dogs to search for rabbit pellets. The dogs surveyed both on base and off base sites. The dogs readily found pellets at the off base sites and two on-base sites along the powerlines along the western edge of the base. At several sites on base that had previously had rabbits, the dogs did not find rabbit sign. At one site, the dogs found sign, but not during all repeated surveys. This data could suggest a lower density of rabbits or a higher extinction rate at more interior sites. More interior sites tend to have more native habitat. To further explore the factors driving this, the Natural Resources Office sent fecal samples for diet analysis in TY 2017. If certain sites are supplying more suitable forage, it is likely they are able to support more rabbits. The Natural Resources Office sent more fecal pellets from both on base and off base sites in TY 2018 for diet analysis to explore seasonal variations and site differences in diet. The low diversity of food resources at interior base sites with more native vegetation may be limiting the density of rabbits on base. The results of the diet analysis should provide useful information to use for on base restoration sites and for regional partners. In TY 2019, the Natural Resources Office assisted a Harvard graduate student correlating our diet analysis data with availability of vegetative resources through stem density counts.

As part of the regional pellet search effort coordinated by the New England Cottontail Technical Committee, technicians conducted pellet searches at four regional plots throughout the training area. Ten-acre regional plots were surveyed two times each. Pellets were found and collected at two plots for DNA analysis by URI, a total of seven samples. URI only analyzed four samples due to time constraints and funding limitations in the regional monitoring program. All four samples analyzed from regional plots were Eastern cottontails. There were no incidental collections or non-regional pellet surveys in TY 2019.

The Natural Resources Office continued active participation on the Technical Committee, working with partners to prioritize and develop actions and efforts to implement the conservation strategy for the species. In Fiscal Year 2020, the Natural Resources Office plans to contract statistical analysis and reporting for the New England cottontail data compiled thus far. This synthesis of New England cottontail research was approved for funding in TY 2019, but was an unfunded request until late in the year. The timing of funding did not provide sufficient time for preparation and contracting. The funds were used for a habitat restoration project in Training Areas BA-6 and BA-7 to benefit the species. The project area was unmanageable with fire and was hazardous for people due to snag density. An excavator is being used to patchily mow understory shrubs and masticate a majority of snags to both directly improve New England Cottontail habitat while facilitating Fiscal Year 20/21 prescribed burning. Winter implementation was planned to minimize potential wildlife impacts combined with leaving 2 to 3 snags per acre.

3.3.4 Agassiz's Clam Shrimp

Clam shrimp were discovered in roadway puddles on base in TY 2015 and continue to be present on Camp Edwards during TY 2019. Initial attempts at identification indicated the clam shrimp could be two state listed species, *Eulimnadia agassizii* and *Limnadia lenticularis*. In TY 2018, the NHESP Aquatic Ecologist confirmed *E. agassizii* in multiple roadway puddles along with the non-listed *Cyzicus gynecia*. *Limnadia lenticularis* has not been identified on base. In TY 2018, NHESP visited Camp Edwards, viewed some of the known clam shrimp locations, and trained MAARNG staff in proper identification of the species likely to be encountered in the Reserve. The Natural Resource Office also received a collection permit to sample clam shrimp on MAARNG lands or any lawfully entered lands in Massachusetts.

E. agassizii occurs in roadway puddles on base. These sites are most often heavily trafficked, unvegetated puddles created by roadway compaction. Several puddles along Herbert and Cat Roads have become large enough to impede use for training. In Fiscal Year 2018, the Natural Resources Office worked with the NHESP

and Oxbow Associates to create a CMP to address the necessary road repairs and provide net benefit for the species. The plan includes several components: habitat creation, experimental treatments, and monitoring.

The CMP calls for the creation of a puddle along the Tank Trail to relocate clam shrimp from Herbert Road. This puddle was created in the fall of 2018 and has been successfully holding water. The relocation of egg-bearing sediment occurred in the late fall/winter of 2018-19. The puddle was surveyed throughout TY 2019 and no clam shrimp have been found to-date. In May 2019, an existing puddle on Canal View Road was modified to create clam shrimp habitat by removing a thick organic layer, filling with rock to make a shallower pool, and laying locally-sourced sand on top (sand from ~100 meters away). Before clam shrimp or egg-bearing sediment could be moved, *Eulimnadia agassizii* were found in the puddle, which was not found to have contained clam shrimp during survey efforts. To repair the site, a dump truck had to haul material through at least one occupied puddle and through the mitigation site while placing the material. It is likely that the clam shrimp were introduced to the site by the truck tires. In TY 2020, two sites along Cat Road will have egg bearing sediment scraped, fill will be added to the puddle, and then the sediment will be laid back in place. This will complete the mitigation actions outlined in the CMP, excluding the monitoring requirements. The experimental treatments will determine if the species can be managed in place to allow for training use and clam shrimp habitat by maintaining shallow puddles.

The second of three years of monitoring required in the CMP was completed in TY 2019. The methodology used was coordinated with NHESP as part of the CMP process. Natural Resource Office staff conducted repeated surveys (biweekly or monthly depending on season) at 12 puddles (10 puddles required by the CMP), some known to have had clam shrimp. Pools were measured for area, depth, temperature and pH, and all aquatic life was recorded. *Eulimnadia agassizii* were found in four of these puddles, one of which was a new site for the species (Canal View Road puddle described above). Unofficial surveys at 11 other pools led to three newly documented *Eulimnadia agassizii* sites.

3.4 SOIL CONSERVATION MANAGEMENT

All military and civilian uses and activities in the Reserve during the year were reviewed by the Natural Resources Office to ensure that they were compatible with the limitations of the underlying soils. All users were instructed to report evidence of soil erosion to Range Control so that potential repairs to roads, bivouac areas and well pads could be identified in a timely manner. None of the existing unimproved roads in the Reserve were made into improved roads as a result of IAGWSP remediation activities during the year. Additionally, any maintenance on unimproved roads during the year did not involve paving the roads.

3.4.1 Erosion

The Integrated Training Area Management Program (ITAM) worked with Camp Edwards Facilities Engineering to conduct limited erosion management on established maneuver trails. No significant projects were conducted.

3.5 VEGETATION, HABITAT AND WILDLIFE MANAGEMENT

The Natural Resources Office manages for a diversity of natural communities, plants, and animals. This supports a sustainable training area for military training and high quality habitat for rare species (Table 3-1) as well as common ones. Particular emphasis is on maintenance or expansion of earlier successional habitats (e.g., grasslands, shrublands, and young forests) due to the conservation value of these habitats and rapidity at which they are lost to trees or other influences. Mechanical restoration, prescribed fire, resource monitoring, invasive plant management and others are important tools used here. During TY 2019, one timber harvest (55 acres) restored an area to historically appropriate shrub savannah conditions, one scrub oak mastication project (10 acres) was implemented in support of prescribed fire and habitat goals, five battle

positions received vegetation management, multiple prescribed burn operations (486 acres) were conducted, and invasive plant management was continued after emphasis on planning and personnel training and licensing. Additionally, six permits were maintained to continue wildlife and fire operations.

Efforts to collect habitat management information for trends analysis were initiated in 2013 and will be continued. Additionally, overall bird surveys were revised in 2013 to use static point-counts and transects through the training area to specifically provide long-term trend data over time and intentionally cover specific categories of training areas and habitats for evaluation of site use and impacts. As sufficient data has been collected and additional efforts are begun, those trends will be reported. With seven years of bird monitoring data, Natural Resource Office staff are currently in the process of evaluating trends for focal species.

3.5.1 Vegetation Surveys

Only one vegetation survey effort was conducted beyond targeted state-listed plant surveys. As part of the ongoing New England cottontail research efforts, Natural Resources-ITAM staff assisted a Harvard graduate student with the field portion of their thesis comparing vegetative characteristics in the Reserve to the New England cottontail diet analysis data collected in TY 2018. Typical vegetation surveys for New England cottontails are based on radiotelemetry locations. This year no rabbit trapping was performed, so vegetation surveys were not needed. Fire monitoring plots were not completed this year. Land navigation surveys are performed on an as needed basis and were completed in TY 2017.

3.5.2 Invasive Plant Species Control Activities

Invasive plants can be native or non-native species that have spread into natural, minimally managed or disturbed plant systems in Massachusetts. They can cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. As defined here, “species” includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation; from the Massachusetts Invasive Plants Advisory Group (MIPAG).

Exotic invasive plants are a management concern both in the training area and within the Cantonment area. Effective management of these species, including autumn olive (*Elaeagnus umbellata*), Oriental bittersweet (*Celastrus orbiculatus*), and shrub honeysuckles (*Lonicera spp.*), is both labor and cost intensive. Natural Resources-ITAM has two trained and licensed Massachusetts core pesticide applicators on staff. With this capability, Natural Resources-ITAM representatives carried out targeted, high-impact herbicide applications at several sites, in the Reserve as well as the Cantonment area. These actions have likely prevented several new species from becoming established on base. ITAM also conducted hand pulling to remove spotted knapweed (*Centaurea stoebe*) from restored training sites on Battle Positions (BPs) 1, 27, 28, and Demo 2, covering 11 acres. Herbicide use is more fully detailed in Section 3.7.

The Natural Resources-ITAM Program field technician actively surveyed the training and Cantonment areas for invasive species, expanding the invasive plant geodatabase. This is an ongoing project that is used to prioritize and record invasive plant control operations, and will tie in with the creation of an updated integrated pest management plan. Field crews maintained updated knowledge of, and monitored for MIPAG Early Detection Priority species, including mile-a-minute vine (*Persicaria perfoliata*), as there are several populations at nearby Crane Wildlife Management Area. Field personnel also continued mapping and treating populations of *Calamagrostis epigejos* (bushgrass), an invasive grass recently found on base. Personnel coordinated regularly with DFW in developing strategies to manage invasive plants, particularly *C. epigejos*, a species that isn't well-known. In TY 2018, Lavoie Horticultural was contracted to eradicate *C. epigejos* from approximately two acres of roadside sites in the Reserve. This treatment was monitored throughout TY 2019, and has achieved nearly 100% control of those patches. Very little follow-up spot treatment is expected at these patches in TY 2020.

Natural Resources-ITAM staff tested several control methods for *C. epigejos* in TY 2019, in order to determine an efficient control method with limited off-target impact. Tests will continue in TY 2020.

The Natural Resources Office is involved in a multi-year effort to stop the spread of black swallow-wort (*Cynanchum louiseae*) from a single one-acre location in the training area. The black swallow-wort is isolated at Former B Range, which was, for a period of time used as a “compost site” leading to the introduction of several invasive plant species. The area is now forested, but has also been significantly re-opened during lead remediation activities adding emphasis to controlling invasive plants and minimizing spread to recent disturbance. This was the fourth year of chemical treatment, and the first year where mistblower treatment was not necessary due to the low quantity of flowering swallow-wort plants left at the site. This species is highly invasive in grasslands as well as forest, and can interrupt the life cycle of monarch butterflies, so keeping it from spreading in the Reserve is a high priority. Spot-treatment will continue in TY 2020 in order to prevent re-establishment. Elsewhere in the training area, other roadside invasive species were treated with cut-and-paint methods in areas deemed high-risk for off-road spread.

Soil disturbance in the training area, particularly in groundwater treatment areas, bivouac areas, dig sites, or along road sides, is often first colonized by pitch pine. As a pine barrens species adapted to wildfires, pitch pine is capable of colonizing highly disturbed soils with little organic matter. The establishment of this species at sites can often lead to the exclusion of other species creating monocultures of little ecological or training value. Hence, in efforts to restore former training areas and create or improve habitat, the Natural Resources and ITAM Office often needs to manage this species to allow the growth of other species, providing improved habitat quality and site sustainability. To this end, ITAM contracted mechanical removal of regenerated pitch pine in one battle position with implementation in early TY 2020, followed up by reseeded with a native grass mix. The Natural Resources Office also conducted mechanical and chemical control of pitch pine, in addition to exotic invasive plants, in the Cantonment grasslands while intentionally marking and leaving “islands” of mixed age and young pitch pine for patchy canopy cover required by frosted elfin butterflies. The Natural Resources Officer removed 1.3 acres of pitch pine. See Section 3.7 for more information on herbicide use.

Many rare plant sites are being encroached by invasive species or overshadowed by native species. In TY 2017, the Natural Resources Office contracted Wilkinson Ecological Design to complete a Vegetation Management Plan for invasive species treatment in rare plant sites and complete the associated MESA permitting. In 2017, Wilkinson completed the site visits and prepared a Vegetation Management Plan, which has since been approved by NHESP. In TY 2018, Wilkinson performed chemical treatment of all invasive plants found at rare plant sites. Natural Resources Office staff performed follow-up treatments where necessary, and monitored the sites in 2019. No major invasive species problems remain at sites where rare plants still exist, but several of the bowls where rare species have disappeared over the years still have high numbers of invasive shrubs and small trees. The Natural Resources-ITAM Office plans to remedy this through tree removal in order to return frost bottom effects to these bowls.

3.5.3 Bird Surveys

This is the seventh year that point counts were conducted along a bird survey route throughout the training area to determine differences in bird activity in a variety of military training areas and habitat types. The routes consisted of 65 sites that were each visited three times to reduce the likelihood of species being undetected. The calculation of detection probabilities for species of survey concern were not calculated in TY 2019 due to other priorities. This will be an objective in the updated Integrated Natural Resources Management Plan (INRMP) and prioritized as needed given other projects. Additionally, with the completion of seven years, the Natural Resources Office will start evaluating trend data as able, prioritizing species of significant conservation interest.

Whip-poor-wills (*Antrostomus vociferus*) and other nightjars were surveyed on May 15 at 32 sites (three routes). In TY 2019, Whip-poor-wills were detected at 22 out of 32 sites. Conditions were less than desirable for nightjar surveys, but Natural Resources Office staff documented 53 Whip-poor-wills. One Eastern Screech Owl and two Northern Saw-whet Owls were also recorded. No other nightjars were heard during official surveys, but Chuck-will's-widow calls were heard in the area during mist-netting surveys with DFW.

For the fifth year, a point-count methodology was implemented in continuation of a state-wide survey of grassland birds coordinated with the DFW and Mass Audubon. This method is intended to be continued to evaluate trends in grassland bird populations and response to management. State-listed species were reported to NHESP (Table 3-1), including Grasshopper Sparrows (*Ammodramus savannarum*) and Upland Sandpipers (*Bartramia longicauda*).

In TY 2019 the Natural Resource-ITAM office continued assisting researchers from DFW and Worcester Polytechnic Institute on a Whip-poor-will study focused on migratory pathways and behaviors of the state-listed species. Three nights of mist-netting were conducted to support the primary investigators with the project. Several Natural Resource-ITAM staff and supporting volunteers participated all three nights and extensive site scouting and support were provided. Several Whip-poor-wills were captured, including multiple recaptures from the previous year allowing for collection of GPS and geolocator data. Seven birds were outfitted with GPS tags (purchase funded by the Natural Resources Office as partner support), which Natural Resource Office will attempt to collect in TY 2020. Camp Edwards is one of multiple study sites in the Commonwealth for this project.

3.5.4 Deer Hunt

There was a deer hunting season in the Reserve during TY 2019 in which 54 deer were taken during 762 hunter days. The Natural Resource Program supports a hunt sufficient to maintain a harvest level that is compatible with a healthy deer herd and healthy ecosystem. MAARNG and DFW generally feel that the recent average of 60 deer per year meets the overall objective.

The Natural Resource Program continues to provide a variety of hunting opportunities to best engage the hunting community and encourage new hunters through events such as the youth day, archery, and military sportsmen hunt. Hunting during TY 2019 included a three-day hunt for paraplegic sportsmen (November 1-3, 2018), a one-day youth hunt (September 29, 2018), a two-day opening for archery scouting (November 5-6, 2018), a three-day archery season (November 8-10, 2018), a two-day hunt for military sportsmen (November 30- December 1, 2018), a six-day shotgun season (December 3-8, 2018), and a two-day primitive (muzzleloader) season (December 14-15, 2018). Graph 3-4 shows the hunter days and deer harvest ratio since TY 2009.

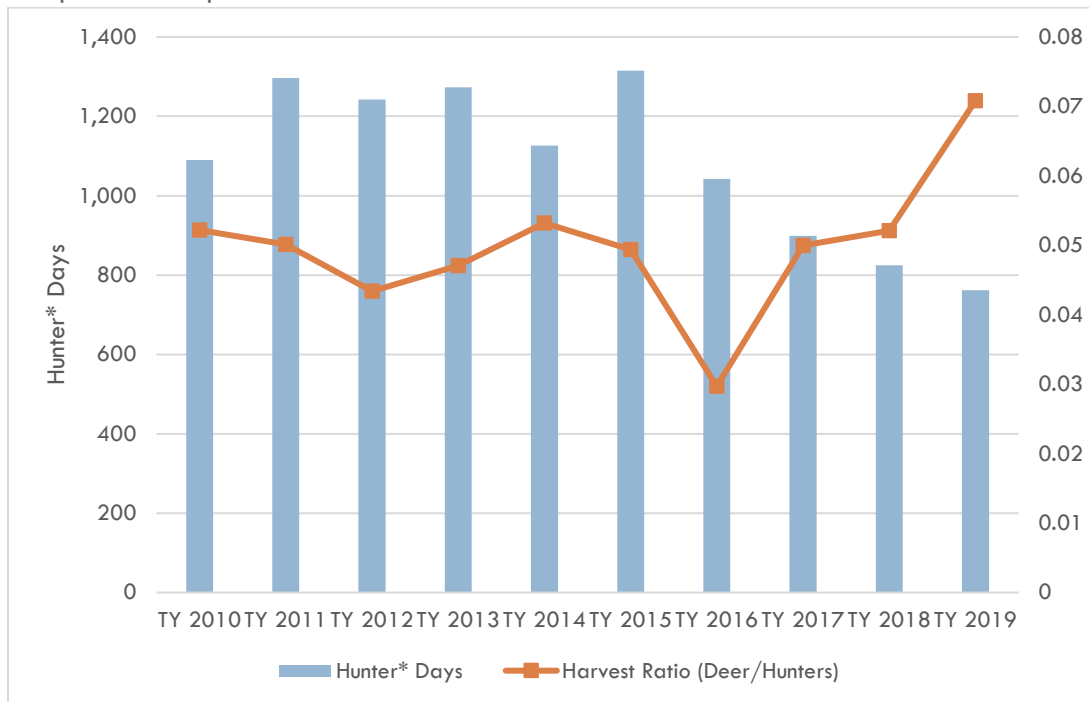
During TY 2019, the Natural Resources Office and the Division of Fisheries and Wildlife conducted hunter surveys to determine hunter preferences and better respond to queries and requests from hunters. Overall, the surveys showed a high level of satisfaction with the hunting program. The draw of this hunting area for most hunters is the large and contiguous hunting area compared to much of the rest of Cape Cod or Southeastern Massachusetts where hunting lands are fragmented by paved roads and neighborhoods with regulatory shooting setbacks. Roughly 45 percent of hunters use the no deer driving areas, and hunters appear to be split (roughly 50/50) on their support and opposition of having a no deer driving area. For context, the no deer driving area constitutes roughly 10-15 percent of available hunting area each year. A majority of hunters (roughly 60 percent) support continuing to rotate the no deer drive area each year rather than having one stationary area. In TY 2019, the Natural Resources Office and the Southeast District Manager for DFW met with the DFG Commissioner to discuss the hunting program and future goals for the program. All parties agreed an advertisement campaign was a top priority to recruit hunters. In TY 2019, the Natural Resource Office created a flyer to advertise the hunting program, and the E&RC distributed it to more than 80 sportsmen's clubs in Massachusetts as well as to natural resource departments in various towns, and on social media.

The goal of the hunt program is to provide recreational opportunities to the public and military and to harvest deer for the health of the herd and for ecosystem management. With the update of the INRMP in TY 2020, specific goals for harvest will be discussed based on past biological data from deer harvested on base and browse surveys aimed at determining habitat impacts.

3.5.5 Wild Turkey Hunt

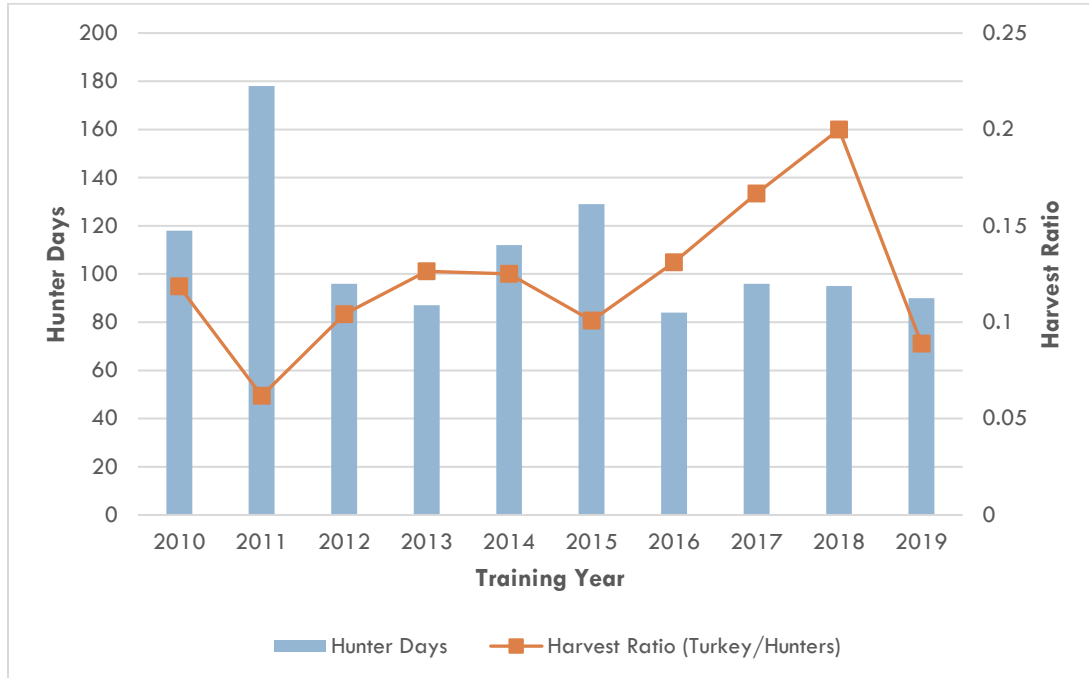
There was a five-day wild turkey hunting season in the Reserve from May 6-10, 2019 during which 90 hunters took eight turkeys. In addition, a one-day youth turkey hunt was held on April 27, 2019 in which five youths participated with four turkeys taken. Graph 3-5 provides information on the wild turkey hunts conducted in the spring since TY 2008.

Graph 3-4 Camp Edwards Deer Harvest



Note: Hunter Days is the sum of the number of hunters each day for each day of the annual hunt.

Graph 3-5 Camp Edwards Turkey Harvest



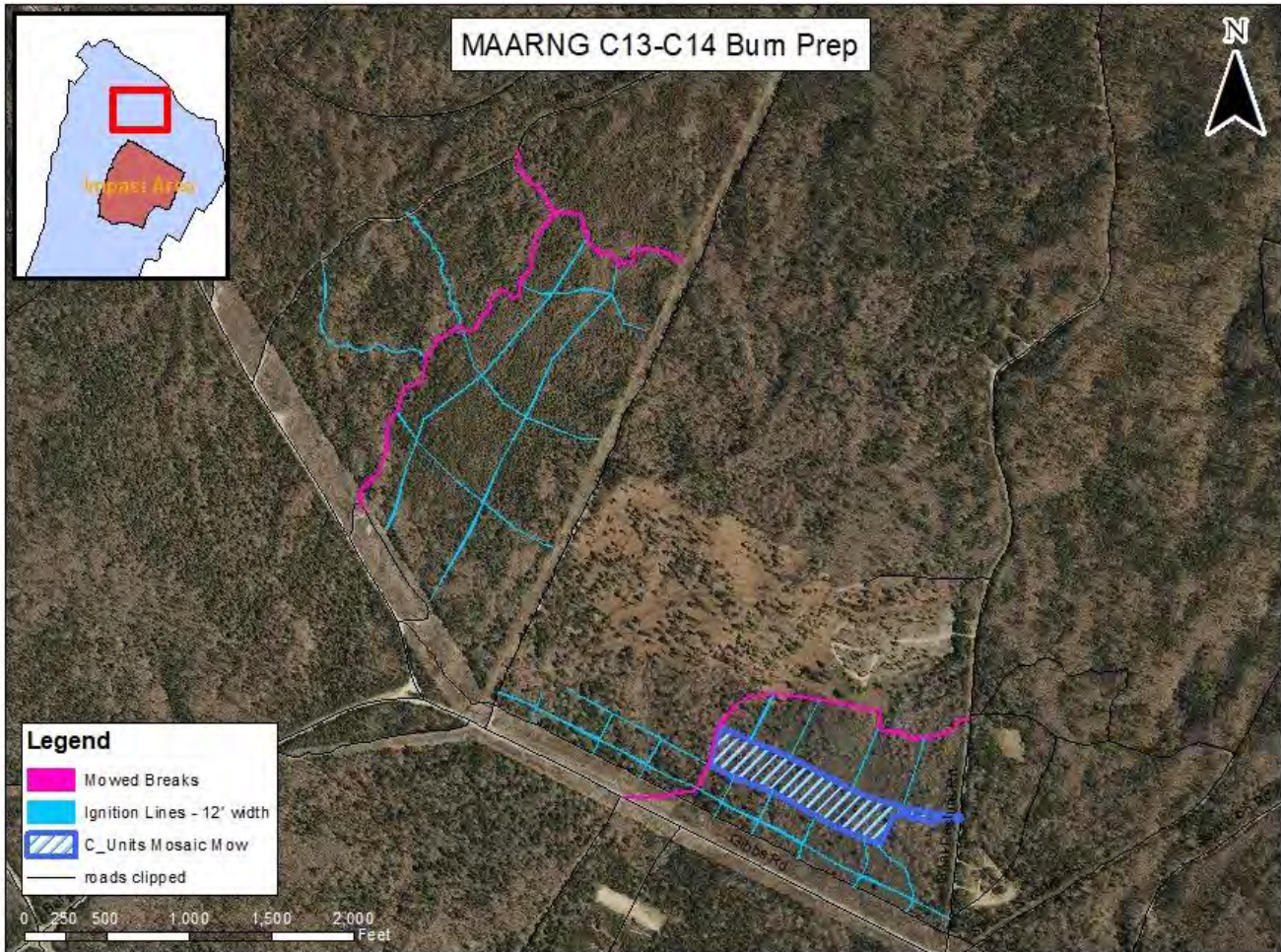
Note: Hunter Days is the sum of the number of hunters each day for each day of the annual hunt.

3.5.6 Restoration Activities

Through the ITAM program, the Natural Resources Office completed significant restoration work on two training sites and habitat patches throughout the base. In the largest project, contractors conducted mechanical thinning of 50 acres in Training Area A-5, restoring militarily advantageous lines of sight from Wheelock Overlook, and increasing access to the perimeter of BP 24. This training-driven project removed all standing trees smaller than 8" DBH (diameter at breast height), and additionally removed all standing dead hardwoods and additionally removed the majority of standing dead hardwoods where the project is surrounded by over 300 acres with an extremely high snag density. In addition to increasing training value, this project restored the site to a patchy shrub-savannah condition more compatible to historic photos of the area and structure most quickly in decline due to succession of the Impact Area to more tree cover. The skid trails resulting from the project were contracted for reseeding using the custom Camp Edwards restoration seed mix created by Lavoie Horticulture. While designing this project, emphasis was placed on maximizing soldier training opportunities while also implementing a very high value pine barrens restoration project. Vegetation response in the first growing season was exceptional and half of the funding for the project was through mitigation for the MPMG range.

A second project was conducted in support of prescribed fire and military operations. In order to establish access for firefighters and firefighting vehicles in challenging terrain and fuels, Cook Forest Products Inc. was contracted to mow 5 miles of 10-foot-wide trails throughout Training Areas C-14 and C-13 (Figure 3-2). In addition to creating these trails, the project also created a 10-acre mosaic mow, removing highly dangerous fuels, vastly improving firefighting access, and increasing habitat value by creating a more savannah-like setting.

Figure 3-2 Training Areas C-13 and C-14 Mowing



Natural Resource and ITAM staff also conducted rehabilitation and maintenance projects using in-house staff and equipment. Staff conducted mowing to improve bivouac and maneuver potential at BPs 1, 14, 16, 27, and 28. Additionally, staff hand-pulled and sprayed woody invasives encroaching on BPs 1, 8, 27, 28, and Demo 2. Herbicide use is more fully detailed in Section 3.7.

3.6 FIRE MANAGEMENT

3.6.1 Prescribed Burn Program

The Natural Resources Office utilizes a prescribed burn program to manage habitat, reduce fuel loads and help prevent wildfires. The program is outlined in the Camp Edwards Fire Management Plan which is available on the E&RC's website: www.massnationalguard.org/ERC/index.htm. The Camp Edwards smoke management permit (#4F02008) was renewed August 20, 2018 and is valid through December 31, 2020.

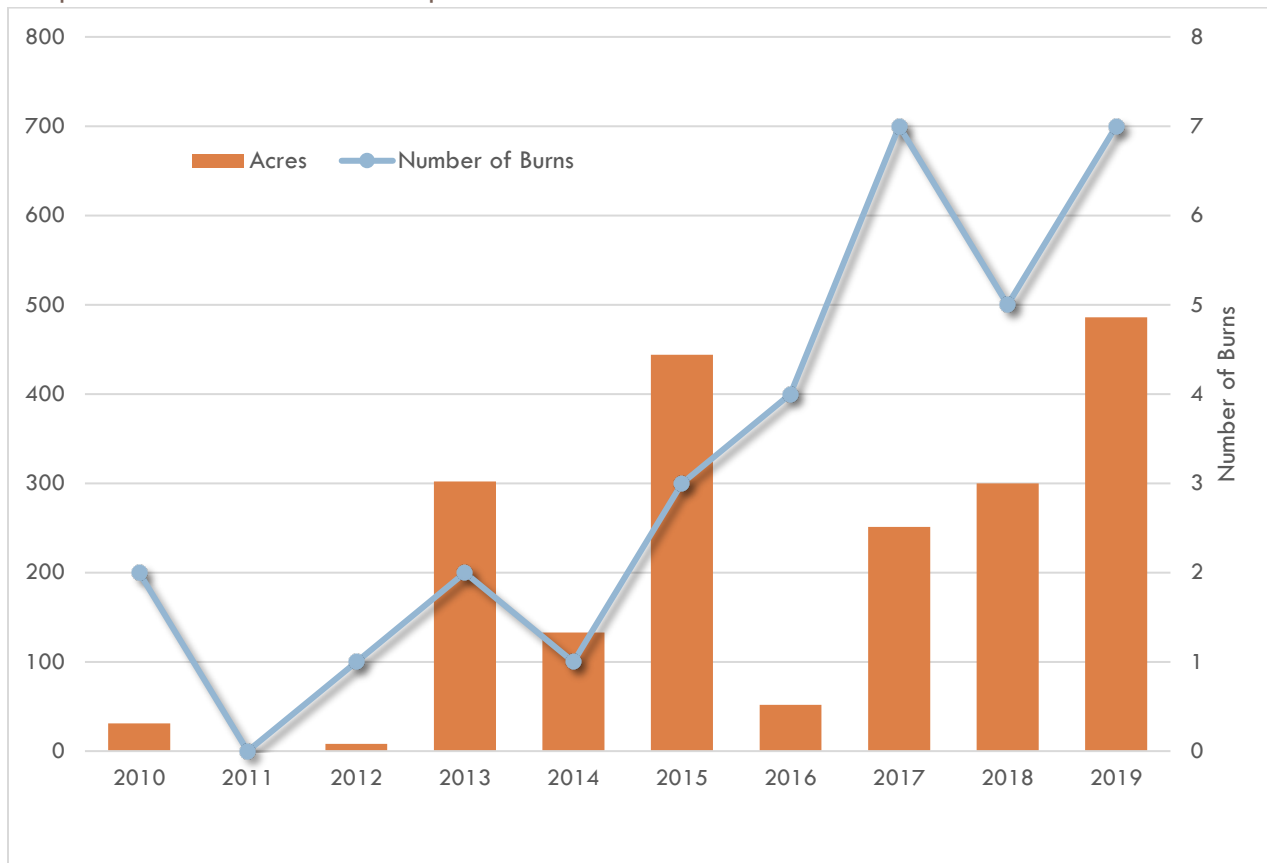
Seven prescribed burn operations were conducted during TY 2019 within the Reserve and seven within the Cantonment area. Altogether, burn operations totaled 486 acres within the Reserve and 110 acres in the Cantonment grasslands. Fall 2018 burning was limited to four training burns for completion of Introduction to Wildland Firefighting classes hosted by the Natural Resources Office from October 9 through October 16, totaling 25 acres. The spring prescribed fire season was extremely active (10 burn days, 571 acres) and comparable only to the spring season of 2004 (9 burn days, 681 acres). Of the spring 2019 operations, two were training burns in Cantonment grasslands, one was a management burn in the grasslands, and the remaining seven

were in the Reserve and focused on pine barrens habitat management within the Impact Area buffer and pine barrens focal areas for restoration. Training areas with prescribed burning include E-4 (242.5 acres), E-1/E-2 (76.5 acres), B-7 (120 acres), and C-14 (47 acres). All Reserve burns in TY 2019 were focused on very high conservation value pitch pine – scrub oak units along with being high priority hazard reduction units surrounding the impact area.

The ten-year prescribed fire accomplishment within the Reserve is shown in Graph 3-6. Long term goals for both number of burn operational days and acres burned were approximately double what was accomplished. However, the Natural Resources Office functionally met programmatic goals for TY 2019 reported in last year’s annual report. Between Cantonment and Training Area (Reserve) operations the goal was exceeded by four burn days and fell just 4 acres short of the total acreage goal (600 acres: 550 pine barrens, 50 grassland).

Prescribed fire goals for TY 2020 are again to have at least eight operational days and burn approximately 600 acres or more of pine barrens (550+ acres) and grassland habitat (40-60 acres). This is a good balance of objectives to meet primary habitat and training lands management objectives while maintaining overall programmatic functions. Significant emphasis has been placed on burning units in the Impact Area buffer and immediately outside this buffer zone. This serves to maximize the mutual benefits and objectives of every operation – improving and maintaining pine barrens habitat, reducing hazardous fuel loading and wildfire potential, and improving training lands for soldiers. The primary limiting factor for wildland fire was weather/climate with more extreme fluctuations in weather conditions (e.g., extended drought broken by extreme rain events) and more frequently shifting weather conditions – particularly with respect to wind and precipitation. Shifting weather forecasts led to multiple instances within TY 2018 of planning and notifying of burn operations with favorable weather forecast, followed by cancellation due to unsuitable conditions developing.

Graph 3-6 Prescribed Fire Accomplishment within the Reserve



Note: Training Year acreage is graphed on the left and the number of burns is graphed on the right axis. Grassland burns are excluded.

3.6.2 Fire Management Training

Wildland fire training remains a critical component of natural resources management and interagency partnerships. The training year began with the completion of an Introduction to Wildland Firefighting (S130/S190) course tailored to municipal firefighters, including JBCC Fire Department. Field days for the training course were completed in mid-October and included active prescribed fire in grassland habitat over the course of four days (one for each firefighter shift). The Natural Resources Office held an internal safety refresher on March 18 for the Camp Edwards Wildland Fire Crew, facilitated by Northeast Forest and Fire Management, LLC. This safety refresher combined safety and operational discussion with a training burn focused on developing operational leadership skills for individuals. The Camp Edwards Wildland Fire Crew also partnered with DCR who instructed an S130/190 training for the MAARNG 179th/180th Firefighter Detachment and Mashpee Wampanoag AmeriCorps Crew. Camp Edwards assisted instruction and hosted the field training on April 7, with live fire in the grasslands. The Natural Resources Office also worked during TY 2019 with Northeast Forest and Fire Management, LLC to plan and host two additional training events that occurred in early TY 2020.

3.7 PEST MANAGEMENT

During TY 2019, Natural Resources and ITAM conducted precisely targeted herbicide spraying of unwanted shrub species encroaching on training features (e.g., landing zones) and invasive species threatening habitat in the Reserve. As part of controlling *Calamagrostis epigejos*, spotted knapweed, pitch pine, sweetfern, bayberry, and scrub oak staff applied Roundup Pro (Glyphosate), Alligare Triclopyr 3 (Triclopyr 3,5,6), and Intensity (Clethodim). Over the course of TY 2019 within the Reserve the total pounds of active ingredient applied was 0.5 lbs Glyphosate, 0.4 lbs. Triclopyr, and 0.05 lbs. Clethodim. Natural Resources-ITAM also used hand pulling to remove spotted knapweed (*Centaurea stoebe*) from restored training sites on BPs 1, 27, 28, and Demo 2, covering 11 acres. Additionally, approximately 25 acres of managed grassland (outside the Reserve) received chemical management of invasive plants with Triclopyr, combined with mechanical and fire management to maximize efficacy.

3.8 AIR QUALITY MANAGEMENT

3.8.1 Air Quality Permits

Potential air emissions from stationary sources at Camp Edwards are below the established federal and state thresholds for the designated primary air pollutants (carbon monoxide, nitrogen oxide, particulate matter, sulfur dioxide, and volatile organic compounds). Thus, Camp Edwards does not require an air quality control permit for stationary source emissions under the provisions of the Clean Air Act (CAA), nor is Camp Edwards required to measure and report actual emissions from its stationary sources. However, the prescribed burn program requires an air quality control permit.

The MassDEP Southeast Regional Office renewed the Camp Edwards smoke management and prescribed burn permit (#4F02008) on August 20, 2018. The permit is good through December 31, 2020.

3.8.2 Air Quality Reports

310 CMR (Code of Massachusetts Regulations) 7.12(2)(b) requires that any person having control of a fuel burning facility or facilities with a maximum energy input capacity of 10,000,000 Btu/hr of natural gas report certain information to MassDEP once every three years. Because of the number of facilities at Camp Edwards, the MAARNG is required to submit a Source Registration/Emissions Statement (SR/ES) report for Camp Edwards every three years on or before the date established by the MassDEP. The Camp Edwards SR/ES report

was submitted December 13, 2019 using calendar year 2017 data; reporting due dates were delayed due to MassDEP's eFile system.

The only MAARNG stationary source emissions locations in the Reserve on Camp Edwards are Range Control and the Ammunition Supply Point.

Biennial smoke management reports administered by MassDEP require reporting and renewal submission at the end of each two year period. The Camp Edwards smoke management permit (#4F02008) was renewed August 20, 2018 and is valid through December 31, 2020. The biennial smoke management report was submitted May 15, 2019. Information on prescribed burn activities within the Reserve for TY 2019 is provided in Section 3.6.

3.9 NOISE MANAGEMENT

The MAARNG published a Statewide Operational Noise Management Plan in December 2007 that provides a strategy for noise management at MAARNG facilities, including Camp Edwards. The plan includes a description of noise environments, including levels from small arms and aircraft training activities. Elements of the plan include education, complaint management, possible noise and vibration mitigation, noise abatement procedures, and land use management. Specific procedures are provided for noise complaints and protocols are provided for providing public notification for blowing up unexploded ordnance in place and for other unusual noise events.

3.10 STORMWATER MANAGEMENT

There were no new stormwater runoff increases in the Reserve due to military training activities, and no new stormwater discharges from military training activities were made directly into wetland resource areas in the Reserve.

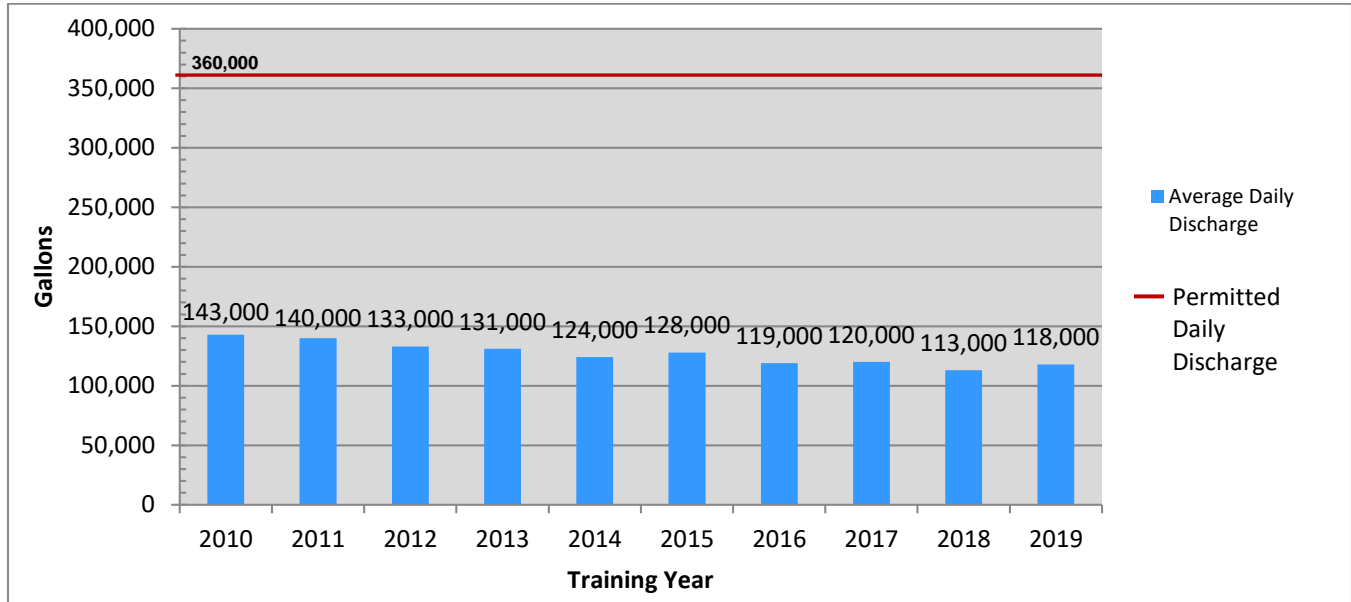
3.11 WASTEWATER MANAGEMENT

Depending on the location of facilities, wastewater and sewage from MAARNG training activities in the Reserve was pumped from portable toilet facilities and hauled off base for disposal at licensed disposal facilities or discharged through the normal operation of existing septic systems (1,000 gallon) at Range Control and the Ammunition Supply Point that are regulated by MassDEP. (Note: There is a septic system at the former Otis Fish & Game Club located on Camp Edwards in the southwestern corner of the Reserve; it is not in use at this time because the building is out of service. There are septic systems within the boundary of the Reserve, at Cape Cod AFS and the USCG Communications Station, that are not subject to Chapter 47 of the Acts of 2002 and the EPSs, but which are regulated by MassDEP.)

3.11.1 Wastewater Treatment Plant Discharge

The Otis ANGB wastewater treatment plant operated within the discharge volume limits of its wastewater discharge permit during TY 2019. The plant discharged 43,238,053 gallons of sewage into the sand filtration beds in the Reserve; a daily average of 118,000 gallons versus its permitted twelve-month moving average flow of 360,000 gallons. Graph 3-7 shows the daily average pumping rate of the Otis system since TY 2010.

Graph 3-7 Wastewater Treatment Plant Discharge



3.12 SOLID WASTE MANAGEMENT

The Camp Edwards Ammunition Supply Point did not turn in any ammunition casings for recycling to the Defense Logistics Agency office in Groton, Connecticut, during TY 2019. Casings are turned in periodically when economical.

The MAARNG published a Statewide Integrated Solid Waste Management Plan for all of its Army National Guard facilities in August 2010. The plan establishes MAARNG policy, responsibilities, goals, and objectives for compliance with statutory requirements for waste minimization, recycling and solid waste disposal. Chapter 8 of the plan includes solid waste management procedures specific to Camp Edwards, as well as identifying potential future solid waste management alternatives.

3.13 HAZARDOUS MATERIALS MANAGEMENT

Camp Edwards has appropriate protocols in place to respond to oils or hazardous materials releases, such as fuel spills, in the Training Area/Reserve. These protocols include the Soldiers Field Card that outlines how Training Area/Reserve users respond if a spill occurs, and Camp Edwards has trained staff to initiate all required spill response actions. All users of the Camp Edwards training lands, including civilians, are required to complete a series of Range Control briefings. Users are directed via verbal instruction, as well as in training videos, to report spills and/or releases of any size to Range Control immediately.

There were three small spills in the Reserve during TY 2019 below the reporting levels established in the Massachusetts Contingency Plan:

- On December 10, 2018 there was a “reportable release” of diesel fuel from a 100 gallon truck-mounted tank. The vehicle and tank belonged to the UXO clean-up contractor, Parsons, which was conducting UXO clearance efforts in the Impact Area. The release was reported to the MassDEP and the clean up was completed in accordance with the Massachusetts Contingency Plan process. A “Permanent Solution Statement” was completed and filed with the MassDEP on February 6, 2019.
- Less than one gallon of suspected diesel fuel was found in the Central Impact Area on March 27, 2019.

- Less than one quart of hydraulic fluid leaked from a broken hose on a brush hog doing work in the Central Impact Area on April 24, 2019.

The spills were cleaned up with any contaminated soil or cleanup materials disposed of in accordance with applicable federal and state environmental regulations.

3.14 HAZARDOUS WASTE MANAGEMENT

The MAARNG complied with its policy of not performing maintenance activities on military vehicles in the Reserve throughout the year. Thus, hazardous wastes normally associated with vehicle maintenance and repair facilities were not generated or stored in the Reserve. Vehicle maintenance is completed at the UTES facility, which is outside of the Reserve. In instances where the Installation Restoration Program (IRP) or IAGWSP use the EPA identification number of the MAARNG to dispose of wastes generated by remediation activities in the Reserve, the E&RC tracks the procedure to ensure compliance with applicable regulations.

There is one hazardous waste Satellite Accumulation Point in the Reserve, established at Range Control in January 2012. Range control accumulates one 55-gallon drum of weapons cleaning rags and patches, and one 55-gallon drum of clean up debris of automotive fluids (i.e. rags, speedy dry and soil contaminated with gasoline, diesel and/or oil). Wastes generated at the Range Control Satellite Accumulation Point are minimal, with a slight increase during Annual Training. On average, the Range Control Satellite Accumulation Point will generate one full 55-gallon drum of waste annually.

3.14.1 Hazardous Waste Disposal and Reporting

A biennial Hazardous Waste Report must be prepared and submitted to EPA and MassDEP in March of even-numbered years reporting on hazardous waste generated by large quantity generators (LQG) during the preceding odd-numbered year. The last report for Camp Edwards was in February 2018 for hazardous waste disposed of during calendar year 2017. Graph 3-8 provides information on the volumes of hazardous waste disposal reported for the past six biennial reports. In addition to the amounts generated and reported in the biennial report, the MAARNG removed approximately 4,400 tons of lead-contaminated soil as part of the IAGWSP cleanup effort in 2017. This material was not reported as part of the biennial report as it was exported to Canada and hazardous waste exported outside the US is not required to be reported in the biennial report.

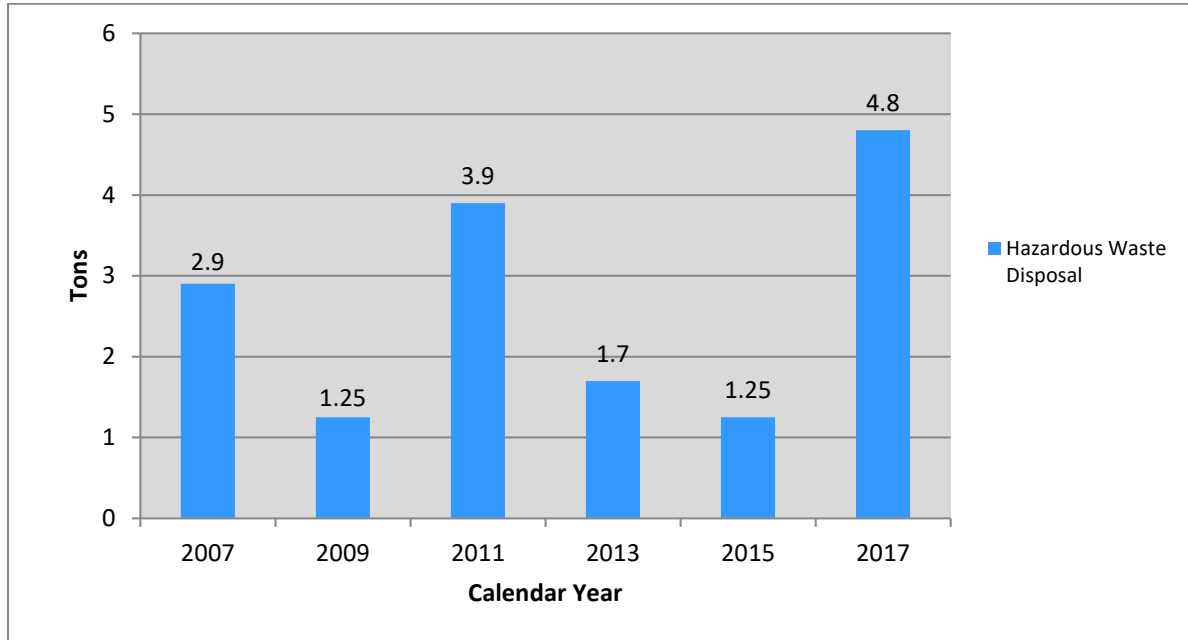
3.15 VEHICLE MANAGEMENT

Unauthorized All Terrain Vehicle (ATV) and dirt bike access to the Training Area continued to be a problem in TY 2019. Range Control officials provided information to the Environmental Police as to locations and times such use was identified to help them adjust their patrols accordingly. As the level of unauthorized ATV and dirt bike access increases, continued coordination with the Environmental and local police takes place. Current efforts have seemed to slow the illegal use of the Reserve for ATV and dirt bike riding. However, this will be an ongoing effort. The entire Reserve/Training area is now posted as off limits. This should help with public awareness and the enforcement of no trespass laws.

3.16 GENERAL USE AND ACCESS MANAGEMENT

The Natural Resource Office hosted two grassland bird tours in the grasslands of Camp Edwards in 2019 on June 8 and June 15 with approximately 20 individuals per tour. The tours were conducted as part of the Sustainable Range Awareness program, a component within the ITAM program. The Sustainable Range Awareness program serves to educate the public on the success of natural resource management taking place on Camp Edwards in support of the military mission.

Graph 3-8 Hazardous Waste Disposal – Camp Edwards



3.17 CULTURAL RESOURCES MANAGEMENT

All MAARNG actions in the Reserve are reviewed by the MAARNG Cultural Resource Manager to ensure compliance with all applicable federal, state and local cultural resource regulations. The MAARNG consults regularly with the Massachusetts State Historic Preservation Office (MA SHPO) ensuring actions are in compliance with Section 106 of the National Historic Preservation Act. In addition to the MA SHPO the MAARNG consults regularly with the Tribes on undertakings that may affect historic properties that the Tribe has attached religious and cultural significance.

3.18 EPS VIOLATIONS

On September 17, 2019 the MAARNG reported a nonconformance with a General Performance Standard to the EMC, which states that “Blank Ammunition for small arms and simulated munitions may be used in areas outside of the small arms ranges, using only blank ammunition and simulated munitions identified on an approved list of munitions. Joint review and approval for inclusion on the list shall be through the Environmental & Readiness Center (E&RC) and the EMC.” The EMC had granted an Approved Non-Standard Training Request on June 20, 2019, which allowed for certain, defined simulated munitions to be used during the CAX exercise (see Section 2.16). After the CAX exercise, the MAARNG discovered that three L600 M119 whistling booby trap simulators were reported to be utilized during the exercise. These simulators were not on the approved munitions list and were not authorized for use as part of the non-standard training request made for the 2019 CAX.

Corrective actions include ensuring that all levels: command, units training, and the Ammunition Supply Point are provided a list of items permanently and temporarily authorized for a particular training event or training at Camp Edwards. The Ammunition Supply Point will make a change within their ammunition reservation program that will not allow unauthorized ammunition or simulators to be reserved. Camp Edwards Range Control will do a final munition check as units check in for their reserved training area or venue.

In a letter dated October 31, 2019, the EMC stated that “based upon a review of information regarding the chemical makeup of the M119 simulator submitted to the EMC and based on the small number of items deployed during the CAX, the EMC has determined that there was no increased environmental harm as a result of the use of these three simulators.” The letter also stated that the EMC concurs that the corrective actions identified by the

Guard are appropriate. The EMC required the Guard to incorporate those actions into an SOP for the use of pyrotechnics and simulated munitions and into the Approved List of Munitions for Camp Edwards.

Appendix G lists violations reported since TY 2010.

3.19 MITIGATION

Outstanding and ongoing mitigation requirements are focused on formalized agreements with the MA DFW: NHESP. Elements below are broken into three categories and are the responsibility of two separate services at JBCC, however a holistic mitigation structure is in development for the joint MANG elements. The first, and previously reported upon mitigation project is grasslands management and other actions associated with the proposed solar array by the MA Air National Guard (Otis Air National Guard Base) at the capped landfill. The second, introduced as a new Conservation Management Permit in last year's *Annual State of the Reservation Report*, is addressing the Aggasiz's Clam Shrimp to support repairs on Cat and Herbert roads. Finally, a Conservation and Management Permit is in development with MADFW NHESP to specifically mitigate for the MPMG while also creating an overarching mitigation bank for several near-term projects and the foreseeable future.

Grassland conversion within the Volpe Parcel (Parcel H of Unit K [see Figure 3-3]) was halted by the 102nd Intelligence Wing after the cancelation of the solar array planned for the capped landfill. Permit negotiations and other delays led to the termination of the project by the Defense Logistics Agency. A 32-acre tree clearing was completed by MAANG in early TY 2019 with chipping and removal of trees that had been cleared and piled in TY 2017. No plans for further conversion by MAANG exist due to the project cancelation. Transfer of two land parcels were completed associated with the solar array project, specifically as mitigation. This includes Special Military Reservation Commission Tract 5 (132 acres, completed 2017) and Parcel H of Unit K (Volpe, 150 acres, completed 2019). The transfer of Parcel H of Unit K was underway, but not completed prior to cancelation of the project, but the transfer was continued forward as part of the overall mitigation bank discussed below.

The mitigation associated with the Aggasiz's Clam Shrimp CMP is discussed in additional detail in Section 3.3.4. In summary, mitigation includes a variety of treatments to occupied puddles to evaluate effects and tolerance of clam shrimp to alterations and relocation. Additionally, there is a three-year monitoring requirement as mitigation. The mitigation actions for clam shrimp in specific features on Cat and Herbert roads were all completed in TY 2019, with some of the road repairs still remaining for completion. The expansive puddle on Herbert Road was completely filled after construction of a new puddle just off the Tank Trail in Training Area BA-1. Sediment samples were collected from a variety of conditions within the puddle after draining by Natural Resource Office personnel on December 17, 2018. To mitigate occupied puddles on Cat Road multiple steps were taken. The first was hardening and repair of an unoccupied puddle on Canal View Road, just west of Dig Site 1. This is also a site for relocation, but was occupied by clam shrimp within one month of repairs. Two additional occupied puddles on Cat Road were repaired in place with removal and replacement of sediment presumably containing encysted eggs. Monitoring was conducted consistent with the CMP.

Coordination with MADFW has been ongoing throughout TY 2019 to develop a "master planning" mitigation strategy for the MANG at JBCC. This was initiated to support the MPMG Range planned for TY 2020, but it quickly became clear that it would be most beneficial for all parties to develop a mitigation plan that encompasses all anticipated projects for the next 5-8 years while also providing for unanticipated projects. Primary projects incorporated into the mitigation strategy are the MPMG Range at the current KD Range location, an Infantry Squad Battle Course at the formerly used Infantry Battle Course location, expansion of Tango and Sierra ranges, Cantonment modernization including the addition of a running track at the gym and classroom buildings in the 1300 area, and the potential for future solar development. The mitigation plan combines project minimization,

take avoidance, land transfers, extensive habitat improvement, and long-term monitoring to provide for net benefit of a large number of state-listed species.

The mitigation plan focuses on species guilds (pine barrens, sandplain grassland) for the majority of species with similar habitat condition needs and/or threats (e.g., loss of open canopy condition through forest closure). The eastern box turtle is treated separately as it has differing needs and threats compared to the other species. Mitigation focal areas, tied to the guilds, have been identified to localize various mitigation actions for maximized benefit. Standards for mitigation have been developed for each type of guild and focal area to ensure sufficient commitments exist and to provide assurances to MADFW for net benefit. For example, pine barrens mitigation will require 20% to 40% of habitat improvement work to be in the form of mechanical forestry as the majority of the pine barrens guild species are threatened and declining due to tree encroachment and canopy closure. In addition to pine barrens and grassland focal areas, forest canopy retention areas are identified for box turtle hibernation and these areas will be managed or left to maintain later successional forest condition and closed tree canopy.

The Natural Resource Office budgeted for proactive mitigation implementation for the MPMG range. Early mitigation can better provide for net benefit by supplying improved or newly available habitat condition for impacted species prior to losses or impacts incurred through project development. A total of \$170,461.50 was spent specifically on contracted mitigation actions for the MPMG range. This includes the 52-acre timber harvest at Wheelock Overlook in Training Area A-5, eight days of prescribed burning (490 acres), and the development of a box turtle construction support and monitoring plan with an initial survey of the MPMG footprint. Additional in-house TY 2019 efforts for actions included in the CMP or to address state-listed species include bat surveys, grassland bird surveys, site-wide bird surveys, and state-listed plant surveys.

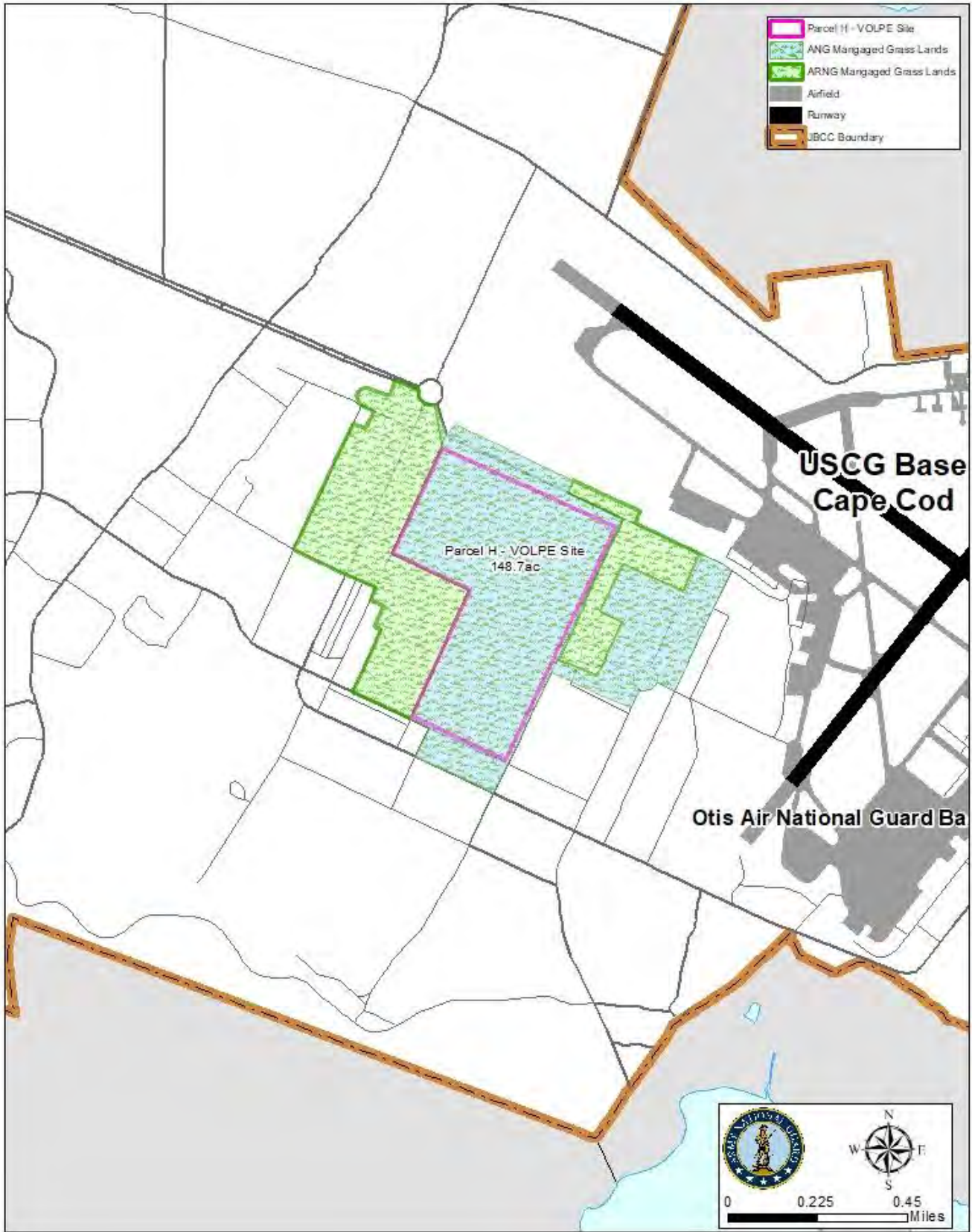
The CMP for the MPMG Range and mitigation bank is scheduled for completion in early calendar year 2020. The TY 2020 *Annual State of the Reservation Report* will include more detailed reporting and progress tracking relative to each project based upon the finalized permit.

3.19.1 Grasslands Restoration (Otis ANGB)

One of the requirements levied by the Secretary of the Executive Office of Environmental Affairs' July 16, 2001 Certificate approving the Massachusetts Military Reservation (MMR) Master Plan/Environmental Impact Report was a commitment by the MAANG to develop and implement a Grasslands Management Plan for its property in the Cantonment Area on Otis ANGB. The plan was published in August 2002, updated in 2008 and reviewed in 2017, as required. Over the past few years it has completed several projects removing trees and restoring approximately 35 acres of grasslands on its property in the grassland management area section of the Cantonment Area, the area which the MAANG indicated it would initiate efforts to restore. Figure 3-3 identifies the general grassland management area of Otis ANGB in the Cantonment Area.

Questions concerning grasslands on Otis ANGB should be addressed to the point of contact for the 102nd Intelligence Wing listed in Appendix B.

Figure 3-3 Grassland Management Areas



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SECTION 4

REMEDIATION PROGRAM ACTIVITIES

4.0 INTRODUCTION

This section of the Annual Report provides summaries on remediation activities in the Reserve during TY 2019.

4.1 INVESTIGATION AND REMEDIATION PROGRAMS

There are two independent cleanup programs operating at JBCC: the IRP and the IAGWSP.

The IRP was initially established at the installation in 1982 under Air National Guard management. Oversight of the program was transitioned to the Air Force Center for Environmental Excellence, now known as the Air Force Civil Engineer Center (AFCEC), in 1996. The program operates under the regulatory guidance of the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The majority of the activity of the IRP has been focused in the Cantonment Area and in off-installation plumes emanating from the Cantonment Area. AFCEC is responsible for two IRP sites in the Reserve: Chemical Spill-19 (CS-19) and Fuel Spill-12 (FS-12) and three Military Munitions Response Program (MMRP) sites: Old K Range, Mock Village, and Otis Gun Club. The MMRP addresses potential threats to human health and the environment from munitions and munitions constituents in non-operational range areas.

The IAGWSP is being managed by the Army National Guard. Investigation of the environmental impacts of training in the upper 14,886 acres of JBCC began in 1996 and cleanup of groundwater contamination began in 2004. Sixteen treatment systems are currently operating on seven groundwater plumes to clean more than 4.1 million gallons of groundwater per day. More than 12 billion gallons of groundwater have been treated to date. While no public or private drinking water supplies are affected by the groundwater contamination being addressed by the IAGWSP, the contamination is being addressed to prevent any possible future exposures. Information on the IAGWSP can be obtained on its website: <http://jbcc-iagwsp.org>.

Both the IRP and IAGWSP have active regulatory participation and community involvement programs. The communities surrounding the installation are kept informed through neighborhood notices and meetings, media releases, community updates, fact sheets, publication and distribution of plans and reports, websites, and information repositories at local libraries.

The programs also meet regularly with EPA Region 1 and MassDEP to discuss findings and determine appropriate response actions. Public comment periods are held, as necessary, to present and solicit input on proposed actions. The programs also provide updates on their activities to public meetings of the joint citizens' advisory team, the JBCC Cleanup Team. The JBCC Cleanup Team includes representatives from the surrounding communities and the regulatory agencies.

The IRP and IAGWSP each operate under different regulatory directives and mostly address different contaminants of concern. However, they share sampling results, equipment, technical innovations, and even a treatment facility. Figure 4-1 shows the areas under remediation by the IRP and the IAGWSP in the Reserve. The map in Figure 4-1 is available at www.jbcc-iagwsp.org/community/facts/jbcc_plume_map_091219.pdf

4.2 INSTALLATION RESTORATION PROGRAM ACTIVITIES IN THE RESERVE

In TY 2019, AFCEC finalized the Comprehensive Site Evaluation (CSE) Phase II (similar to a Site Inspection) investigation at 10 MMRP sites, including the three sites that are located in the Reserve. A streamlined Remedial Investigation/Feasibility Study (RI/FS) was prepared for the Mock Village and is in regulatory review. A RI was completed at the Old K Range and an FS is being drafted. A RI was prepared for the Otis Gun Club and is in regulatory review. Numerous 2.36-inch rockets and other ordnance were discovered at the Old K Range during the CSE Phase II and RI field work. Because some of the rockets contained high explosives, this site has been placed off limits to nonofficial uses in perpetuity.

In addition to the MMRP sites, AFCEC manages two groundwater plumes in the reserve (CS-19 and FS-12). AFCEC closed a former site referred to as CS-18 which was also located in the reserve.

In TY 2019, groundwater monitoring was conducted at CS-19 where the contaminant of concern is RDX. RDX was detected above the EPA risk-based level of 0.97 µg/L in two of eleven monitoring wells sampled. The highest RDX concentration (1.5 µg/L) was detected at a well located just downgradient of the source area.

AFCEC also manages three 1.5 MW wind turbines at JBCC, two of which are located in the reserve. Each turbine produces, on average, a credit of \$500,000 per year which offsets the energy use in the IRP by 100%. The turbine operation is curtailed for the northern long eared bat from July 15 to October 15, 30 minutes before sunset to 30 minutes after sunrise for wind speeds less than 4.5 meters per second. There were no reported bat or bird strikes during TY 2019.

4.3 IMPACT AREA GROUNDWATER STUDY PROGRAM ACTIVITIES

During TY 2019, the IAGWSP operated groundwater treatment systems for plumes associated with the Demolition Area 1, J-3 Range, J-2 Range (northern and eastern), the J-1 Range (southern and northern), and the Central Impact Area (CIA). These systems are treating approximately 4.1 million gallons of water per day.

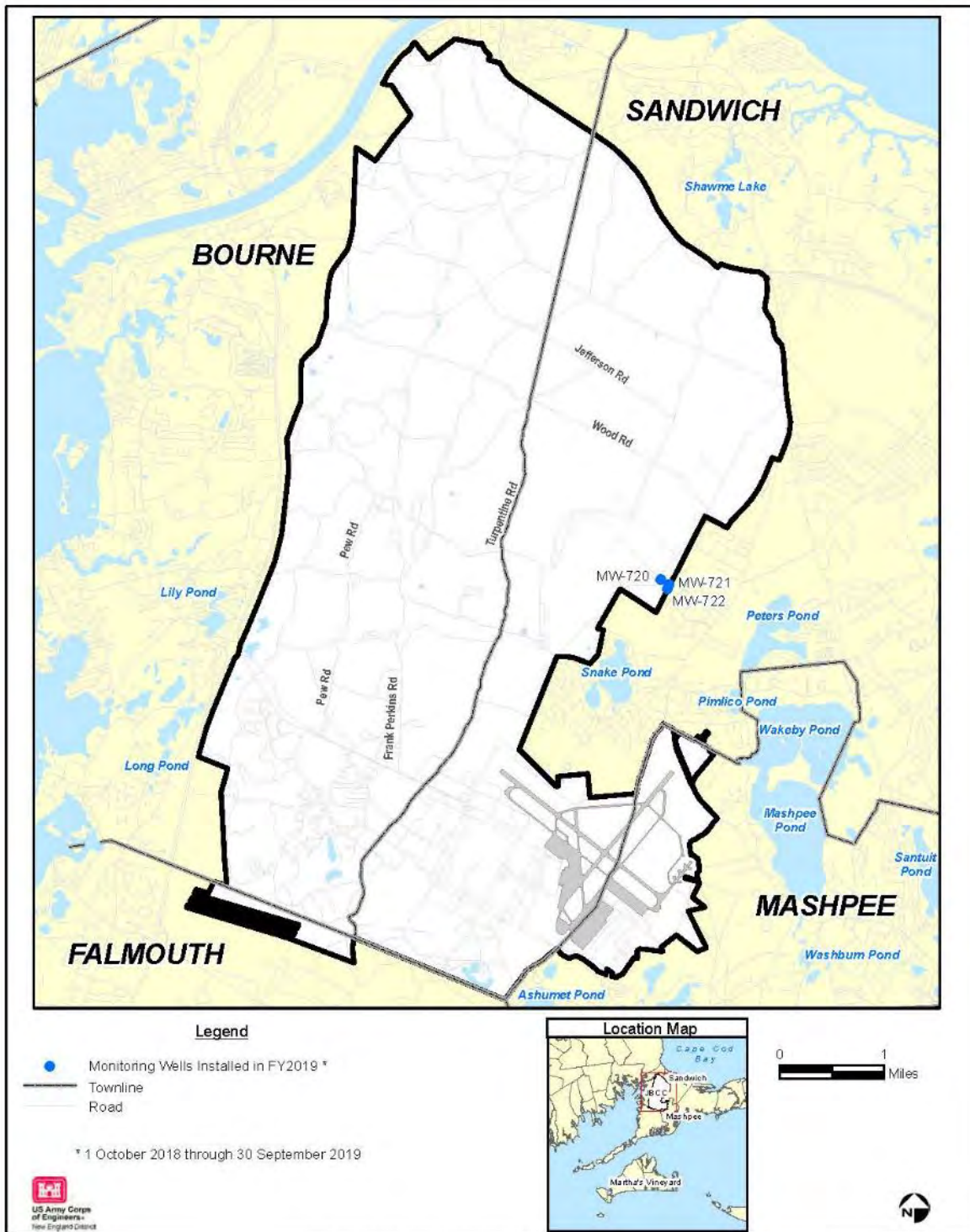
Removal of munitions from the source of the CIA plume continued in TY 2019. Work on Phase III Areas 1 and 2 (25 acres) of the CIA long-term source area response continued throughout the year. In the Central Impact Area, 68 acres have been cleared to 90%. Teams from the Army Corps of Engineers used Metal Mapper, a multi-sensor electromagnetic detection technology, for the removal efforts. This geophysical technology is designed to discriminate between munitions and scrap metal in the subsurface. Use of the Metal Mapper allows the program to increase the efficiency of unexploded ordnance removal while reducing impacts to the surface soil and vegetation when compared to traditional excavation techniques.

The IAGWSP evaluated whether Per- and polyfluoroalkyl substances (PFAS) are present in the groundwater from sites where open burning/open detonation (OB/OD) is known to have occurred. A driving assumption in the selection of monitoring wells for PFAS sampling is that if firefighting foams were used at these sites they likely would have been used in conjunction with the OB/OD activities and, therefore, any PFAS compounds that were released would have been co-released with other contaminants associated with those activities. A sampling work plan for PFAS was developed by IAGWSP and approved by EPA and MassDEP in April 2019. As a part of this investigation, samples for PFAS analyses were collected from monitoring wells and treatment system influent at Demolition Area 1, and the J Ranges (J-1 Northern, J-2 Northern, J-2 Eastern and J-3 Ranges).

No detections were observed in treatment system influent samples collected at Demolition Area 1 or J-2 Eastern and no detections at other locations exceeded the EPA PFAS/PFOA or MassDEP current regulatory thresholds. However, some resampling has/will occur at some of the wells where the highest detections were observed, particularly at J-2 Northern, where an influent sample was slightly elevated (but still below the regulatory thresholds).

Three new monitoring wells were added in TY 2019 (Figure 4-2) to aid in long-term monitoring of plumes with remedies in place and to provide data to finalize ongoing investigations. The monitoring wells were installed in support of groundwater investigations at the J-1(southern) plume.

Figure 4-2 IAGWSP Wells Installed During TY 2019



Impact Area Groundwater Study Program
Monitoring Wells Installed in FY2019

FIGURE
1

M:\MMR\2019\NewWellsMap\Figures\NewWells_FY19_120219.pdf
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December 3, 2019, DWN, SAW, CKP, PJR

SECTION 5 MISCELLANEOUS MILITARY AND CIVILIAN ACTIVITIES AND ENVIRONMENTAL PROGRAM PRIORITIES

5.0 MISCELLANEOUS MILITARY ACTIVITIES

5.1 PROJECTS AT CAMP EDWARDS

5.1.1 Trespassing and Critical Infrastructure Protection

In coordination with the MANG and the EMC, using mitigation money received by the EMC from Eversource (then NStar) in 2012 for a wetlands-related EPS violation for the transmission lines running through the Reserve, the DFW's Southeast District posted signage on the base border during TY 2019. The signs were posted every 100 feet on the perimeter of the Reserve. The signs read "No Trespassing, Camp Edwards * Upper Cape Water Supply Reserve, Access controlled by Camp Edwards Commander." Signage language was agreed upon by the military and the state. Three cameras purchased using the same money also will be installed in key areas where trespassing is a concern.



Photograph 5-1 Signage posted on the Reserve border.

5.2 JOINT BASE CAPE COD EXECUTIVE DIRECTOR

The Adjutant General of the Massachusetts National Guard established the position of the Executive Director of JBCC in late TY 2012. The primary roles of the position are to ensure inter-agency communication and coordination are implemented and practiced and that government and community stakeholders are kept informed. Additionally, the Executive Director is responsible for looking at efficiencies that might be gained through consolidation and cost-sharing of base operating support operations and activities.

The Executive Director serves as the Adjutant General's representative to the Joint Oversight Group that considers items of mutual concern. The Executive Director also serves on the Commonwealth of Massachusetts's Military Asset and Security Strategy Task Force helping to secure the military bases of the Commonwealth. Brigadier General Christopher Faux was appointed JBCC Executive Director in June 2018.

5.3 MISCELLANEOUS CIVILIAN ACTIVITIES

5.3.1 Eversource Projects

As part of the Mid Cape Reliability Project, Eversource plans to upgrade an existing Eversource switching station (Bourne Switching Station #917) located on an easement in the Reserve (Figure 5-2). Eversource evaluated several sites for minimal loss of training land and impact to state priority habitat. Eversource will site the switching station southwest of the current substation (Figure 5-1). The property transfers between Eversource and the state leaves a net benefit of approximately 2.51 acres for the MAARNG for training. Because the Reserve is land protected under Article 97 Articles of Amendment to the Constitution of the Commonwealth of Massachusetts, legislation was required to be passed to change the use of the property. Governor Charlie Baker signed the bill to change its use in August 2018. Eversource submitted an Environmental Notification Form to the MEPA office on December 17, 2018. Eversource is currently working through the property transfer with the MAARNG. Completion of the project is anticipated for 2023.

As part of the construction, there will be approximately 52,000 cubic yards of soil that will be removed from the site. Eversource had the soil sampled with samples being tested for the following characterization parameters: VOCs, semi-volatile organic compounds, total petroleum hydrocarbons (TPH), polychlorinated biphenyls, Massachusetts Contingency Plan (MCP; 310 CMR 40.0000) 14 metals, conductivity, corrosivity, ignitability, reactivity, pH, pesticides, herbicides, perchlorate, and explosives. The MAARNG will be able to repurpose all but approximately 2,000 yards on Camp Edwards.

Over the last seven years, the EMC and the MANG at Camp Edwards have been involved stakeholders in Eversource's proposal to replace the switching station. Other partner agencies include MEPA, NHESP and DFW, the Cape Cod Commission, and the four Upper Cape Cod towns surrounding JBCC.

In addition, Eversource has come to the MAARNG with a new reliability project for another utility line from the switching station running down Cape to the Town of Barnstable. This will create a redundant line that will help ensure the Cape has reliable power. Eversource will use its current easement for the project.

Figure 5-1 Eversource Switching Station Area



5.3.2 Cape Cod Canal Transportation Study

In November 2014, the Massachusetts Department of Transportation (MassDOT) announced that it is conducting the Cape Cod Canal Transportation Study to identify existing and future transportation deficiencies and needs around the Cape Cod Canal area in Bourne and Sandwich. Due to the age of the Bourne and Sagamore bridges crossing the canal and the increasing need to maintain them, the study was devised to entail the development and analysis of a full range of transportation alternatives including highway, interchange, and non-highway improvements, as well as options and design elements that improve access for all transportation modes.

The final study was released in October 2019 and recommends intersection improvements including upgrades to the Bourne Rotary, interchange investments at Belmont Circle, relocation the Route 6 westbound Exit 1C and adding an additional Route 6 eastbound travel lane from the Canal to approximately Exit 2. Some changes could have potential impacts to JBCC and specifically the Camp Edwards Training Site. The final report is available online at <https://www.mass.gov/lists/cape-cod-canal-study-documents#cape-cod-canal-transportation-study:-final-report->

MassDOT established a “Working Group” comprised of town and regional officials and interested organizations to obtain input on the study. The Working Group included representation from the JBCC commands and the EMC.

The Army Corps of Engineers conducted its own study of the Bourne and Sagamore Bridges: the Major Rehabilitation Evaluation Report. The draft report was released in October 2019, which recommends replacing the Bourne and Sagamore bridges with new bridges parallel to the old bridges. Each new bridge would have four travel lanes, an auxiliary lane, a median, shoulders and a bicycle/pedestrian lane. It is estimated that the Army Corps of Engineers would need to acquire 4.5 acres for the Sagamore Bridge and 11 acres for the Bourne Bridge. The report states that commercial properties in Bourne and Sagamore would need to be acquired. The Army Corps of Engineers held a comment period on the report beginning in October 2019 with five public meetings, once of which was held in Bourne on October 16, 2019. The final report is anticipated for February 2020.

5.4 ENVIRONMENTAL PROGRAM PRIORITIES

5.4.1 TY 2019 Environmental Program Priorities

The following subsections provide a list of the environmental program priorities established for TY 2019 as published in the TY 2018 Annual Report for its activities associated with the Reserve and the status of achieving them.

Natural Resources Management

- Engage appropriate stakeholders to conduct an INRMP review of operation and effect and update as needed. (On-going)
- Address potential federal status changes to species at Camp Edwards through interagency consultation and planning. (On-going)
- Further develop supplemental plans for Natural Resources/ITAM long-term budgets and implementation, including invasive species, wildland fire, and land rehabilitation. (On-going)
- Continue implementation and refinement of management focused monitoring of rare species, habitat management, and training capabilities. (On-going)
- Continue offering regional wildland fire training to support regional programs and partner agencies and organizations. (On-going)
- Continue upscaling of habitat and land management actions, including mechanical work and prescribed burning, through internal actions and partnerships. (On-going)
- Continue and further develop interagency partnerships with Massachusetts Division of Fisheries and Wildlife, NHESP, US Fish and Wildlife Service, EMC, DCR, MassDEP, and others through active engagement to seek mutual benefit. (On-going)

Cultural Resources Management

- Conduct applicable reviews of all IAGWSP, IRP and MAARNG proposed activities in the Reserve for potential cultural resources impacts. (Accomplished)
- Document any new occurrences of identified cultural resources. (None identified)

Other E&RC Environmental Management Programs

- Coordinate required soil, lysimeter and groundwater sampling at active firing ranges in accordance with approved range management plans. (Accomplished)
- Provide appropriate support to Camp Edwards for small arms range development. (Accomplished)
- Continue to support Camp Edwards through the environmental process for proposed training venues in the Reserve. (Accomplished)
- Provide support as needed to the JBCC Executive Director Office with regards to community involvement and environmental and training issues. (Accomplished)
- Attend all scheduled EMC, CAC and SAC meetings, both internally and externally, that may involve activities within and surrounding the Reserve. (Accomplished)
- Provide information on environmental program activities regarding the Reserve. (Accomplished)
- Work closely with Camp Edwards, the Natural Resources Office and the EMC to ensure training is compatible with the EPSs. (Accomplished)
- Provide support for the EMC and its advisory councils as required in Chapter 47 of the Acts of 2002. (Accomplished)
- Publish the final TY 2018 *State of the Reservation Report*. (Accomplished)

5.4.2 TY 2020 Environmental Program Priorities

The following subsections provide a list of environmental program priorities for Camp Edwards for activities associated with the Reserve in TY 2020.

Natural Resources and ITAM Management

- Engage appropriate stakeholders to conduct an INRMP review of operation and effect and update as needed.
- Address potential federal status changes to species at Camp Edwards through interagency consultation and planning.
- Further develop supplemental plans for Natural Resources/ITAM long-term budgets and implementation, including invasive species, wildland fire, and land rehabilitation.
- Continue implementation and refinement of management focused monitoring of rare species, habitat management, and training capabilities.
- Continue offering regional wildland fire training to support regional programs and partner agencies and organizations.
- Continue upscaling of habitat and land management actions, including mechanical work and prescribed burning, through internal actions and partnerships.
- Continue and further develop interagency partnerships with Massachusetts Division of Fisheries and Wildlife, NHESP, US Fish and Wildlife Service, EMC, DCR, MassDEP, and others through active engagement to seek mutual benefit.

Other E&RC Environmental Management Programs

- Coordinate required soil, lysimeter and groundwater sampling at active firing ranges in accordance with approved range management plans.
- Provide appropriate support to Camp Edwards for small arms range development.

- Continue to support Camp Edwards through the environmental process for proposed training venues in the Reserve.
 - Provide support as needed to the JBCC Executive Director Office with regards to community involvement and environmental and training issues.
 - Attend all scheduled EMC, CAC and SAC meetings, both internally and externally, that may involve activities within and surrounding the Reserve.
 - Provide information on environmental program activities regarding the Reserve.
 - Work closely with Camp Edwards, the Natural Resources Office and the EMC to ensure training is compatible with the EPSs.
- Provide support for the EMC and its advisory councils as required in Chapter 47 of the Acts of 2002.
 - Publish the final TY 2019 *State of the Reservation Report*.

APPENDIX A

ENVIRONMENTAL PERFORMANCE STANDARDS

ENVIRONMENTAL PERFORMANCE STANDARDS APRIL 6, 2017

For Massachusetts National Guard Properties at the Massachusetts Military Reservation

CAMP EDWARDS TRAINING AREA GENERAL PERFORMANCE STANDARDS

None of the following banned military training activities shall be allowed in the Camp Edwards Training Areas:

- Artillery live fire
- Mortar live fire
- Demolition live fire training
- Artillery bag burning
- Non-approved digging, deforestation or vegetation clearing
- Use of 'CS', riot control, or tear gas for training outside the NBC bunkers
- Use of field latrines with open bottoms
- Vehicle refueling outside designated Combat Service Area and Fuel Pad locations
- Field maintenance of vehicles above operator level

Limitations on the use of small arms ammunition and live weapon fire fall into the following two categories:

- Live weapon fire is prohibited outside of established small arms ranges. Live weapon fire is not allowed on established small arms ranges except in accordance with Environmental Performance Standard 19, other applicable Performance Standards, and a range-specific plan approved through the Environmental Management Commission (EMC).
- Blank ammunition for small arms and simulated munitions may be used in areas outside of the small arms ranges, using only blank ammunition and simulated munitions identified on an approved list of munitions. Joint review and approval for inclusion on the list shall be through by the Environmental & Readiness Center (E&RC) and the EMC.

Each user will be responsible for proper collection, management, and disposal of the wastes they generate, as well for reporting on those actions.

Use and application of hazardous materials or disposal of hazardous waste shall be prohibited except as described in the Groundwater Protection Policy.

Vehicles are only authorized to use the existing network of improved and unimproved roads, road shoulders, ranges and bivouac areas, except where necessary for land rehabilitation and management, water supply development, and remediation, or where roads are closed for land rehabilitation and management.

Protection and management of the groundwater resources in the Camp Edwards Training Area will focus on the following:

- Development of public and Massachusetts Military Reservation water supplies.
- Preservation and improvement of water quality and quantity (recharge).
- Activities compatible with the need to preserve and develop the groundwater resources.

All users of the Camp Edwards Training Area must comply with the provisions of the Groundwater Protection Policy and any future amendments or revisions to the restrictions and requirements. These will apply to all uses and activities within the overlays relative to Wellhead Protection, Zone II's within the Cantonment Area, and the Camp Edwards Training Areas.

Development of water supplies will be permitted within the Camp Edwards Training Area after review and approval by the managing agencies, principally the Department of the Army and its divisions, together with the Massachusetts Department of Environmental Protection, and the Massachusetts Division of Fish and Wildlife.

All phases of remediation activities will be permitted within the Camp Edwards Training Area after review and approval by the managing agencies, principally the Department of the Army and its divisions, together with the federal and state agencies who will have jurisdiction for remediation.

Pollution prevention and management of the Camp Edwards training ranges will focus on and include the following:

The Camp Edwards Training Area, including the Small Arms Ranges (SAR) and their associated "Surface Danger Zones," and any areas where small arms or other munitions or simulated munitions are used, shall be managed as part of a unique water supply area under an adaptive management program that integrates pollution prevention, and best management practices (BMP), including the recovery of projectiles. This will be done through individual range-specific plans that are written by the Massachusetts National Guard and approved for implementation through the EMC and any other regulatory agency having statutory and/or regulatory oversight. Adaptive, in this context, means making decisions as part of a continual process of monitoring, reviewing collected data, evaluating advances in range monitoring, design and technology, and responding with management actions as dictated by the resulting information and needs of protecting the environment while providing compatible military training within the Upper Cape Water Supply Reserve.

A range plan shall be designed and followed to reduce the potential for an unintended release to the environment outside of the established containment system(s) identified in the range-specific plans. All users must be aware of, and comply with, the Environmental Performance Standards that are applicable to all SAR activities. Any range specific requirements will be coordinated through the E&RC with the EMC, incorporating those specific requirements into the appropriate range-specific plans and range information packets. Camp Edwards SAR Pollution Prevention Plan shall be followed to prevent or minimize releases of metals or other compounds related to the normal and approved operation of each SAR. The adaptive SAR management program components required in each range-specific plan shall include:

- Consultation with applicable agencies with oversight of the training area before undertaking any actions that are subject to state and/or federal regulatory requirements.
- Specific recovery plans for the removal and proper disposition of spent projectiles, residues and solid waste associated with the weapons, ammunition, target systems, and/or their operation and maintenance.
- Reduction of adverse impacts to the maximum extent feasible, including consideration for the design/redesign and/or relocation of the activity or encouraging only those activities that result in meeting the goal of overall projectile and/or projectile constituent containment.
- Internal and external coordination of documentation for the Camp Edwards range management programs and other related Camp Edwards management programs including: the Integrated
- Training Area Management Program, Range Regulations, Camp Edwards Environmental Management System, Civilian Use Manual, and Standard Operating Procedures.
- Long-term range maintenance, monitoring and reporting of applicable parameters and analysis.

The Massachusetts National Guard shall ensure that all training areas where munitions or simulated munitions are used or come to be located, including range areas, range surface danger zones, and any other areas within the Upper Cape Water Supply Reserve that are operational ranges are maintained and monitored following approved management plans that include planning for pollution prevention, sustainable range use and where applicable, restoration.

Protection and management of the vegetation of the Camp Edwards Training Area for focus on the following:

- Preservation of the habitat for federal- and state-listed rare species and other wildlife.
- Preservation of the wetland resource areas.
- Activities compatible with the need to manage and preserve the vegetative resources.
- Realistic field training needs.
- Identification and restoration of areas impacted by training activities.

Goals for the Adaptive Ecosystem Management approach to management of the Camp Edwards properties will be as follows:

- Management of the groundwater for drinking water resources
- Conservation of endangered species.
- Management of endangered species habitat for continuation of the species.
- Ensuring compatible military training activities.
- Allowing for compatible civilian use.
- Identification and restoration of areas impacted by training activities.

The Environmental Performance Standards will be incorporated into the programs and regulations of the Massachusetts National Guard as follows. Those standards relating to natural resources management shall be incorporated as standards into each of the state and federal environmental management programs and attached as an appendix or written into the documentation accompanying the plan or program. All the Environmental Performance Standards will be attached to the Integrated Training Area Management Plan 'Trainer's Guide' and to the Camp Edwards Range Regulations. Modification of the Standards Operating Procedures will include review and conformance with the Environmental Performance Standards for trainers and soldiers at Camp Edwards.

SPECIFIC RESOURCE PERFORMANCE STANDARDS IN THE CAMP EDWARDS TRAINING AREA

1. Groundwater Resources Performance Standards

1.1. All actions, at any location within the Camp Edwards Training Areas, must preserve and maintain groundwater quality and quantity, and protect the recharge areas 1:0 existing and potential water supply wells. All areas within Camp Edwards Training Areas will be managed as State Zone U, and, where designated, Zone I, water supply areas.

1.2 The following standards shall apply to designated Wellhead Protection Areas:

- The 400-foot radius around approved public water supply wells will be protected from all access with signage. That protection will be maintained by the owner and/or operator of the well, or the leaseholder of the property.
- No new stormwater discharges may be directed into Zone I areas.

- No in ground septic system will be permitted within a Zone I area.
- No solid wastes may be generated or held within Zone I areas except as incidental to the construction, operation, and management of a well.
- Travel in Zone I areas will be limited to foot travel or to vehicles required for construction, operation, and maintenance of wells.
- No new or existing bivouac activity or area shall be located within a Zone I area.
- All other areas will be considered as Zone II designated areas and will be subject to the standards of the Groundwater Protection Policy.

1.3 Land-use activities that do not comply with either the state Wellhead Protection regulations (310 CMR 22.00 et seq.) or the Groundwater protection Policy are prohibited.

1.4 All activities will support and not interfere with either the Impact Area Groundwater Study and/or the Installation Restoration Program. All activities shall conform to the requirements of Comprehensive Environmental Response, Compensation and Liability Act, the Massachusetts Contingency Plan, and the Safe Drinking Water Act.

1.5 Extraction, use, and transfer of the groundwater resources must not degrade [e.g. draw down surface waters] in freshwater ponds, vernal pools, wetlands, and marine waters, unless properly reviewed, mitigated, and approved by the managing and regulating agencies.

1.6 Land uses and activities in the Camp Edwards Training Areas will meet the following standards:

- Will conform to all existing and applicable federal, state and local regulations.
- Must be able to be implemented without interference with ongoing remediation projects.
- Allow regional access to the water supplies on the Massachusetts Military Reservation.

1.7 The following programs and standards will be used as the basis for protecting groundwater resources in the Camp Edwards Training Areas:

- Groundwater Protection Policy.
- Federal and Department of Defense environmental programs: Integrated Natural Resources Management Plan, Integrated Training Area Management Program, Range Regulations, Spill Prevention Control and Countermeasures Plan (or equivalent), Installation Restoration *Plan*, Impact Area Groundwater Study, or other remediation programs.
- State and federal laws and regulations pertaining to water supply.

2. Wetlands and Surface Water Performance Standards

2.1 Since there are relatively few wetland resources found at the Massachusetts Military Reservation, and since they are important to the support of habitat and water quality on the properties, the minimum standard will be no net loss of any of the wetland resources or their 100-foot buffers.

2.2 Land uses and activities will be managed to prevent and mitigate new adverse impacts and eliminate or reduce existing conditions adverse to wetlands and surface water resource areas. Impacts from remediation activities may be acceptable with implementation of reasonable alternatives.

2.3 Wetland area management priorities:

- Protection of existing; wetland resource areas for their contributions to existing and potential drinking water supplies.
- Protection of wetlands for rare species and their habitats.
- Protection of human health and safety.

2.4. Activities will be managed to preserve and protect wetlands and vernal pools as defined by applicable, federal, state, and local regulations. These activities will include replacement or replication of all wetland resource buffer areas, which are lost after completion of an activity or use.

2.5 All land altering activities within 100 feet of a certified vernal pool must be reviewed before commencement by the Massachusetts Department of Environmental Protection/Wetlands Unit and the Natural Heritage and Endangered Species Program within the Division of Fish and Wildlife for impacts to wildlife and habitat. The certification of vernal pools will be supported by the on site personnel and will proceed with the assistance of the appropriate state agencies.

2.6 All new uses or activities will be prohibited within the wetlands and their 100-foot buffers, except those associated with an approved habitat enhancement or restoration program; those on existing improved and unimproved roads where appropriate sediment and erosion controls are put in place prior to the activity; or those where no practicable alternative to the proposed action is available. No new roads should be located within the 100-foot buffers. Existing roads within such buffers should be relocated provided that:

- The relocation does not cause greater environmental impact to other resources.
- There are funds and resources allocated for resource management and that those resources are approved and available for the relocation.

2.7 During the period of 15 February to 15 May, listed roads/trails within 500 feet of wetlands will be closed to vehicle access to protect the migration and breeding of amphibians. Emergency response and environmental management activities will not be restricted.

- Donnelly and Little Halfway Ponds maneuver trails (excluding the permanently closed section along the eastern edge of Donnelly Pond) from Frank Perkins Road north to Wood Road
- Red Maple Swamp trail from Wood Road north and east to Avery Road
- Orchard and Jefferson Roads (continuous) from Cat Road south and east to Burgoyne Road
- Maneuver trail(s) in powerline easement north of Gibbs Road from Goat Pasture Road west to the boundary of training areas C-13 and C-14
- Grassy Pond trail (side access to Sierra Range) from Gibbs Road south to Sierra Range
- Sandwich Road from the powerline easement north to the gas pipeline right of way
- Bypass Bog/Mike Range Road from entrance to Mike Range south and west to Greenway Road

2.8 No new bivouac area shall be located within 500 feet of any wetland. Any existing bivouac within a wetland buffer shall be relocated provided there are funds and resources allocated for the relocation.

3. Rare Species Performance Standards

3.1 As the Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife has identified the entire Massachusetts Military Reservation as State Priority Habitat for state-listed species (version dated 2000-2001), all activities and uses must comply with the Massachusetts Endangered Species Act and its regulations.

3.2 Where activities and uses are not specifically regulated under the Camp Edwards Training Area Range and Environmental Regulations, including these Environmental Performance Standards, the MMR Environmental and Readiness Center must review the activities for conformance with the Integrated Natural Resource Management Plan, and shall- consult with the Natural Heritage and Endangered Species Program regarding potential impacts to state-listed species.

3.3 All activities impacting rare species habitat must be designed to preserve or enhance that habitat as determined by the MMR Environmental and Readiness Center in consultation with the Natural Heritage and Endangered Species Program.

3.4 Users are prohibited from interfering with state and federal listed species.

3.5 Users will report all sightings of recognized listed species, e.g. box turtles, within any area of the Massachusetts Military Reservation.

4. Soil Conservation Performance Standards

4.1 Activities and uses must be compatible with the limitations of the underlying soils. Limitations on uses and activities may be made where the soils or soil conditions would not support the activity.

4.2 Agricultural soil types will be preserved for future use.

4.3 Any perennial or intermittent stream identified by the Environmental & Readiness Center Office will be protected from siltation by retaining undisturbed vegetative buffers to the extent feasible.

4.4 Cultural resource evaluations must be completed before any earth-moving operation may take place in undisturbed areas with high potential for cultural resources, and earth moving may be limited to specific areas (See Cultural Resource Performance Standards).

4.5 An erosion control analysis will be made part of the land management programs (Integrated Natural Resource Management Plan, the Integrated Training Area Management Program, Range Regulations, Civilian Use, and Standard Operating Procedures) for the Camp Edwards Training Area, including appropriate mitigation measures where existing or potential erosion problems are identified.

4.6 For all improved and unimproved roads, ditches and drainage ways:

- All unimproved roads, ditches, roads and drainage ways identified for maintenance will be cleaned of logs, slash and debris.
- Unimproved roads and roads may not otherwise be improved unless approved for modification.
- Any trail, ditch, road, or drainage way damaged by activities will be repaired in accordance with the hazard and impact it creates.

4.7 Erosion-prone sites will be inspected periodically to identify damage and mitigation measures.

5. Vegetation Management Performance Standards

5.1 All planning and management activities impacting vegetation

- Will ensure the maintenance of native plant communities, and
- Shall be performed to maintain the biological diversity.

5.2 Revegetation of disturbed sites will be achieved by natural and artificial recolonization by native species.

5.3 Timber harvesting or clear-cutting of forested areas should not occur on steep slopes with unstable soils or within the buffers to wetland resources.

5.4 Vegetation management will be subject to a forest management and fire protection program prepared by the users in accordance with federal standards, and carried out in a manner acceptable to the Massachusetts Military Reservation Committee and other state agencies or commissions, as may be designated by the Commonwealth of Massachusetts.

6. Habitat Management Performance Standards

6.1 The Camp Edwards Training Area will be managed as a unique rare species and wildlife habitat area under an adaptive ecosystem management program that integrates ecological, socio-economic, and institutional perspectives, and which operates under the following definitions:

- Adaptive means making decisions as part of a continual process of monitoring, reviewing collected data, and responding with management actions as dictated by the resulting information and needs of the system.
- Ecosystem means a system-wide understanding of the arrangements of living and non-living things, and the forces that act upon and within the system.
- Management entails a multi-disciplinary approach where potentially competing interests are resolved with expert analysis, user and local interest considerations, and a commitment to compromise interests when the broader goal is achieved to manage the Camp Edwards Training Area as a unique wildlife habitat area.

6.2 The adaptive ecosystem management program will include:

- Coordinated documentation for the management programs, Integrated Natural Resource Management Plan, the Integrated Training Area Management Program, Range Regulations, Civilian Use, and Standard Operating Procedures.
- The Massachusetts National Guard Environmental and Readiness Center staff and necessary funding to support its ecosystem management plans, as related to the amount of training occurring.
- Cooperative agreements to create a management team of scientific and regulatory experts.
- Long-term land maintenance, monitoring of resources and trends, study and analysis.
- Recovery plans for species and habitats identified for improvement.
- Consultation with Federal and State agencies charged with oversight of the Endangered Species Program before any actions that may affect state and federal-listed species habitat.
- Reduction of adverse impacts to the maximum extent possible, including consideration for the relocation of the activity or encouraging only those activities that result in meeting a habitat management goal.
- Habitat management activities designed to promote protection and restoration of native habitat types.

7. Wildlife Management Performance Standards

7.1 Native wildlife habitats and ecosystems management will focus on the following:

- Protecting rare and endangered species, and,
- Maintaining biodiversity.

7.2 Hunting, recreation and educational trips must be approved, scheduled, planned, and supervised through Range Control.

7.3 Any activity or use will prioritize protection of life, property, and natural resource values at the boundaries of the Camp Edwards Training Area where wildlife interfaces with the surrounding built environment.

7.4 Wildlife management will include the following actions, specific to the species targeted for management:

- Development and implementation of a plan to monitor hunting of game species.
- Planning for multi-use objectives for recreation and hunting that incorporate public input and recommendations.
- Development of suitable monitoring programs for federal and state-listed species, and regular exchange of information with the Natural Heritage and Endangered Species Program.

8. Air Quality Performance Standard

8.1 All uses and activities will be responsible for compliance with both the State Implementation Plan for Air Quality and the Federal Clean Air Act.

8.2 Air quality management activities will include air sampling if required by regulation of the activity.

9. Noise Management Performance Standards

9.1 Noise management activities shall conform to the Army's Environmental Noise Management Program policies for evaluation, assessment, monitoring, and response procedures.

10. Pest Management Performance Standards

10.1 Each user will develop and implement an Integrated Pest Management Program to control pest infestations that may include outside contracting of services. Non-native biological controls should not be considered unless approved by federal and state agencies.

10.2 Each user will be held responsible for management of pests that threaten rare and endangered species, or are exotic and invasive species, Invasive plant species that may be considered pest species are those defined by the United States Fish and Wildlife Service and the Massachusetts Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife office. Site-specific analysis will be performed before implementation of any proposed pest management plans.

10.3 Pest vegetation control must be balanced against environmental impact and any proposed pest management activities, including the use of herbicides and mechanical methods, within rare species habitat areas must be approved by the Natural Heritage and Endangered Species Program, or in the case of federally listed species, by the United States Fish and Wildlife Service.

10.4 Only herbicide formulations approved by the United States Environmental Protection Agency, the Department of Agriculture, the agency managing the user, and the Commonwealth of Massachusetts may be applied.

10.5 Herbicides and pesticides will not be applied by aerial spraying unless required by emergency conditions and approved under applicable state and federal regulations.

11. Fire Management Performance Standards

11.1 All activities and uses shall manage, prevent, detect, and suppress fires on the Camp Edwards Training Area in coordination with the local and state fire services and natural resource managers in the Environmental & Readiness Center.

11.2 Prescribed burns will be used as a habitat management and fire prevention tool. Prescribed burns will be used to reduce natural fire potential and create or maintain diverse and rare species habitat.

11.3 Pre-suppression activities will include strategic firebreaks and other management of vegetation in high risk and high-incidence areas. The Integrated Natural Resource Management Plan and Fire Management Plan will be consulted for proposed actions.

11.4 Other than the above, no open fires are allowed.

12. Stormwater Management Performance Standards

12.1 All stormwater facilities shall comply with the State Department of Environmental Protection Guidelines for Stormwater Management, including Best Management Practices and all other applicable standards for control and mitigation of increased storm water flow rates and improvement of water quality.

12.2 All increases in stormwater runoff will be controlled within the user's property.

12.3 No new stormwater discharges will be made directly into wetlands or wetland resource areas.

13. Wastewater Performance Standards

13.1 All wastewater and sewage disposal will be in conformance with the applicable Federal and Massachusetts Department of Environmental Protection agency regulations.

14. Solid Waste Performance Standards

14.1 All solid waste streams (i.e., wastes not meeting the criteria for hazardous wastes) will be monitored and managed to substitute, reduce, recycle, modify processes, implement best management practices, and/or reuse waste, thereby reducing the total tonnage of wastes,

14.2 All users will be held responsible for collection, removal and disposal outside of the Camp Edwards Training Areas of solid wastes generated by their activities.

14.3 All users must handle solid wastes using best management practices to minimize nuisance odors, windblown litter, and attraction of vectors.

14.4 No permanent disposal of solid waste within the Groundwater protection Policy area/Camp Edwards field training areas will be permitted.

15. Hazardous Materials Performance Standards

15.1 Where they are permitted, use and application of hazardous materials shall be otherwise minimized in accordance with pollution prevention and waste minimization practices, including material substitution.

15.2 No permanent disposal of hazardous wastes within the Groundwater protection Policy area/Camp Edwards field training areas will be permitted.

15.3 Fuel Management

15.3.1 Spill Prevention, Control, and Countermeasure Plan, is in place to reduce potential for a release. Camp Edwards Spill Response Plan is in place to respond to a release if an event should occur. All users will comply with these plans at the Camp Edwards Training Area.

15.3.2 If found, non-complying underground fuel storage tanks will be removed in accordance with state and federal laws and regulations to include remediation of contaminated soil.

15.3.3 No storage or movement of fuels for supporting field activities, other than in vehicle fuel tanks, will be permitted except in approved containers no greater than five gallons in capacity.

15.3.4 New storage tanks are prohibited unless they meet the following requirements:

- Are approved for maintenance heating, or, permanent emergency generators and limited to propane or natural gas fuels.
- Conform to the Groundwater Protection Policy and applicable codes.

15.4 Non-fuel Hazardous Material Storage

15.4.1 No storage above those quantities necessary to support field training activities will be allowed within the Camp Edwards Training Area except where necessary to meet regulatory requirements, and where provided with secondary containment.

15.4.2 When required by applicable regulation, the user shall implement a Spill Prevention, Control and Containment/Emergency Response or other applicable response plan.

16. Hazardous Waste Performance Standards

16.1 All uses shall comply with applicable local, state, and federal regulations governing hazardous waste generation, management, and disposal (including overlays relative to Wellhead Protection, Zone II' s within the Cantonment Area) .

16.2 Accumulations of hazardous waste shall be handled in accordance with regulations governing accumulation and storage.

16.3 Existing facilities must implement pollution prevention and waste minimization procedures (process modifications, material substitution, recycling, and best management practices) to minimize waste generation and hazardous materials use.

16.4 Occupants and users will be held responsible for removing all solid or hazardous wastes generated during the period of use/tenancy/visitation upon their departure or in accordance with other applicable or relevant regulations.

16.5 Remedial activities undertaken under the Installation Restoration Program, the Impact Area Groundwater Study Program, the Massachusetts Contingency Plan, or other governing remediation programs are exempt from additional regulation (e.g., waste generation volume limits). Removal, storage, and disposal of contaminated material are required to comply with all state, and federal regulations.

16.6 Post-remedial uses and activities at previously impacted sites will be allowed in accordance with terms and conditions of the applicable regulations.

16.7 All hazardous wastes will be transported in accordance with federal Department of Transportation regulations governing shipment of these materials.

16.8 Transport shall reduce the number of trips for transfer and pick-up of hazardous wastes for disposal to extent feasible. Tills may include planning appropriate routes that minimize proximity to sensitive natural resource areas, and reducing internal transfers of material, including transfers from bulk storage tanks to drums, tankers, carboys, or other portable containers or quantities.

16.9 No permanent disposal of hazardous wastes within the Groundwater Protection Policy area/Camp Edwards field training areas will be permitted.

17. Vehicle Performance Standards

17.1 Vehicles within the Camp Edwards Training Area will be limited to the existing improved and unimproved road system except where required for natural resource management or property maintenance or where off-road activity areas are located and approved by the Environmental and Readiness Center in consultation with the Massachusetts Division of Fisheries and Wildlife.

17.2 Unimproved, established access ways will be limited to use by vehicles in accordance with soil conditions as described in the Soil Conservation Performance Standards.

17.3 The number of military and civilian vehicles within the Camp Edwards Training Area will be controlled using appropriate scheduling and signage.

18. General Use and Access Performance Standards

18.1 General User Requirements. Requirements that will apply to all users, both public and private, in the Camp Edwards Training Area include the following:

- All acts that pollute the groundwater supply are prohibited.
- No litter or refuse of any sort may be thrown or left in or on any property.
- All users will be held responsible for providing, maintaining, and re- moving closed-system, sanitary facilities necessary for their use and activity.
- No person shall wade or swim in any water body except for activities approved by the Massachusetts National Guard including remediation, scientific study, or research.
- Vehicles may only be driven on roads authorized and designated for such use and parked in designated areas, and may not cross any designated wetland.
- Public users may not impede the military training activities.

18.2. Civilian Use Manual. To guide public conduct on the Massachusetts Military Reservation, a Civilian Use Manual will be prepared and periodically updated. All civilian users will obtain and follow this Manual.

18.3. Siting and Design Performance Standards

18.3.1 New or expanded buildings should not be proposed within the Camp Edwards Training Areas, with the following exceptions:

- Buildings to support allowed training, operations and activities, including upgrading of those facilities currently in place,
- Buildings used for the purposes of remediation activities,
- Buildings used for the purposes of development, operation and maintenance of water supplies,
- Buildings used for the purpose of natural resource and land management.

19. Range Performance Standards

19.1. All operational ranges including but not limited to small arms ranges (SAR) shall be managed to minimize harmful impacts to the environment within the Upper Cape Water Supply Reserve. Range management at each range shall include to the maximum extent practicable metal recovery and recycling, prevention of fragmentation and ricochets, and prevention of sub-surface percolation of residue associated with the range operations. Camp Edwards shall be held responsible for the implementation of BMPs by authorized range users, including collection and removal of spent ammunition and associated debris.

19.2. Small arms ranges shall only be used in accordance with approved range plans. These plans shall be designed to minimize to the maximum extent practicable the release of metals or other contaminants to the environment outside of specifically approved containment areas/systems. Occasional ricochets that result in rounds landing outside of these containment areas is expected and every effort to minimize and correct these occurrences shall be taken. Failure to follow the approved range plans shall be considered a violation of this EPS.

19.3. All operational SARs shall be closely monitored by the Massachusetts National Guard to assess compliance of the approved range plans as well as the implementation and effectiveness of the range specific BMPs.

19.4. Camp Edwards/Massachusetts National Guard Environmental and Readiness Center shall staff and request appropriate funding to support its SAR management plans.

19.5. All users must use and follow Camp Edwards' Range Control checklists and procedures to:

- Minimize debris on the range (e.g. shell casings, used targets)
- Minimize or control residues on the ranges resulting from training (e.g., unburned constituents, metal shavings from the muzzle blast)
- Ensure the range is being used for the designated purpose in accordance with all applicable plans and approvals

19.6. Camp Edwards is responsible for following range operation procedures and maintaining range pollution prevention systems. Range BMPs shall be reviewed annually for effectiveness and potential improvements in their design, monitoring, maintenance, and operational procedures in an effort to continually improve them. Each year the annual report shall detail the range-specific activities including, but not limited to, the number of rounds fired, number of shooters and their organization, and the number of days the range was in use. The annual report will also detail active SAR groundwater well and lysimeter results, as well as any range maintenance/management activities that took place that training year and the result of such activities, i.e. lbs of brass and projectiles recovered and recycled, etc. The Massachusetts National Guard shall provide regular and unrestricted access for the EMC to all its data and information, and will provide immediate access to environmental samples from the range, including range management and monitoring systems and any other applicable activities operating on the ranges.

19.7. Range plans and BMPs for training areas shall be reviewed and/or updated at least every three years. Management plans for new and upgraded ranges shall be in place prior to construction or utilization of the range. Range plans, at a minimum, will address long-term sustainable use, hydrology and hydrogeology, physical design, operation, management procedures, record keeping, pollution prevention, maintenance, monitoring, and applicable technologies to ensure sustainable range management. Range plans shall be integrated with other training area planning processes and resources.

19.8. The Massachusetts National Guard shall establish procedures for range maintenance and where applicable, maintenance and/or clearance operations to permit the sustainable, compatible, and safe use of operational ranges for their intended purpose within the Upper Cape Water Supply Reserve. In determining the frequency and degree of range maintenance and clearance operations, the Massachusetts National Guard shall consider, at a minimum, the environmental impact and safety hazards, each range's intended use, lease requirements, and the quantities and types of munitions or simulated munitions expended on that range.

APPENDIX B

LIST OF CONTACTS

LIST OF CONTACTS

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APPENDIX C FIRING RANGE AND SOLDIER VALIDATION LANE INFORMATION

Operations Maintenance and Monitoring Activities

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
JULIET & KILO RANGE
TY 2019

Date	Juliet	Kilo
3 Oct 18	Maintenance: 120 gallons pumped (4 cm)	Maintenance: 150 gallons pumped (W 5 cm; E 6.5 cm)
13 Oct 18	Pre/post fire inspection; (28 cm); maintenance: 300 gallons pumped (3.5 cm)	Pre/post fire inspection (W 19 cm; E 6.5 cm); maintenance: 130 gallons pumped (W 3.5 cm; E 6.5 cm)
17 Oct 18	-----	Maintenance: seams, bullet pocket, and hole repairs (W 14 cm; E 6.5 cm)
19, 21 Oct 18	-----	Pre/post fire inspection (W 14 cm; E 6.5 cm)
25 Oct 18	Maintenance: 55 gallons pumped (2.5 cm)	Maintenance: 80 gallons pumped (W 3 cm; E 6.5 cm)
2 Nov 18	Pre/post fire inspection (6 cm)	Pre/post fire inspection (W 14 cm; E 6.5 cm)
6 Nov 18	-----	Maintenance: 280 gallons pumped (W 4 cm; E 6.5 cm)
7 Nov 18	-----	Pre/post fire inspection (W 4 cm; E 6.5 cm)
9 Nov 18	Pre/post fire inspection (7 cm)	-----
16 Nov 18	-----	Maintenance: 60 gallons pumped (W 4.5 cm; E 6.5 cm)
16, 17 Nov 18	Pre/post fire inspection (12 cm)	Pre/post fire inspection (W 4.5 cm; E 6.5 cm)
28 Nov 18	-----	Maintenance: 800 gallons pumped (W 4.5 cm; E 6.5 cm)
29 Nov 18	Maintenance: 480 gallons pumped (4.5 cm)	-----
6 Dec 18	Maintenance: 300 gallons pumped (6.5 cm)	Maintenance: 450 gallons pumped (W 4 cm; E 6.5 cm)
17 Dec 19	-----	Maintenance: 290 gallons pumped (W 4 cm; E 6.5 cm)
18 Dec 18	Maintenance: 200 gallons pumped (7 cm)	-----
2 Jan 19	-----	Maintenance: 1,120 gallons pumped (W 5 cm; E 6.5 cm)
3 Jan 19	Maintenance: 400 gallons pumped (6.5 cm)	
16 Jan 19	Maintenance: 180 gallons pumped (5 cm)	Maintenance: 180 gallons pumped (W 12 cm; E 6.5 cm)
29 Jan 19	Maintenance: 700 gallons pumped (10 cm)	Maintenance: 1,230 gallons pumped (W 14 cm; E 6.5 cm)
30 Jan 19	Maintenance: tarp cover replaced (10 cm)	-----
6 Feb 19	Maintenance: 180 gallons pumped (3.5 cm)	Maintenance: 190 gallons pumped (W 4 cm; E 6.5 cm)
1 Mar 19	-----	Pre/post fire inspection (W 12 cm; E 6.5 cm)
4, 6 Apr 19	-----	Pre/post fire inspection (W 13.5 cm; E 6.5 cm)
12 Apr 19	Maintenance: seam repair (8 cm)	Maintenance: 100 gallons pumped (W 1 cm; E 6.5 cm)

Date	Juliet	Kilo
13 Apr 19	-----	Pre/post fire inspection (W 1 cm; E 6.5 cm)
24 Apr 19	-----	Maintenance: 100 gallons pumped (W 3.5 cm; E 6.5 cm)
3 May 19	-----	Pre/post fire inspection (W 10 cm; E 6.5 cm)
4 May 19	-----	Pre/post fire inspection (W 10 cm; E 6.5 cm)
8 May 19	Pre/post fire inspection (8 cm)	Pre/post fire inspection (W 13 cm; E 6.5 cm)
10 May 19	-----	Pre/post fire inspection (W 13 cm; E 6.5 cm)
13 May 19	-----	Maintenance: 70 gallons pumped (W 1.5 cm; E 6.5 cm)
18, 19 May 19	-----	Pre/post fire inspection (W 1.5 cm; E 6.5 cm)
19 May 19	Pre/post fire inspection (8 cm)	-----
31 May 19	Pre/post fire inspection (10 cm)	Pre/post fire inspection (W 10 cm; E 6.5 cm)
1 June 19	-----	Pre/post fire inspection (W 10 cm; E 6.5 cm)
7 June 19	Maintenance: 100 gallons pumped (2.5 cm)	Maintenance: 70 gallons pumped (W 2.5 cm; E 6.5 cm)
29 June 19	-----	Pre/post fire inspection (W 8 cm; E 6.5 cm)
20 July 19	-----	Pre/post fire inspection (W 8 cm; E 6.5 cm)
8 Aug 19	Maintenance: 60 gallons pumped (2 cm)	Maintenance: 100 gallons (W 4 cm; E 6.5 cm)
10 Aug 19	-----	Pre/post fire inspection (W 4 cm; E 6.5 cm)
3 Sep 19	-----	Maintenance: 40 gallons (W 4 cm; E 6.5 cm)
8 Sep 19	-----	Pre/post fire inspection (W 4cm; E 6.5 cm)
27 Sep 19	Pre/post fire inspection (2 cm)	Pre/post fire inspection (W 10 cm; E 6.5 cm)
28 Sep 19	-----	Pre/post fire inspection (W 6 cm; E 6.5 cm)

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
SIERRA & INDIA RANGES
TY 2019

Sierra and India Ranges Maintenance Activities for TY 2019		
Date	Sierra	India
9, 11 Oct 18	Maintenance: Berm repair and hydro seeding	-----
10, 11 Oct 18	-----	Maintenance: Berm repair and hydro seeding
2, 3 Nov 18	Pre/post fire inspection	-----
19, 21 Oct 18	-----	Pre/post fire inspection
2, 4 Nov 18	-----	Pre/post fire inspection
7 Nov 18	Pre/post fire inspection	Pre/post fire inspection
9 Nov 18	Pre/post fire inspection	-----
16 Nov 18	-----	Pre/post fire inspection
12 Dec 18	Inspection (EMC)	Inspection (EMC)
5 Jan 19	-----	Pre/post fire inspection
1, 2 Mar 19	-----	Pre/post fire inspection
4, 5 Apr 19	-----	Pre/post fire inspection
6 Apr 19	Pre/post fire inspection	-----
12, 13 Apr 19	Pre/post fire inspection	Pre/post fire inspection
3 May 19	Pre/post fire inspection	-----
4 May 19	Pre/post fire inspection	Pre/post fire inspection
18 May 19	Pre/post fire inspection	-----
31 May 19	Pre/post fire inspection	-----
1, 2 Jun 19	Pre/post fire inspection	Pre/post fire inspection
8 Jun 19	Pre/post fire inspection	-----
14, 15 Jun 19	-----	Pre/post fire inspection
14, 16 Jun 19	Pre/post fire inspection	-----
29, 30 Jun 19	-----	Pre/post fire inspection
30 Jun 19	Pre/post fire inspection	-----
31 July 19	Pre/post fire inspection	-----
6 Aug 19	Pre/post fire inspection	-----
9, 10 Aug 19	Pre/post fire inspection	Pre/post fire inspection
10, 11 Aug 19	Pre/post fire inspection	-----
16 Aug 19	-----	Pre/post fire inspection
6, 7 Sep 19	Pre/post fire inspection	Pre/post fire inspection
20 Sep 19	Pre/post fire inspection	-----
27 Sep 19	Pre/post fire inspection	Pre/post fire inspection
28 Sep 19	Pre/post fire inspection	-----

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
LIMA RANGE
TY 2019

Lima Range Maintenance Activities for TY 2019	
Date	Activity
16 Nov 18	Pre/post fire inspection
19 Nov 18	Pre/post fire inspection
3 May 19	Pre/post fire inspection
7 June 19	Pre/post fire inspection
7 Sept 19	Pre/post fire inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
ECHO RANGE
TY 2019

Echo Range Maintenance Activities for TY 2019	
Date	Activity
5,6 Apr 19	Pre/post fire inspection
24 Sep 19	Pre/post fire inspection

Lead Ammunition Use

Juliet, Kilo, Tango and Echo Ranges

LEAD AMMUNITION USE HISTORY								
JULIET RANGE								
Training Year	.40 Cal Lead	9 mm Lead	7.62 mm Lead	5.56 mm Lead	.38 Cal Lead	.45 Cal Lead	.233 Cal Lead	Total
TY 2019	0	17,774	0	12,315	0	0	0	30,089
TY 2018	0	12,781	0	23,802	0	0	0	36,583
TY 2017	0	26,108	0	25,789	0	0	0	51,897
TY 2016	0	9,200	0	51,852	0	0	0	61,052
TY 2015	2,500	24,828	0	36,938	0	1,000	0	65,266
TY 2014	2,400	18,874	9,000	6,663	0	0	0	36,937
TY 2013	2,450	9,260	0	27,286	0	0	1,200	40,196
TY 2012	750	12,819	0	14,457	0	0	3,000	31,026
TY 2011	0	16,911	0	46,630	0	0	0	63,541
TY 2010	0	7,311	0	27,060	0	0	0	34,371
TY 2009	0	4,780	0	11,482	0	0	0	16,262
TY 2008	0	0	0	0	0	0	0	0
TY 2007	0	0	0	0	0	0	0	0
TOTAL	8,100	160,646	9,000	284,274	0	1,000	4,200	467,220

Note: A STAPP™ bullet capture system was installed at Juliet Range in August/September 2008.

LEAD AMMUNITION USE HISTORY								
KILO RANGE								
Training Year	.40 Cal Lead	9 mm Lead	7.62 mm Lead	5.56 mm Lead	.38 Cal Lead	.45 Cal Lead	.233 Cal Lead	Total
TY 2019	0	44,428	0	36,751	0	0	0	81,179
TY 2018	0	25,803	0	93,539	0	0	0	119,342
TY 2017	0	50,147	0	65,515	0	0	0	115,662
TY 2016	0	21,373	0	28,265	0	0	0	49,638
TY 2015	0	15,601	0	54,372	0	0	0	69,973
TY 2014	0	31,304	0	49,052	0	0	0	80,356
TY 2013	0	731	0	73,011	0	0	0	73,742
TY 2012	0	7,181	0	52,731	0	0	0	59,912
TY 2011	14,362	9,850	0	100,942	0	0	0	125,154
TY 2010	1,450	7,500	0	51,412	0	0	0	60,362
TY 2009	0	6,675	0	23,108	0	0	0	29,783
TY 2008	0	0	0	0	0	0	0	0
TY 2007	0	0	0	0	0	0	0	0
TOTAL	15,812	220,593	0	628,698	0	0	0	865,103

Note: A STAPP™ bullet capture system was installed at Kilo Range in August/September 2008.

LEAD AMMUNITION USE HISTORY									
TANGO RANGE									
Training Year	.40 Cal Lead	9 mm Lead	7.62 mm Lead	5.56 mm Lead	.38 Cal Lead	.45 Cal Lead	.233 Cal Lead	.22 Cal Lead	Total
TY 2017	0	2,250	4,240	9,380	0	0	0	625	16,495
TY 2016	0	4,200	0	0	0	0	0	0	4,200
TY 2015	0	5,240	0	1,720	0	0	0	0	6,960
TY 2014	0	0	0	3,220	0	0	0	0	3,220
TY 2013	1,600	1,800	0	2,000	0	0	4,550	0	9,950
TY 2012	2,800	7,373	0	1,944	0	0	0	0	12,117
TY 2011	5,200	6,765	0	25,157	0	0	0	0	37,122
TY 2010	40,341	2,496	0	41,042	0	6,449	0	0	90,328
TY 2009	0	31,985	0	105,077	300	0	0	0	137,362
TY 2008	4,075	9,094	4,556	0	0	0	0	0	17,725
TY 2007	0	0	0	8,547	0	0	0	0	8,547
TOTAL	54,016	71,203	8,796	198,087	300	6,449	4,550	625	344,026

Note: A STAPP™ bullet capture system was installed at Tango Range in July 2006 and dismantled in October 2017.

LEAD AMMUNITION USE HISTORY					
ECHO RANGE					
Training Year	.40 Cal Lead	9 mm Lead	.38 Cal Lead	.45 Cal Lead	Total
TY 2019	0	4,350	0	0	4,350
TY 2018	0	0	0	0	0
TY 2017	0	0	0	0	0
TY 2016	0	0	0	0	0
TY 2015	0	347 ¹	0	0	347
TY 2014	0	0	0	0	0
TY 2013	0	0	0	0	0
TY 2012	0	0	0	0	0
TY 2011	0	0	0	0	0
TY 2010	0	0	0	0	0
TY 2009	0	0	0	0	0
TY 2008	0	0	0	0	0
TY 2007	0	100 ¹	0	0	100
TOTAL	0	4,797	0	0	4,797

Notes: Echo Range became operational in Fall 2019.

1. Firing at Echo Range in TY 2007 and TY 2015 were part of tests for reintroducing lead ammunition.

LEAD AMMUNITION USE HISTORY							
CUMULATIVE							
Training Year	Echo Range	Sierra Range	KD Range	Tango Range	Juliet Range	Kilo Range	Total
TY 2019	4,350	0	0	0	30,089	81,179	115,618
TY 2018	0	0	0	0	36,583	119,342	155,925
TY 2017	0	0	0	16,495	51,897	115,662	184,054
TY 2016	0	0	0	4,200	61,052	49,638	114,890
TY 2015	347 ¹	0	1,993 ³	6,960	65,266	69,973	144,539
TY 2014	0	0	0	3,220	36,937	80,356	120,513
TY 2013	0	0	0	9,950	40,196	73,742	123,888
TY 2012	0	0	0	12,117	31,026	59,912	103,055
TY 2011	0	2,120 ²	0	37,122	63,541	125,154	227,937
TY 2010	0	0	0	90,328	34,371	60,362	185,061
TY 2009	0	0	0	137,362	16,262	29,783	183,407
TY 2008	0	0	0	17,725	0	0	17,725
TY 2007	100 ¹	0	0	8,547	0	0	8,647
TOTAL	4,797	2,120	1,993	344,026	467,220	865,103	1,685,259

Notes: 1. Firing at Echo Range in TY 2007 and TY 2015 were part of tests for reintroducing lead ammunition.

2. Firing at Sierra Range in TY 2011 was part of a Line of Sight Analysis test.

3. Firing at KD Range in TY 2015 was part of a planning-level noise assessment.

Copper Ammunition Use

Sierra and India Ranges

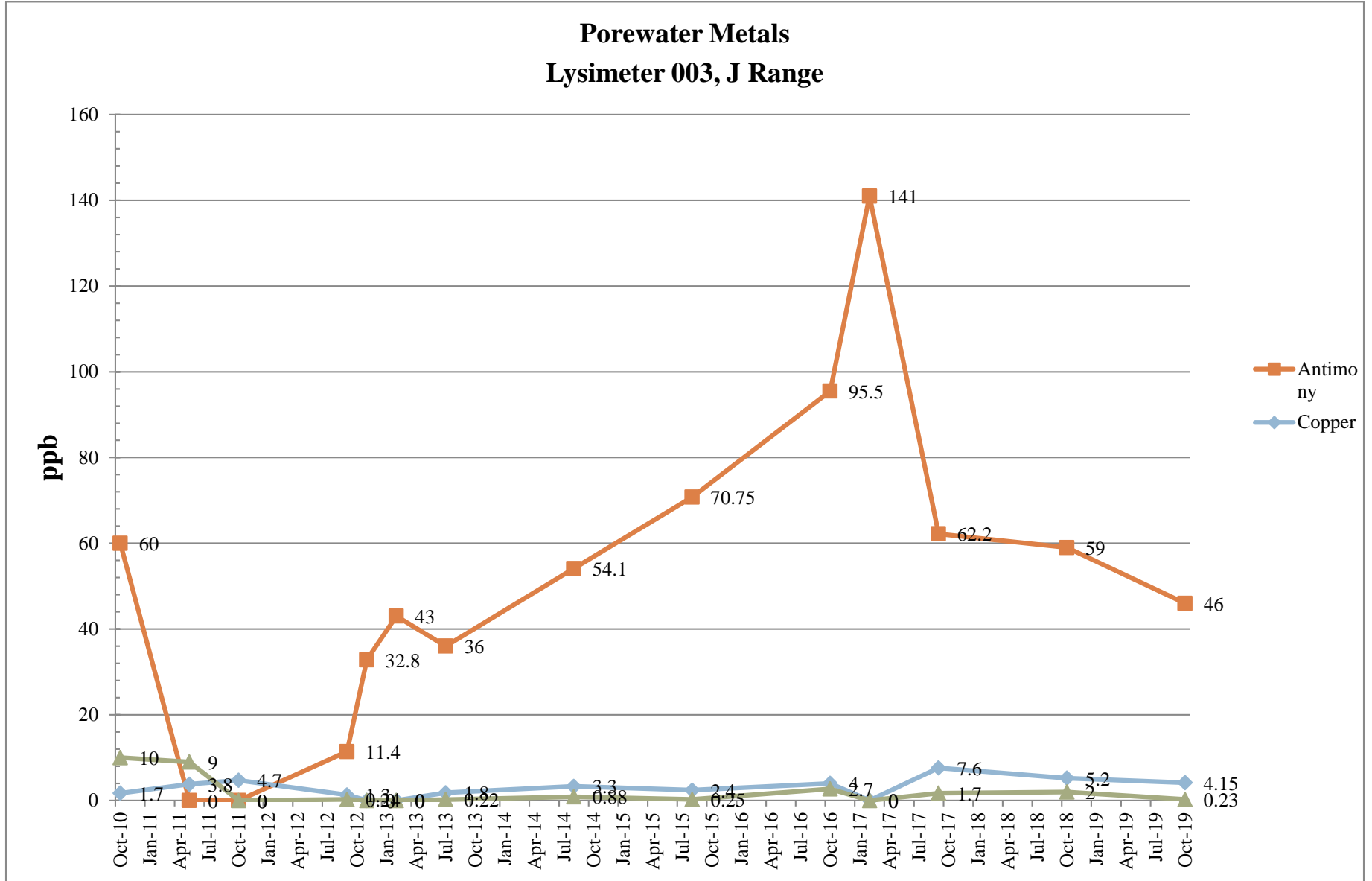
COPPER AMMUNITION USE HISTORY SIERRA AND RANGES			
Training Year	Sierra Range 5.56 Copper	India Range 5.56 Copper	Total
TY 2019	98,426	71,098	169,524
TY 2018	98,393	105,143	203,536
TY 2017	95,905	109,892	205,797
TY 2016	80,747	60,571	141,318
TY 2015	66,086	12,947	79,033
TY 2014	46,804	27,872	74,676
TY 2013	34,493	10,918	45,411
TY 2012	34,359	6,601	40,960
TOTAL	555,213	400,249	960,255

Note: Firing of copper ammunition began at Sierra Range on July 8, 2012 and at India Range on September 15, 2012.

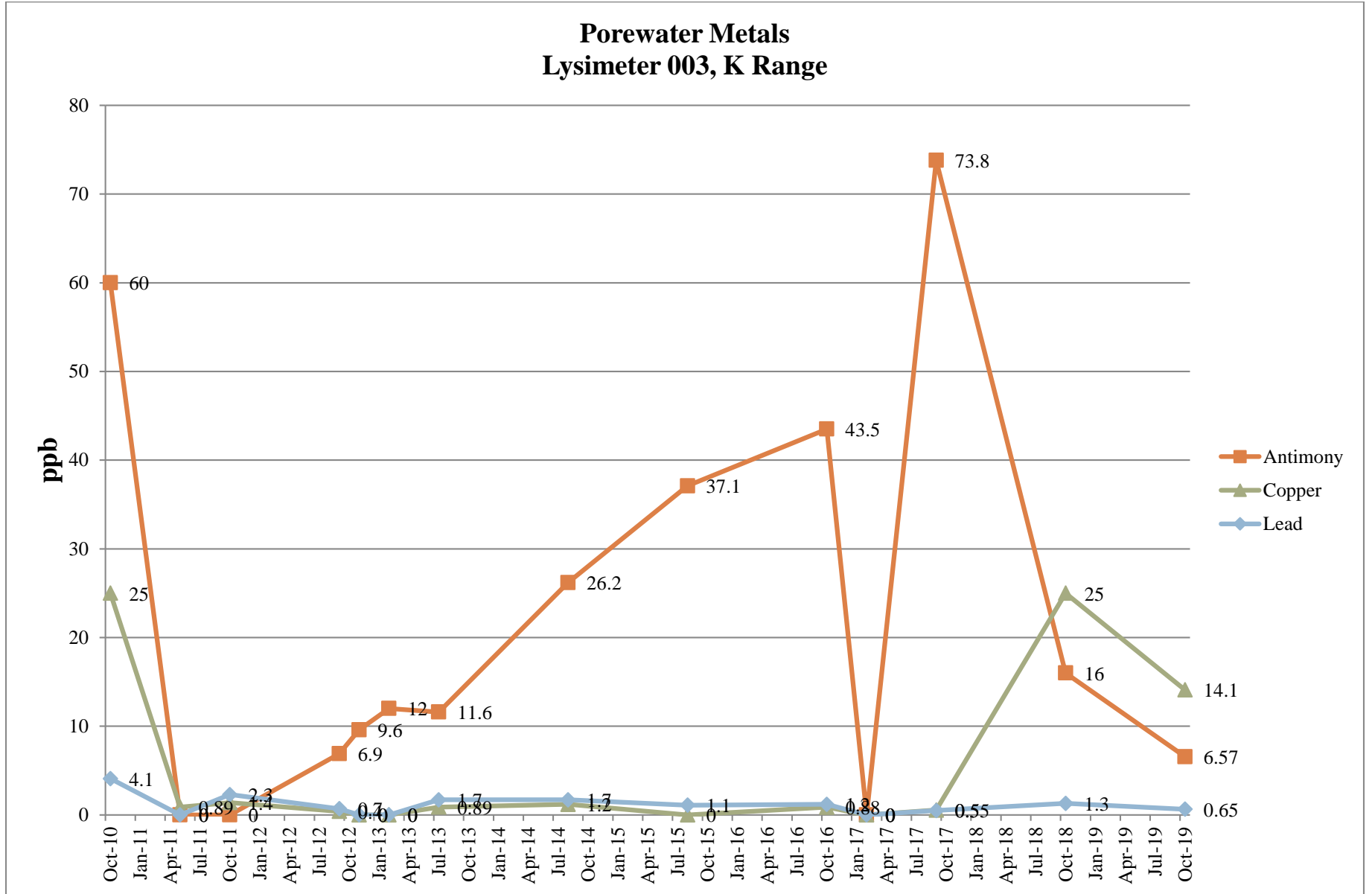
Juliet, Kilo, Tango and India Ranges

Porewater Graphs

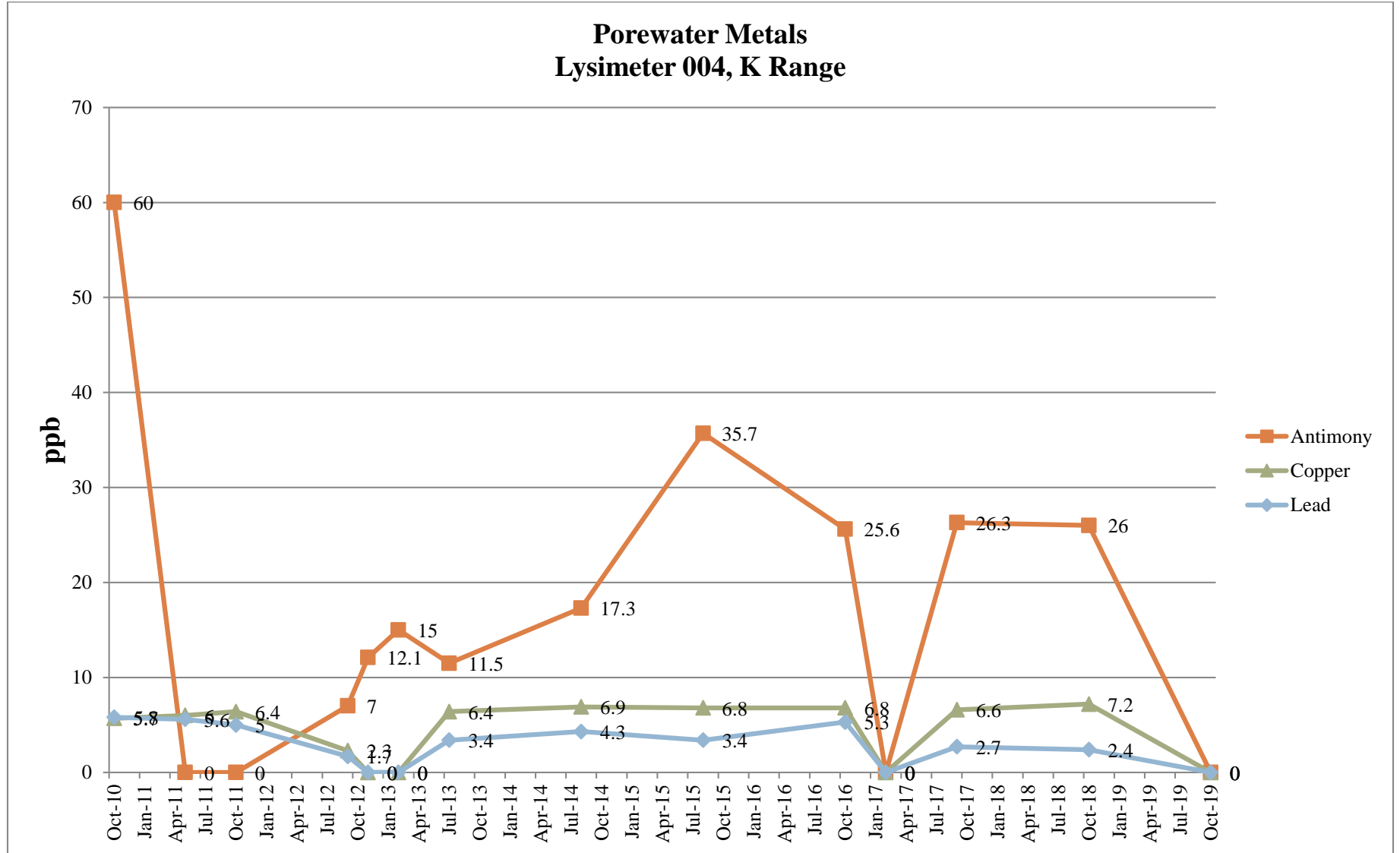
Porewater Metals, Lysimeter 003, J Range



Porewater Metals, Lysimeter 003, K Range

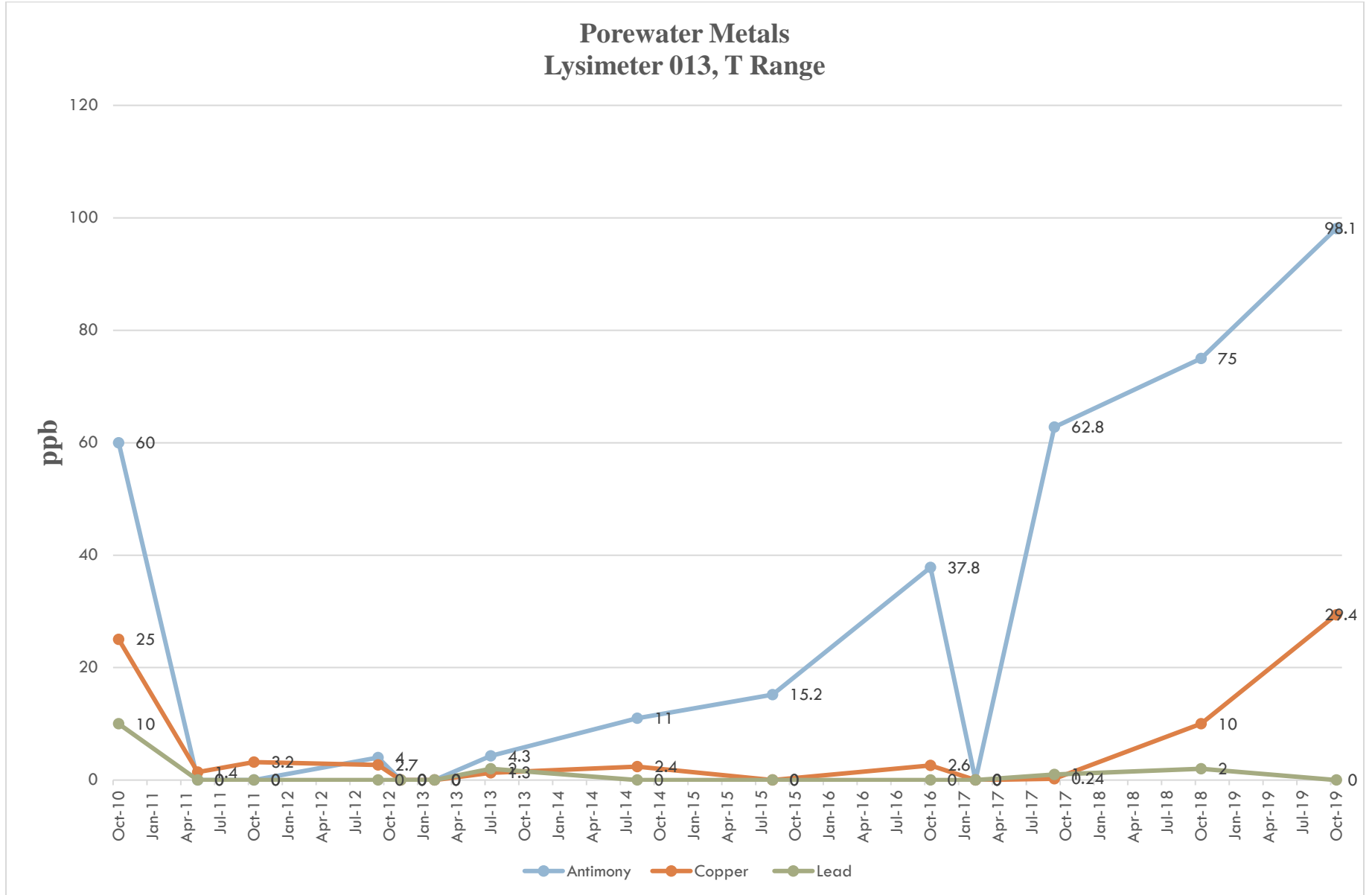


Porewater Metals, Lysimeter 004, K Range

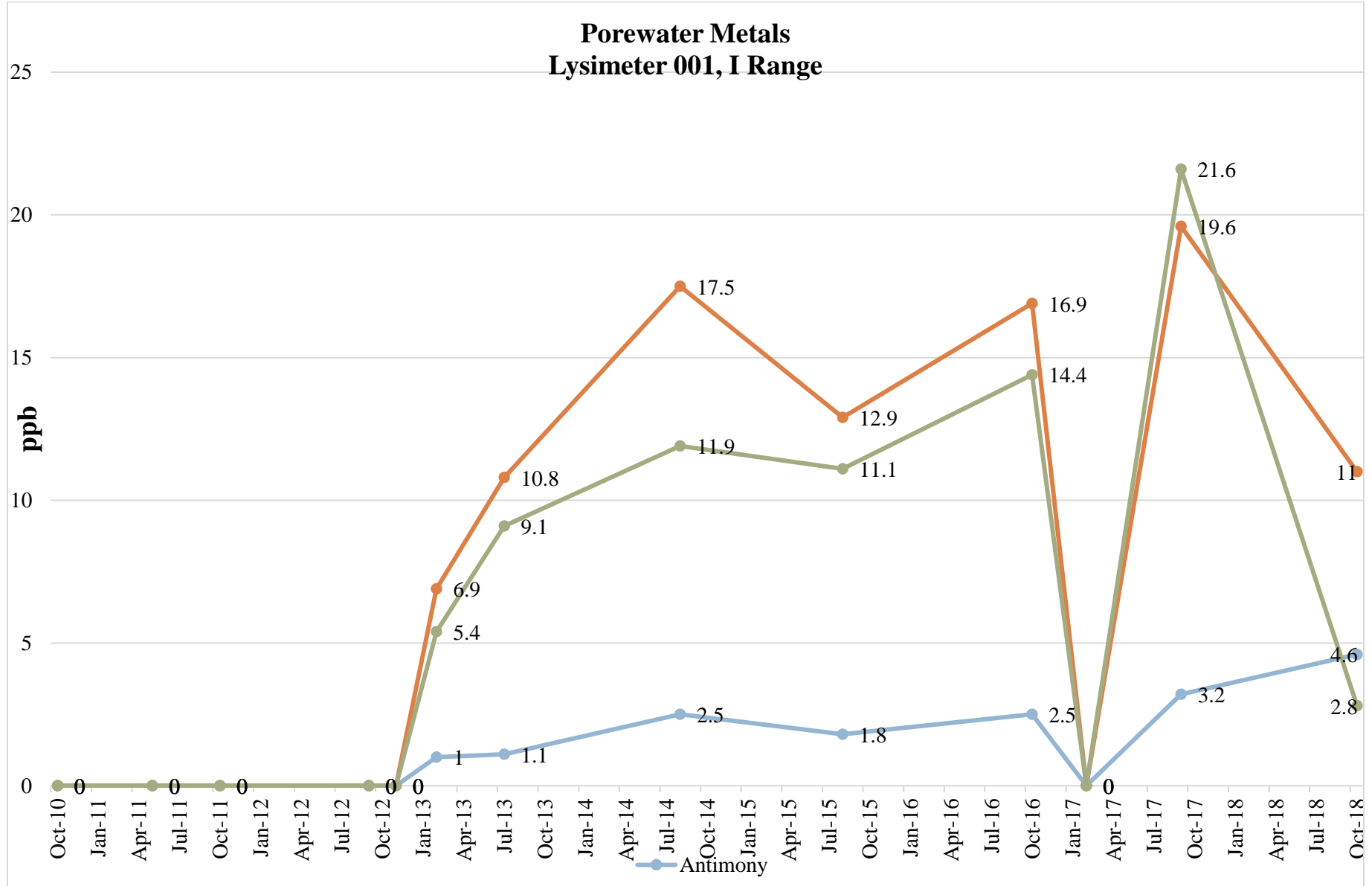


Note: October 2019, unable to obtain sample from the lysimeter.

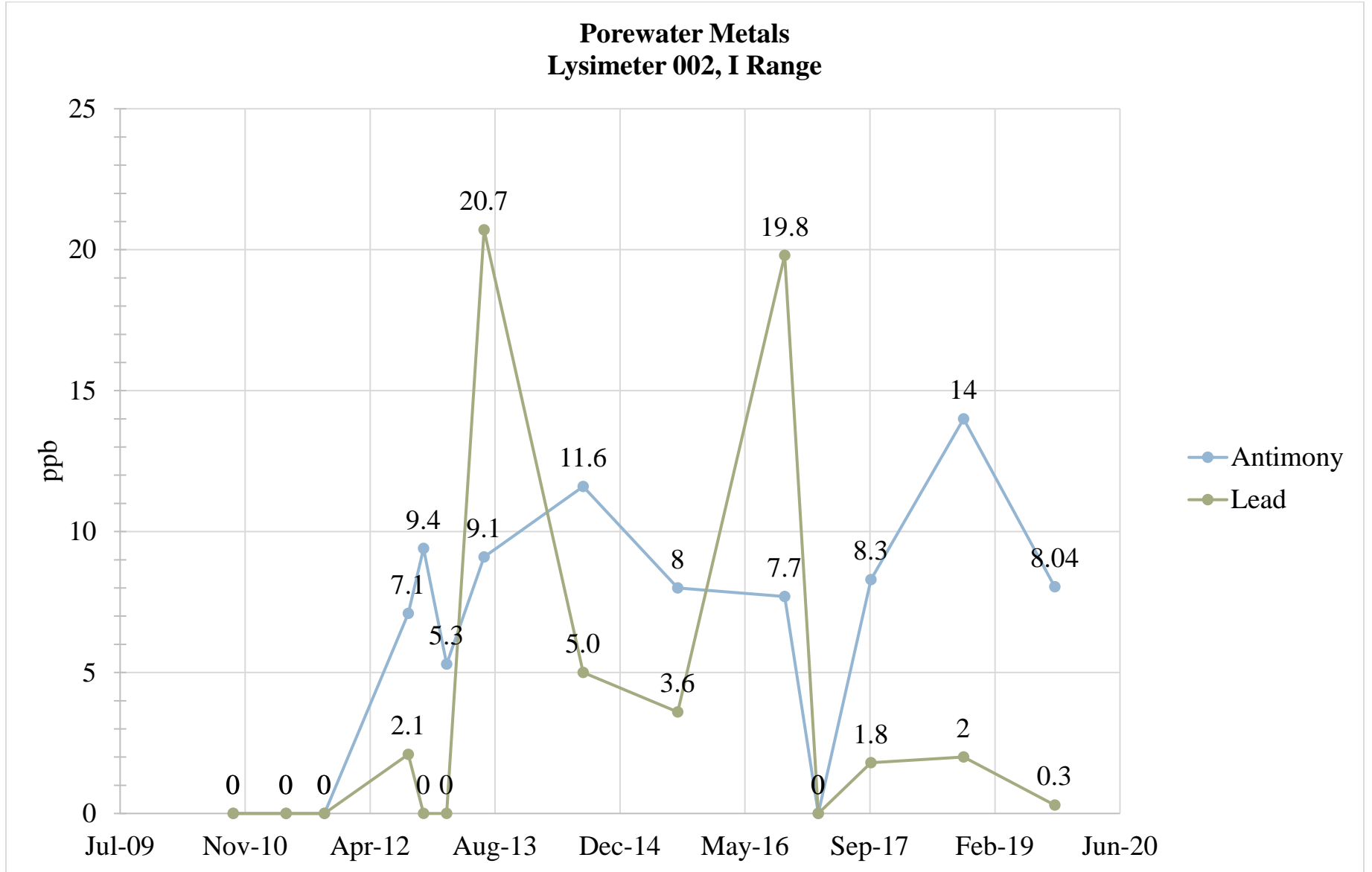
Porewater Metals, Lysimeter 013, T Range



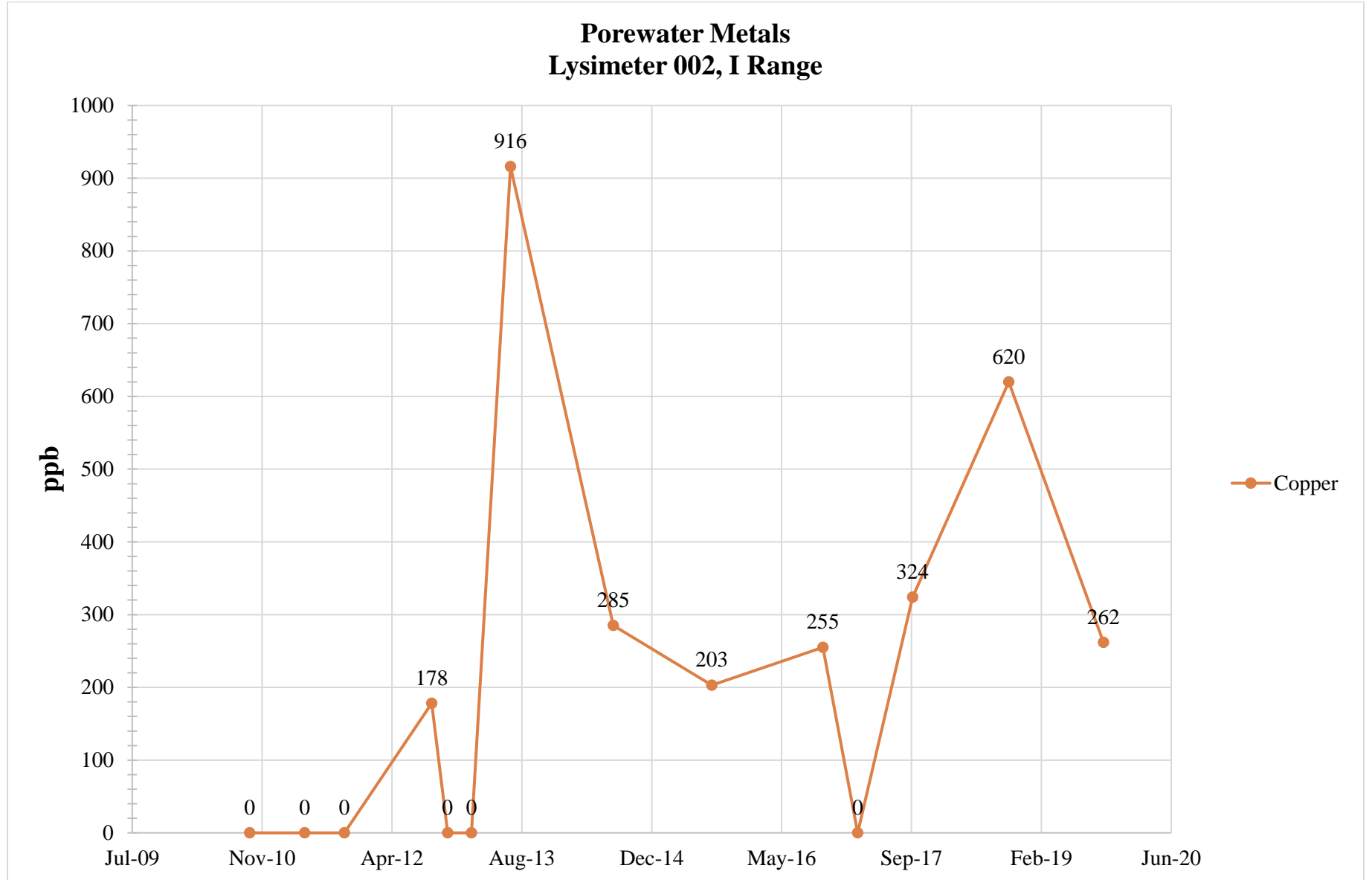
Porewater Metals, Lysimeter 001, I Range



Porewater metals, Lysimeter 002, I Range



Porewater Metals, Lysimeter 002, I Range



Firing Range Sampling Reports

Soil Sampling Results

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
E Range	SSERNG001_OCT19	Soil	Antimony	SW6010C	mg/kg	0.43	0.69	0.43	0.06	UJ	ND, MS%R	300
E Range	SSERNG001_OCT19	Soil	Calcium	SW6010C	mg/kg	428	8.6	6.9	1.6	J	MS%R	
E Range	SSERNG001_OCT19	Soil	Chloride	SW9056A	mg/L	11	20	10	0.993	J	TR	
E Range	SSERNG001_OCT19	Soil	Copper	SW6010C	mg/kg	4.42	2.2	0.86	0.14			10,000
E Range	SSERNG001_OCT19	Soil	Lead	SW6010C	mg/kg	11.2	0.43	0.34	0.075			3,000
E Range	SSERNG001_OCT19	Soil	Magnesium	SW6010C	mg/kg	681	8.6	6.9	0.59	J	MS%R	
E Range	SSERNG001_OCT19	Soil	pH	SW9045D	pH units	5.4	0.1	--	0.1			
E Range	SSERNG001_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	240	19	9.4	4.9			
E Range	SSERNG001_OCT19	Soil	Potassium	SW6010C	mg/kg	397	86	43	2.5			
E Range	SSERNG001_OCT19	Soil	Sodium	SW6010C	mg/kg	24.7	86	43	1.3	J	TR	
E Range	SSERNG001_OCT19	Soil	Sulfate	SW9056A	mg/L	8.7	10	5.0	0.637	J	TR	
E Range	SSERNG002_OCT19	Soil	Antimony	SW6010C	mg/kg	0.41	0.65	0.41	0.057	U	ND	300
E Range	SSERNG002_OCT19	Soil	Calcium	SW6010C	mg/kg	399	8.2	6.5	1.5			
E Range	SSERNG002_OCT19	Soil	Chloride	SW9056A	mg/L	14	20	10	0.993	J	TR	
E Range	SSERNG002_OCT19	Soil	Copper	SW6010C	mg/kg	5.26	2	0.82	0.13			10,000
E Range	SSERNG002_OCT19	Soil	Lead	SW6010C	mg/kg	11.8	0.41	0.33	0.071			3,000
E Range	SSERNG002_OCT19	Soil	Magnesium	SW6010C	mg/kg	718	8.2	6.5	0.55			
E Range	SSERNG002_OCT19	Soil	pH	SW9045D	pH units	5.4	0.1	--	0.1			
E Range	SSERNG002_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	200	19	9.4	4.9			
E Range	SSERNG002_OCT19	Soil	Potassium	SW6010C	mg/kg	395	82	41	2.4			
E Range	SSERNG002_OCT19	Soil	Sodium	SW6010C	mg/kg	22.7	82	41	1.2	J	TR	
E Range	SSERNG002_OCT19	Soil	Sulfate	SW9056A	mg/L	11	10	5.0	0.637			
E Range	SSERNG003_OCT19	Soil	Antimony	SW6010C	mg/kg	0.33	0.52	0.33	0.046	U	ND	300
E Range	SSERNG003_OCT19	Soil	Calcium	SW6010C	mg/kg	506	6.6	5.2	1.2			
E Range	SSERNG003_OCT19	Soil	Chloride	SW9056A	mg/L	14	20	10	0.993	J	TR	
E Range	SSERNG003_OCT19	Soil	Copper	SW6010C	mg/kg	4.98	1.6	0.66	0.11			10,000
E Range	SSERNG003_OCT19	Soil	Lead	SW6010C	mg/kg	11.7	0.33	0.26	0.057			3,000
E Range	SSERNG003_OCT19	Soil	Magnesium	SW6010C	mg/kg	779	6.6	5.2	0.45			
E Range	SSERNG003_OCT19	Soil	pH	SW9045D	pH units	5.6	0.1	--	0.1			
E Range	SSERNG003_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	200	15	7.5	3.9			
E Range	SSERNG003_OCT19	Soil	Potassium	SW6010C	mg/kg	388	66	33	1.9			
E Range	SSERNG003_OCT19	Soil	Sodium	SW6010C	mg/kg	22.9	66	33	0.98	J	TR	
E Range	SSERNG003_OCT19	Soil	Sulfate	SW9056A	mg/L	7.8	10	5.0	0.637	J	TR	
E Range	SSERNG003_OCT19EB	Water	Alkalinity, total	SM2320B	mg/L	2.3	5.0	4.0	0.23	J	TR	
E Range	SSERNG003_OCT19EB	FIELDQC	Antimony	SW6020A	µg/L	0.16	1.0	0.50	0.055	J	TR	300
E Range	SSERNG003_OCT19EB	FIELDQC	Calcium	SW6020A	µg/L	39	100	80	21	J	TR	

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
E Range	SSERNG003_OCT19EB	FIELDQC	Chloride	SW9056A	mg/L	1.0	2.0	1.0	0.0993	U	ND	
E Range	SSERNG003_OCT19EB	FIELDQC	Copper	SW6020A	µg/L	1.1	3.0	2.0	0.19	J	TR	10,000
E Range	SSERNG003_OCT19EB	FIELDQC	Lead	SW6020A	µg/L	0.12	1.0	0.50	0.075	J	TR	3,000
E Range	SSERNG003_OCT19EB	FIELDQC	Magnesium	SW6020A	µg/L	15	100	80	8	J	TR	
E Range	SSERNG003_OCT19EB	FIELDQC	Phosphorus, total	E365.4	mg/L	0.080	0.10	0.080	0.0461	U	ND	
E Range	SSERNG003_OCT19EB	FIELDQC	Potassium	SW6020A	µg/L	400	1,000	400	31	U	ND	
E Range	SSERNG003_OCT19EB	FIELDQC	Sodium	SW6020A	µg/L	130	1,000	400	19	J	TR	
E Range	SSERNG003_OCT19EB	FIELDQC	Sulfate	SW9056A	mg/L	0.50	1.0	0.50	0.064	U	ND	
E Range	SSERNG003_OCT19EB	FIELDQC	Sulfate	SW9056A	mg/L	0.50	1.0	0.50	0.064	U	ND	
E Range	SSERNG004_OCT19	Soil	Antimony	SW6010C	mg/kg	0.26	0.41	0.26	0.036	U	ND	300
E Range	SSERNG004_OCT19	Soil	Calcium	SW6010C	mg/kg	518	5.2	4.1	0.93			
E Range	SSERNG004_OCT19	Soil	Chloride	SW9056A	mg/L	24	20	10	0.993			
E Range	SSERNG004_OCT19	Soil	Copper	SW6010C	mg/kg	5.27	1.3	0.52	0.082			10,000
E Range	SSERNG004_OCT19	Soil	Lead	SW6010C	mg/kg	12.2	0.26	0.21	0.045			3,000
E Range	SSERNG004_OCT19	Soil	Magnesium	SW6010C	mg/kg	771	5.2	4.1	0.35			
E Range	SSERNG004_OCT19	Soil	pH	SW9045D	pH units	5.6	0.1	—	0.1			
E Range	SSERNG004_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	280	21	11	5.5			
E Range	SSERNG004_OCT19	Soil	Potassium	SW6010C	mg/kg	423	52	26	1.5			
E Range	SSERNG004_OCT19	Soil	Sodium	SW6010C	mg/kg	25.4	52	26	0.77	J	TR	
E Range	SSERNG004_OCT19	Soil	Sulfate	SW9056A	mg/L	6.8	10	5.0	0.637	J	TR	
E Range	SSERNG005_OCT19	Soil	Antimony	SW6010C	mg/kg	0.044	0.5	0.32	0.044	J	TR	300
E Range	SSERNG005_OCT19	Soil	Calcium	SW6010C	mg/kg	657	6.3	5	1.1			
E Range	SSERNG005_OCT19	Soil	Chloride	SW9056A	mg/L	14	20	10	0.993	J	TR	
E Range	SSERNG005_OCT19	Soil	Copper	SW6010C	mg/kg	3.92	1.6	0.63	0.1			10,000
E Range	SSERNG005_OCT19	Soil	Lead	SW6010C	mg/kg	10.5	0.32	0.25	0.055			3,000
E Range	SSERNG005_OCT19	Soil	Magnesium	SW6010C	mg/kg	652	6.3	5	0.43			
E Range	SSERNG005_OCT19	Soil	pH	SW9045D	pH units	5.5	0.1	—	0.1			
E Range	SSERNG005_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	240	18	8.8	4.6			
E Range	SSERNG005_OCT19	Soil	Potassium	SW6010C	mg/kg	367	63	32	1.8			
E Range	SSERNG005_OCT19	Soil	Sodium	SW6010C	mg/kg	23.2	63	32	0.95	J	TR	
E Range	SSERNG005_OCT19	Soil	Sulfate	SW9056A	mg/L	8.0	10	5.0	0.64	J	TR	
E Range	SSERNG006_OCT19	Soil	Antimony	SW6010C	mg/kg	0.42	0.67	0.42	0.059	U	ND	300
E Range	SSERNG006_OCT19	Soil	Calcium	SW6010C	mg/kg	574	8.4	6.7	1.5			
E Range	SSERNG006_OCT19	Soil	Chloride	SW9056A	mg/L	11	20	10	0.993	J	TR	
E Range	SSERNG006_OCT19	Soil	Copper	SW6010C	mg/kg	16.5	2.1	0.84	0.13			10,000
E Range	SSERNG006_OCT19	Soil	Lead	SW6010C	mg/kg	14.1	0.42	0.34	0.073			3,000

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
E Range	SSERNG006_OCT19	Soil	Magnesium	SW6010C	mg/kg	882	8.4	6.7	0.57			
E Range	SSERNG006_OCT19	Soil	pH	SW9045D	pH units	5.6	0.1	--	0.1			
E Range	SSERNG006_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	230	16	8.1	4.2			
E Range	SSERNG006_OCT19	Soil	Potassium	SW6010C	mg/kg	422	84	42	2.4			
E Range	SSERNG006_OCT19	Soil	Sodium	SW6010C	mg/kg	26.8	84	42	1.3	J	TR	
E Range	SSERNG006_OCT19	Soil	Sulfate	SW9056A	mg/L	12	10	5.0	0.637			
I Range	SSIRNG001_OCT19	Soil	Antimony	SW6010C	mg/kg	0.45	0.57	0.36	0.05	J	TR	300
I Range	SSIRNG001_OCT19	Soil	Calcium	SW6010C	mg/kg	936	7.1	5.7	1.3			
I Range	SSIRNG001_OCT19	Soil	Chloride	SW9056A	mg/L	14	20	10	0.993	J	TR	
I Range	SSIRNG001_OCT19	Soil	Copper	SW6010C	mg/kg	27.9	1.8	0.71	0.11			10,000
I Range	SSIRNG001_OCT19	Soil	Lead	SW6010C	mg/kg	70.3	0.36	0.28	0.062			3,000
I Range	SSIRNG001_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,130	7.1	5.7	0.48			
I Range	SSIRNG001_OCT19	Soil	pH	SW9045D	pH units	5.8	0.1	--	0.1			
I Range	SSIRNG001_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	560	30	15	7.8			
I Range	SSIRNG001_OCT19	Soil	Potassium	SW6010C	mg/kg	559	71	36	2.1			
I Range	SSIRNG001_OCT19	Soil	Sodium	SW6010C	mg/kg	33.1	71	36	1.1	J	TR	
I Range	SSIRNG001_OCT19	Soil	Sulfate	SW9056A	mg/L	4.8	10	5.0	0.64	J	TR	
J Range	SSJRNG001_OCT19	Soil	Antimony	SW6010C	mg/kg	0.45	0.71	0.44	0.062	J	TR/MS%R	300
J Range	SSJRNG001_OCT19	Soil	Calcium	SW6010C	mg/kg	5,130	8.9	7.1	1.6			
J Range	SSJRNG001_OCT19	Soil	Chloride	SW9056A	mg/L	8.1	20	10	0.993	J	TR/MS%R	
J Range	SSJRNG001_OCT19	Soil	Copper	SW6010C	mg/kg	34.8	2.2	0.89	0.14			10,000
J Range	SSJRNG001_OCT19	Soil	Lead	SW6010C	mg/kg	32.1	0.44	0.36	0.078	J	MS%R	3,000
J Range	SSJRNG001_OCT19	Soil	Magnesium	SW6010C	mg/kg	7,250	8.9	7.1	0.61			
J Range	SSJRNG001_OCT19	Soil	pH	SW9045D	pH units	7.8	0.1	--	0.1			
J Range	SSJRNG001_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	300	21	11	5.5			
J Range	SSJRNG001_OCT19	Soil	Potassium	SW6010C	mg/kg	2,760	89	44	2.6	J	MS%R	
J Range	SSJRNG001_OCT19	Soil	Sodium	SW6010C	mg/kg	80	89	44	1.3	J	TR	
J Range	SSJRNG001_OCT19	Soil	Sulfate	SW9056A	mg/L	18	10	5.0	0.64	J	MS%R	
J Range	SSJRNG002_OCT19	Soil	Antimony	SW6010C	mg/kg	0.47	0.78	0.49	0.068	J	TR	300
J Range	SSJRNG002_OCT19	Soil	Calcium	SW6010C	mg/kg	2,540	9.7	7.8	1.8			
J Range	SSJRNG002_OCT19	Soil	Chloride	SW9056A	mg/L	17	20	10	0.993	J	TR	
J Range	SSJRNG002_OCT19	Soil	Copper	SW6010C	mg/kg	15.5	2.4	0.97	0.16			10,000
J Range	SSJRNG002_OCT19	Soil	Lead	SW6010C	mg/kg	52.4	0.49	0.39	0.085			3,000
J Range	SSJRNG002_OCT19	Soil	Magnesium	SW6010C	mg/kg	2,160	9.7	7.8	0.66			
J Range	SSJRNG002_OCT19	Soil	pH	SW9045D	pH units	7.2	0.1	--	0.1			
J Range	SSJRNG002_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	300	18	8.8	4.6			

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
J Range	SSJRNG002_OCT19	Soil	Potassium	SW6010C	mg/kg	677	97	49	2.8			
J Range	SSJRNG002_OCT19	Soil	Sodium	SW6010C	mg/kg	39.5	97	49	1.5	J	TR	
J Range	SSJRNG002_OCT19	Soil	Sulfate	SW9056A	mg/L	9.1	10	5.0	0.637	J	TR	
J Range	SSJRNG003_OCT19	Soil	Antimony	SW6010C	mg/kg	0.49	0.66	0.41	0.058	J	TR	300
J Range	SSJRNG003_OCT19	Soil	Calcium	SW6010C	mg/kg	2,260	8.2	6.6	1.5			
J Range	SSJRNG003_OCT19	Soil	Chloride	SW9056A	mg/L	13	20	10	0.993	J	TR	
J Range	SSJRNG003_OCT19	Soil	Copper	SW6010C	mg/kg	19.7	2.0	0.82	0.13			10,000
J Range	SSJRNG003_OCT19	Soil	Lead	SW6010C	mg/kg	79.3	0.41	0.33	0.072			3,000
J Range	SSJRNG003_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,880	8.2	6.6	0.56			
J Range	SSJRNG003_OCT19	Soil	pH	SW9045D	pH units	7.1	0.1	--	0.1			
J Range	SSJRNG003_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	280	15	7.5	3.9			
J Range	SSJRNG003_OCT19	Soil	Potassium	SW6010C	mg/kg	611	82	41	2.4			
J Range	SSJRNG003_OCT19	Soil	Sodium	SW6010C	mg/kg	40.2	82	41	1.2	J	TR	
J Range	SSJRNG003_OCT19	Soil	Sulfate	SW9056A	mg/L	7.8	10	5.0	0.64	J	TR	
J Range	SSJRNG004_OCT19	Soil	Antimony	SW6010C	mg/kg	0.58	0.72	0.45	0.063	J	TR	300
J Range	SSJRNG004_OCT19	Soil	Calcium	SW6010C	mg/kg	2,630	9.0	7.2	1.6			
J Range	SSJRNG004_OCT19	Soil	Chloride	SW9056A	mg/L	16	20	10	0.993	J	TR	
J Range	SSJRNG004_OCT19	Soil	Copper	SW6010C	mg/kg	23.2	2.2	0.90	0.14			10,000
J Range	SSJRNG004_OCT19	Soil	Lead	SW6010C	mg/kg	69.7	0.45	0.36	0.078			3,000
J Range	SSJRNG004_OCT19	Soil	Magnesium	SW6010C	mg/kg	2,270	9.0	7.2	0.61			
J Range	SSJRNG004_OCT19	Soil	pH	SW9045D	pH units	7.2	0.1	--	0.1			
J Range	SSJRNG004_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	240	19	9.4	4.9			
J Range	SSJRNG004_OCT19	Soil	Potassium	SW6010C	mg/kg	724	90	45	2.6			
J Range	SSJRNG004_OCT19	Soil	Sodium	SW6010C	mg/kg	44.8	90	45	1.3	J	TR	
J Range	SSJRNG004_OCT19	Soil	Sulfate	SW9056A	mg/L	8.3	10	5.0	0.64	J	TR	
J Range	SSJRNG005_OCT19	Soil	Antimony	SW6010C	mg/kg	0.44	0.72	0.45	0.063	J	TR	300
J Range	SSJRNG005_OCT19	Soil	Calcium	SW6010C	mg/kg	2,590	9.0	7.2	1.6			
J Range	SSJRNG005_OCT19	Soil	Chloride	SW9056A	mg/L	20	20	10	0.993			
J Range	SSJRNG005_OCT19	Soil	Copper	SW6010C	mg/kg	30.6	2.2	0.9	0.14			10,000
J Range	SSJRNG005_OCT19	Soil	Lead	SW6010C	mg/kg	129	0.45	0.36	0.078			3,000
J Range	SSJRNG005_OCT19	Soil	Magnesium	SW6010C	mg/kg	2,460	9.0	7.2	0.61			
J Range	SSJRNG005_OCT19	Soil	pH	SW9045D	pH units	7.2	0.1	--	0.1			
J Range	SSJRNG005_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	300	21	11	5.5			
J Range	SSJRNG005_OCT19	Soil	Potassium	SW6010C	mg/kg	727	90	45	2.6			
J Range	SSJRNG005_OCT19	Soil	Sodium	SW6010C	mg/kg	44.4	90	45	1.3	J	TR	
J Range	SSJRNG005_OCT19	Soil	Sulfate	SW9056A	mg/L	9.1	10	5.0	0.64	J	TR	

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
J Range	SSJRNG006_OCT19	Soil	Antimony	SW6010C	mg/kg	0.19	0.54	0.34	0.047	J	TR	300
J Range	SSJRNG006_OCT19	Soil	Calcium	SW6010C	mg/kg	1,190	6.8	5.4	1.2			
J Range	SSJRNG006_OCT19	Soil	Chloride	SW9056A	mg/L	11	20	10	0.993	J	TR	
J Range	SSJRNG006_OCT19	Soil	Copper	SW6010C	mg/kg	11.1	1.7	0.68	0.11			10,000
J Range	SSJRNG006_OCT19	Soil	Lead	SW6010C	mg/kg	69.2	0.34	0.27	0.059			3,000
J Range	SSJRNG006_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,110	6.8	5.4	0.46			
J Range	SSJRNG006_OCT19	Soil	pH	SW9045D	pH units	6.9	0.1	--	0.1			
J Range	SSJRNG006_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	260	14	6.9	3.6			
J Range	SSJRNG006_OCT19	Soil	Potassium	SW6010C	mg/kg	481	68	34	2			
J Range	SSJRNG006_OCT19	Soil	Sodium	SW6010C	mg/kg	25.8	68	34	1	J	TR	
J Range	SSJRNG006_OCT19	Soil	Sulfate	SW9056A	mg/L	3.7	10	5.0	0.64	J	TR	
K Range	SSKRNG001_OCT19	Soil	Antimony	SW6010C	mg/kg	0.704	0.6	0.38	0.053	J	MS%R	300
K Range	SSKRNG001_OCT19	Soil	Calcium	SW6010C	mg/kg	4,950	7.6	6.0	1.4	J	MS%R	
K Range	SSKRNG001_OCT19	Soil	Chloride	SW9056A	mg/L	8.8	20	10	0.993	J	TR	
K Range	SSKRNG001_OCT19	Soil	Copper	SW6010C	mg/kg	53.7	1.9	0.76	0.12	J	MS%R	10,000
K Range	SSKRNG001_OCT19	Soil	Lead	SW6010C	mg/kg	21.7	0.38	0.3	0.066	J	MS%R	3,000
K Range	SSKRNG001_OCT19	Soil	Magnesium	SW6010C	mg/kg	9,630	7.6	6.0	0.51			
K Range	SSKRNG001_OCT19	Soil	pH	SW9045D	pH units	7.8	0.1	--	0.1			
K Range	SSKRNG001_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	510	48	24	12			
K Range	SSKRNG001_OCT19	Soil	Potassium	SW6010C	mg/kg	3,480	76	38	2.2			
K Range	SSKRNG001_OCT19	Soil	Sodium	SW6010C	mg/kg	116	76	38	1.1			
K Range	SSKRNG001_OCT19	Soil	Sulfate	SW9056A	mg/L	10	10	5.0	0.637			
K Range	SSKRNG002_OCT19	Soil	Antimony	SW6010C	mg/kg	0.49	0.62	0.39	0.055	J	TR	300
K Range	SSKRNG002_OCT19	Soil	Calcium	SW6010C	mg/kg	3,240	7.8	6.2	1.4			
K Range	SSKRNG002_OCT19	Soil	Chloride	SW9056A	mg/L	21	20	10	0.993			
K Range	SSKRNG002_OCT19	Soil	Copper	SW6010C	mg/kg	20.6	2.00	0.78	0.12			10,000
K Range	SSKRNG002_OCT19	Soil	Lead	SW6010C	mg/kg	30.8	0.39	0.31	0.068			3,000
K Range	SSKRNG002_OCT19	Soil	Magnesium	SW6010C	mg/kg	2,860	7.8	6.2	0.53			
K Range	SSKRNG002_OCT19	Soil	pH	SW9045D	pH units	7.3	0.1	--	0.1			
K Range	SSKRNG002_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	310	19	9.4	4.9			
K Range	SSKRNG002_OCT19	Soil	Potassium	SW6010C	mg/kg	802	78	39	2.3			
K Range	SSKRNG002_OCT19	Soil	Sodium	SW6010C	mg/kg	40.8	78	39	1.2	J	TR	
K Range	SSKRNG002_OCT19	Soil	Sulfate	SW9056A	mg/L	4.0	10	5.0	0.637	J	TR	
K Range	SSKRNG003_OCT19	Soil	Antimony	SW6010C	mg/kg	0.31	0.50	0.31	0.044	J	TR	300
K Range	SSKRNG003_OCT19	Soil	Calcium	SW6010C	mg/kg	1,940	6.2	5.0	1.1			
K Range	SSKRNG003_OCT19	Soil	Chloride	SW9056A	mg/L	15	20	10	0.993	J	TR	

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
K Range	SSKRNG003_OCT19	Soil	Copper	SW6010C	mg/kg	11.3	1.6	0.62	0.1			10,000
K Range	SSKRNG003_OCT19	Soil	Lead	SW6010C	mg/kg	52.6	0.31	0.25	0.054			3,000
K Range	SSKRNG003_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,970	6.2	5	0.43			
K Range	SSKRNG003_OCT19	Soil	pH	SW9045D	pH units	7.1	0.1	--	0.1			
K Range	SSKRNG003_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	290	21	11	5.5			
K Range	SSKRNG003_OCT19	Soil	Potassium	SW6010C	mg/kg	629	62	31	1.8			
K Range	SSKRNG003_OCT19	Soil	Sodium	SW6010C	mg/kg	33.6	62	31	0.94	J	TR	
K Range	SSKRNG003_OCT19	Soil	Sulfate	SW9056A	mg/L	4.4	10	5.0	0.64	J	TR	
K Range	SSKRNG004_OCT19	Soil	Antimony	SW6010C	mg/kg	0.29	0.45	0.28	0.04	J	TR	300
K Range	SSKRNG004_OCT19	Soil	Calcium	SW6010C	mg/kg	2,200	5.7	4.5	1.0			
K Range	SSKRNG004_OCT19	Soil	Chloride	SW9056A	mg/L	13	20	10	0.993	J	TR	
K Range	SSKRNG004_OCT19	Soil	Copper	SW6010C	mg/kg	13.1	1.4	0.57	0.091			10,000
K Range	SSKRNG004_OCT19	Soil	Lead	SW6010C	mg/kg	28.6	0.28	0.23	0.049			3,000
K Range	SSKRNG004_OCT19	Soil	Magnesium	SW6010C	mg/kg	2,120	5.7	4.5	0.39			
K Range	SSKRNG004_OCT19	Soil	pH	SW9045D	pH units	7.1	0.1	--	0.1			
K Range	SSKRNG004_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	230	19	9.4	4.9			
K Range	SSKRNG004_OCT19	Soil	Potassium	SW6010C	mg/kg	617	57	28	1.6			
K Range	SSKRNG004_OCT19	Soil	Sodium	SW6010C	mg/kg	32.6	57	28	0.85	J	TR	
K Range	SSKRNG004_OCT19	Soil	Sulfate	SW9056A	mg/L	4.6	10	5.0	0.64	J	TR	
K Range	SSKRNG004_OCT19	Soil	Sulfate	SW9056A	mg/L	4.6	10	5.0	0.64	J	TR	
K Range	SSKRNG005_OCT19	Soil	Antimony	SW6010C	mg/kg	0.29	0.73	0.46	0.064	J	TR	300
K Range	SSKRNG005_OCT19	Soil	Calcium	SW6010C	mg/kg	2,240	9.1	7.3	1.6			
K Range	SSKRNG005_OCT19	Soil	Chloride	SW9056A	mg/L	14	20	10	0.993	J	TR	
K Range	SSKRNG005_OCT19	Soil	Copper	SW6010C	mg/kg	14.1	2.3	0.91	0.15			10,000
K Range	SSKRNG005_OCT19	Soil	Lead	SW6010C	mg/kg	36.9	0.46	0.36	0.079			3,000
K Range	SSKRNG005_OCT19	Soil	Magnesium	SW6010C	mg/kg	2,080	9.1	7.3	0.62			
K Range	SSKRNG005_OCT19	Soil	pH	SW9045D	pH units	7.3	0.1	--	0.1			
K Range	SSKRNG005_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	280	19	9.4	4.9			
K Range	SSKRNG005_OCT19	Soil	Potassium	SW6010C	mg/kg	681	91	46	2.6			
K Range	SSKRNG005_OCT19	Soil	Sodium	SW6010C	mg/kg	34.7	91	46	1.4	J	TR	
K Range	SSKRNG005_OCT19	Soil	Sulfate	SW9056A	mg/L	5.5	10	5.0	0.637	J	TR	
K Range	SSKRNG005_OCT19	Soil	Sulfate	SW9056A	mg/L	5.5	10	5.0	0.637	J	TR	
K Range	SSKRNG006_OCT19	Soil	Antimony	SW6010C	mg/kg	0.11	0.64	0.4	0.057	J	TR	300
K Range	SSKRNG006_OCT19	Soil	Calcium	SW6010C	mg/kg	1,180	8.1	6.4	1.5			
K Range	SSKRNG006_OCT19	Soil	Chloride	SW9056A	mg/L	18	20	10	0.993	J	TR	
K Range	SSKRNG006_OCT19	Soil	Copper	SW6010C	mg/kg	11	2	0.81	0.13			10,000

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
K Range	SSKRNG006_OCT19	Soil	Lead	SW6010C	mg/kg	24.5	0.4	0.32	0.07			3,000
K Range	SSKRNG006_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,060	8.1	6.4	0.55			
K Range	SSKRNG006_OCT19	Soil	pH	SW9045D	pH units	6.8	0.1	--	0.1			
K Range	SSKRNG006_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	200	15	7.5	3.9			
K Range	SSKRNG006_OCT19	Soil	Potassium	SW6010C	mg/kg	455	81	40	2.3			
K Range	SSKRNG006_OCT19	Soil	Sodium	SW6010C	mg/kg	24.8	81	40	1.2	J	TR	
K Range	SSKRNG006_OCT19	Soil	Sulfate	SW9056A	mg/L	9.9	10	5.0	0.637	J	TR	
L Range	SSLRNG001_OCT19	Soil	Antimony	SW6010C	mg/kg	0.094	0.57	0.35	0.05	J	TR	300
L Range	SSLRNG001_OCT19	Soil	Calcium	SW6010C	mg/kg	1,990	7.1	5.7	1.3			
L Range	SSLRNG001_OCT19	Soil	Chloride	SW9056A	mg/L	35	20	10	0.993			10,000
L Range	SSLRNG001_OCT19	Soil	Copper	SW6010C	mg/kg	13.3	1.8	0.71	0.11			
L Range	SSLRNG001_OCT19	Soil	Lead	SW6010C	mg/kg	13.2	0.35	0.28	0.062			3,000
L Range	SSLRNG001_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,440	7.1	5.7	0.48			
L Range	SSLRNG001_OCT19	Soil	pH	SW9045D	pH units	5.5	0.1	--	0.1			300
L Range	SSLRNG001_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	530	48	24	12			
L Range	SSLRNG001_OCT19	Soil	Potassium	SW6010C	mg/kg	741	71	35	2.1			300
L Range	SSLRNG001_OCT19	Soil	Sodium	SW6010C	mg/kg	42.6	71	35	1.1	J	TR	
L Range	SSLRNG001_OCT19	Soil	Sulfate	SW9056A	mg/L	4.2	10	5.0	0.64	J	TR	300
L Range	SSLRNG002_OCT19	Soil	Antimony	SW6010C	mg/kg	0.42	0.68	0.42	0.059	U	ND	
L Range	SSLRNG002_OCT19	Soil	Calcium	SW6010C	mg/kg	6,020	8.4	6.8	1.5			10,000
L Range	SSLRNG002_OCT19	Soil	Chloride	SW9056A	mg/L	46	20	10	0.993			
L Range	SSLRNG002_OCT19	Soil	Copper	SW6010C	mg/kg	15.3	2.1	0.84	0.14			3,000
L Range	SSLRNG002_OCT19	Soil	Lead	SW6010C	mg/kg	12	0.42	0.34	0.074			
L Range	SSLRNG002_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,530	8.4	6.8	0.57			300
L Range	SSLRNG002_OCT19	Soil	pH	SW9045D	pH units	7.8	0.1	--	0.1			
L Range	SSLRNG002_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	370	35	18	9.1			300
L Range	SSLRNG002_OCT19	Soil	Potassium	SW6010C	mg/kg	724	84	42	2.5			
L Range	SSLRNG002_OCT19	Soil	Sodium	SW6010C	mg/kg	47.4	84	42	1.3	J	TR	300
L Range	SSLRNG002_OCT19	Soil	Sulfate	SW9056A	mg/L	13	10	5.0	0.637			
S Range	SSSRNG001_OCT19	Soil	Antimony	SW6010C	mg/kg	0.648	0.43	0.27	0.038			300
S Range	SSSRNG001_OCT19	Soil	Calcium	SW6010C	mg/kg	976	5.4	4.3	0.97			
S Range	SSSRNG001_OCT19	Soil	Chloride	SW9056A	mg/L	23	20	10	0.993			10,000
S Range	SSSRNG001_OCT19	Soil	Copper	SW6010C	mg/kg	50.6	1.3	0.54	0.086			
S Range	SSSRNG001_OCT19	Soil	Lead	SW6010C	mg/kg	17.8	0.27	0.21	0.047			3,000
S Range	SSSRNG001_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,020	5.4	4.3	0.36			
S Range	SSSRNG001_OCT19	Soil	pH	SW9045D	pH units	6.1	0.1	--	0.1			

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
S Range	SSSRNG001_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	290	15	7.5	3.9			
S Range	SSSRNG001_OCT19	Soil	Potassium	SW6010C	mg/kg	497	54	27	1.6			
S Range	SSSRNG001_OCT19	Soil	Sodium	SW6010C	mg/kg	27.6	54	27	0.8	J	TR	
S Range	SSSRNG001_OCT19	Soil	Sulfate	SW9056A	mg/L	8.2	10	5.0	0.637	J	TR	
T Range	SSTRNG001_OCT19	Soil	Antimony	SW6010C	mg/kg	0.089	0.78	0.49	0.068	J	TR/MS%R	300
T Range	SSTRNG001_OCT19	Soil	Calcium	SW6010C	mg/kg	3,130	9.8	7.8	1.8			
T Range	SSTRNG001_OCT19	Soil	Chloride	SW9056A	mg/L	34	20	10	0.993	J	MS%R	
T Range	SSTRNG001_OCT19	Soil	Copper	SW6010C	mg/kg	17.5	2.4	0.98	0.16			10,000
T Range	SSTRNG001_OCT19	Soil	Lead	SW6010C	mg/kg	17.3	0.49	0.39	0.085	J	MS%R	3,000
T Range	SSTRNG001_OCT19	Soil	Magnesium	SW6010C	mg/kg	3,550	9.8	7.8	0.66			
T Range	SSTRNG001_OCT19	Soil	pH	SW9045D	pH units	7.4	0.1	--	0.1			
T Range	SSTRNG001_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	340	32	16	8.4			
T Range	SSTRNG001_OCT19	Soil	Potassium	SW6010C	mg/kg	1,600	98	49	2.8			
T Range	SSTRNG001_OCT19	Soil	Sodium	SW6010C	mg/kg	67	98	49	1.5	J	TR	
T Range	SSTRNG001_OCT19	Soil	Sulfate	SW9056A	mg/L	24	10	5.0	0.637			
T Range	SSTRNG002_OCT19	Soil	Antimony	SW6010C	mg/kg	0.15	0.74	0.46	0.065	J	TR	300
T Range	SSTRNG002_OCT19	Soil	Calcium	SW6010C	mg/kg	2,030	9.3	7.4	1.7			
T Range	SSTRNG002_OCT19	Soil	Chloride	SW9056A	mg/L	66	20	10	0.993			
T Range	SSTRNG002_OCT19	Soil	Copper	SW6010C	mg/kg	14.4	2.3	0.93	0.15			10,000
T Range	SSTRNG002_OCT19	Soil	Lead	SW6010C	mg/kg	39.6	0.46	0.37	0.081			3,000
T Range	SSTRNG002_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,540	9.3	7.4	0.63			
T Range	SSTRNG002_OCT19	Soil	pH	SW9045D	pH units	6.8	0.1	--	0.1			
T Range	SSTRNG002_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	460	29	14	7.5			
T Range	SSTRNG002_OCT19	Soil	Potassium	SW6010C	mg/kg	713	93	46	2.7			
T Range	SSTRNG002_OCT19	Soil	Sodium	SW6010C	mg/kg	41.6	93	46	1.4	J	TR	
T Range	SSTRNG002_OCT19	Soil	Sulfate	SW9056A	mg/L	8.9	10	5.0	0.64	J	TR	
T Range	SSTRNG003_OCT19	Soil	Antimony	SW6010C	mg/kg	0.618	0.7	0.43	0.061	J	TR	300
T Range	SSTRNG003_OCT19	Soil	Calcium	SW6010C	mg/kg	3,640	8.7	7	1.6			
T Range	SSTRNG003_OCT19	Soil	Chloride	SW9056A	mg/L	33	20	10	0.993			
T Range	SSTRNG003_OCT19	Soil	Copper	SW6010C	mg/kg	75.8	2.2	0.87	0.14			10,000
T Range	SSTRNG003_OCT19	Soil	Lead	SW6010C	mg/kg	176	0.43	0.35	0.076			3,000
T Range	SSTRNG003_OCT19	Soil	Magnesium	SW6010C	mg/kg	2,010	8.7	7	0.59			
T Range	SSTRNG003_OCT19	Soil	pH	SW9045D	pH units	7	0.1	--	0.1			
T Range	SSTRNG003_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	1,400	85	42	22			
T Range	SSTRNG003_OCT19	Soil	Potassium	SW6010C	mg/kg	767	87	43	2.5			
T Range	SSTRNG003_OCT19	Soil	Sodium	SW6010C	mg/kg	50.5	87	43	1.3	J	TR	

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
T Range	SSTRNG003_OCT19	Soil	Sulfate	SW9056A	mg/L	4.7	10	5.0	0.64	J	TR	
T Range	SSTRNG004_OCT19	Soil	Antimony	SW6010C	mg/kg	0.32	0.81	0.51	0.071	J	TR	300
T Range	SSTRNG004_OCT19	Soil	Calcium	SW6010C	mg/kg	2,430	10	8.1	1.8			
T Range	SSTRNG004_OCT19	Soil	Chloride	SW9056A	mg/L	30	20	10	0.993			
T Range	SSTRNG004_OCT19	Soil	Copper	SW6010C	mg/kg	174	2.5	1	0.16			10,000
T Range	SSTRNG004_OCT19	Soil	Lead	SW6010C	mg/kg	113	0.51	0.41	0.089			3,000
T Range	SSTRNG004_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,760	10	8.1	0.69			
T Range	SSTRNG004_OCT19	Soil	pH	SW9045D	pH units	7	0.1	--	0.1			
T Range	SSTRNG004_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	700	40	20	10			
T Range	SSTRNG004_OCT19	Soil	Potassium	SW6010C	mg/kg	702	100	51	3			
T Range	SSTRNG004_OCT19	Soil	Sodium	SW6010C	mg/kg	50.9	100	51	1.5	J	TR	
T Range	SSTRNG004_OCT19	Soil	Sulfate	SW9056A	mg/L	6.4	10	5.0	0.64	J	TR	
T Range	SSTRNG005_OCT19	Soil	Antimony	SW6010C	mg/kg	0.24	0.41	0.26	0.036	J	TR	300
T Range	SSTRNG005_OCT19	Soil	Calcium	SW6010C	mg/kg	2,940	5.1	4.1	0.92			
T Range	SSTRNG005_OCT19	Soil	Chloride	SW9056A	mg/L	26	20	10	0.993			
T Range	SSTRNG005_OCT19	Soil	Copper	SW6010C	mg/kg	29.1	1.3	0.51	0.082			10,000
T Range	SSTRNG005_OCT19	Soil	Lead	SW6010C	mg/kg	119	0.26	0.2	0.045			3,000
T Range	SSTRNG005_OCT19	Soil	Magnesium	SW6010C	mg/kg	1,560	5.1	4.1	0.35			
T Range	SSTRNG005_OCT19	Soil	pH	SW9045D	pH units	7.1	0.1	--	0.1			
T Range	SSTRNG005_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	720	40	20	10			
T Range	SSTRNG005_OCT19	Soil	Potassium	SW6010C	mg/kg	634	51	26	1.5			
T Range	SSTRNG005_OCT19	Soil	Sodium	SW6010C	mg/kg	43.2	51	26	0.77	J		
T Range	SSTRNG005_OCT19	Soil	Sulfate	SW9056A	mg/L	2.6	10	5.0	0.637	J	TR	
T Range	SSTRNG006_OCT19	Soil	Antimony	SW6010C	mg/kg	0.22	0.73	0.46	0.064	J		300
T Range	SSTRNG006_OCT19	Soil	Calcium	SW6010C	mg/kg	5,020	9.2	7.3	1.7			
T Range	SSTRNG006_OCT19	Soil	Chloride	SW9056A	mg/L	16	20	10	0.993	J		
T Range	SSTRNG006_OCT19	Soil	Copper	SW6010C	mg/kg	33.3	2.3	0.92	0.15			10,000
T Range	SSTRNG006_OCT19	Soil	Lead	SW6010C	mg/kg	178	0.46	0.37	0.08			3,000
T Range	SSTRNG006_OCT19	Soil	Magnesium	SW6010C	mg/kg	2,620	9.2	7.3	0.62			
T Range	SSTRNG006_OCT19	Soil	pH	SW9045D	pH units	7.3	0.1	--	0.1			
T Range	SSTRNG006_OCT19	Soil	Phosphorus, total	E365.4	mg/kg	920	76	38	20			
T Range	SSTRNG006_OCT19	Soil	Potassium	SW6010C	mg/kg	1,040	92	46	2.7			
T Range	SSTRNG006_OCT19	Soil	Sodium	SW6010C	mg/kg	88.9	92	46	1.4	J	TR	
T Range	SSTRNG006_OCT19	Soil	Sulfate	SW9056A	mg/L	9.4	10	5.0	0.637	J	TR	

Notes:

µg/L = microgram(s) per liter

ND = nondetectable

CAMP EDWARDS SMALL ARMS RANGE BASELINE SOIL MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (mg/kg)
DL = detection limit		LOQ = limit of quantitation										
ID = identifier		TR = trace result (<LOQ and >DL)										
J = estimated value		U = not detected										

Firing Range Sampling Reports

Lysimeter Sampling Results

CAMP EDWARDS SMALL ARMS RANGE BASELINE POREWATER MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (µg/L)
I Range	LYIRNG001_OCT19	Water	Alkalinity, total	SM2320B	mg/L	4.0	5.0	4.0	0.23	U	ND	
I Range	LYIRNG001_OCT19	Water	Antimony	SW6020A	µg/L	3.1	1.0	0.055	0.50			6
I Range	LYIRNG001_OCT19	Water	Calcium	SW6020A	µg/L	2,140	100	21	80			
I Range	LYIRNG001_OCT19	Water	Chloride	SW9056A	mg/L	2.3	2.0	1.0	0.0993			
I Range	LYIRNG001_OCT19	Water	Copper	SW6020A	µg/L	9.18	3.0	0.19	2.0			1300
I Range	LYIRNG001_OCT19	Water	Lead	SW6020A	µg/L	2.79	1.0	0.075	0.50			15
I Range	LYIRNG001_OCT19	Water	Magnesium	SW6020A	µg/L	596	100	8.0	80			
I Range	LYIRNG001_OCT19	Water	Potassium	SW6020A	µg/L	2,490	1,000	31	400			
I Range	LYIRNG001_OCT19	Water	Sodium	SW6020A	µg/L	1,700	1,000	19	400			
I Range	LYIRNG001_OCT19	Water	Sulfate	SW9056A	mg/L	32	1.0	0.50	0.064			
I Range	LYIRNG002_OCT19	Water	Alkalinity, total	SM2320B	mg/L	22	5.0	4.0	0.23			
I Range	LYIRNG002_OCT19	Water	Antimony	SW6020A	µg/L	8.04	1.0	0.055	0.50			6
I Range	LYIRNG002_OCT19	Water	Calcium	SW6020A	µg/L	20400	100	21	80			
I Range	LYIRNG002_OCT19	Water	Chloride	SW9056A	mg/L	18	2.0	1.0	0.0993			
I Range	LYIRNG002_OCT19	Water	Copper	SW6020A	µg/L	262	3.0	0.19	2.0			1300
I Range	LYIRNG002_OCT19	Water	Lead	SW6020A	µg/L	0.30	1.0	0.075	0.50	J	TR	15
I Range	LYIRNG002_OCT19	Water	Magnesium	SW6020A	µg/L	4960	100	8.0	80			
I Range	LYIRNG002_OCT19	Water	Potassium	SW6020A	µg/L	2,560	1,000	31	400			
I Range	LYIRNG002_OCT19	Water	Sodium	SW6020A	µg/L	6,420	1,000	19	400			
I Range	LYIRNG002_OCT19	Water	Sulfate	SW9056A	mg/L	12	1.0	0.50	0.064			
J Range	LYJRNG001_OCT19	Water	Alkalinity, total	SM2320B	mg/L	45	5.0	4.0	0.23			
J Range	LYJRNG001_OCT19	Water	Antimony	SW6020A	µg/L	0.994	1.0	0.055	0.50	J	TR	6
J Range	LYJRNG001_OCT19	Water	Calcium	SW6020A	µg/L	9410	100	21	80			
J Range	LYJRNG001_OCT19	Water	Chloride	SW9056A	mg/L	2.4	2.0	1.0	0.0993			
J Range	LYJRNG001_OCT19	Water	Copper	SW6020A	µg/L	2.53	3.0	0.19	2.0	J	TR	1300
J Range	LYJRNG001_OCT19	Water	Lead	SW6020A	µg/L	0.14	1.0	0.075	0.50	J	TR	15
J Range	LYJRNG001_OCT19	Water	Magnesium	SW6020A	µg/L	4900	100	8.0	80			
J Range	LYJRNG001_OCT19	Water	Potassium	SW6020A	µg/L	3,630	1,000	31	400			
J Range	LYJRNG001_OCT19	Water	Sodium	SW6020A	µg/L	2,260	1,000	19	400			
J Range	LYJRNG001_OCT19	Water	Sulfate	SW9056A	mg/L	1.1	1.0	0.50	0.064			
J Range	LYJRNG002_OCT19	Water	Alkalinity, total	SM2320B	mg/L	64	5.0	4.0	0.23			
J Range	LYJRNG002_OCT19	Water	Antimony	SW6020A	µg/L	1.35	1.0	0.055	0.50			6
J Range	LYJRNG002_OCT19	Water	Calcium	SW6020A	µg/L	14,600	100	21	80			
J Range	LYJRNG002_OCT19	Water	Chloride	SW9056A	mg/L	3.4	2.0	1.0	0.0993			
J Range	LYJRNG002_OCT19	Water	Copper	SW6020A	µg/L	3.27	3.0	0.19	2.0			1300
J Range	LYJRNG002_OCT19	Water	Lead	SW6020A	µg/L	0.46	1.0	0.075	0.50	J	TR	15
J Range	LYJRNG002_OCT19	Water	Magnesium	SW6020A	µg/L	7830	100	8.0	80			
J Range	LYJRNG002_OCT19	Water	Potassium	SW6020A	µg/L	2,910	1,000	31	400			

CAMP EDWARDS SMALL ARMS RANGE BASELINE POREWATER MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (µg/L)
J Range	LYJ RNG002_OCT19	Water	Sodium	SW6020A	µg/L	2,200	1,000	19	400			
J Range	LYJ RNG002_OCT19	Water	Sulfate	SW9056A	mg/L	1.6	1.0	0.50	0.064			
J Range	LYJ RNG003_OCT19	Water	Alkalinity, total	SM2320B	mg/L	130	5.0	4.0	0.23			
J Range	LYJ RNG003_OCT19	Water	Antimony	SW6020A	µg/L	46	1.0	0.055	0.50			6
J Range	LYJ RNG003_OCT19	Water	Calcium	SW6020A	µg/L	47700	100	21	80			
J Range	LYJ RNG003_OCT19	Water	Chloride	SW9056A	mg/L	2.6	2.0	1.0	0.0993			
J Range	LYJ RNG003_OCT19	Water	Copper	SW6020A	µg/L	4.15	3.0	0.19	2.0			1300
J Range	LYJ RNG003_OCT19	Water	Lead	SW6020A	µg/L	0.23	1.0	0.075	0.50	J	TR	15
J Range	LYJ RNG003_OCT19	Water	Magnesium	SW6020A	µg/L	3380	100	8.0	80			
J Range	LYJ RNG003_OCT19	Water	Potassium	SW6020A	µg/L	91	1,000	31	400	J	TR	
J Range	LYJ RNG003_OCT19	Water	Sodium	SW6020A	µg/L	3,660	1,000	19	400			
J Range	LYJ RNG003_OCT19	Water	Sulfate	SW9056A	mg/L	3.5	1.0	0.50	0.064			
K Range	LYK RNG001_OCT19	Water	Alkalinity, total	SM2320B	mg/L	40	5.0	4.0	0.23			
K Range	LYK RNG001_OCT19	Water	Antimony	SW6020A	µg/L	0.574	1.0	0.055	0.50	J	TR	6
K Range	LYK RNG001_OCT19	Water	Calcium	SW6020A	µg/L	9,020	100	21	80			
K Range	LYK RNG001_OCT19	Water	Chloride	SW9056A	mg/L	3.8	2.0	1.0	0.0993			
K Range	LYK RNG001_OCT19	Water	Copper	SW6020A	µg/L	1.2	3.0	0.19	2.0	J	TR	1300
K Range	LYK RNG001_OCT19	Water	Lead	SW6020A	µg/L	0.50	1.0	0.075	0.50	U	ND	15
K Range	LYK RNG001_OCT19	Water	Magnesium	SW6020A	µg/L	4900	100	8.0	80			
K Range	LYK RNG001_OCT19	Water	Potassium	SW6020A	µg/L	727	1,000	31	400	J	TR	
K Range	LYK RNG001_OCT19	Water	Sodium	SW6020A	µg/L	3,840	1,000	19	400			
K Range	LYK RNG001_OCT19	Water	Sulfate	SW9056A	mg/L	2.7	1.0	0.50	0.064			
K Range	LYK RNG002_OCT19	Water	Alkalinity, total	SM2320B	mg/L	35	5.0	4.0	0.23			
K Range	LYK RNG002_OCT19	Water	Antimony	SW6020A	µg/L	0.25	1.0	0.055	0.50	J	TR	6
K Range	LYK RNG002_OCT19	Water	Calcium	SW6020A	µg/L	7200	100	21	80			
K Range	LYK RNG002_OCT19	Water	Chloride	SW9056A	mg/L	2.6	2.0	1.0	0.0993			
K Range	LYK RNG002_OCT19	Water	Copper	SW6020A	µg/L	1.0	3.0	0.19	2.0	J	TR	1300
K Range	LYK RNG002_OCT19	Water	Lead	SW6020A	µg/L	0.090	1.0	0.075	0.50			15
K Range	LYK RNG002_OCT19	Water	Magnesium	SW6020A	µg/L	4840	100	8.0	80			
K Range	LYK RNG002_OCT19	Water	Potassium	SW6020A	µg/L	419	1,000	31	400	J	TR	
K Range	LYK RNG002_OCT19	Water	Sodium	SW6020A	µg/L	2,400	1,000	19	400			
K Range	LYK RNG002_OCT19	Water	Sulfate	SW9056A	mg/L	0.88	1.0	0.50	0.064	J	TR	
K Range	LYK RNG003_OCT19	Water	Alkalinity, total	SM2320B	mg/L	9.7	5.0	4.0	0.23			
K Range	LYK RNG003_OCT19	Water	Antimony	SW6020A	µg/L	6.57	1.0	0.055	0.50			6
K Range	LYK RNG003_OCT19	Water	Calcium	SW6020A	µg/L	3,100	100	21	80			
K Range	LYK RNG003_OCT19	Water	Chloride	SW9056A	mg/L	3.5	2.0	1.0	0.0993			
K Range	LYK RNG003_OCT19	Water	Copper	SW6020A	µg/L	14.1	3.0	0.19	2.0			1300
K Range	LYK RNG003_OCT19	Water	Lead	SW6020A	µg/L	0.65	1.0	0.075	0.50	J	TR	15

CAMP EDWARDS SMALL ARMS RANGE BASELINE POREWATER MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (µg/L)
K Range	LYKRNG003_OCT19	Water	Magnesium	SW6020A	µg/L	498	100	8.0	80			
K Range	LYKRNG003_OCT19	Water	Potassium	SW6020A	µg/L	785	1,000	31	400	J	TR	
K Range	LYKRNG003_OCT19	Water	Sodium	SW6020A	µg/L	2,810	1,000	19	400			
K Range	LYKRNG003_OCT19	Water	Sulfate	SW9056A	mg/L	1.3	1.0	0.50	0.064			
L Range	LYLRNG001_OCT19	Water	Alkalinity, total	SM2320B	mg/L	6.5	5.0	4.0	0.23			
L Range	LYLRNG001_OCT19	Water	Antimony	SW6020A	µg/L	0.076	1.0	0.50	0.055	J	TR	6
L Range	LYLRNG001_OCT19	Water	Calcium	SW6020A	µg/L	1550	100	80	21			
L Range	LYLRNG001_OCT19	Water	Chloride	SW9056A	mg/L	1.9	2.0	1.0	0.0993	J	TR	
L Range	LYLRNG001_OCT19	Water	Copper	SW6020A	µg/L	12	3.0	2.0	0.19			1300
L Range	LYLRNG001_OCT19	Water	Lead	SW6020A	µg/L	1.12	1.0	0.50	0.075			15
L Range	LYLRNG001_OCT19	Water	Magnesium	SW6020A	µg/L	323	100	80	8			
L Range	LYLRNG001_OCT19	Water	Phosphorus, total	E365.4	mg/L	0.080	0.10	0.080	0.0461	U	ND	
L Range	LYLRNG001_OCT19	Water	Potassium	SW6020A	µg/L	1,880	1,000	400	31			
L Range	LYLRNG001_OCT19	Water	Sodium	SW6020A	µg/L	1,300	1,000	400	19			
L Range	LYLRNG001_OCT19	Water	Sulfate	SW9056A	mg/L	1.6	1.0	0.50	0.064			
L Range	LYLRNG001_OCT19	Water	Sulfate	SW9056A	mg/L	1.6	1.0	0.50	0.064			
L Range	LYLRNG002_OCT19	Water	Alkalinity, total	SM2320B	mg/L	100	5.0	4.0	0.23			
L Range	LYLRNG002_OCT19	Water	Antimony	SW6020A	µg/L	0.14	1	0.5	0.055	J	TR	6
L Range	LYLRNG002_OCT19	Water	Calcium	SW6020A	µg/L	43,900	100	80	21			
L Range	LYLRNG002_OCT19	Water	Chloride	SW9056A	mg/L	2.0	2.0	1.0	0.0993	J	TR	
L Range	LYLRNG002_OCT19	Water	Copper	SW6020A	µg/L	1.8	3.0	2.0	0.19	J	TR	1300
L Range	LYLRNG002_OCT19	Water	Lead	SW6020A	µg/L	0.50	1.0	0.50	0.075	U	ND	15
L Range	LYLRNG002_OCT19	Water	Magnesium	SW6020A	µg/L	488	100	80	8			
L Range	LYLRNG002_OCT19	Water	Phosphorus, total	E365.4	mg/L	0.080	0.10	0.080	0.0461	U	ND	
L Range	LYLRNG002_OCT19	Water	Potassium	SW6020A	µg/L	697	1,000	400	31	J	TR	
L Range	LYLRNG002_OCT19	Water	Sodium	SW6020A	µg/L	2,090	1,000	400	19			
L Range	LYLRNG002_OCT19	Water	Sulfate	SW9056A	mg/L	0.13	1.0	0.50	0.064	J	TR	
L Range	LYLRNG002_OCT19	Water	Sulfate	SW9056A	mg/L	0.13	1.0	0.50	0.064	J	TR	
S Range	LYSBGD01_OCT19	Water	Alkalinity, total	SM2320B	mg/L	2.9	5.0	4.0	0.23	J	TR, Background Sample	
S Range	LYSBGD01_OCT19	Water	Antimony	SW6020A	µg/L	0.39	1.0	0.055	0.50	J	TR, Background Sample	6
S Range	LYSBGD01_OCT19	Water	Calcium	SW6020A	µg/L	12400	100	21	80		Background Sample	
S Range	LYSBGD01_OCT19	Water	Chloride	SW9056A	mg/L	59	10	5.0	0.50		Background Sample	
S Range	LYSBGD01_OCT19	Water	Copper	SW6020A	µg/L	1.8	3.0	0.19	2.0	J	TR, Background Sample	1300
S Range	LYSBGD01_OCT19	Water	Lead	SW6020A	µg/L	0.21	1.0	0.075	0.50	J	TR, Background Sample	15
S Range	LYSBGD01_OCT19	Water	Magnesium	SW6020A	µg/L	3050	100	8	80		Background Sample	
S Range	LYSBGD01_OCT19	Water	Potassium	SW6020A	µg/L	2,080	1,000	31	400		Background Sample	
S Range	LYSBGD01_OCT19	Water	Sodium	SW6020A	µg/L	24,700	1,000	19	400		Background Sample	
S Range	LYSBGD01_OCT19	Water	Sulfate	SW9056A	mg/L	12	1.0	0.50	0.064		Background Sample	

CAMP EDWARDS SMALL ARMS RANGE BASELINE POREWATER MONITORING RESULTS 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (µg/L)
S Range	LYSRNG001_OCT19	Water	Alkalinity, total	SM2320B	mg/L	71	5.0	4.0	0.23			
S Range	LYSRNG001_OCT19	Water	Antimony	SW6020A	µg/L	1.29	1.0	0.055	0.5			6
S Range	LYSRNG001_OCT19	Water	Calcium	SW6020A	µg/L	27,400	100	21	80			
S Range	LYSRNG001_OCT19	Water	Chloride	SW9056A	mg/L	5.4	2.0	1.0	0.0993			
S Range	LYSRNG001_OCT19	Water	Copper	SW6020A	µg/L	4.33	3.0	0.19	2.0			1300
S Range	LYSRNG001_OCT19	Water	Lead	SW6020A	µg/L	0.13	1.0	0.075	0.50	J	TR	15
S Range	LYSRNG001_OCT19	Water	Magnesium	SW6020A	µg/L	2480	100	8.0	80			
S Range	LYSRNG001_OCT19	Water	Potassium	SW6020A	µg/L	861	1,000	31	400	J	TR	
S Range	LYSRNG001_OCT19	Water	Sodium	SW6020A	µg/L	5,800	1,000	19	400			
S Range	LYSRNG001_OCT19	Water	Sulfate	SW9056A	mg/L	3.0	1.0	0.50	0.064			
S Range	LYSRNG002_OCT19	Water	Alkalinity, total	SM2320B	mg/L	3.6	5.0	4.0	0.23	J	TR	
S Range	LYSRNG002_OCT19	Water	Antimony	SW6020A	µg/L	0.14	1.0	0.055	0.50	J	TR	6
S Range	LYSRNG002_OCT19	Water	Calcium	SW6020A	µg/L	912	100	21	80			
S Range	LYSRNG002_OCT19	Water	Chloride	SW9056A	mg/L	3.1	2.0	1.0	0.0993			
S Range	LYSRNG002_OCT19	Water	Copper	SW6020A	µg/L	1.2	3.0	0.19	2.0	J	TR	1300
S Range	LYSRNG002_OCT19	Water	Lead	SW6020A	µg/L	0.22	1.0	0.075	0.50	J	TR	15
S Range	LYSRNG002_OCT19	Water	Magnesium	SW6020A	µg/L	228	100	8.0	80			
S Range	LYSRNG002_OCT19	Water	Potassium	SW6020A	µg/L	2,480	1,000	31	400			
S Range	LYSRNG002_OCT19	Water	Sodium	SW6020A	µg/L	1,560	1,000	19	400			
S Range	LYSRNG002_OCT19	Water	Sulfate	SW9056A	mg/L	0.93	1.0	0.50	0.064	J	TR	
T Range	LYTBGD01_OCT19	Water	Alkalinity, total	SM2320B	mg/L	3.6	5.0	4.0	0.23	J	TR, Background Sample	
T Range	LYTBGD01_OCT19	Water	Antimony	SW6020A	µg/L	0.080	1.0	0.055	0.50	J	TR, Background Sample	6
T Range	LYTBGD01_OCT19	Water	Calcium	SW6020A	µg/L	633	100	21	80		Background Sample	
T Range	LYTBGD01_OCT19	Water	Chloride	SW9056A	mg/L	9.5	2.0	1.0	0.0993		Background Sample	
T Range	LYTBGD01_OCT19	Water	Copper	SW6020A	µg/L	1.3	3.0	0.19	2.0	J	TR, Background Sample	1300
T Range	LYTBGD01_OCT19	Water	Lead	SW6020A	µg/L	0.11	1.0	0.075	0.50	J	TR, Background Sample	15
T Range	LYTBGD01_OCT19	Water	Magnesium	SW6020A	µg/L	1240	100	8.0	80		Background Sample	
T Range	LYTBGD01_OCT19	Water	Potassium	SW6020A	µg/L	180	1,000	31	400	J	TR, Background Sample	
T Range	LYTBGD01_OCT19	Water	Sodium	SW6020A	µg/L	6,000	1,000	19	400		Background Sample	
T Range	LYTBGD01_OCT19	Water	Sulfate	SW9056A	mg/L	4.7	1.0	0.50	0.064		Background Sample	
T Range	LYTRNG012_OCT19	Water	Alkalinity, total	SM2320B	mg/L	6.1	5.0	4.0	0.23			
T Range	LYTRNG012_OCT19	Water	Antimony	SW6020A	µg/L	0.22	1.0	0.055	0.50	J	TR	6
T Range	LYTRNG012_OCT19	Water	Calcium	SW6020A	µg/L	706	100	21	80			
T Range	LYTRNG012_OCT19	Water	Chloride	SW9056A	mg/L	0.42	2.0	1.0	0.0993	J	TR	
T Range	LYTRNG012_OCT19	Water	Copper	SW6020A	µg/L	4.68	3.0	0.19	2.0			1300
T Range	LYTRNG012_OCT19	Water	Lead	SW6020A	µg/L	0.39	1.0	0.075	0.50	J	TR	15
T Range	LYTRNG012_OCT19	Water	Magnesium	SW6020A	µg/L	420	100	8.0	80			
T Range	LYTRNG012_OCT19	Water	Potassium	SW6020A	µg/L	300	1,000	31	400	J	TR	

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T Range	LYTRNG012_OCT19	Water	Sodium	SW6020A	µg/L	1,100	1,000	19	400			
T Range	LYTRNG012_OCT19	Water	Sulfate	SW9056A	mg/L	0.076	1.0	0.50	0.064	J	TR	
T Range	LYTRNG013_OCT19	Water	Alkalinity, total	SM2320B	mg/L	39	5.0	4.0	0.23			
T Range	LYTRNG013_OCT19	Water	Antimony	SW6020A	µg/L	98.1	1.0	0.055	0.50			6
T Range	LYTRNG013_OCT19	Water	Calcium	SW6020A	µg/L	10,200	100	21	80			
T Range	LYTRNG013_OCT19	Water	Chloride	SW9056A	mg/L	4.0	2.0	1.0	0.0993			
T Range	LYTRNG013_OCT19	Water	Copper	SW6020A	µg/L	29.4	3.0	0.19	2.0			1300
T Range	LYTRNG013_OCT19	Water	Lead	SW6020A	µg/L	0.17	1.0	0.075	0.50	J	TR	15
T Range	LYTRNG013_OCT19	Water	Magnesium	SW6020A	µg/L	2700	100	8.0	80			
T Range	LYTRNG013_OCT19	Water	Potassium	SW6020A	µg/L	11,000	1,000	31	400			
T Range	LYTRNG013_OCT19	Water	Sodium	SW6020A	µg/L	5,430	1,000	19	400			
T Range	LYTRNG013_OCT19	Water	Sulfate	SW9056A	mg/L	8.8	1.0	0.50	0.064			
T Range	LYTRNG013_OCT19 FD	Water	Alkalinity, total	SM2320B	mg/L	40	5.0	4.0	0.23			
T Range	LYTRNG013_OCT19 FD	Water	Antimony	SW6020A	µg/L	93.7	1.0	0.055	0.50			6
T Range	LYTRNG013_OCT19 FD	Water	Calcium	SW6020A	µg/L	9460	100	21	80			
T Range	LYTRNG013_OCT19 FD	Water	Chloride	SW9056A	mg/L	4.0	2.0	1.0	0.0993			
T Range	LYTRNG013_OCT19 FD	Water	Copper	SW6020A	µg/L	28.5	3.0	0.19	2.0			1300
T Range	LYTRNG013_OCT19 FD	Water	Lead	SW6020A	µg/L	0.18	1.0	0.075	0.50	J	TR	15
T Range	LYTRNG013_OCT19 FD	Water	Magnesium	SW6020A	µg/L	2590	100	8.0	80			
T Range	LYTRNG013_OCT19 FD	Water	Potassium	SW6020A	µg/L	10,600	1,000	31	400			
T Range	LYTRNG013_OCT19 FD	Water	Sodium	SW6020A	µg/L	5,210	1,000	19	400			
T Range	LYTRNG013_OCT19 FD	Water	Sulfate	SW9056A	mg/L	9.0	1.0	0.50	0.064			

Notes:

µg/L = microgram(s) per liter

DL = detection limit

ID = identifier

J = estimated value

ND = nondetectable

LOQ = limit of quantitation

TR = trace result (<LOQ and >DL)

U = not detected



Juliet and Kilo Ranges, STAPP bullet catcher system, Camp Edwards, Massachusetts
 LY=Lysimeter, MW=Monitoring Well, SS=Soil Sample



Tango Range with STAPP bullet catcher system, Camp Edwards, Massachusetts
 LY=Lysimeter, MW=Monitoring Well, SS=Soil Sample



India Range, Copper Ammunition Only, Camp Edwards, Massachusetts.
LY=Lysimeter, MW=Monitoring Well, SS=Soil Sample

Firing Range Sampling Reports

Groundwater Sampling Results

CAMP EDWARDS SMALL ARMS RANGE BASELINE GROUNDWATER MONITORING RESULTS OCTOBER 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (µg/L)
E Range	MW-468S_OCT19	Water	Alkalinity, total	SM2320B	mg/L	9.0	5.0	4.0	0.23			
E Range	MW-468S_OCT19	Water	Antimony	SW6020A	µg/L	0.5	1.0	0.055	0.50	U	ND	3
E Range	MW-468S_OCT19	Water	Calcium	SW6020A	µg/L	3,970	100	21	80			
E Range	MW-468S_OCT19	Water	Chloride	SW9056A	mg/L	10	2.0	1.0	0.0993			
E Range	MW-468S_OCT19	Water	Copper	SW6020A	µg/L	1.2	3.0	0.19	2.0	J	TR	650
E Range	MW-468S_OCT19	Water	Lead	SW6020A	µg/L	0.18	1.0	0.075	0.50	J	TR	7.5
E Range	MW-468S_OCT19	Water	Magnesium	SW6020A	µg/L	2870	100	8.0	80			
E Range	MW-468S_OCT19	Water	Potassium	SW6020A	µg/L	1,010	1,000	31	400			
E Range	MW-468S_OCT19	Water	Sodium	SW6020A	µg/L	8,460	1,000	19	400			
E Range	MW-468S_OCT19	Water	Sulfate	SW9056A	mg/L	9.3	1.0	0.50	0.064			
I Range	MW-639S_OCT19	Water	Alkalinity, total	SM2320B	mg/L	7.3	5.0	4.0	0.23			
I Range	MW-639S_OCT19	Water	Antimony	SW6020A	µg/L	0.50	1.0	0.055	0.50	U	ND	3
I Range	MW-639S_OCT19	Water	Calcium	SW6020A	µg/L	2,350	100	21	80			
I Range	MW-639S_OCT19	Water	Chloride	SW9056A	mg/L	9.1	2.0	1.0	0.0993			
I Range	MW-639S_OCT19	Water	Copper	SW6020A	µg/L	0.74	3.0	0.19	2.0	J	TR	650
I Range	MW-639S_OCT19	Water	Lead	SW6020A	µg/L	0.50	1.0	0.075	0.50	U	ND	7.5
I Range	MW-639S_OCT19	Water	Magnesium	SW6020A	µg/L	1810	100	8.0	80			
I Range	MW-639S_OCT19	Water	Potassium	SW6020A	µg/L	628	1,000	31	400	J	TR	
I Range	MW-639S_OCT19	Water	Sodium	SW6020A	µg/L	6,800	1,000	19	400			
I Range	MW-639S_OCT19	Water	Sulfate	SW9056A	mg/L	6.4	1.0	0.50	0.064			
J Range	MW-471S_OCT19	Water	Alkalinity, total	SM2320B	mg/L	12	5.0	4.0	0.23			
J Range	MW-471S_OCT19	Water	Antimony	SW6020A	µg/L	0.089	1.0	0.055	0.50	J	TR	3
J Range	MW-471S_OCT19	Water	Calcium	SW6020A	µg/L	3280	100	21	80			
J Range	MW-471S_OCT19	Water	Chloride	SW9056A	mg/L	6.4	2.0	1.0	0.0993			
J Range	MW-471S_OCT19	Water	Copper	SW6020A	µg/L	1.2	3.0	0.19	2.0	J	TR	650
J Range	MW-471S_OCT19	Water	Lead	SW6020A	µg/L	0.23	1.0	0.075	0.50	J	TR	7.5
J Range	MW-471S_OCT19	Water	Magnesium	SW6020A	µg/L	2240	100	8.0	80			
J Range	MW-471S_OCT19	Water	Potassium	SW6020A	µg/L	770	1,000	31	400	J	TR	
J Range	MW-471S_OCT19	Water	Sodium	SW6020A	µg/L	4,870	1,000	19	400			
J Range	MW-471S_OCT19	Water	Sulfate	SW9056A	mg/L	4.8	1.0	0.50	0.064			
J Range	MW-471S_OCT19 FD	Water	Alkalinity, total	SM2320B	mg/L	12	5.0	4.0	0.23			
J Range	MW-471S_OCT19 FD	Water	Antimony	SW6020A	µg/L	0.08	1.0	0.055	0.50	J	TR	3
J Range	MW-471S_OCT19 FD	Water	Calcium	SW6020A	µg/L	3180	100	21	80			
J Range	MW-471S_OCT19 FD	Water	Chloride	SW9056A	mg/L	6.5	2.0	1.0	0.0993			
J Range	MW-471S_OCT19 FD	Water	Copper	SW6020A	µg/L	0.99	3.0	0.19	2.0	J	TR	650
J Range	MW-471S_OCT19 FD	Water	Lead	SW6020A	µg/L	0.20	1.0	0.075	0.50	J	TR	7.5

CAMP EDWARDS SMALL ARMS RANGE BASELINE GROUNDWATER MONITORING RESULTS OCTOBER 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (µg/L)
J Range	MW-471S_OCT19 FD	Water	Magnesium	SW6020A	µg/L	2290	100	8.0	80			
J Range	MW-471S_OCT19 FD	Water	Potassium	SW6020A	µg/L	771	1,000	31	400	J	TR	
J Range	MW-471S_OCT19 FD	Water	Sodium	SW6020A	µg/L	4,850	1,000	19	400			
J Range	MW-471S_OCT19 FD	Water	Sulfate	SW9056A	mg/L	4.9	1.0	0.50	0.064			
J Range	MW-472S_OCT19	Water	Alkalinity, total	SM2320B	mg/L	9.7	5.0	4.0	0.23			
J Range	MW-472S_OCT19	Water	Chloride	SW9056A	mg/L	8.9	2.0	1.0	0.0993			
J Range	MW-472S_OCT19	Water	Magnesium	SW6020A	µg/L	2710	100	8	80			
J Range	MW-472S_OCT19	Water	Potassium	SW6020A	µg/L	688	1,000	31	400	J	TR	
J Range	MW-472S_OCT19	Water	Sodium	SW6020A	µg/L	4,800	1,000	19	400			
J Range	MW-472S_OCT19	Water	Sulfate	SW9056A	mg/L	5.0	1.0	0.50	0.064			
K Range	MW-474S_OCT19	Water	Alkalinity, total	SM2320B	mg/L	9.0	5.0	4.0	0.23			
K Range	MW-474S_OCT19	Water	Antimony	SW6020A	µg/L	0.50	1.0	0.055	0.50	U	ND	3
K Range	MW-474S_OCT19	Water	Calcium	SW6020A	µg/L	2350	100	21	80			
K Range	MW-474S_OCT19	Water	Chloride	SW9056A	mg/L	9.4	2.0	1.0	0.0993			
K Range	MW-474S_OCT19	Water	Copper	SW6020A	µg/L	0.72	3.0	0.19	2.0	J	TR	650
K Range	MW-474S_OCT19	Water	Lead	SW6020A	µg/L	0.50	1.0	0.075	0.50	U	ND	7.5
K Range	MW-474S_OCT19	Water	Magnesium	SW6020A	µg/L	2630	100	8.0	80			
K Range	MW-474S_OCT19	Water	Potassium	SW6020A	µg/L	763	1,000	31	400	J	TR	
K Range	MW-474S_OCT19	Water	Sodium	SW6020A	µg/L	6,910	1,000	19	400			
K Range	MW-474S_OCT19	Water	Sulfate	SW9056A	mg/L	4.4	1.0	0.50	0.064			
S Range	MW-465S_OCT19	Water	Alkalinity, total	SM2320B	mg/L	20	5.0	4.0	0.23			
S Range	MW-465S_OCT19	Water	Antimony	SW6020A	µg/L	0.50	1.0	0.055	0.50	U	ND	3
S Range	MW-465S_OCT19	Water	Calcium	SW6020A	µg/L	5150	100	21	80			
S Range	MW-465S_OCT19	Water	Chloride	SW9056A	mg/L	6.1	2.0	1.0	0.0993			
S Range	MW-465S_OCT19	Water	Copper	SW6020A	µg/L	0.60	3.0	0.19	2.0	J	TR	650
S Range	MW-465S_OCT19	Water	Lead	SW6020A	µg/L	0.20	1.0	0.075	0.50	J	TR	7.5
S Range	MW-465S_OCT19	Water	Magnesium	SW6020A	µg/L	2490	100	8	80			
S Range	MW-465S_OCT19	Water	Potassium	SW6020A	µg/L	678	1,000	31	400	J	TR	
S Range	MW-465S_OCT19	Water	Sodium	SW6020A	µg/L	6,250	1,000	19	400			
S Range	MW-465S_OCT19	Water	Sulfate	SW9056A	mg/L	6.6	1.0	0.50	0.064	J	FD RPD	
S Range	MW-465S_OCT19FD	Water	Alkalinity, total	SM2320B	mg/L	17	5.0	4.0	0.23			
S Range	MW-465S_OCT19FD	Water	Antimony	SW6020A	µg/L	0.089	1.0	0.055	0.50	J	TR	3
S Range	MW-465S_OCT19FD	Water	Calcium	SW6020A	µg/L	5,430	100	21	80			
S Range	MW-465S_OCT19FD	Water	Chloride	SW9056A	mg/L	6.2	2.0	1.0	0.0993			
S Range	MW-465S_OCT19FD	Water	Copper	SW6020A	µg/L	1.2	3.0	0.19	2.0	J	TR	650
S Range	MW-465S_OCT19FD	Water	Lead	SW6020A	µg/L	0.47	1.0	0.075	0.50	J	TR	7.5

CAMP EDWARDS SMALL ARMS RANGE BASELINE GROUNDWATER MONITORING RESULTS OCTOBER 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (µg/L)
S Range	MW-465S_OCT19FD	Water	Magnesium	SW6020A	µg/L	2620	100	8	80			
S Range	MW-465S_OCT19FD	Water	Potassium	SW6020A	µg/L	719	1,000	31	400	J	TR	
S Range	MW-465S_OCT19FD	Water	Sodium	SW6020A	µg/L	6,550	1,000	19	400			
S Range	MW-465S_OCT19FD	Water	Sulfate	SW9056A	mg/L	11	1.0	0.50	0.064	J	FD RPD	
S Range	MW-466S_OCT19	Water	Alkalinity, total	SM2320B	mg/L	23	5.0	4.0	0.23			
S Range	MW-466S_OCT19	Water	Antimony	SW6020A	µg/L	0.50	1.0	0.055	0.50	U	ND	3
S Range	MW-466S_OCT19	Water	Calcium	SW6020A	µg/L	5,610	100	21	80			
S Range	MW-466S_OCT19	Water	Chloride	SW9056A	mg/L	7.4	2.0	1.0	0.0993	J	MS%R	
S Range	MW-466S_OCT19	Water	Copper	SW6020A	µg/L	1.4	3.0	0.19	2.0	J	TR	650
S Range	MW-466S_OCT19	Water	Lead	SW6020A	µg/L	0.13	1.0	0.075	0.50	J	TR	7.5
S Range	MW-466S_OCT19	Water	Magnesium	SW6020A	µg/L	2640	100	8	80			
S Range	MW-466S_OCT19	Water	Potassium	SW6020A	µg/L	751	1,000	31	400	J	TR	
S Range	MW-466S_OCT19	Water	Sodium	SW6020A	µg/L	8,300	1,000	19	400			
S Range	MW-466S_OCT19	Water	Sulfate	SW9056A	mg/L	6.3	1.0	0.50	0.064			
T Range	MW-467S_OCT19	Water	Alkalinity, total	SM2320B	mg/L	11	5.0	4.0	0.23			
T Range	MW-467S_OCT19	Water	Antimony	SW6020A	µg/L	0.5	1.0	0.055	0.50	U	ND	3
T Range	MW-467S_OCT19	Water	Calcium	SW6020A	µg/L	7530	100	21	80			
T Range	MW-467S_OCT19	Water	Chloride	SW9056A	mg/L	6.1	2.0	1.0	0.0993			
T Range	MW-467S_OCT19	Water	Copper	SW6020A	µg/L	0.66	3.0	0.19	2.0	J	TR	650
T Range	MW-467S_OCT19	Water	Lead	SW6020A	µg/L	0.5	1.0	0.075	0.50	U	ND	7.5
T Range	MW-467S_OCT19	Water	Magnesium	SW6020A	µg/L	3070	100	8	80			
T Range	MW-467S_OCT19	Water	Potassium	SW6020A	µg/L	703	1,000	31	400	J	TR	
T Range	MW-467S_OCT19	Water	Sodium	SW6020A	µg/L	8,990	1,000	19	400			
T Range	MW-467S_OCT19	Water	Sulfate	SW9056A	mg/L	21	1.0	0.50	0.064			
T Range	MW-467S_OCT19 EB	FIELDQC	Alkalinity, total	SM2320B	mg/L	1.8	5.0	4.0	0.23	J	TR	
T Range	MW-467S_OCT19 EB	Water	Antimony	SW6020A	µg/L	0.096	1.0	0.055	0.50	J	TR	3
T Range	MW-467S_OCT19 EB	Water	Calcium	SW6020A	µg/L	82	100	21	80	J	TR	
T Range	MW-467S_OCT19 EB	FIELDQC	Chloride	SW9056A	mg/L	0.10	2.0	1.0	0.0993	J	TR	
T Range	MW-467S_OCT19 EB	Water	Copper	SW6020A	µg/L	0.94	3.0	0.19	2.0	J	TR	650
T Range	MW-467S_OCT19 EB	Water	Lead	SW6020A	µg/L	0.15	1.0	0.075	0.50	J	TR	7.5
T Range	MW-467S_OCT19 EB	Water	Magnesium	SW6020A	µg/L	22	100	8.0	80	J	TR	
T Range	MW-467S_OCT19 EB	Water	Potassium	SW6020A	µg/L	48	1,000	31	400	J	TR	
T Range	MW-467S_OCT19 EB	Water	Sodium	SW6020A	µg/L	249	1,000	19	400	J	TR	
T Range	MW-467S_OCT19 EB	FIELDQC	Sulfate	SW9056A	mg/L	0.50	1.0	0.50	0.064	U	ND	

Notes:

µg/L = microgram(s) per liter

ND = nondetectable

CAMP EDWARDS SMALL ARMS RANGE BASELINE GROUNDWATER MONITORING RESULTS OCTOBER 2019

Site List	Field Sample ID	Matrix	Analyte	Analytical Method	Units	Lab Result	LOQ	LOD	DL	Qualifier	Reason	OMMP Action Levels (µg/L)
DL = detection limit			LOQ = limit of quantitation									
ID = identifier			TR = trace result (<LOQ and >DL)									
J = estimated value			U = not detected									

Firing Range Sampling Reports

XRF Results

CAMP EDWARDS SMALL ARMS RANGE XRF COPPER READING RESULTS 2019

Site List	Location ID	Date Sampled	Test Method	Analyte	Result Value (ppm)	OMMP Action Levels (mg/kg)
Sierra Range	50 m backstop, Lane 4	10/07/2019	XRF	Copper	62	10,000
Sierra Range	50 m backstop, Lane 4	10/07/2019	XRF	Copper	65	10,000
Sierra Range	50 m backstop, Lane 4	10/07/2019	XRF	Copper	58	10,000
Sierra Range	100 m backstop, Lane 6	10/07/2019	XRF	Copper	316	10,000
Sierra Range	100 m backstop, Lane 6	10/07/2019	XRF	Copper	319	10,000
Sierra Range	100 m backstop, Lane 6	10/07/2019	XRF	Copper	317	10,000
Sierra Range	320 m backstop, Lane 4	10/07/2019	XRF	Copper	23	10,000
Sierra Range	320 m backstop, Lane 4	10/07/2019	XRF	Copper	25	10,000
Sierra Range	320 m backstop, Lane 4	10/07/2019	XRF	Copper	20	10,000
Notes: m = meter ppm = parts per million XRF = X-ray Fluorescence						

Soldier Validation Lane Annual Report

The Soldier Validation Lane Report will be available in the *Final State of the Reservation Report*

Camp Edwards — Massachusetts Army National Guard

Soldier Validation Lane Annual Monitoring Report

December 2019

(NHESP Tracking No.: 08-24210)

Soldier Validation Lane Use

No containers were placed or moved in soldier validation lanes (SVL) in 2019. All maneuver activities associated with the lanes were limited to established roads, road shoulders, and roadways within the power line right of ways.

SVL Assessments after 2019 Training Season

All SVL sites with conex containers were visited in December 2019 to evaluate training impacts at sites during the 2019 training season. The assessment methodology matched the assessment performed in the Baseline Condition Assessment Report and FYs 12-18, to provide a means of comparison. The conex containers replicate buildings and prop materials are utilized to create a more realistic setting, such as barrels, bicycles, grills, tires, wall sections, etc. Some of these items were moved around the sites, but there were no major additions or subtractions made in 2019. The chain link fence around SVL 3 has been removed (Fig. 1). The erosion control implemented in 2016-2017 at SVL 3 remains unchanged, but the erosion along the pathway hasn't worsened (Fig. 2). SVL 17 was not surveyed this year, and will no longer be surveyed, as all conex containers were removed from the site prior to last year's surveys.

Conclusion

All regulatory conditions were followed during use of the SVLs for training. Most erosion and rutting impacts have remained static on the lanes as expected with regular levels of vehicle use and regular stormwater runoff on dirt roads. No areas were repaired in 2019 other than the fence removal at SVL 3. Based on a renewed LRAM emphasis on managing pitch pine before it can choke out training areas, all SVLs will be prioritized for removing juvenile pitch pine encroaching on training assets. The MAARNG will continue to strive to minimize environmental impacts from these lanes by following the established guidelines.



Figure 1: Fence removal at SVL 3. Thought to be replacement in progress in 2018 survey.



Figure 2: Erosion control at SVL 3, no major erosion since 2017.

APPENDIX D

ENVIRONMENTAL LAWS AND REGULATIONS

ENVIRONMENTAL LAWS AND REGULATIONS GOVERNING MAARNG ACTIVITIES IN THE RESERVE			
Reserve EPS	Federal Law / Regulation	State Law / Regulation	DoD Regulation
Groundwater Resources	Clean Water Act	Drinking Water Quality Standards (310 CMR 22.00)	AR 200-1
	Safe Drinking Water Act	State Wellhead Protection (310 CMR 22.21) Water Management Act (310 CMR 36.00)	AR 200-2 Camp Edwards Regulation (CER) 385-63
Wetlands and Surface Water	Clean Water Act	Massachusetts Wetlands Protection Act	AR 200-2
	Coastal Zone Management Act Floodplains Management (EO 11988) Protection of Wetlands (EO 11990) Rivers and Harbors Act of 1899 Sikes Act Wetlands Management (EO 11990)	(M.G.L. c. 131, s40; 310 CMR 100.00)	CER 385-63
Rare Species	Federal Endangered Species Act Sikes Act	Massachusetts Endangered Species Act (M.G.L. c. 131A, 321 CMR 10.00)	AR 200-1 AR 200-2 AR 200-3 CER 385-63
Soil Conservation	Sikes Act		AR 200-1
	Soils and Water Conservation Act Use of Off-Road Vehicles on Public Lands (EO 11989)		AR 200-2 AR 200-3 CER 385-63
Vegetation Management	American Indian Religious Freedom Act		AR 200-1
	Environmental Justice (EO 12898) Exotic Organisms (EO 11987) Sikes Act		AR 200-2 AR 200-3 CER 385-63
Habitat Management	Sikes Act	Massachusetts Endangered Species Act (M.G.L. c. 131A, 321 CMR 10.00)	AR 200-1 AR 200-2 AR 200-3 CER 385-63
Wildlife Management	Fish and Wildlife Conservation Act		AR 200-1
	Migratory Bird Conservation Act Migratory Bird Treaty Act Sikes Act		AR 200-2 AR 200-3 CER 385-63
Air Quality	Clean Air Act	State Air Quality Regulations (310 CMR 4.00)	AR 200-1 AR 200-2 CER 385-63

**ENVIRONMENTAL LAWS AND REGULATIONS
GOVERNING MAARNG ACTIVITIES IN THE RESERVE**

Reserve EPS	Federal Law / Regulation	State Law / Regulation	DoD Regulation
Noise Management	Federal Interagency Committee		AR 200-1
	Land Noise Control Act Occupational Safety & Health Act Use Planning Standards on Urban Noise, Guidelines for Considering Noise in Land Planning and Control (June 1990)		AR 200-2
Pest Management	Animal Damage Control Act		DoD 4150.7
	Federal Insecticide, Fungicide, and Rodenticide Act		AR 200-1
	Noxious Weed Act		AR 200-2
	Resource Conservation and Recovery Act		AR 200-5
	Sikes Act		AR 420-47
	Toxic Substances Control Act		
Fire Management	Clean Air Act	State Air Quality Regulations	AR 200-1
	Sikes Act	(310 CMR 4.00)	AR 200-2
	The National Fire Code		AR 200-3
	Uniform Fire Code		AR 420-90 CER 385-63
Storm Water Management	Clean Water Act	Massachusetts Wetlands Protection Act	AR 200-1
	NPDES discharge permitting and limitations	(M.G.L. c. 131 s.40, 310 CMR 10.00.)	AR 200-2
Wastewater	Clean Water Act	Title V (310 CMR 15.00)	AR 200-1 CER 385-63
Solid Waste	Resource Conservation and Recovery Act	State Solid Waste Handling and Disposal	AR 200-1
	Toxic Substances Control Act	(310 CMR 16.00/19.00)	AR 200-2
			AR 420-47 CER 385-63
Hazardous Materials	Asbestos Hazard Emergency Response (40 CFR 763)	Hazardous Substances Labeling Law (105 CMR 650.00)	AR 200-1
	Federal Insecticide, Fungicide and Rodenticide Act		AR 200-2
	Hazard Communication Standard Program (29 CFR 1910.1200)		CER 385-63
	Lead Contamination Control Act OSHA (29 CFR 1910, 29 USC 91-596)		
	Poison Prevention Packaging Act		
	Toxic Substances Control Act		

**ENVIRONMENTAL LAWS AND REGULATIONS
GOVERNING MAARNG ACTIVITIES IN THE RESERVE**

Reserve EPS	Federal Law / Regulation	State Law / Regulation	DoD Regulation
Hazardous Waste	Clean Air Act	Department of Transportation	AR 200-1
	Clean Water Act	regulations regarding shipping	AR 200-2
	Emergency Preparedness and Community Right-To-Know Act	and transportation, Hazardous Waste Management and	AR 420-47
	Federal Facilities Compliance Act	Transportation (310 CMR	CER 385-63
	Hazardous Waste Operations and Emergency Response	30.000)	
	Medical Waste Tracking	Management of Medical Waste (105 CMR 480)	
	National Fire Code	Pesticide use (333 CMR 1.00 –	
	Oil Pollution Act	12.00)	
	Pollution Prevention Act	Solid waste facilities	
	Resource Conservation and Recovery Act	management (310 CMR	
	The National Contingency Plan	16.00/19.00)	
	Underground Storage Tank Program (RCRA, Title I)	State right-to-know requirements (105 CMR 670.00)	
	Uniform Building and Fire Codes	Title V (310 CMR 15.00)	
	Comprehensive Environmental Response, Compensation, and Liability Act	Toxic use reduction (310 CMR 5.00)	
		Underground storage tanks standards (527 CMR 4.00 and 9.0)	
	Massachusetts Contingency Plan (310 CMR 40.00)		
Vehicle	Use of Off-Road Vehicles on Public Lands (EO 11989)		AR 200-2 CER 385-63
General Use And Access	Use of Off-Road Vehicles on Public Lands (EO 11989)		AR 200-1 AR 200-2 CER 385-63

**ENVIRONMENTAL LAWS AND REGULATIONS
GOVERNING MAARNG ACTIVITIES IN THE RESERVE**

Reserve EPS	Federal Law / Regulation	State Law / Regulation	DoD Regulation
Cultural Resources (This EPS refers to archeological resources only; the list of regulations cited here has therefore been restricted to those that pertain to protection of archeological resources)	Antiquities Act of 1906 Archeological and Historic Preservation Act of 1974 Archeological Resources Protection Act of 1979 Consultation and Coordination with Indian Tribal Governments (Executive Order 13175) Curation of Federally Owned/Administered Archeological Collections Executive Memorandum of April 19, 1994 – Government-to-Government Relations with American Tribal Governments National Environmental Policy Act of 1966, as amended Native American Graves Protection and Repatriation Act of 1990	Massachusetts General Laws, Chapter 9, sections 26-27C as amended by Chapter 254 of the Acts of 1988 (950 CMR 71.00) Massachusetts Environmental Policy Act (MEPA) Massachusetts General Laws Chapter 30, sections 61 through 62H, inclusive (301 CMR 11.00) Massachusetts General Laws, Chapter 38, section 6B; Chapter 9, sections 26A and 27C; Chapter 7, section 38A; Chapter 114, section 17; as amended by Chapter 659 of the Acts of 1983 and Chapter 386 of the Acts of 1989	AR 200-2 AR 200-4 DA PAM 200-4 Office of the Secretary of Defense, Annotated Policy Document for the American Indian and Alaska Native Policy (27 October 1999)

DOD Regulations include all regulations and directives of the Department of Defense, Department of the Army, and National Guard Bureau.

AR = Army Regulation

CER – Camp Edwards Regulation

CFR – Code of Federal Regulations

CMR - Code of Massachusetts Regulations

DA PAM = Department of Army Pamphlet

EO – Executive Order

M.G.L – Massachusetts General Laws

RCRA – Resource Conservation and Recovery Act

APPENDIX E

WATER SUPPLY INFORMATION

2019 Long Term Monitoring Sentry Well Sampling Results
Upper Cape Regional Water Supply Cooperative

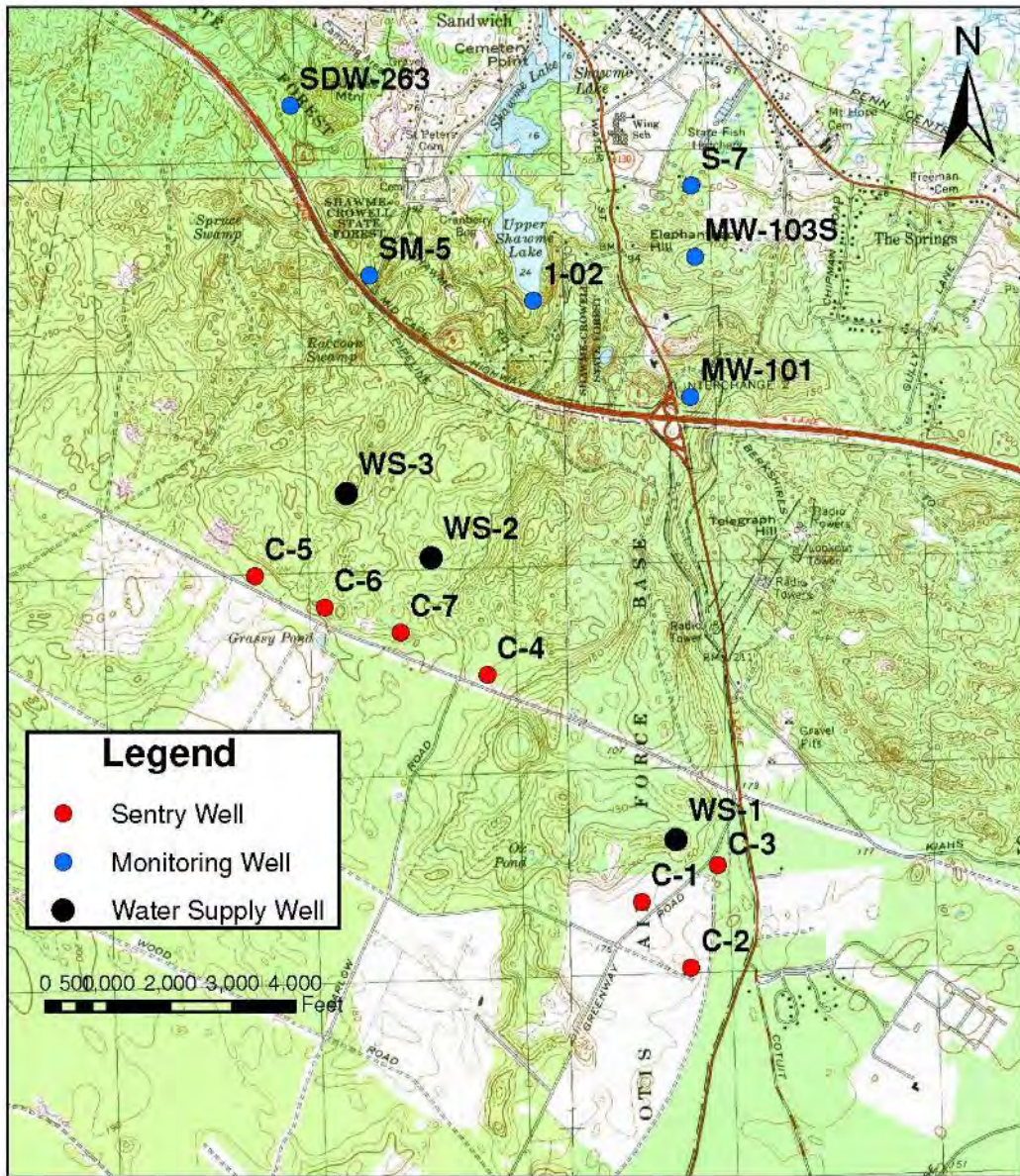


Figure 1
Long-term Monitoring Well Network
Upper Cape Regional Water Supply Cooperative
Cape Cod, Massachusetts



LETTER OF TRANSMITTAL			
DATE:	06/27/2019	JOB NO:	17006-00
ATTENTION:	Mr. Richard Rondeau		
RE:	Sentry Well Sampling Results-2019 Sampling Round		
Upper Cape Regional Water Supply (UCRWS)			
Long-Term Monitoring, Sentry Well Sampling Results			

TO: Mr. Richard Rondeau
MassDEP – Southeast Regional Office
20 Riverside Drive
Lakeville, MA 02347

WE ARE SENDING YOU: Attached Under separate cover via FedEx UPS USPS **the following items:**
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REMARKS:
 Hi Richard,
 Attached are the results for the Upper Cape Regional Water Supply Cooperative 2019 Sentry Well Sampling Round of the intermediate screens. If you have any questions or require additional information, please give me a call at 978-452-9696.
 Thank you,
 Olaf Westphalen

COPY TO: Dan Mahoney – UCRWS, w/encl. File 17006-00/WLC3609 SIGNED: 

If enclosures are not as noted, kindly notify us at once.
 Thank You!



Environmental
Infrastructure
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June 27, 2019

Mr. Dan Mahoney, Chair
Upper Cape Regional Water Supply Cooperative (UCRWS)
P.O. Box 373
Mashpee, MA 02649-0373

Subject: **Results of 2019 Sampling Round**
Long Term Monitoring Well Sampling Services
Upper Cape Regional Water Supply (UCRWS) Cooperative – Long-Term Monitoring Plan

Dear Mr. Mahoney:

In accordance with our proposal dated July 29, 2015, and as authorized by the UCRWS on March 14, 2019, we are pleased to submit the results of the 2019 Sampling Round that was performed by Watermark Environmental, Inc. (Watermark) on May 22 and 23, 2019. During the 2019 Sampling Round, seven (7) intermediate well screens (C-11 through C-71) were sampled in accordance with the UCRWS Long-Term Monitoring (LTM) Plan, as amended on October 22, 2007. The groundwater sample analyses were performed by Envirotech Laboratories, Inc. of Sandwich, Massachusetts (Envirotech), Eurofins TestAmerica Laboratories, Inc. of Savannah, Georgia and its subsidiaries (Eurofins TestAmerica), and their subcontractor Chemserve Environmental Laboratory, of Milford, New Hampshire.

We have completed a review of the Sample Data Summary and Extended Data Packages provided by Eurofins TestAmerica and by Envirotech and have confirmed that the quality control objectives established for field sampling and laboratory analyses efforts have been effectively met. The laboratory results of the sampling effort have been tabulated in the attached 2019 Sampling Results Tables (Attachment A). Results for all volatile organic compounds (VOCs), 1,2-dibromoethane (EDB), perchlorate, and explosives compounds were non-detect, with the exception of chloroform. The results are consistent with historic data for these monitoring wells.

The chloroform detections at C-11, C-21, and C-41 through C-71, were all below the Massachusetts Drinking Water Guideline. Water quality results were at or below their respective standards.

Once again, we appreciate this opportunity to be of service to the UCRWS and we look forward to working with you in the future. If you have any questions regarding this submittal, please do not hesitate to contact me at (978) 452-9696.

Sincerely,
WATERMARK

Olaf Westphalen, PG, LSP
Project Manager

Attachments:

Attachment A: 2019 Sampling Results Tables
Attachment B: Chain of Custody Forms, Low Flow Data – Field Results, 2019 Sampling Event

cc: J. Spangenberg (Watermark)
File 17006-00/WLC3609

Watermark

ATTACHMENT A
2019 Sampling Results Tables

Watermark

Table 1-1
Physical-Chemical Parameters
Intermediate Screens at Sentry Wells – 2019 Sampling Results
Upper Cape Regional Water Supply

Sample ID	Water Quality Standard Level ⁽¹⁾	Laboratory Reporting Limit	C-11	C-21	C-31	C-41	C-51	C-61	C-71
Sample Date			05/22/2019	05/22/2019	05/22/2019	05/22/2019	05/23/2019	05/23/2019	05/23/2019
Physical-Chemical									
pH Method SM 4500 II-B	6.5 - 8.5 ⁽²⁾	NA	7.15	6.89	7.74	6.91	7.02	7.07	7.21
Alkalinity - Total, as CaCO ₃ (mg/L) Method SM 2320 B	NE	2.5	6.4	5.7	7.2	8.0	5.3	6.7	7.6
Turbidity (NTU) Method SM 2130 B	TT	1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	1.7
Specific Conductance (µmhos/cm @ 25 °C) Method EPA 120.1	NE	10.0	49	46	43	59	43	41	45

Notes:

⁽¹⁾ Water Quality Standard Levels are the Massachusetts Maximum Contaminant Level [(MCMCL), 2016] unless otherwise noted.

⁽²⁾ Water Quality Standard Levels are from the Secondary Maximum Contaminant Levels [(SMCL), 2016]

Samples were analyzed by Envirotech Laboratories Inc. of Sandwich, Massachusetts.

NE = Not Established

NA = Not Applicable

µmhos/cm = micromhos per centimeter

TT = Treatment Technique

mg/L = Milligrams per Liter

NTU = Nephelometric Turbidity Units

< = Less Than

°C = degrees Celsius

Prepared By: BG

Checked By: MUM

Water

Table 1-2
Volatile Organic Compounds – EPA Method 524.2 (mg/L)
Intermediate Screens at Sentry Wells – 2019 Sampling Results
Upper Cape Regional Water Supply

Sample ID	Water Quality Standard Level ⁽¹⁾ (mg/L)	Laboratory Reporting Limit (mg/L)	C-11	C-21	C-31	C-41	C-51	C-61	C-71
			05/22/2019	05/22/2019	05/22/2019	05/22/2019	05/23/2019	05/23/2019	05/23/2019
Trans-1,3-Dichloropropene	0.0004 ^(1,4)	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	0.7	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Trichlorofluoromethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Hexachlorobutadiene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Isopropylbenzene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
p-Isopropyltoluene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Methylene chloride (Dichloromethane)	0.005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Naphthalene	0.140 ⁽²⁾	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzene	0.005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
n-Propylbenzene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Styrene	0.1	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1,1,2-Tetrachloroethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1,2,2-Tetrachloroethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1,1,2,2-Pentachloroethane	0.005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Toluene	1	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2,3-Trichlorobenzene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2,4-Trichlorobenzene	0.07	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1,1-Trichloroethane	0.2	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1,2-Trichloroethane	0.005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Trichloroethene	0.005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2,3-Trichloropropane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2,4-Trimethylbenzene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,3,5-Trimethylbenzene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Vinyl chloride	0.002	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
o-Xylene	10 ⁽³⁾	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
m-Xylene & p-Xylene	10 ⁽³⁾	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bromobenzene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bromodichloromethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bromoform	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bromomethane	0.010 ⁽²⁾	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Methyl tert-butyl ether (MTBE)	0.070 ⁽²⁾	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
n-Butylbenzene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
sec-Butylbenzene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
tert-Butylbenzene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Carbon tetrachloride	0.005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlorobenzene	0.1	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dibromochloromethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chloroethane	NE	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloroform	0.07 ⁽²⁾	0.0005	0.0013	0.00068	<0.0005	0.00063	0.0042	0.00089	0.002
Chloromethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2-Chlorotoluene (o-Chlorotoluene)	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
4-Chlorotoluene (p-Chlorotoluene)	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dibromomethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichlorobenzene (o-DCB)	0.6	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,3-Dichlorobenzene (m-DCB)	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,4-Dichlorobenzene (p-DCB)	0.005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dichlorodifluoromethane	1.4 ⁽²⁾	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1-Dichloroethane	0.070 ⁽²⁾	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichloroethane	0.005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1-Dichloroethylene	0.007	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
cis-1,2-Dichloroethylene	0.07	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Trans-1,2-Dichloroethylene	0.1	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichloropropane	0.005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,3-Dichloropropane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2,2-Dichloropropane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,1-Dichloropropene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
cis-1,3-Dichloropropene	0.0004 ^(3,4)	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2-Butanone (MEK)	4 ⁽²⁾	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4-Methyl-2-pentanone (MIBK)	0.35 ⁽²⁾	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bromochloromethane	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Notes:

- ⁽¹⁾ Water Quality Standard Levels are the Massachusetts Maximum Contaminant Level [(M)MCL], 2016] unless otherwise noted.
 - ⁽²⁾ Water Quality Standard Levels are the Massachusetts Drinking Water Guidelines developed by the Office of Research and Development.
 - ⁽³⁾ Xylene Standard based on Total Xylene
 - ⁽⁴⁾ Water Quality Standard listed is for 1,3-dichloropropene (i.e., the sum of cis-1,3-dichloropropene and trans-1,3-dichloropropene).
- Samples analyzed by TestAmerica Laboratories, Inc. of Savannah, Georgia.
 Samples that are **bold** were detected above laboratory reporting limits.

= Less Than NE = Not Established mg/L = Milligrams per Liter

Prepared By: BC
 Checked By: MM

Watermark

Table 1-3
Explosive Compounds – EPA Method SW8330 (mg/L)
Intermediate Screens at Sentry Wells – 2019 Sampling Results
Upper Cape Regional Water Supply

Sample ID	Water Quality Standard Level ⁽¹⁾ (mg/L)	Laboratory Reporting Limit (mg/L)	C-11	C-21	C-31	C-41	C-51	C-61	C-71
Sample Date			05/22/2019	05/22/2019	05/22/2019	05/22/2019	05/23/2019	05/23/2019	05/23/2019
2,6-Diamino-4-nitrotoluene	NE	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2,4-Diamino-6-nitrotoluene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
HMX	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
RDX	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
Picric acid	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
1,3,5-Trinitrobenzene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
1,3-Dinitrobenzene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
Nitrobenzene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
Tetryl	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
Nitroglycerin	NE	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4,6-Trinitrobenzene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
4-Amino-2,6-dinitrobenzene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
2-Amino-4,6-dinitrobenzene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
2,6-Dinitrobenzene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
2,4-Dinitrobenzene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
2-Nitrotoluene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
3-Nitrotoluene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
4-Nitrotoluene	NE	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
PETN	NE	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:

⁽¹⁾ Water Quality Standard Levels are the Massachusetts Maximum Contaminant Level [(MCMCL), 2016] unless otherwise noted. Samples analyzed by Eurofins TestAmerica Laboratories, Inc. of South Burlington, Vermont.

< = Less Than

NE = Not Established

mg/L = Milligrams per Liter

Prepared By: BK
 Checked By: MJM

Watermark

Table 1-4
Perchlorate – EPA Method 314.0 and EDB – EPA Method 504.1 (mg/L)
Intermediate Screens at Sentry Wells – 2019 Sampling Results
Upper Cape Regional Water Supply

Sample ID	Water Quality Standard Level ⁽¹⁾ (mg/L)	Laboratory Reporting Limit (mg/L)	C-11	C-21	C-31	C-41	C-51	C-61	C-71
Sample Date			05/22/2019	05/22/2019	05/22/2019	05/22/2019	05/23/2019	05/23/2019	05/23/2019
Perchlorate	0.002	0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
1,2-Dibromoethane (EDB)	0.00002	0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017

Notes:

⁽¹⁾ Water Quality Standard Levels are the Massachusetts Maximum Contaminant Level (MCL), 2016 unless otherwise noted.

Perchlorate analyzed by Chemserve Environmental Laboratory of Milford, New Hampshire.

EDB analyzed by Eurofins TestAmerica Laboratories, Inc. of Savannah, Georgia.

< Less Than mg/L = Milligrams per Liter

Prepared By: BG
 Checked By: MIM

Watermark

ATTACHMENT B
Chain of Custody Forms, Low Flow Data – Field Results, 2019 Sampling Event

Eurofins TestAmerica, Savannah

5102 LaRoche Avenue
Savannah, GA 31404
Phone (912) 354-7858 Fax (912) 352-6165

Chain of Custody Record

380325 Boston

380325 Boston



Client Information Client Contact: Brian Geringer Email: bgeringer@clafwestphalen.com Phone: 978-452-9696		Lab and: Conner Keaton E-Mail: keaton.conner@testamerica.com		Client Tracking # (C): 880-103532-40586.1 Page: Page 1 of 1			
Company: WaterMark Environmental, Inc. Address: 175 Cabot Street City: Lowell State, Zip: MA 01854 Phone: 978-452-9696 Email: claf@clafwestphalen.com Project Name: Joint Base Cape Cod 2019 Site: UCR45		Due Date Requested: TAT Requested (days): 14 Day		Analysis Requested Preservation Codes: A - HCL M - Hexane B - NaOH N - None C - Zn Acetate O - AsMA3 D - Nitric Acid P - Na2SO4 E - NaOH Q - Na2SO3 F - MeOH R - Na2S2O3 G - Acetone S - MeOH H - Acetic Acid T - TSP Encapsulation I - Ice U - Acetone J - Di Water V - MeOH K - EDTA W - pH 4.5 L - VOA X - other (specify)			
Sample Identification		Field Filtered Sample (Yes or No) NO Perform MS/MS (Yes or No) NO 824.2 - Preserved (MOD) Custom Subst Template 834.1 - (MOD) Requested Analytes 83300 - 83300 Relative Subst/Analyte: EPA 316 & Perchlorate (PUL Filtered) 824.2 - Preserved (MOD) Custom Subst Template		Total Number of Containers			
Sample ID TB-05-2019 C1-I-2019 C2-I-2019 C3-I-2019 C4-I-2019 C5-I-2019 C6-I-2019 C7-I-2019	Sample Date 05/22/19 " " 1240 " " 1025 " " 1025 05/23/19 " " 1405 " " 1130 " " 1020 " " 0905	Sample Time 0800 1135 1025 1025 1405 1130 1020 0905	Sample Type G G G G G G G G	Matrix Water Water Water Water Water Water Water Water	Preservation Code R N N N A X	Total Number of Containers 5 9 9 9 9 9 9 9	Special Instructions/Note: Hold EDB Analysis IF EDB Detected Call Claf W.
Possible Hazard Identification <input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison 3 <input type="checkbox"/> Unknown <input type="checkbox"/> Radiological		Sample Disposal (A fee may be assessed if samples are retained longer than 1 month) <input type="checkbox"/> Return To Client <input type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For					
Deliverable Requested: I, II, III, IV, Other (specify)		Special Instructions/QC Requirements: - Request Samples SMP to IA in GA - Explosives Ship to IA in VT - Chemistry to analyze perchlorate samples					
Empty Kit Relinquished by: [Signature] Date/Time: 5/23/19 1511 Company: [Signature]		Date/Time: 5-23-19 1511 Company: [Signature]		Date/Time: 5-23-19 1511 Company: [Signature]			
Custody Seal Intact <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Other Temperature(s) and Other Remarks: 4/3/4/					

Page 49 of 57

6/10/2019

880-103532 Chain of Custody



Ver: 01/16/2019

CHAIN OF CUSTODY FORM						ENVIROTECH LABS, INC.		Client: Watermark Environmental	
Proj. No.		Project Name: Upper Cape Regional Water Supply UCRWS-2019				8 Jan Sebastian Dr., Unit 12 Sandwich, MA 02563 (508)888-6450/1-800-339-8450 FAX (508)888-6446		175 Cabot St Lowell, MA 01854 cell: 617-960-6476 Phone#: 978-452-9696 ext. 213 brian.geringer@watermarkenv.com	
Sampler: B. Geringer / R. Gannon									
Lab ID:	Date	Time	Comp	Grab	Sample location	container	Pres.	Analysis Requested	
191380 A	5/22/19	1025		X	C3-I-55219 m	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity	
B	5/22/19	1135		X	C4-I-55219 m	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity	
C	5/22/19	1240		X	C2-I-55219 m	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity	
D	5/22/19	1405		X	C4-I-55219 m	500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity	
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity	
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity	
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity	
				X		500 ml	ice	pH, Specific Conductance, Turbidity, Alkalinity	
Relinquished: 12:25		Date/Time: 5/22/19 1450		Received: DB 5/22/19 1450		Relinquished:		Date/Time	
Relinquished:		Date/Time		Received:		Relinquished:		Date/Time	

Site I.D.: UCRWS
 Well I.D.: CA-I
 Pump Start: 1155
 Sample Time: 1240



GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = _____ ft.
 Static Water Level (WL) (from T.O.C.) = 101.01 ft.
 Well Depth (from T.O.C.) = 183 ft.

Date: 5/22/19
 Well Diameter (d) = 8.4" inches
 Screen Depth 143 to 183 Feet below grade
 Sampler(s): B. Geringer / R. Garrison

Height of Water in Well (T):
 T = depth (ft) - Static Water Level (ft)
 T = 183 - 101.01
 T = 81.99 ft. Well Volume: 221 (gallons)

Low Flow Yes No
 Pumping Device: MFO / Dedicated Bladder Pump
 Sampling Device: " "
 Pump Intake (depth below TOC): _____ Feet
 Actual Purge Volume: 18.0 Liters (Gallons)

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (umhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
1155	Start Pump - Adjust Flow									NO odor / skew
1205	9.96	5.45	52	1.23	11.69	262.6	450	101.01	Color/ Clear	" "
1210	9.92	5.67	52	1.36	11.40	269.6	450	101.01	" "	↓
1215	9.91	5.70	52	1.34	11.22	274.3	450	101.01	" "	
1220	9.92	5.73	52	1.32	10.99	281.1	450	101.01	" "	
1225	9.98	5.68	52	1.22	10.75	297.1	450	101.01	" "	
1230	10.01	5.69	52	0.99	10.78	303.7	450.0	101.01	" "	
1235	10.06	5.67	52	1.17	10.90	306.0	450	101.01	" "	
	Reached Stabilization, Collect Sample For VOCs, perchlorate, explosives, pH, Specific Conductivity, Turbidity									
	Sample ID: CA-I-2019									

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: UCRWS
 Well I.D.: C3-I
 Pump Start: 0920
 Sample Time: 1025



GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = N/A ft
 Static Water Level (WL) (from T.O.C.) = 101.51 ft
 Well Depth (from T.O.C.) = 245 ~~±~~ ft
 Date: 5/22/19
 Well Diameter (d) = 2.4" inches
 Screen Depth = 191 to 241 Feet below grade
 Sampler(s): B. Geringer/R. Gardner
 Height of Water in Well (T):
 T = 2.45 depth (ft) - 101.51 Static Water Level (ft)
 T = 143.49 ft
 Well Volume: ± 37 (gallons)
 Low Flow: Yes No
 Purging Device: MP10 Pump Controller/Dedicated Bladder
 Sampling Device: " "
 Pump Intake (depth below TOC): " " Feet
 Actual Purge Volume: ± 18.0 Liters (Gallons)

Time	Temp. (°C) (±.3%)	pH (SU) (±0.1)	Specific Conductance (µmhos/cm) (±.3%)	Turbidity (NTUs) (±10%, 10±1)	D.O. (mg/l) (±.10%)	ORP (mV) (±.10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
0920	Start Pump									NO odor/Sheen
0930	10.19	5.58	50	1.33	11.01	223.4	300	101.51	Clear/ Colorless	" "
0935	10.17	5.58	50	1.88	10.94	222.0	300	101.51	" "	
0940	10.14	5.57	50	2.67	10.90	221.2	300	101.51	" "	
0945	10.25	5.80	50	2.27	10.71	216.0	300	101.51	" "	
0950	10.32	5.84	49	1.97	10.53	221.5	300	101.51	" "	
0955	10.27	5.83	49	1.55	10.27	233.2	300	101.51	" "	
1000	10.34	5.79	49	1.62	10.16	238.6	300	101.51	" "	
1005	10.33	5.80	49	1.56	10.10	243.9	300	101.51	" "	
1010	10.31	5.82	49	1.47	10.04	251.4	300	101.51	" "	
1015	10.36	5.80	49	1.44	10.02	252.6	300	101.51	" "	
1020	10.40	5.76	48	1.41	10.01	254.3	300	101.51	" "	

Reach Stabilization, Collect Sample For VOCs, Perchlorate, explosives, pH, Specific Conductivity, Turbidity & Alkalinity
 Sample ID: C3-I-2019

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site ID: UCRWS
 Well ID: C4-I
 Pump Start: 1310
 Sample Time: 1405



GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = _____ ft
 Static Water Level (WL) (from T.O.C.) = 130.39 ft
 Well Depth (from T.O.C.) = 300 ft
 Date: 5/22/19
 Well Diameter (d) = 2.4 inches
 Screen Depth: 260 to 300 Feet below grade
 Sampler(s): B. Germyer / R. Gausman
 Height of Water in Well (T):
 T = depth (ft) - Static Water Level (ft)
 T = 300 - 130.39
 T = 169.61 ft
 Well Volume: 44 (gallons)
 Low Flow: _____
 Purging Device: MPIO Controller / Dedicated Pump
 Sampling Device: _____
 Pump Intake (depth below TOC): _____ Feet
 Actual Purge Volume: 22.5 Liters (Gallons)

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (µmhos/cm) (± 3%)	Turbidity (NTUs) (±10% if >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/Clarity	Comments
1310	Start Pump									NO odor / Sheen
1320	10.85	5.52	60	1.26	10.05	265.1	450	130.39	Color Clear	" "
1325	10.88	5.52	65	1.80	10.99	304.1	450	130.39	" "	" "
1330	10.90	5.56	65	1.79	11.00	323.8	450	130.39	" "	" "
1335	10.91	5.59	66	1.77	11.03	334.3	450	130.39	" "	" "
1340	10.77	5.60	66	1.56	11.16	356.7	450	130.39	" "	" "
1345	10.85	5.65	65	2.78	11.19	367.7	450	130.39	" "	" "
1350	10.86	5.66	66	1.19	11.21	382.0	450	130.39	" "	" "
1355	10.83	5.61	65	1.23	11.25	385.0	450	130.39	" "	" "
1400	10.75	5.60	65	1.35	11.25	389.2	450	130.39	" "	" "
Reach Stabilization - Collect Sample for VOCs, Perchlorate, explosives, PH, Specific Conductivity, Turbidity, & Alkalinity										
Sample ID: C4-I-2019										

Volume in gallons/foot for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: UCRWS
 Well I.D.: C5-I
 Pump Start: 1045
 Sample Time: 1130



GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL = _____ ft
 Static Water Level (WL) (from T.O.C.) = 134.41 ft
 Well Depth (from T.O.C.) = 245 ft

Date: 5/23/19
 Well Diameter (d) = 2.4 inches
 Screen Depth: 191 to 241 Feet below grade
 Sampler(s): B. Gesinger / R. Garrison
 Low Flow Purging Device: MP10 / Dedicated Bladder
 Sampling Device: _____
 Pump Intake (depth below TOC): _____ Feet
 Actual Purge Volume: 18 Liters (Gallons)

Height of Water in Well (T):
 T = depth (ft) - Static Water Level (ft)
 T = 245 - 134.41
 T = 110.59 ft
 Well Volume: ≈ 29 (gallons)

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (µmhos/cm) (± 3%)	Turbidity (NTUs) (± 10% if > 1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
1045	Start Pump									No odor / Sheen
1050	10.33	5.49	49	1.21	11.93	228.8	450	134.41	Colorless	" "
1055	10.32	5.49	49	1.06	12.09	237.9	450	134.41	" "	" "
1100	10.26	5.53	49	0.93	12.02	244.9	450	134.41	" "	" "
1105	10.22	5.55	49	1.07	12.03	250.8	450	134.41	" "	" "
1110	10.29	5.57	49	1.11	11.99	255.1	450	134.41	" "	" "
1115	10.31	5.61	49	1.01	11.86	258.4	450	134.41	" "	" "
1120	10.31	5.64	49	1.12	11.77	262.3	450	134.41	" "	" "
1125	10.31	5.67	49	1.05	11.69	265.1	450	134.41	" "	" "
Reach Stabilization, Collect Sample for VOCs, perchlorate, explosives, pH, Specific Conductivity, Turbidity & Alkalinity										
Sample ID: C5-I-2019										

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: UCRWS
 Well I.D.: C6-I
 Pump Start: 0935
 Sample Time: 1020



GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL - _____ ft
 Static Water Level (WL) (from T.O.C.) = 141.21 ft
 Well Depth (from T.O.C.) = 230 ft

Date: 5/23/19
 Well Diameter (d) = 2.4 inches
 Screen Depth 190 to 230 Feet below grade
 Sampler(s): B. Geringer / R. Garrison
 Low Flow Purging Device: Yes No
 Purging Device: MRO / Dedicated Bladder Pump
 Sampling Device: "
 Pump Intake (depth below TOC): _____ Feet
 Actual Purge Volume: 18 Liters (Gallons)

Height of Water in Well (T):
 T = depth (ft) - Static Water Level (ft)
 T = 230 - 141.21
 T = 88.79 ft
 Well Volume: 23 (gallons)

Time	Temp. (°C) (± 3%)	pH (SU) (± 0.1)	Specific Conductance (µmhos/cm) (± 3%)	Turbidity (NTUs) (± 10%, >1)	D.O. (mg/l) (± 10%)	ORP (mV) (± 10)	Flow Rate (ml/min)	Static water Level	Color/ Clarity	Comments
0935	Start Pump									NO odor/Sheen
0945	10.35	5.36	48	1.35	11.74	215.2	450	141.21	Clear/ Colorless	" "
0950	10.28	5.51	48	1.29	11.58	217.0	" "	141.21	" "	" "
0955	10.26	5.56	48	1.37	11.44	220.3	" "	141.21	" "	" "
1000	10.30	5.60	48	1.11	11.41	223.6	" "	" "	" "	" "
1005	10.34	5.64	48	0.97	11.37	226.8	" "	" "	" "	" "
1010	10.33	5.66	48	1.19	11.31	230.1	" "	" "	" "	" "
1015	10.34	5.70	48	1.13	11.26	231.8	" "	" "	" "	" "
	Reach Stabilization	Collect Sample	For VOCs,	perchlorate,	explosives,	PH, Specific	Conductivity,	Turbidity,	Alkalinity	
	Sample ID:	C6-I-2019								

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

Site I.D.: UCRWS
 Well I.D.: C7-I
 Pump Start: 0800 0810
 Sample Time: 0905



GROUNDWATER SAMPLING DATA SHEET

Depth to NAPL - _____ ft
 Static Water Level (WL) (from T.O.C.) = 155.59 ft
 Well Depth (from T.O.C.) = 287 ft

Date: 5/23/19
 Well Diameter (d) = 2.4 inches
 Screen Depth 247 to 287 Feet below grade
 Sampler(s): B. Geringer / R. Garrison
 Low Flow Purging Device: MP10 Control Box / Dedicated Bladder Pump
 Sampling Device: " "
 Pump Intake (depth below TOC): _____ Feet
 Actual Purge Volume: 18 Liters (Gallons)



Height of Water in Well (T):
 T = depth (ft) - Static Water Level (ft)
 T = 287 - 155.59
 T = 131.41 ft
 Well Volume: 34 (gallons)

Time	Temp. (°C) (±.3%)	pH (SU) (±0.1)	Specific Conductance (µmhos/cm) (±.3%)	Turbidity (NTU) (±.1%) (±.1)	D.O. (mg/l) (±.10%)	ORP (mV) (±.10)	Flow Rate (ml/min)	Static water Level	Color/Clarity	Comments
0800	Start Pump	- No Flow	- Ants in line							No odor / Sheen
0810	Re-establish	Flow								" "
0815	10.41	7.56	56	1.34	10.89	203.6	400	155.59	Clear / Colorless	" "
0820	10.20	5.76	51	1.21	11.53	236.0	" "	155.59	" "	" "
0825	10.18	5.55	53	1.70	11.62	226.6	" "	155.59	" "	" "
0830	10.17	5.58	53	1.67	11.37	221.0	" "	155.59	" "	" "
0835	10.15	5.65	53	1.35	11.31	219.2	" "	155.59	" "	" "
0840	10.20	5.70	53	1.23	11.17	218.6	" "	155.59	" "	" "
0845	10.19	5.76	53	1.13	11.14	218.6	" "	155.59	" "	" "
0850	10.25	5.79	53	1.23	11.16	219.6	" "	155.59	" "	" "
0855	10.26	5.80	53	1.34	11.09	220.8	" "	155.59	" "	" "
0900	10.23	5.83	53	1.12	11.07	222.5	" "	155.59	" "	" "

Reached Stabilization - Collect Sample for VOCs, Perchlorate, explosives, PH, Specific Conductivity, Turbidity & Alkalinity
 Sample ID: C7-I-2019

Volume in gallons/feet for common monitoring well sizes: 1-inch = 0.041, 2-inch = 0.163, 3-inch = 0.367, 4-inch = 0.652, 6-inch = 1.468

102nd Intelligence Wing
Water Quality Report

	<p>2018 Consumer Confidence Report For Otis Air National Guard Base Joint Base Cape Cod, Massachusetts MASSDEP PWSID #4096001</p>	
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This report is a snapshot of the drinking water quality that we provided between January 1 and December 31, 2018. Included are details about where your water comes from, what it contains, and how it compares to state and federal standards. We continually strive to adopt new methods for delivering the best-quality drinking water to you. As new challenges to drinking water safety emerge, we remain vigilant in meeting the goals of source water protection, water conservation, and community education while continuing to serve the needs of our water users.

PUBLIC WATER SYSTEM INFORMATION

Address: **Otis Air National Guard Base on Joint Base Cape Cod, Massachusetts**
 Contact Person: Mr. Richard Souza
 Telephone #: (508) 968-4102

Water System Improvements

Our water system is routinely inspected by the Massachusetts Department of Environmental Protection (MassDEP). MassDEP inspects our system for its technical, financial, and managerial capacity to provide safe drinking water to you. To ensure that we provide the highest quality of water available, your water system is operated by a Massachusetts certified operator who oversees the routine operations of our system. As part of our ongoing commitment to service, the MassDEP Drinking Water Program has determined that the public water supply system at Otis Air National Guard Base is compliant with all national Primary Drinking Water Standards and MassDEP Drinking Water Regulations.

DRINKING WATER SOURCE

Where Does My Drinking Water Come From?

Our drinking water supply is provided entirely by groundwater. J-Well (4096001-01G), which is located on Herbert Road, is our primary pumping station. We are also connected to the Upper Cape Regional Water Supply Cooperative. The Cooperative's water sources come from three wells located in the northeastern corner of Joint Base Cape Cod. On average, we provide up to 300,000 gallons of high-quality water every day. All of the Otis public water supply is drawn from the Sagamore Lens of the Cape Cod single-source aquifer. This lens runs from the Cape Cod Canal eastward into the town of Yarmouth. To learn more about our watershed on the Internet, go to the U.S. Environmental Protection Agency's (EPA) "Surf Your Watershed" website at the following link: <http://cfpub.epa.gov/surf/locate/index.cfm>

Source Name	MassDEP Source ID#	Source Type	Location of Source
J-Well	4096001-01G	Groundwater	Herbert Road

Is My Water Treated?

Our drinking water is treated with potassium carbonate, sodium fluoride, and sodium hypochlorite. The water in this geographic area is naturally acidic, with an average pH of 5.9 (7.0 is neutral). Acidic water can be harmful to the distribution system. Potassium carbonate is used to buffer the water to as close to a neutral pH as possible. At the request of the U.S. Coast Guard, which is the owner and operator of the family housing area, sodium fluoride is added to the water. This compound has proven effective in strengthening teeth. Finally, sodium hypochlorite is used to disinfect the water supply by killing bacteria. We make every effort to provide you with safe and pure drinking water. To improve the quality of the water delivered to you, we treat it to remove several contaminants. The water quality of our system is constantly monitored by us and MassDEP to determine the effectiveness of existing water treatment and to determine if any additional treatment is required.

How Are These Sources Protected?

The Source Water Assessment and Protection (SWAP) Program, established under the federal Safe Drinking Water Act, requires every state to inventory land uses within the recharge areas of all public water supply sources; to assess the susceptibility of drinking water sources to contamination from these land uses; and to publicize the results to provide support for improved protection.

MassDEP has prepared a SWAP Report for the water supply source(s) serving this water system. The SWAP Report assesses the susceptibility of public water supplies.

What is My System's Ranking?

A susceptibility ranking of HIGH was assigned to this system due to the absence hydrogeological barriers (i.e., clay) that can prevent contaminant migration.

Where Can I See The SWAP Report?

Information on obtaining the complete SWAP Report is available by contacting the Water Supply Superintendent at (508) 968-4102. To access the SWAP Report on the Internet, go to the Source Water Assessment & Protection (SWAP) Program Website at the following link:

<https://www.mass.gov/service-details/the-source-water-assessment-protection-swap-program>

What Are the Key Issues For Our Water Supply?

We are all concerned about the quality of the water we drink. Our drinking water well may be threatened by many potential contaminant sources, including storm runoff, road salting, and improper disposal of hazardous materials. Also, being a military facility, Otis Air National Guard Base has the potential of having fuel, chemicals, and other material(s) as possible sources of contamination. Citizens and on base personnel can work together to better protect these drinking water sources.

What Can Be Done To Improve Protection?

Residents can help protect sources by:

- Practicing good septic system maintenance
- Supporting water supply protection initiatives when implemented
- Taking hazardous household chemicals to locally established hazardous materials collection days
- Limiting pesticide and fertilizer use, etc.

SUBSTANCES FOUND IN TAP WATER

Sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals. In some cases, water travels over the surface of the land or through the ground and dissolves radioactive material. The water can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

Microbial contaminants – such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Inorganic contaminants – such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial, or domestic wastewater discharges, oil and gas production, mining, and farming.

Pesticides and herbicides – which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.

Organic chemical contaminants – including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

Radioactive contaminants – which can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, MassDEP and U.S. EPA prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. The Food and Drug Administration (FDA) and Massachusetts Department of Public Health (DPH) regulations establish limits for contaminants in bottled water that must provide the same protection for public health.

All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline at (800) 426-4791.

IMPORTANT DEFINITIONS

Maximum Contaminant Level (MCL) – The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

Maximum Contaminant Level Goal (MCLG) – The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

Action Level (AL) – The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

90th Percentile – Out of every 10 homes sampled, 9 were at or below this level.

Secondary Maximum Contaminant Level (SMCL) – These standards are developed to protect the aesthetic qualities of drinking water and are not health based.

Unregulated Contaminants – Unregulated contaminants are those for which EPA has not established drinking water standards. The purpose of unregulated monitoring is to assist EPA in determining their occurrence in drinking water and whether future regulation is warranted.

Massachusetts Office of Research and Standards Guideline (ORSG) – This is the concentration of a chemical in drinking water, at or below which, adverse health effects are unlikely to occur after chronic (lifetime) exposure. If exceeded, it serves as an indicator of the potential need for further action.

Treatment Technique (TT) – A required process intended to reduce the level of a contaminant in drinking water.

Running Annual Average (RAA) – The average of four consecutive quarter of data.

Maximum Residual Disinfectant Level (MRDL) – The highest level of a disinfectant (chlorine, chloramines, chlorine dioxide) allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

Maximum Residual Disinfectant Level Goal (MRDLG) – The level of a drinking water disinfectant (chlorine, chloramines, chlorine dioxide) below which there is no known expected risk to health. MRDLG's do not reflect the benefits of the use of disinfectants to control microbial contaminants.

Level 1 Assessment – A Level 1 assessment is a study of the water system to identify potential problems and determine (if possible) why total coliform bacteria have been found in our water system.

Level 2 Assessment – A Level 2 assessment is a very detailed study of the water system to identify potential problems and determine (if possible) why an *E. coli* MCL violation has occurred and/or why total coliform bacteria have been found in our water system on multiple occasions.

UNITS OF MEASUREMENT

- MFL = Million Fibers per Liter
- mrem/year = millirem per year (a measure of radiation absorbed by the body)
- N/A = Not Applicable
- ND = Not Detected
- pCi/L = picocuries per liter (a measure of radioactivity)
- ppb = parts per billion, or micrograms per liter (ug/L)
- ppm = parts per million, or milligrams per liter (mg/L)
- ppt = parts per trillion, or nanograms per liter (ng/L)

WATER QUALITY TESTING RESULTS

What Does This Data Represent?

The water quality information presented in the table is from the most recent round of testing done in accordance with the regulations. All data shown was collected during the last calendar year unless otherwise noted in the table.

Bacteria	MCL/TT	MCLG	Value	Date	Violation (Y/N)	Possible Source(s) of Contamination
Total Coliform Bacteria	0	0	0	2018	N	Human and animal fecal waste

What About Lead Exposure?

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Otis Air National Guard Base is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline at (800) 426-4791 or on the Internet, at the following link:

<http://www.epa.gov/safewater/lead>

Substance (unit of measurement)	Date(s) Collected	90 TH Percentile	Action Level	MCLG	# of sites sampled	# of sites above Action Level	Possible Source(s) of Contamination
Lead (ppb)	2018	0.2	15	0	40	0	Corrosion of household plumbing systems; Erosion of natural deposits
Copper (ppm)	2018	0.448	1.3	1.3	40	0	Corrosion of household plumbing systems; Erosion of natural deposits; Leaching from wood preservatives

Regulated Contaminant	Date(s) Collected	Highest Result	Range Detected	MCL or MRDL	MCLG or MRDLG	Violation (Y/N)	Possible Source(s) of Contamination
Inorganic Contaminants							
Asbestos (MFL)	2013	N/A	ND	7	7	N	Decay of asbestos cement water mains; erosion of natural deposits
Barium (ppm)	2018	0.016	0.00-0.016	2	2	N	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Chromium (ppb)	2015	0.51	0.00-0.51	100	100	N	Discharge from pulp mills; erosion of natural deposits
Fluoride (ppm)*	2018	0.76	0.00-0.76	4	4	N	Erosion of natural deposits; water additive which promotes strong teeth; discharge from fertilizer and aluminum factories
*Fluoride also has a secondary contaminant level (SMCL) of 2 ppm.							
Nitrate (ppm)	2018	1.92	0.07-1.92	10	10	N	Runoff from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits
Nitrite (ppm)	2017	ND	N/A	1	1	N	Runoff from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits
Perchlorate (ppb)	2018	ND	N/A	2	N/A	N	Rocket propellants, fireworks, munitions, flares, blasting agents
Radioactive Contaminants							
Radium 226 & 228 (pCi/L) (combined values)	2015	1.10	0.623-1.10	5	0	N	Erosion of natural deposits
Disinfectants and Disinfection By-Products							
Total Trihalomethanes (TTHMs) (ppb)	QTR3 (2018)	24.8	20.2-29.4	80	N/A	N	Byproduct of drinking water chlorination
Haloacetic Acids (HAA5) (ppb)	QTR3 (2018)	4.27	2.68-5.86	60	N/A	N	Byproduct of drinking water disinfection
Chlorine (ppm)	Monthly in (2018)	1.87	0.01-1.87	4	4	N	Water additive used to control microbes

Unregulated and Secondary Contaminants

Unregulated contaminants are those for which there are no established drinking water standards. The purpose of unregulated contaminant monitoring is to assist regulatory agencies in determining their occurrence in drinking water and whether future regulation is warranted.

Unregulated Contaminants	Date(s) Collected	Result or Range Detected	Average Detected	SMCL	ORSG	Possible Source(s) of Contamination
Bromodichloromethane	2015	2.70	1.35	N/A	N/A	Trihalomethane; by-product of drinking water chlorination
Chloroform (ppb)	2018	2.13-2.16	2.145	N/A	70	By-product of drinking water chlorination (In non-chlorinated sources it may be naturally occurring)
Chromium-6	2015	0.29	0.145	N/A	N/A	Discharge from steel and pulp mills; Erosion of natural deposits
Dibromodichloromethane	2015	3.40	1.70	N/A	N/A	Trihalomethane; By-product of drinking water chlorination
Manganese* (ppb)	2017	0.016	0.008	N/A	300	Erosion of natural deposits
*US EPA has established a lifetime health advisory (HA) value of 300 ppb for manganese to protect against concerns of potential neurological effects, and a one-day and 10-day HA of 1000 ppb for acute exposure.						
Methyl tertiary butyl ether* or MTBE (ppb)	2016	0.63	0.315	20-40	70	Fuel additive; leaks and spills from gasoline storage tanks.
*EPA has established a lifetime Health Advisory (HA) of 0.3 mg/L and an acute HA at 1.0 mg/L						
Sodium (ppm)	2018	5.8-14.0	9.9	N/A	20	Discharge from the use and improper storage of sodium-containing de-icing compounds or in water-softening agents

COMPLIANCE WITH DRINKING WATER REGULATIONS

Does My Drinking Water Meet Current Health Standards?

We are committed to providing you with the best water quality available. We are proud to report that last year your drinking water met all applicable health standards regulated by the state and federal government.

Health Effects Statements

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants may be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The U.S. EPA/CDC (Centers for Disease Control and Prevention) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline at (800) 426-4791 or on the Internet, at the following link: <http://water.epa.gov/drink/hotline>

EDUCATIONAL INFORMATION

Do I Need To Be Concerned about Certain Contaminants Detected in My Water?

This is an alert about your drinking water and a cosmetic dental problem that might affect children under nine years of age. At low levels, fluoride can help prevent cavities, but children drinking water containing more than 2 ppm of fluoride may develop cosmetic discoloration of their permanent teeth (dental fluorosis). The drinking water provided by your community water system at Otis Air National Guard Base has a fluoride concentration of 0.7 mg/l. Dental fluorosis, in its moderate or severe forms, may result in a brown staining and/or pitting of the permanent teeth. This problem occurs only in developing teeth, before they erupt from the gums. Children under nine should be provided with alternative sources of drinking water or water that has been treated to remove the fluoride to avoid the possibility of staining and pitting of their permanent teeth. You may also want to contact your dentist about proper use by young children of fluoride containing products. Older children and adults may safely drink the water. Drinking water containing more than 4 ppm of fluoride (the U.S. Environmental Protection Agency's drinking water standard) can increase your risk of developing bone disease.

Your drinking water does not contain more than 4 ppm of fluoride, but we're required to notify you when we discover the fluoride levels in your drinking water to exceed 2 ppm because of the cosmetic dental problem. Some home water treatment units are available to remove fluoride from drinking water. To learn more about available home water treatment units, you may call the NSF International at 1-800-NSF-MARK (1-800-673-6275). For more information, please call the Water Superintendent at (508) 968-4102 or for additional information on fluoride in drinking water, contact the Massachusetts Department of Public Health, Office of Oral Health, (617) 624-5943.

Cross-Connection Control and Backflow Prevention

Otis Air National Guard Base makes every effort to ensure that the water delivered to your home and business is clean, safe and free of contamination. Our staff works very hard to protect the quality of the water delivered to our customers from the time the water is extracted via deep wells from underground aquifers or withdrawal point from a surface water source, throughout the entire treatment and distribution system. But what happens when the water reaches your home or business? Is there still a need to protect the water quality from contamination caused by a cross-connection? If so, how?

What is a cross-connection?

A cross-connection occurs whenever the drinking water supply is or could be in contact with potential sources of pollution or contamination. Cross-connections exist in piping arrangements or equipment that allows the drinking water to come in contact with non-potable liquids, solids, or gases (hazardous to humans) in event of a backflow.

What is a backflow?

Backflow is the undesired reverse of the water flow in the drinking water distribution lines. This backward flow of water can occur when the pressure created by equipment or a system such as a boiler or air-conditioning is higher than the water pressure inside the water distribution line (back pressure), or when the pressure in the distribution line drops due to routine occurrences such as water main breaks or heavy water demand causing the water to flow backward inside the water distribution system (back siphonage). Backflow is a problem that many water consumers are unaware of, a problem that each and every water customer has a responsibility to help prevent.



What can I do to help prevent a cross-connection?

Without the proper protection something as simple as a garden hose has the potential to contaminate or pollute the drinking water lines in your house. In fact over half of the country's cross-connection incidents involve unprotected garden hoses. There are very simple steps that you as a drinking water user can take to prevent such hazards, they are:

- NEVER submerge a hose in soapy water buckets, pet watering containers, pool, tubs, sinks, drains, or chemicals.
- NEVER attached a hose to a garden sprayer without the proper backflow preventer.
- Buy and install a hose bibb vacuum breaker in any threaded water fixture. The installation can be as easy as attaching a garden hose to a spigot. This inexpensive device is available at most hardware stores and home-improvement centers.
- Identify and be aware of potential cross-connections to your water line.
- Buy appliances and equipment with backflow preventers.
- Buy and install backflow prevention devices or assemblies for all high and moderate hazard connections.

If you are the owner or manager of a property that is being used as a commercial, industrial, or institutional facility you must have your property's plumbing system surveyed for cross-connection by your water purveyor. If your property has NOT been surveyed for cross-connection, contact your water department to schedule a cross-connection survey.

ADDITIONAL INFORMATION

Tap Water vs. Bottled Water

Thanks in part to aggressive marketing, the bottled water industry has successfully convinced us all that water purchased in bottles is a healthier alternative to tap water. However, according to a four-year study conducted by the Natural Resources Defense Council (NRDC), bottled water is not necessarily cleaner or safer than most tap water. In fact, about 25 percent of bottled water is actually just bottled tap water (40 percent according to government estimates).

The Food and Drug Administration (FDA) is responsible for regulating bottled water, but these rules allow for less rigorous testing and purity standards than those required by the U.S. EPA for community tap water. For instance, the high mineral content of some bottled waters makes them unsuitable for babies and young children. Further, the FDA completely exempts bottled water that's packaged and sold within the same state, which accounts for about 70 percent of all bottled water sold in the United States.

People spend 10,000 times more per gallon for bottled water than they typically do for tap water. If you get your recommended eight glasses a day from bottled water, you could spend up to \$1,400 annually. The same amount of tap water would cost about 73 cents. Even if you installed a filter device on your tap, your annual expenditure would be far less than what you'd pay for bottled water.

For a detailed discussion on the NRDC study results, check out "The Truth About Tap" website at the following link: www.nrdc.org/water/drinking/qbw.asp

Brown, Red, Orange, or Yellow Water

Brown, red, orange, or yellow water is usually caused by rust. The different colors can be attributed to varying chemical oxidation states of the iron (rust) and by varying concentrations of the rust in the water. There are two major sources that can cause water to be rusty:

- The water mains, or
- The water pipes in your building

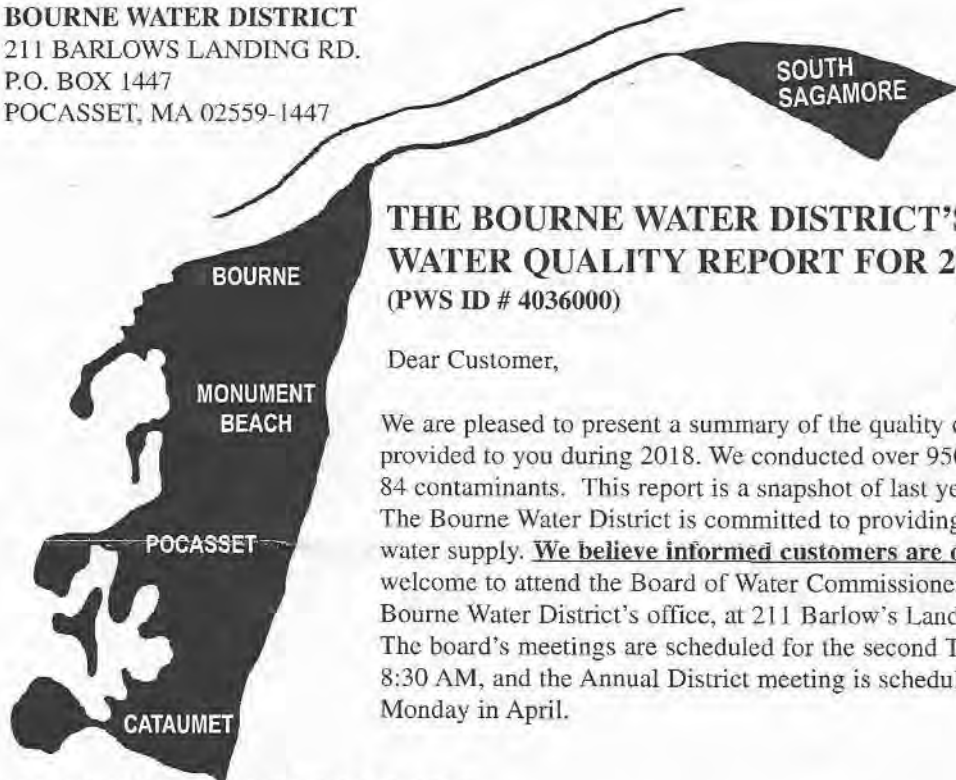
Rusty water occurs from sediment or rust from the inside walls of the water mains. The rust can be disturbed and temporarily suspended in water with unusual water flows from water main breaks or maintenance or by flushing of a hydrant. This discolored water is not a health threat.

When the water is discolored it is recommended to either not wash laundry or to use a rust stain remover or regular detergent but not chlorine bleach as it will react with the iron to form a permanent stain.

The other major cause of brown, red, orange or yellow water is rusty water pipes in your building. Water that is being discolored by rusty pipes is not a health hazard.

Bourne Water District
Water Quality Report 2018

BOURNE WATER DISTRICT
 211 BARLOWS LANDING RD.
 P.O. BOX 1447
 POCASSET, MA 02559-1447



**THE BOURNE WATER DISTRICT'S
 WATER QUALITY REPORT FOR 2018**
 (PWS ID # 4036000)

Dear Customer,

We are pleased to present a summary of the quality of the drinking water provided to you during 2018. We conducted over 950 tests for more than 84 contaminants. This report is a snapshot of last year's water quality. The Bourne Water District is committed to providing you with a reliable water supply. **We believe informed customers are our best allies.** You are welcome to attend the Board of Water Commissioners meetings held at the Bourne Water District's office, at 211 Barlow's Landing Road in Pocasset. The board's meetings are scheduled for the second Tuesday of the month at 8:30 AM, and the Annual District meeting is scheduled on the fourth Monday in April.

WATER SOURCES AND TREATMENT

The Bourne Water District is supplied by 10 different sources, 7 of our own gravel packed well sites and 3 gravel packed well sites from the Upper Cape Regional Water Supply Cooperative. Four of our well sites are in the Monument Beach area of the Town Forest. The other two wells are in the Cataumet area of the Town of Bourne. One well is on Joint Base Cape Cod and we have one transfer station on Connery Ave. The Bourne Water District treats all supplies with lime slurry for corrosion control. The lime slurry is used to raise the pH of the water. This makes the water less aggressive to the copper pipe and lead joints in your homes to prevent exposure to lead and copper.

WHAT DOES THE FOLLOWING TABLE MEAN?

- Action Level (AL)** The concentration of a contaminant which if exceeded triggers treatment or other requirements.
- Maximum Contaminant Level (MCL)** The highest level of a contaminant that is allowed in the drinking water. The MCL is set as close to the MCLG as feasible using the best available treatment technology.
- Maximum Contaminant Level Goal (MCLG)** The level of a contaminant in the drinking water below which there is no known or expected risk to health. The MCLG allow for a margin of safety.
- 90th Percentile** Out of every 10 houses sampled, 9 were below this level.

KEY TO TABLE

- AL = Action Level
- MCL = Maximum Contaminant Level
- MCLG = Maximum Contaminant Level Goal
- MFL = million fibers per liter
- Mrem/year = millirems per year (a measure of radiation absorbed by the body)
- NTU = Nephelometric Turbidity Units
- pci/l = picocuries per liter (a measurement of radioactivity)
- ppm = parts per million, or milligrams per liter (mg/l)
- ppb = parts per billion, or micrograms per liter (ug/l)
- ppt = parts per trillion, or nanograms per liter
- ppq = parts per quadrillion, or picograms per liter
- TT = Treatment Technique

DISTRIBUTION SYSTEM WATER QUALITY This report summarizes only those items detected during Sampling not all contaminants that are monitored

Microbial Results	Highest Detected	Range Detected	MCL	MCLG	Violation	Possible Source of Contamination
Total Coliform Bacteria**	80	0-80	0	0	yes	Naturally present in the environment
Fecal Coliform or E. Coli	0	0	0	0	No	Human and Animal Fecal Waste

* Compliance with the Fecal Coliform/E. Coli MCL is determined upon additional repeat testing
 ** Total Coliform: Coliform are bacteria that are naturally present in the environment and are used as an indicator that other potentially harmful bacteria may be present

Lead and Copper	Dates collected	90th Percentile	Action Level	MCLG	# of sites sampled	# Sites above Action Level	Violation	Possible Source of Contamination
Lead (ppb)	4/1/2018 thru 12/31/2018	0.0033	15	0	120	1	No	Corrosion of household plumbing systems; Erosion of natural deposits
Copper (ppm)	4/1/2018 thru 12/31/2018	0.279	1.3	1.3	120	3	No	Corrosion of household plumbing systems; Erosion of natural deposits

TESTING FOR LEAD - If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Bourne Water District is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When you water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information about lead in drinking water, testing methods and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at <http://www.epa.gov/safewater/lead>.

SUMMARY OF FINISHED WATER CHARACTERISTICS

Reported Contaminants	Date(s) collected	Highest Detect Value	Range Detected	MCL	MCLG	Violation	Possible Source of Contamination
Inorganic Contaminants:							
Barium (ppm)	2018	0.009	0.002-0.009	2	2	No	Discharge of drilling waste; discharge from metal refineries; erosion of natural deposits
Nitrate * (ppm)	2018	0.35	0.08-0.35	10	10	No	Runoff from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits
Perchlorate ** (ppb)	2018	"J" 0.23	0-0.23 "J"	2	-	No	Rocket propellants, fireworks, munitions, flares, blasting agents* (see note below)
* Nitrate	Nitrate in drinking water at levels above 10ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask advise from your health care provider.						
** Perchlorate	Perchlorate interferes with the normal function of the thyroid gland and thus has the potential to affect growth and development, causing brain damage and other adverse effects, particularly in fetuses and infants. Pregnant women, the fetus, infants and children up to the age of 12, and people with hypothyroid condition are particularly susceptible to perchlorate toxicity. *J" values are required when the results are above the MDL(0.012) and below the MRL(0.05)						
Organic Contaminants							
Tetrachloroethylene(PCE)(ppb)	2018	2.42	0-2.42	5	-	No	Discharge from factories and dry cleaners
Chloroform (ppb)	2018	1.27	0-1.27	ORSG 70	NA	No	By-product of drinking water chlorination
CIS-1,2 Dichloroethylene (ppb)	2018	2.03	1.35-2.03	70	NA	No	Runoff from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits
Secondary Contaminants							
Magnesium (ppm)	2018	18.3	1.44-18.3	-	-	-	Natural Mineral and Organics Matter
Chloride (ppm)	2018	41	7.3-41	250	NA	-	Natural Mineral, Road Salt
Calcium (ppm)	2018	19	3.7-19	-	-	-	Natural Mineral and Organics Matter
Iron (ppb)	2018	1.7	0.03-1.70	300	NA	-	Erosion of Natural Deposits and oxidation of iron components
Manganese (ppb)*	2018	0.041	0-0.041	50	NA	-	Erosion of Natural Deposits
Sodium (ppm)**	2018	28**	5.7-28	-	20	-	Road Salting; erosion of natural deposits

Potassium (ppm)	2018	1.2	0.05-1.2	-	-	-	Natural Mineral and Organics Matter
Sulfate (ppm)	2018	7	4.1-7.0	250	250	-	Natural Sources
Zinc (ppm)	2018	0.01	0.002-0.010	5	NA	-	Erosion of Natural Deposits, and industrial discharge

* EPA has established a lifetime health advisory (HA) for Manganese at 300ppb and an acute at 1000ppb
 ** Sodium is a naturally-occurring element found in soil and water. It is necessary for the normal functioning or regulating fluids in human systems. Some people, however, have difficulty regulating fluid volume as a result of several diseases, including congestive heart failure and hypertension. The guideline of 20mg/L for sodium represents a level in water that physicians and sodium sensitive individuals should be aware of in cases where sodium exposures are being carefully controlled. For additional information, contact your health care provider, your local Board of Health or the Massachusetts Dept. of Public Health, Bureau of Environmental Health Assessment at 617-624-5757.

NATIONAL PRIMARY DRINKING WATER REGULATION COMPLIANCE

The Total Coliform rule requires water systems to meet a stricter limit for Coliform bacteria. Coliform bacteria are harmless, but the presence in water can be an indication of disease-causing bacteria. When Coliform bacteria is found, special follow up tests are done to determine if harmful bacteria are present in the water supply. Over 500 Coliform samples were taken throughout the Bourne Water District in the year 2017.

During December of 2018 Bourne Water District was required 1 Level 1 assessment. 1 Level 1 assessment was completed. In addition, we were required to take no corrective actions. During 2018, 2 Level 2 assessments were required to be completed for our water system. 2 Level 2 assessments were completed. In addition, we were required to take 6 corrective actions and we have completed all 6 of the actions.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead and copper in drinking water is primarily from materials and components associated with service lines and home plumbing. The Bourne Water District is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead and copper exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead and copper in your water, you may wish to have your water tested. Information on lead and copper in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at <http://www.epa.gov/safewater/lead>.

Sodium: ORSG = 20 Sodium sensitive individuals, such as those experiencing hypertension, kidney failure or congestive heart failure, should be aware of the levels of sodium in their drinking water where exposures are carefully being controlled. Massachusetts Office of Research and Standard Guidelines (ORSG): This is the concentration of a chemical in drinking water, at or below which, adverse health effects are likely to occur after chronic (lifetime) exposure, with a margin of safety. If exceeded, it serves as an indicator of the potential need for further action.

If you are interested in a more detailed report, contact Robert Prophett at 508-563-2294.

REQUIRED ADDITIONAL HEALTH INFORMATION:

To insure that tap water is safe to drink, Department of Environmental Protection (DEP) and Environmental Protection Agency (EPA) prescribes limits on the amounts of certain contaminants in water provided by public water systems. Food and Drug Administration (FDA) and the Massachusetts Department of Public Health regulations establish limits for contaminants in bottled water. Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency Safe Drinking Water Hotline (1-800-426-4791). The sources of drinking water (both tap and bottled) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and radioactive material and can pick up substances resulting from the presence of animals or from human activity. Contaminants that may be present in the sources include:

- (A) Microbial contaminants such as viruses and bacteria which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.
- (B) Inorganic contaminants such as salts and metals which can be naturally-occurring or result from urban storm runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.
- (C) Pesticides and herbicides, which may come from a variety of sources such as agriculture, storm water runoff and residential uses.
- (D) Organic chemical contaminants, including synthetic and volatile organics which are by-products of industrial processes and petroleum production and can also come from gas stations, urban storm water runoff and septic systems.
- (E) Radioactive contaminants, which can be naturally occurring or be the results of oil and gas production and mining activities. In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. FDA regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infections by Cryptosporidium are available from the Safe Drinking Water Hotline (1-800-426-4791).

SOURCE WATER ASSESSMENT

The Bourne Water District had a source water assessment performed by the MA. Department of Environmental Protection in 2002. The Source Water Assessment and Protection (SWAP) program, established under the Federal Safe Drinking Water Act requires every state to:

- Inventory land uses within the recharge areas of all public water supply sources.
- Assess the susceptibility of drinking water sources to contamination from these land uses.
- Publicize the results to provide support for improved protection.

A susceptibility ranking of high was assigned to the Bourne Water District using the information collected during the assessment by the DEP. The high ranking was due to the potential contamination from land uses such as auto repair shops, truck terminal, furniture refinishing, auto salvage operation, an industrial park and activities in the recharge area (Zone II's) of some of the wells. The complete SWAP report is available at the Bourne Water District's office. For more information contact Robert Prophett at 508-563-2294.

CROSS CONNECTION

A cross connection is a connection between a drinking water pipe and a polluted source. The pollution can come from your own home. For instance, you're going to spray fertilizer on your lawn, and you hook up your hose to the sprayer that contains the fertilizer. If the water pressure drops (say because of a fire hydrant being used or water main break) when the hose is connected to the fertilizer sprayer, the fertilizer may be sucked back into the drinking water pipes through your hose. Using an anti-siphon backflow-prevention device on your sprayer or hose bib can prevent this problem.

The Bourne Water District recommends using devices with an anti-siphon feature or equipping hose bibs with hose bib vacuum breakers to prevent against back flow. For additional information on cross connections and on the status of your water system's cross connection program, please contact Robert Prophett at 508-563-2294.

UPPER CAPE REGIONAL WATER SUPPLY COOPERATIVE (PWS #4261024)

The Upper Cape Regional Water Supply consists of three groundwater supply wells located on the Massachusetts Military Reservation. A Board of Managers representing the four member public water supply systems manages the Cooperative. The member public water supply systems include Bourne Water District, Sandwich Water District, Mashpee Water District and the Town of Falmouth. The Cooperative also has capacity to supply water to the Joint Base Cape Cod public water system, and the Barnstable County Jail.

Wells #1, #2, #3 are located in a forested area of the northeastern portion of the Joint Base Cape Cod (JBCC). The JBCC has adopted a Groundwater Protection Plan to prohibit inappropriate activities in the Zone II areas of community public water supply wells. In addition, the creation of the Environmental Management Commission provides oversight over activities on the northern portion of the JBCC. For information regarding the Groundwater Protection Plan call Elizabeth Kirkpatrick at (508) 968-6487. For information regarding the Environmental Management Commission call Len Pinaud at (508) 946-2871. For questions regarding SWAP or other information about Upper Cape Regional Water Supply CCR contact Don Rugg at (508) 888-7262.

2018 WATER QUALITY DATA

Listed below are the substances detected in water samples collected during the most recent sampling period from the three (3) wells that comprise the Upper Cape Drinking Water Supply Cooperative.

Inorganic Contaminants	Year Sampled	Highest Result	Range of Detections	MCL	MCLG	Violation (Y/N)	Possible Sources
Nitrate	2018	0.07 ppm	0.07 ppm	10 ppm	10 ppm	No	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits
Radioactive Contaminants	Year Sampled	Amount Detected	Range of Detections	MCL	MCLG	Violation	Possible Sources
Radium 228	2015	0.623 pCi/L	NA	5 pCi/L	0	No	Erosion of natural deposits
Combined Radium	2015	0.623 pCi/L	NA	5 pCi/L	0	No	Erosion of natural deposits
Unregulated and Secondary Contaminants	Year Sampled	Amount Detected	Range of Detections	SMCL	ORSG	Violation	Possible Sources
Chloroform	2018	2.16 ppb	1.30-2.16 ppb	NA	70 ppb	No	Trihalomethane: by-product of drinking water chlorination. In non-chlorinated sources, chloroform may be naturally occurring
Sodium	2018	5.8 ppm	NA	NA	20 ppm	No	Natural erosion, road salt

APPENDIX F

RARE SPECIES REPORTED TO NATURAL HERITAGE AND ENDANGERED SPECIES PROGRAM

LIST OF RARE SPECIES REPORTED TO NHESP HISTORY										
Common/Scientific Names	TY 2010	TY 2011	TY 2012	TY 2013	TY 2014	TY 2015	TY 2016	TY 2017	TY 2018	TY 2019
BIRDS										
Grasshopper Sparrow ¹ (<i>Ammodramus savannarum</i>)	50	26	40	36	26	46 (23)	59 (16)	44 (15)	47 (16)	(20)
Northern Harrier ² (<i>Circus cyaneus</i>)	9	4	5	8	12	Wintering	Wintering	Wintering	Wintering	Wintering
Upland Sandpiper ¹ (<i>Bartramia longicauda</i>)	29	3	3	15	3	12 (7)	20 (6)	23 (8)	20 (7)	(12)
Northern Parula (<i>Parula Americana</i>)	0	0	0	0	0	0	0	0	0	
Sharp-shinned Hawk ² (<i>Accipiter striatus</i>)	0	0	0	2	2	1	0	0	0	0
Vesper Sparrow (<i>Poocetes gramineus</i>)	8	3	1	3	1	0	0	0	0	0
Whip-poor-will ³ (<i>Caprimulgus vociferous</i>)	0	0	201	51	156	96	87	52	110	53
Long-eared Owl ² (<i>Asio otus</i>)	0	0	0	0	1	0	0	0	0	0
Bald Eagle ² (<i>Haliaeetus leucocephalus</i>)	0	0	0	0	0	3	0	0	0	0
ODONATES										
Comet Darner ⁴ (<i>Anax longipes</i>)	6	14	4	0	5	0	N/A	N/A	N/A	N/A
Spatterdock Darner ⁴ (<i>Aeshna mutata</i>)	7	10	14	0	9	0	N/A	N/A	N/A	N/A

LIST OF RARE SPECIES REPORTED TO NHESP HISTORY										
Common / Scientific Names	TY 2010	TY 2011	TY 2012	TY 2013	TY 2014	TY 2015	TY 2016	TY 2017	TY 2018	TY 2019
REPTILES and AMPHIBIANS										
Eastern Box Turtle <i>(Terrapene carolina carolina)</i>	13	29	13	11	15	0	38	42	43	58
BUTTERFLIES and MOTHS⁵										
Barrens Buckmoth <i>(Hemileuca maia)</i>	0	0	0	0	4 clusters	13	90	95	0	4
Pine Barrens Speranza <i>(Speranza exonerate)</i>	0	0	0	0	0	0	44	13	0	0
Sandplain Euchlaena <i>(Euchlaena madusaria)</i>	0	0	0	0	0	0	3	7	0	0
Coastal Swamp Metarranthis <i>(Metarranthis pilosaria)</i>	0	0	0	0	0	0	1	1	0	0
Melsheimer's Sack Bearer <i>(Cicinnus melsheimeri)</i>	0	0	0	0	0	0	2	0	0	0
Gerhard's Underwing <i>(Catocala herodias)</i>	0	0	0	0	0	0	33	10	0	0
Pine Barrens Zale <i>(Zale lunifera)</i>	0	0	0	0	0	0	13	8	0	0
Barrens Dagger Moth <i>(Acronicta albarufa)</i>	0	0	0	0	0	0	1	0	0	0
Drunk Apamea <i>(Apamea inebriata)</i>	0	0	0	0	0	0	1	0	0	0
Chain-dotted Geometer <i>(Cingilia catenaria)</i>	0	0	0	0	0	0	0	0	0	1
Pink Sallow <i>(Psectraglaea carnosia)</i>	0	0	0	0	0	0	9	5	0	0

LIST OF RARE SPECIES REPORTED TO NHESP										
HISTORY										
Common / Scientific Names	TY 2010	TY 2011	TY 2012	TY 2013	TY 2014	TY 2015	TY 2016	TY 2017	TY 2018	TY 2019
BUTTERFLIES and MOTHS⁵										
Pink Streak (<i>Dargida rubripennis</i>)	0	0	0	0	0	0	25	0	0	0
Unexpected Cynia (<i>Cynia inopinatus</i>)	0	0	0	0	0	0	0	1	0	11
Coastal Heathland Cutworm (<i>Abagrotis benjamini</i>)	0	0	0	0	0	0	0	1	0	0
Pine Barrens Lycia (<i>Lycia ypsilon</i>)	0	0	0	0	0	0	0	2	0	0
Water-willow Stem Borer (<i>Papipema sulphurata</i>)	0	0	0	0	0	0	0	1	0	0
Waxed Sallow Moth (<i>Chaetagnaea cerata</i>)	0	0	0	0	0	0	0	2	0	0
Frosted Elfin ⁶ (<i>Callophrys irus</i>)	0	0	0	0	0	0	0	5	5	TBD
CRUSTACEANS										
Agassiz's Clam Shrimp ⁷ (<i>Eulimnadia agassizii</i>)	0	0	0	0	0	1	0	6	38	9
PLANTS										
Adder's Tongue Fern ^{8,10} (<i>Ophioglossum pusillum</i>)	138	48	84	542	1,467	256	98	247	0	25
Broad Tinker's Weed ^{9,10} (<i>Triosteum perfoliatum</i>)	56	233	332	1,230	297 plants 945 stems	4,861 plants 11,611 stems	113	127	0	200

LIST OF RARE SPECIES REPORTED TO NHESP										
HISTORY										
Common/Scientific Names	TY 2010	TY 2011	TY 2012	TY 2013	TY 2014	TY 2015	TY 2016	TY 2017	TY 2018	TY 2019
PLANTS										
Torrey's Beak Rush ¹¹ (<i>Rhynchospora Torreyana</i>)	4,800	2,606	4,416	910	N/A	N/A	N/A	N/A	N/A	N/A
American Arborvitae ¹² (<i>Thuja occidentalis</i>)	0	0	0	0	0	4	4	N/A	N/A	N/A
MAMMALS										
Northern Long-Eared Bat ^{13,14} (<i>Myotis septentrionalis</i>)	0	0	0	0	8	22 (2)	TBD	TBD	TBD	TBD
Little Brown Bat ¹³ (<i>Myotis lucifugus</i>)	0	0	0	0	4	40	TBD	TBD	TBD	TBD
Tricolored Bat ¹³ (<i>Perimyotis subflavus</i>)	0	0	0	0	11	11	TBD	TBD	TBD	TBD

¹ Starting TY 2019, numbers represent individuals observed in a given year rather than the total number of birds observed throughout repeated surveys as was reported in past years. The numbers in parantheses represent this new way of reporting individuals applied to past years' data. Also, the 2015 numbers reported in past annual reports included birds found on the Coast Guard airfield, which is not reported by MAARNG Natural Resources. Numbers in this version for years TY 2015 to TY 2019 are accurate. ² NHESP is only accepting reports of nesting raptors, rather than opportunistic observations of individuals. Reports are provided as relevant, but common wintering birds or migrants are not individually tracked or reported (e.g., Northern Harrier). ³ As of TY 2016, quantities only reflect the results of annual survey routes during May, after totaling the minimum number (between two observers) heard at each site. In prior years, the number shown reflects the quantity reported to NHESP, which may include multiple survey windows and repeated counts. ⁴ Spatterdock Darner is no longer on NHESP's rare species list. Also, Odonate surveys were suspended after TY 2015. ⁵ Moths were extensively surveyed under contract with the Lloyd Center for the Environment between 2016 and 2017. There were no surveys in 2018, and MAARNG staff is not recording flight records of Barrens Buckmoth, as they are ubiquitous around the Reserve. 2019 quantities represent individuals or groups of individuals (a group of Barrens Buckmoth caterpillars on a single leaf is counted as one, as are a pair of Unexpected Cynnia caterpillars sharing the same butterflyweed plant). ⁶ MAARNG staff did not perform surveys for *Callophrys irus* in 2019, but facilitated USFWS surveys. Results are pending, but USFWS staff found Frosted Elms across a wider area than was previously known. ⁷ Numbers represent only locations where species was found and ID confirmed by either NHESP Aquatic Ecologist or trained MAARNG staff. ⁸ Several known *Ophioglossum* sites could not be surveyed in TY 2016 due to a lack of cease-fire agreement with the off-base Monument Beach Shooting Club. ⁹ Surveys performed in 2015 did not differentiate *Triosteum perfoliatum* from *T. aurantiacum*, greatly increasing the number of individuals reported. For this reason, *Triosteum perfoliatum* was not reported to NHESP in 2015. ¹⁰ In 2018, only sites with historic records and no recent records were surveyed, and this should not be interpreted as a loss of rare plants between 2017 and 2018. ¹¹ Torrey's beak rush is on Coast Guard land and the Natural Resource Office is no longer monitoring this site. ¹² NHESP is not interested in tracking this population, as it is likely of anthropogenic origin (pers. comm. with State Botanist, Bob Wernerehl). ¹³ Acoustic monitoring collects "call sequence" data and the true number of individuals is unknown. Numbers in the table reflect the number of survey sites with acoustic detections. Numbers are reported to NHESP, but not tracked by them due to current uncertainty in using acoustic identifications. TY 2018/2019 data is still being processed, these numbers are to be determined at a later date (TBD). ¹⁴ Number in parentheses is captured individuals trackable by NHESP due to species identification confirmation versus acoustic data.

APPENDIX G

ENVIRONMENTAL PERFORMANCE STANDARDS

VIOLATIONS HISTORY

EPS VIOLATIONS HISTORY			
TRAINING YEAR	REPORTED VIOLATION	EXPLANATION OF VIOLATION	CORRECTIVE ACTION
TY 2019	General Performance Standard	Three L600 M119 whistling booby trap simulators were used; they are not on the approved munitions list and were not authorized for use. The MAARNG reported a nonconformance to the EMC on September 17, 2019.	All levels: command, units training and the ASP will be provided a list of items permanently and temporarily authorized for a particular training event. The ASP will make a change in their ammunition reservation program that will not allow unauthorized ammunition or simulators to be reserved. Camp Edwards Range Control will do a final munition check as units check in for their reserved training area or venue.
TY 2018	Rare Species EPS (EPS 3)	A road puddle containing state-listed Agassiz clam shrimp was filled by a unit training at Dig Site 1. The MAARNG forwarded a formal notice of violation to the EMC on May 16, 2018.	Camp Edwards will, after relocation of the clam shrimp and in concert with the CMP, fill the puddles, use signage to avoid infilling of relevant puddles, and educate users as to how they are supposed to coordinate with Camp Edwards before taking actions outside of their training plan while in the Reserve.
TY 2017	None	-----	-----
TY 2016	General Performance Standard	Eight thousand paintball rounds were fired by a unit on the IMT range (Dig Site 3) without permission or prior coordination. The MAARNG forwarded a formal notice of violation to the EMC on November 9, 2015.	Unit soldiers cleaned and cleared the area of debris, discussion of the seriousness of the violation with the Unit Commander and told of actions needed for compliance when wanting to train with any unapproved munition. Camp Edwards staff conducted a Range Officer in Charge and Range Safety brief audit to validate content and effectiveness. Range Control staff will conduct assessments of units while they are training in the Reserve to ensure activities are within established performance standards.
TY 2015	Vehicle Performance Standard EPS (EPS 17)	A pickup truck was driven into, off road, and placed in Training Area BA-7 as a temporary training aid. The MAARNG forwarded a formal notice of violation to the EMC on June 5, 2015.	Camp Edwards staff conducted a Range Officer in Charge and Range Safety brief audit to validate content and effectiveness. Range Control staff will conduct assessments of units while they are training in the Reserve to ensure activities are within established performance standards.
TY 2014	None	-----	-----
TY 2013	None	-----	-----

EPS VIOLATIONS HISTORY			
TRAINING YEAR	REPORTED VIOLATION	EXPLANATION OF VIOLATION	CORRECTIVE ACTION
TY 2012	Small Arms Range EPS (EPS 19)	On November 7, 2011, the EMC issued a notice for failure to remove water from bullet traps on all three active small arms ranges within the prescribed time periods on multiple occasions during TY 2011. The EPA also cited the MAARNG for a violation for the same failure.	The MAARNG submitted a Response Packet to the EMC in early December 2011 which included: 1) a Notification Protocol should it not be able to comply with a requirement of the OMMPs; 2) a STAPP™ Range Tarp Cover Project Description; 3) Water Removal Contracting and Budgeting provisions; 4) creation of a Camp Edwards Sustainable Range Program Working Group; and 5) a Standard Operating Procedure for STAPP™ System Range Maintenance Procedures and Inspections.
TY 2011	Wetlands & Surface Water EPS (EPS 2) & General Use and Access EPS (EPS 18)	On May 17, 2011 military vehicles (Humvees) were driven into an off limits area within 100 feet of Donnelly Pond in the B 8 Training Area. On the same date, Humvees were driven on a seasonably restricted road in the B 8 Training Area.	The using unit notified Range Control and the EMC's Environmental Officer, who was present at Range Control when the using unit reported the violation. The MAARNG reestablished the seasonal road closure and closing of unauthorized access points in the B 8 Training Area, revisited all seasonal road closure areas to ensure road blocks and proper signage was in place, and conducted a debriefing by Range Control of the involved unit.
TY 2010	None	-----	-----