STATE OF THE RESERVATION REPORT

TRAINING YEAR 2022• CAMP EDWARDS
FINAL

Final Annual State of the Reservation Report, Camp Edwards, Training Year 2022
March 2023

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PREFACE

The Annual *State of the Reservation Report* (the Annual 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 describes the nature and extent of military training and other activities taking place in the Camp Edwards Training Area/Upper Cape Water Supply Reserve. In addition, it describes 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 (Training Area/Reserve). The Annual Report illustrates that coordinated military training can occur in the Camp Edwards Training Area/Upper Cape Water Supply Reserve in a manner that is compatible with the natural resources purposes of water supply and wildlife habitat protection.

The Annual *State of the Reservation Report* covers the Massachusetts National Guard's Training Year 2022, which ran from October 1, 2021 to September 30, 2022; 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 compliance with applicable local, state, and federal regulations. 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.

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

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 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 Training Area/Reserve during Training Year 2022. Data is provided on the levels of training in the various training areas in the Training Area/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 Training Area/Reserve and program compliance with the Environmental Performance Standards for the Training Area/Reserve for the training year.

Section 4, Remediation Program Activities, provides a summary of remediation activities undertaken in the Training Area/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 2022 that may not be directly related to a Massachusetts Army National Guard environmental management program, actions in the Training Area/Reserve, or specific Environmental Performance Standards for the Training Area/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 Training Area/Reserve to interested stakeholders and the community at large. In good faith, the Annual Report is provided to the Environmental Management Commission's Environmental Officer, and the Commission's Science Advisory Council and Community Advisory Council for their input.

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.

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 Training Area/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 Upper Cape Water Supply Reserve within the Camp Edwards Training Area.

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 2022 (October 1, 2021 – September 30, 2022).

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, which are all outside of the Upper Cape Water Supply Reserve/Camp Edwards Training Area.

Small Arms Ranges

Small arms ranges allow live-fire qualification training with weapons of a small caliber, i.e., pistols, rifles and semi-automatic and automatic rifles. 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 four operational 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. The small arms ranges are situated around the perimeter of the Impact Area, with range firing toward 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.

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.

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 2022. 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@army.mil. The Massachusetts National Guard Environmental & Readiness Center's website is: https://www.massnationalguard.org/ERC/index.htm. The Environmental Management Commission's website may be found at: https://www.mass.gov/info-details/environmental-management-commission-emc

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ACRONYMS

AFCEC	Air Force Civil Engineer Center
AgCS	Agassiz's Clam Shrimp (*Eulimnadia agassizii*)
AmCS	American Clam Shrimp (*Limnadia lenticularis*)
ANGB	Air National Guard Base
AR	Army Regulation
ATV	All Terrain Vehicle
BP	Battle Position
CAA	Clean Air Act
CAC	Community Advisory Council
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
CPMPP	Construction Period Monitoring and Protection Plan
CRREL	Cold Regions Research and Engineering Laboratory
CS	Chemical Spill
CSE	Comprehensive Site Evaluation
CSCRMP	Clam Shrimp Conservation and Roadway Maintenance Plan
DBH	Diameter at Breast Height
DCR	Department of Conservation and Recreation
DFG	Department of Fish and Game
DFW	Division of Fisheries and Wildlife
DoD	Department of Defense
E&RC	Environmental & Readiness Center
EMC	Environmental Management Commission
EPA	Environmental Protection Agency
EPR	Enhanced Performance Round
EPS	Environmental Performance Standard
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
IWFMP	Integrated Wildland Fire Management Plan
IRP	Installation Restoration Program
ITAM	Integrated Training Area Management

Acronyms, continued

JBCC	Joint Base Cape Cod
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
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
NWCG	National Wildfire Coordinating Group
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
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
SAC	Science Advisory Council
SDZ	Surface Danger Zone
SGCN	Species of Greatest Conservation Need
SFS	Space Force Station
SR/ES	Source Registration/Emissions Statement
SVL	Soldier Validation Lane

Acronyms, continued

TA	Training Area
TSA	Training Support Area
TTB	Tactical Training Base
TY	Training Year
UAS	Unmanned Aerial System
UMass	University of Massachusetts
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
WFPC	Wildland Fire Program Coordinator
WPA	Wetlands Protection Act
WWTP	Waste Water Treatment Plant

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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 (Training Area/Reserve). The Upper Cape Water Supply Reserve is located on, and is contiguous with, the 14,886 acres of the Camp Edwards Training Area. (See Section 1.1 and Figure 1-1).

1.1 JOINT BASE CAPE COD STRUCTURE

Joint Base Cape Cod is a multi-service military installation and is home to the Massachusetts Army National Guard's (MAARNG) Camp Edwards, the Massachusetts Air National Guard's (MAANG) Otis Air National Guard Base (ANGB), the United States Coast Guard's (USCG) Base Cape Cod, USCG Air Station Cape Cod, the U.S. Space Force's Cape Cod Space Force Station (SFS), 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).

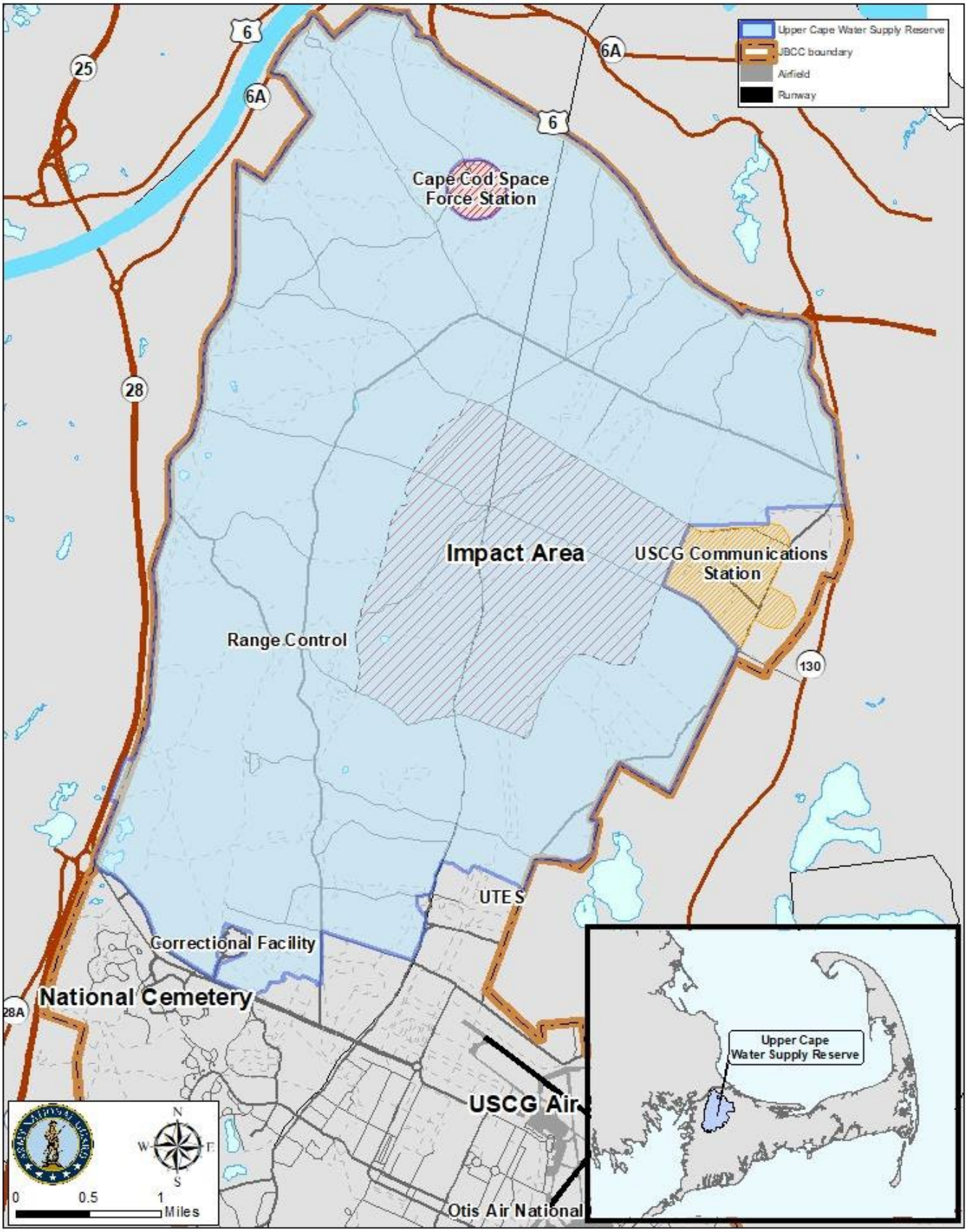
The Camp Edwards Training Area comprises 14,886 acres of the northern portion of JBCC. The remaining Camp Edwards military-controlled area of JBCC lies in the southern portion, or Cantonment Area. The Commonwealth of Massachusetts owns the land comprising Camp Edwards and leases the property to the Department of the Army, who in turn licenses the land to MAARNG for training.

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 SFS, 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 Training Area/Reserve. The USCG's Communications Station is located on a 542-acre parcel along the northeastern side of the Training Area/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 Training Area/Reserve. The locations of these facilities are shown in Figure 1-1. These facilities are located on land not under the control of the Massachusetts National Guard; therefor, detailed information concerning activities at these facilities is not included in the Annual Report. Questions pertaining to activities at Cape Cod SFS, the Coast Guard Communications Station, and the Barnstable County Correctional Facility should be addressed to the persons listed in Appendix A of this report.

The Commonwealth of Massachusetts has issued three utility easements on its state-owned property in the Training Area/Reserve: an electrical power line easement (Eversource), a natural gas pipeline easement (National

Figure 1-1 Map of Joint Base Cape Cod



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 Environmental Performance Standards (EPSs) (see Appendix B) in the Training Area/Reserve, coordinates the actions of environmental agencies of the Commonwealth in the enforcement of environmental laws and regulations in the Training Area/Reserve, as appropriate, and facilitates an open and public review of all activities in the Training Area/Reserve. The legislation also states that the environmental agencies on the EMC retain all their respective, independent enforcement authority.

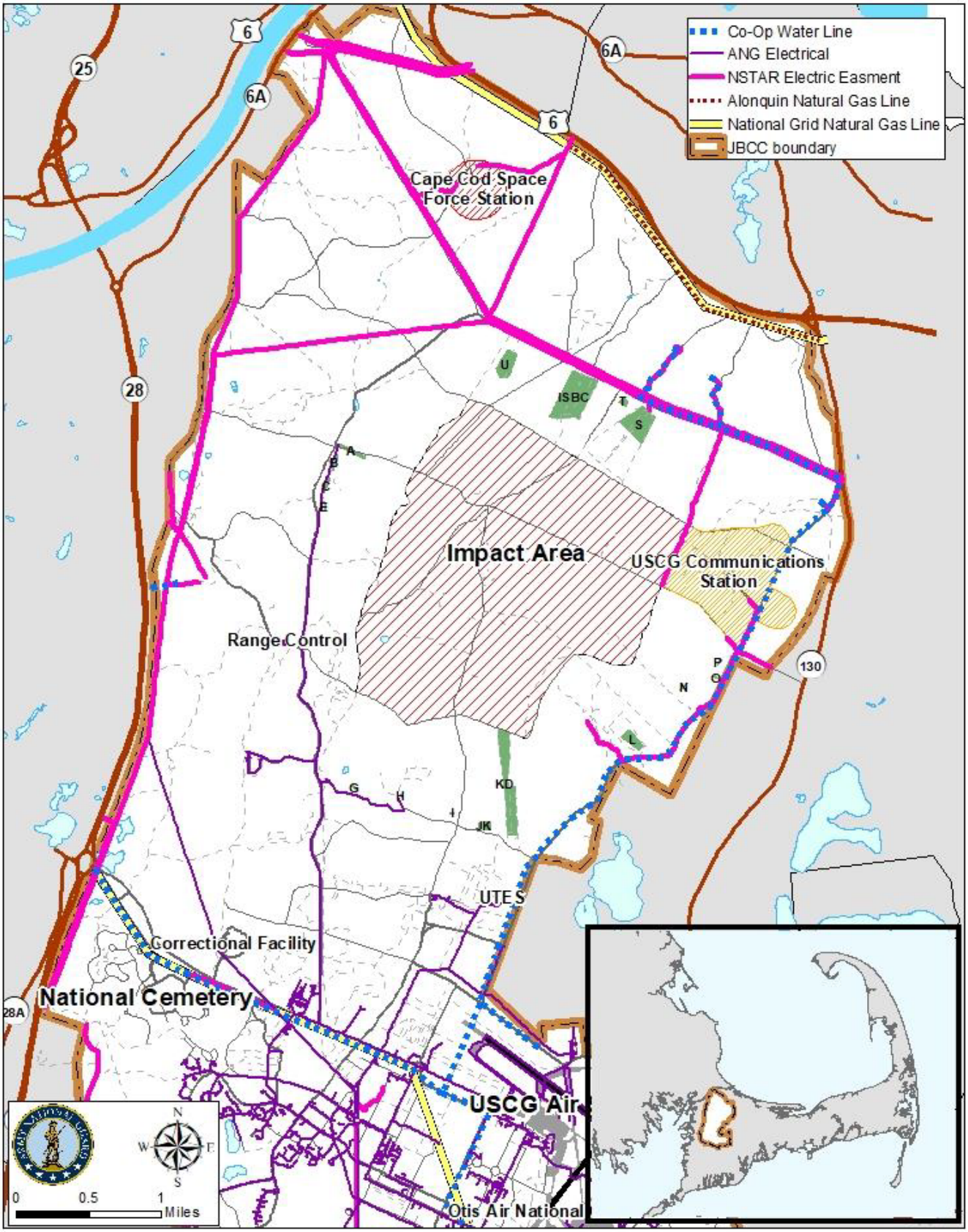
Chapter 47 of the Acts of 2002 also directed that the EMC be assisted by two advisory councils, appointed by the Governor of Massachusetts. The Community Advisory Council (CAC), consisting of 15 members, assists the EMC by providing advice on issues related to the protection of the water supply and wildlife habitat within the Training Area/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 Training Area/Reserve.

Chapter 47 of the Acts of 2002 also established an Environmental Officer for the Training Area/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 Training Area/Reserve and the impact of those activities and uses on the water supply and wildlife habitat. 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 Training Area/Reserve. He has full access to all points in the Training Area/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 and civilians and civilian contractors in the Training Area/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 Training Area/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.

During TY 2022, the SAC met in June and September, and the CAC met in June. The EMC met in July 2022. The advisory councils 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. At the EMC meeting in July 2022, the SAC Ad Hoc Committee was extended for two years to 2024. Please see Section 2.2 for further discussion. Minutes from the meetings may be found at https://www.mass.gov/info-details/environmental-management-commission-emc

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 operational active small arms ranges in the Training Area/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 2022.

The Massachusetts National Guard (MANG) reports on some Cantonment Area training activities to provide context for why soldiers then move into the Training Area/Reserve 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 into 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 Training Area/Reserve.

2.1 CAMP EDWARDS TRAINING AREA/UPPER CAPE WATER SUPPLY RESERVE

2.1.1 Military and Civilian Use

The MAARNG has approximately 5,789 soldiers who train on average one weekend per month and one two-week cycle during a training year. The Training Area/Reserve is also utilized by other DoD and law enforcement agencies (i.e.: Marines, US Coast Guard, Barnstable County Sheriff's Department, and Federal and local law enforcement). 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 2021) to the year of execution (TY 2022) units confirm geographical areas and training sites within the Training Area/Reserve.

Military training activities in the Training Area/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 small arms ranges in the Training Area/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 2022, while Table 2-2 shows their utilization for each of the past ten training years. For specific training area use for TY 2022 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, safety and environmental regulations.

Military training activities in the Training Area/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 color-coded personnel use by training area for TY 2022. Figure 2-3 shows a color-coded personnel use by training area for each of the past ten training years. Figure 2-4 provides a color-coded ten year personnel use by training for the past ten training years. Figure 2-5 shows color-coded daily usage by training area for TY 2022. Figure 2-6 shows a color-coded daily usage by training area for each of the past ten training years with Figure 2-7 providing a color-coded ten year daily usage by training area for the past ten training years. For example, as seen in Figure 2-7, training areas B-8 was not used and B-9 was lightly used, and area B-11 shows a high use; this is a result of the closing and opening of the B-8 and B-9 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 (SDZ) for the Club's rifle range and therefore are closed when the Club's range is operational. An SDZ is a notional, undisturbed safety area extending out from a small arms range where there is a one-in-a-million chance that a bullet may land. The MAARNG and the Club coordinate schedules to ensure safety of Soldiers and Club members.

Graph 2-1 shows personnel use by training area for TY 2022 and the average personnel use by training area for TY 2013 to TY 2022; Graph 2-2 shows days used by training area for TY 2022 and the average days used by training area for TY 2013 to TY 2022. Use of specific training areas is dependent upon its capacity to hold Soldiers, its terrain to support a given training exercise, and restoration of training venues through the cleanup and the Integrated Training Area Management (ITAM) programs. Over the last several years training has focused on collective exercises where training areas that can support these training events are used.

As units become aware that the ranges and other training venues at Camp Edwards meet qualification standards, the use of the areas where 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, legacy contamination cleanup activities (managed by Air Force Civil Engineer Center (AFCEC)/Impact Area Groundwater Study Program (IAGWSP) [See Section 4.0]) in the Training Area/Reserve have resulted in small arms ranges and other training venues being unavailable for use. However, as clean-up activities have been completed these training venues are again available for compatible military use. So, with new ranges, training venues, and eventual completion of the cleanup program, Training Area use and numbers will fluctuate accordingly.

In Table 2-1 and Table 2-2, civilian use includes use of the ranges and training areas in the Training Area/Reserve and the Training Support Areas (TSA) 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 public deer and turkey hunting seasons during TY 2022. 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.

TABLE 2-1 OVERVIEW OF TRAINING USE - TY 2022

		PERSONNEL	
Area	**Training Days/Events**	**Military Personnel**	**Civilian Personnel**
Ranges	181	7,558	62
Training Areas	1,088	56,246	526
Training Support Areas	2,625	83,499	11,551
TOTAL	**3,894**	**147,303**	**12,139**

Figure 2-1 Camp Edwards Training Area and Ranges

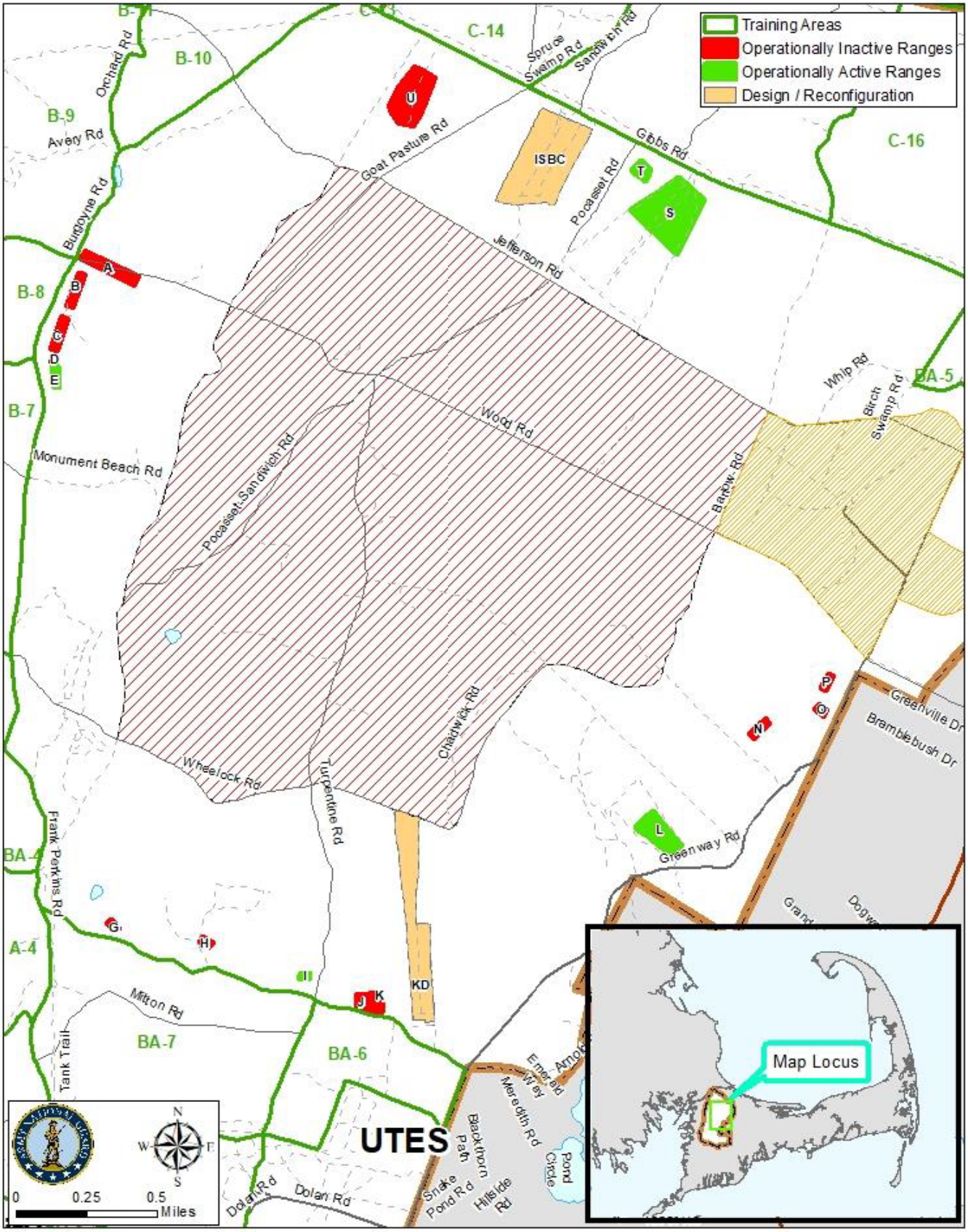


Figure 2-2 Personnel Usage by Training Area in the Training Area/Reserve, TY 2022

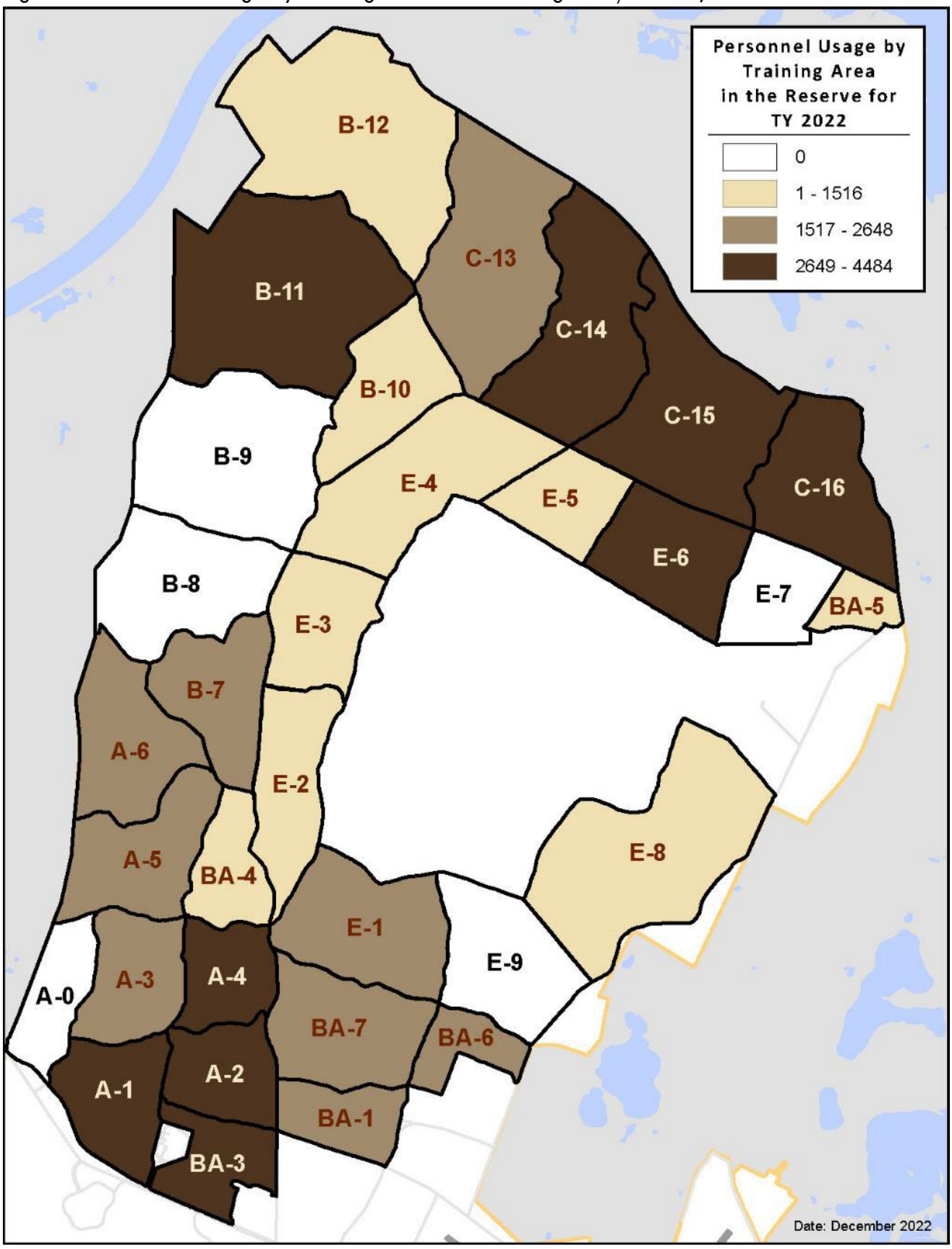
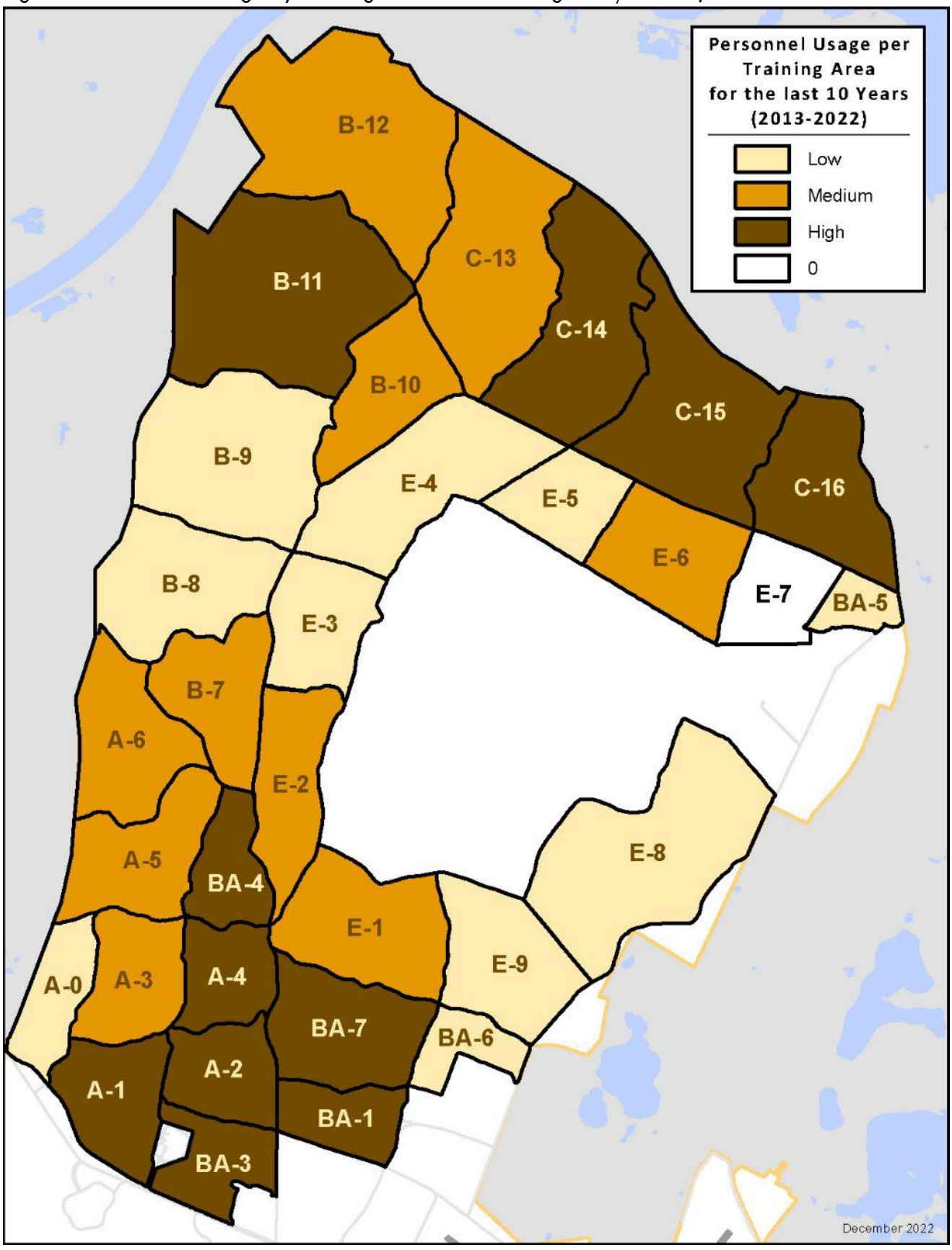
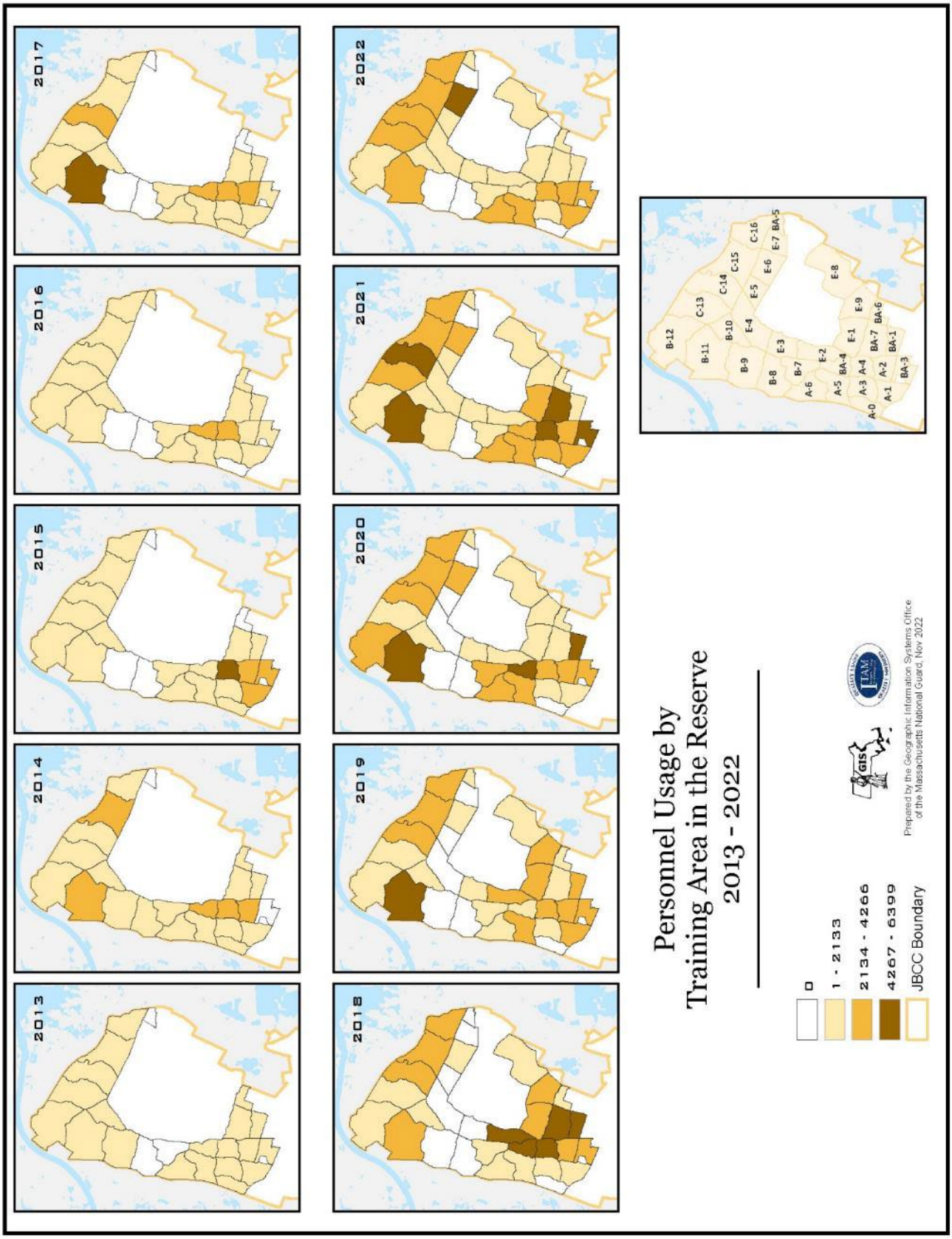


Figure 2-3 Personnel Usage by Training Area in the Training Area/Reserve, TY 2013 – TY 2022



Low=169-8,363 personnel, Medium=8,364-19,418 personnel, High=19,419-39,769 personnel

Figure 2-4 Ten Year Personnel Use by Training Area in the Training Area/Reserve, TY 2013 - TY 2022



Note: Prior to 2018, the E training areas were not available for use and are not delineated in the 2013 to 2017 graphics.

Figure 2-5 Daily Usage per Training Area in the Training Area/Reserve, TY 2022

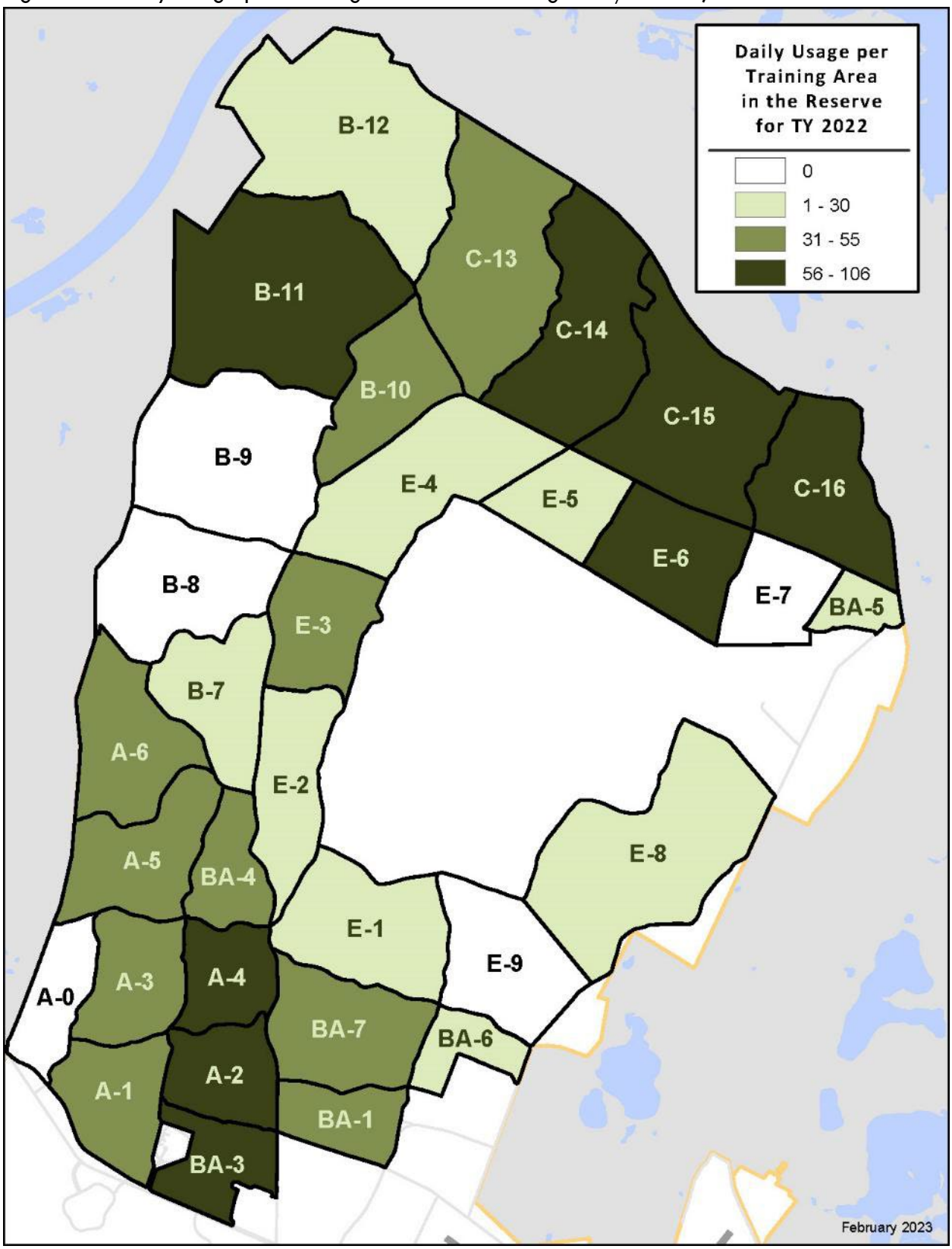
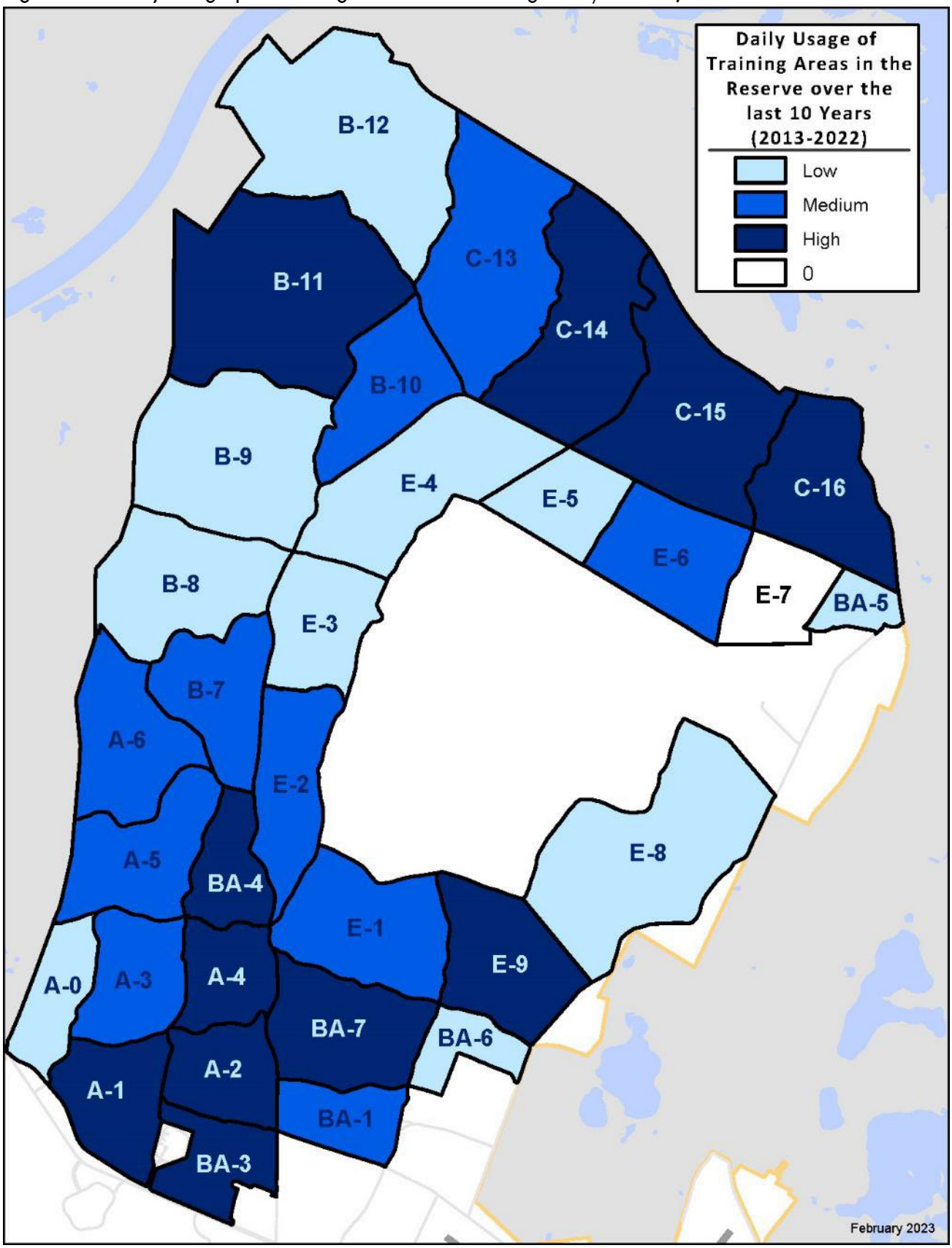
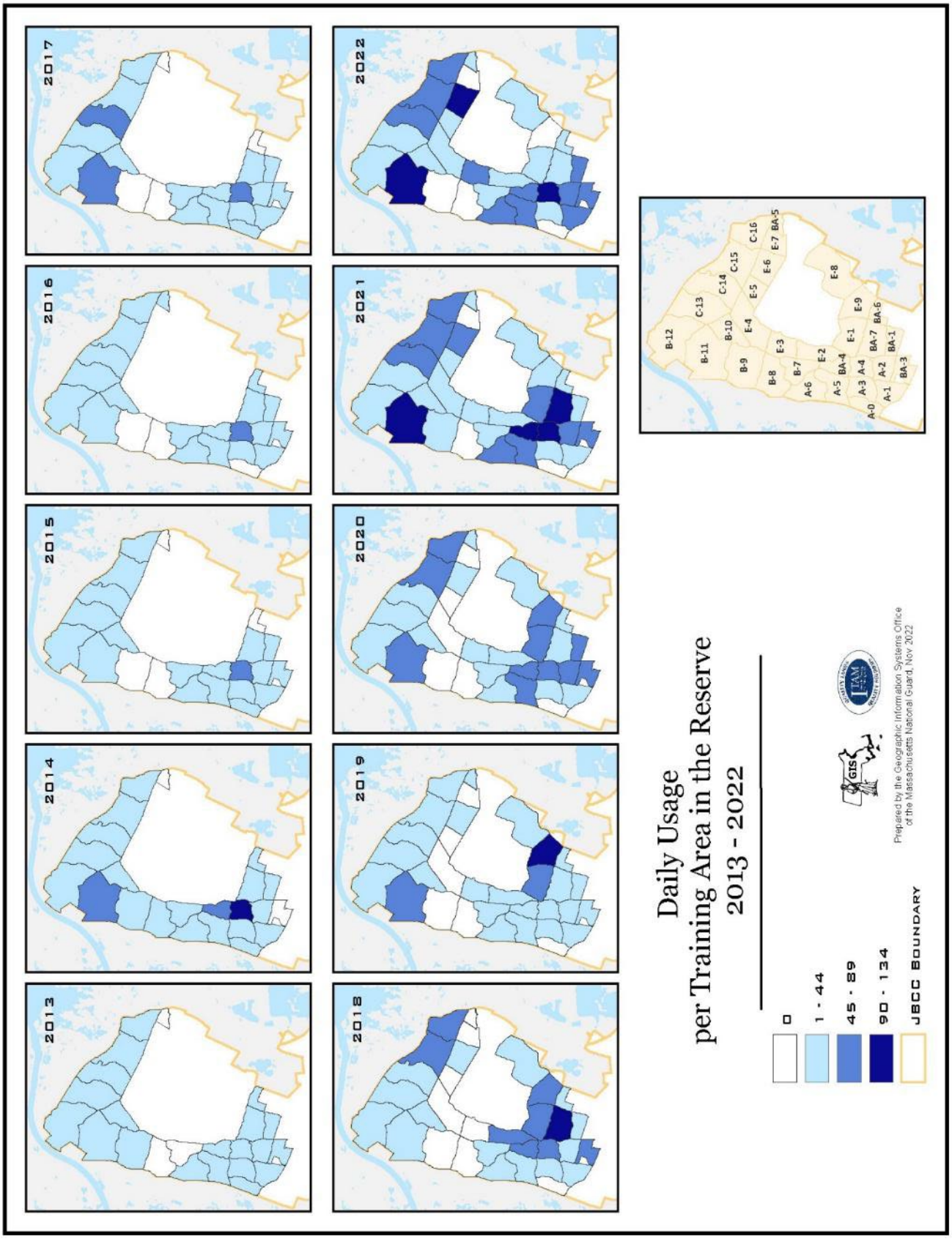


Figure 2-6 Daily Usage per Training Area in the Training Area/Reserve, TY 2013 – TY 2022



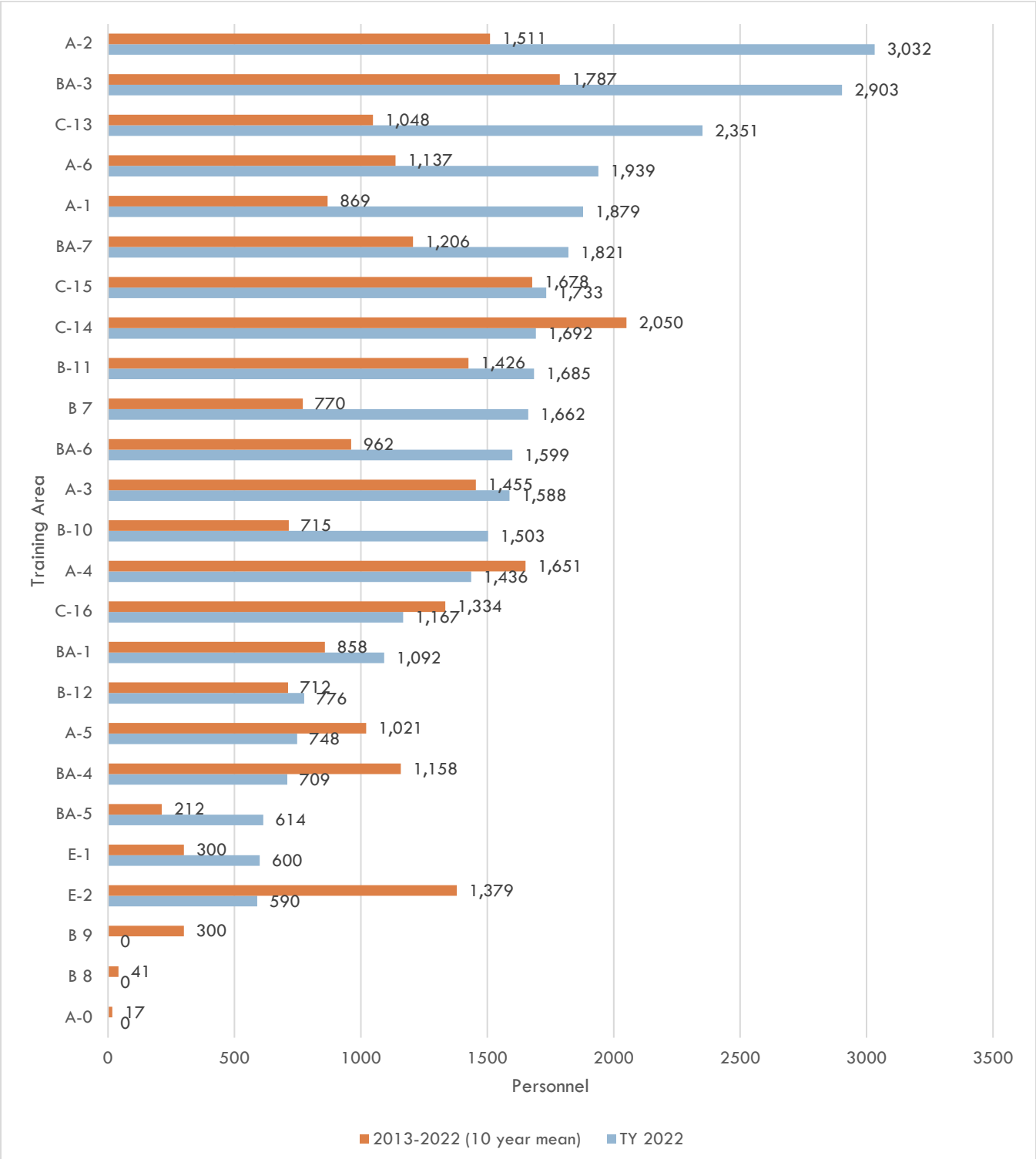
Low=4-113 days, Medium=114-307 days, High=308-706 days

Figure 2-7 Ten Year Daily Usage by Training Area in the Training Area/Reserve, TY 2013 – TY 2022



Note: Prior to 2018, the E training areas were not available for use and are not delineated in the 2013 to 2017 graphics.

Graph 2-1 Personnel Use by Training Area



Graph 2-2 Days Used by Training Area

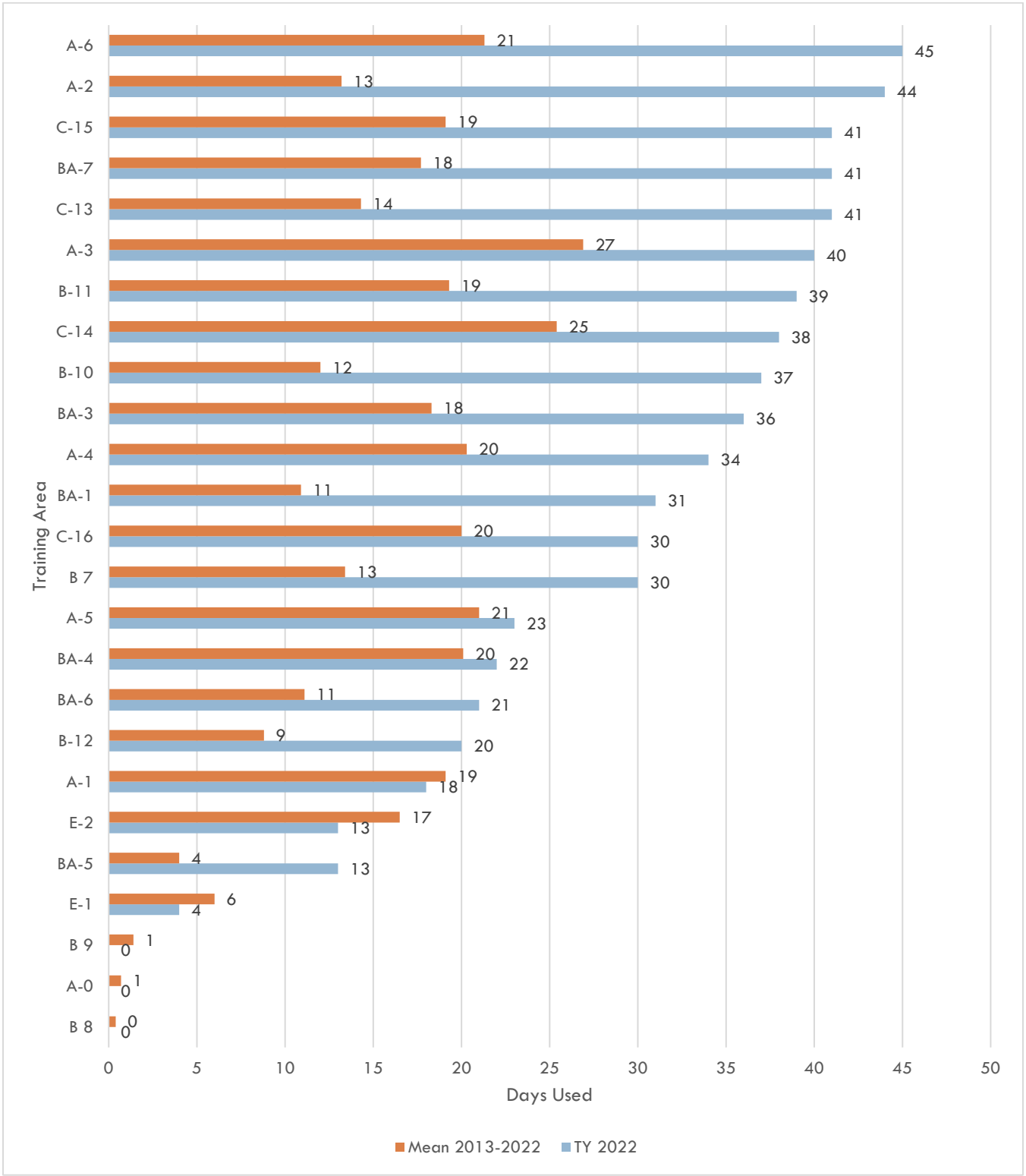


TABLE 2-2 TRAINING USE HISTORY

Training Year	Training Days/Events	Military Personnel	Civilian Personnel
TY 2022	3,894	147,303	12,139
TY 2021	3,947	168,145	6,021
TY 2020	3,041	138,474	6,828
TY 2019	2,481	94,874	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
TOTAL	**24,816**	**1,180,160**	**51,197**

In the table above, civilian usage numbers in TY 2019-2022 are higher than in past training years; this is due in part to the Cape Cod Police Academy's use of Camp Edwards facilities over the past four years as well as a Federal Emergency Management Agency training that took place in TY 2019.

2.2 SCIENCE ADVISORY AD HOC COMMITTEE

On November 2, 2017, the EMC formed an Ad Hoc Committee to the SAC to review the current small arms range environmental monitoring process and aide in developing the most appropriate monitoring processes for those ranges. Committee members are SAC member Phil Gschwend, a geochemist, SAC member Denis LeBlanc, US Geological Survey, and Jay Clausen from the US Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL), 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 Ad Hoc Committee was most recently extended to 2024 during the EMC meeting in July 2022.

The committee did not meet during TY 2022. At the SAC meeting in September 2022, the MAARNG brought forward several potential topics, including monitoring, lysimeter placement and soil sampling locations, that may be discussed at future SAC Ad Hoc Committee meetings.

2.3 RANGE UPDATE

The current operational active small arms ranges on Camp Edwards are Sierra, India, Lima, Echo, and Tango ranges. Juliet and Kilo ranges are currently operational inactive as their STAPP™ systems have been dismantled (see Section 2.4.2). The ISBC and KD ranges are undergoing rehabilitation. Although not a small arms range, Lima Range, a 40 mm practice grenade range, will be discussed in this section. The locations of these ranges are shown in Figure 2-1. Each range is guided by an Operations, Maintenance, and Monitoring Plan (OMMP) that outlines range specific monitoring to ensure the environment is protected to the maximum extent practicable. OMMPs are living documents that are in continuous review and updated as coordinated with the EMC EO. The pre, post, and detailed inspection form has been revised for the OMMPs in March 2022.

From the monitoring of the small arms ranges, it has been shown that there are no exceedances of the OMMP action levels in soil or ground water at the ranges. For porewater (lysimeters) there have been exceedances of the OMMP action levels for antimony (Sb) at ranges using legacy soil for backstop berms. Those ranges include

India, Juliet, Kilo, and Tango Ranges. There were no porewater exceedances at the firing line or mid-range lysimeters. For discussion on Sb exceedances on the ranges see Section 2.8.1.

2.4 TANGO RANGE

Tango Range is a 25-meter EPR (copper) zeroing range with 32 firing positions with one target in each lane. Tango Range was redeveloped as an EPR range during TY 2021 in support of weapons qualification at Sierra Range. To safely use Tango Range, target and firing lines were moved 25 meters north to move them out of the SDZ of the adjoining Sierra Range, such that both ranges can be used simultaneously. Soldiers zero their weapons at Tango Range and then move to the adjacent Sierra Range to conduct weapons qualification.

At the July 19, 2022, EMC meeting the MAARNG requested that the EMC authorize its Environmental Officer to approve the redesign and rewrite of the OMMP for the redeveloped Tango Range at Camp Edwards. The EMC voted to authorize the EMC EO to take those actions. In a September 6, 2022, letter, the EMC EO approved the Tango Range Design Plans and the Tango Range OMMP, and the range is operational.

2.4.1 Range Maintenance and Sampling

A list of Range Control's inspection activities at Tango Range in TY 2022 is included in Appendix C.

In October 2022, groundwater and surface soil samples were collected from Tango 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 show no exceedance of the Action Levels specified in the OMMP.

A figure showing the monitoring wells, lysimeters and soil sampling locations on Tango Range and the sampling results for TY 2022 are available in Appendix C. A lysimeter is planned to be installed on Tango Range for 2023.

2.5 SIERRA RANGE

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. The following weapons are authorized for use on Sierra and India Ranges: the M16 and M4 rifles, the M249 machine gun with 5.56mm ammunition, and the M240 machine guns (India Range only) using 7.62mm ammunition.

2.5.1 Range Maintenance and Sampling

Maintenance activities during TY 2022 at Sierra Range included filling bullet pockets in the berms. A list of Range Control's inspection and maintenance activities at Sierra Range in TY 2022 is included in Appendix C.

In October 2022, groundwater, porewater, and surface soil samples were collected from Sierra 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, porewater, and groundwater analyses continue to show no exceedance of the Action Levels specified in the OMMP.

Figures showing the monitoring wells, lysimeters and soil sampling locations on Sierra Range and the sampling results for TY 2022 are available in Appendix C.

2.6 INDIA RANGE

India Range is a 25-meter small arms 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.

2.6.1 Range Maintenance and Sampling

At India Range, maintenance activities included repairing and filling bullet pockets. A list of Range Control's inspection and maintenance activities at India Range in TY 2022 is included in Appendix C.

In October 2022, groundwater, porewater, and surface soil samples were collected from 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. For porewater there was an action level exceedance (6 ppb) for antimony at 7.8 ppb. This exceedance is consistent, slight decrease, with past exceedances for this lysimeter. Porewater antimony action level exceedances are discussed in Section 2.8.1.

A figure showing the monitoring wells, lysimeters and soil sampling locations on India Range and the sampling results for TY 2022 are available 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. 9mm 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/military police firearms qualification course.

The backstop berm is 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 topsoil that slows projectiles and allows for vegetation and slope stabilization.

Echo Range became operational in September 2019.

2.7.1 Range Maintenance and Sampling

Maintenance activities included repairing bullet pockets on the backstop berm. Bullets Pockets are repaired by the addition and or by moving soil from beneath the pocket back into the bullet pocket. Berms and bullet pockets are inspected prior to and after each use. Bullet pocket harvesting has not been identified as being needed at this date. The MAARNG coordinates with the EMC with regards to berm maintenance and projectile harvesting. A list of Range Control's maintenance and inspection activities at Echo Range in TY 2022 is included in Appendix C.

In October 2022, 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 for soil or groundwater. There are no lysimeters on Echo range.

A figure showing the monitoring well and soil sampling locations on Echo Range and the sampling results for TY 2022 are available in Appendix C.

2. 8 JULIET AND KILO RANGES

The Juliet Range and Kilo Range STAPP™ systems (installed to capture and contain lead ammunition) were dismantled in Fall 2020. Lead rifle ammunition is no longer authorized for most MAARNG units, and it is not authorized for use at Camp Edwards, which is why Juliet and Kilo ranges, with their associated STAPP™ systems, are no longer required. Juliet and Kilo Ranges are now in operational inactive status. Annual sampling continued in 2022 for those ranges (see Section 2.8.1). For 2023, monitoring of these ranges will be conducted by the IAGWSP and reported as required. These ranges will not be presented in the 2023 Sate of the Reservation Report.

2.8.1 Range Sampling

Juliet and Kilo Ranges are now in operational inactive status. Sampling of porewater on the ranges continued in 2022.

In October 2022, porewater and groundwater samples were collected from the Juliet and Kilo 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 of the groundwater analyses continue to show no trends or significant concentrations when compared to the Action Levels specified in the OMMPs and as compared to background levels. Porewater results indicate an exceedance of the Action Level (6 ppb) for antimony in a lysimeters on Kilo Range (11 ppb). Figures showing lysimeter locations and data are available in Appendix C. Of note lysimeter 3 on Juliet Range was damaged during the STAPP system removals and is no longer available for sampling

Antimony is in lead alloy bullets and in bullet primers. There are two causes of increased antimony in porewater:

- legacy range soils, where lead-antimony bullets were fired, were used for berm and range construction at Juliet, Kilo, and Tango ranges.
- phosphates added to range soils (1998-1999) and lime to adjust pH and to immobilize lead in legacy soils

Another finding of the Ad Hoc Committee through lab studies at CRREL, published February 2021, in New Hampshire is that antimony is not threatening the groundwater. The work determined that the previous use of phosphates for lead immobilization and pH amendments were the cause of increased antimony in porewater and that there is not a threat to the groundwater. Soil amendments were halted several years ago at the direction of the SAC Ad Hoc committee. It has also been determined through soil sampling that antimony mobility is limited to surface soils where amendments were applied. A description of the work conducted by CRREL can be found in Appendix C.

2.9 LIMA RANGE

Lima Range is a 40 mm practice grenade range. In 2012, the Environmental Protection Agency (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. According to the Safety Data Sheet, the Day-Glo-Orange marking powder is considered to be non-toxic. 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. Station 1 consists of a prone fighting position with sandbags for support and two zeroing targets at 200 meters. Station 2 consists of an upright log or wall, a kneeling firing position about four feet high, and two point-type targets. The targets include a simulated window or door of a building at 100 meters and a small bunker or fighting position at 125 meters. Station 3 consists of a fighting position and two targets. The targets are a two-person bunker at 175 meters and an automatic weapon position at 200 meters. The bunker represents a point target, while the automatic weapons position represents an area target. Station 4 consists of a prone fighting position with a log or sandbag support and two area type targets at 250 meters and 350 meters.

2.9.1 Range Maintenance and Sampling

Maintenance activities included fixing the bunker targets. The MAARNG has replaced the posts and netting used on Lima Range to contain the 40 mm practice rounds with two six-foot-concrete block berms. The block berms will be a more permanent and easily managed for the capture and recovery of the rounds. A list of Range Control's inspection and maintenance activities Lima Range in TY 2022 is included in Appendix C.

In October 2022 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 for soil and porewater. Groundwater at Lima Range is being monitored and remediated by the IAGWSP under a USEPA Administrative Order.

A figure showing the monitoring wells, lysimeters and soil sampling locations on Lima Range and the sampling results for TY 2022 are available in Appendix C.

2.10 RANGE USAGE DATA

A total of 1,861,266 rounds of copper ammunition has been fired at Camp Edwards since its use was approved: 1,159,915 at Sierra Range, 610,332 at India Range, and 56,946 at Tango Range. The total number of copper ammunition rounds fired includes 14,098 at the inactive operational ISBC Range, which was used for two approved, non-standard training events in June and July 2022; and 19,975 rounds fired on Echo range during two non-standard training events in TY 2021. Graph 2-3 provides a summary of copper ammunition fired at Sierra, India and Tango ranges since use of copper ammunition was approved at them. The graph shows an upward trend in copper ammunition use. During TY 2020, the MAARNG transitioned to all copper-based rifle ammunition. Information on the number of copper ammunition fired on Sierra, India, and Tango ranges each training year from 2013 through 2022 is provided in Appendix C.

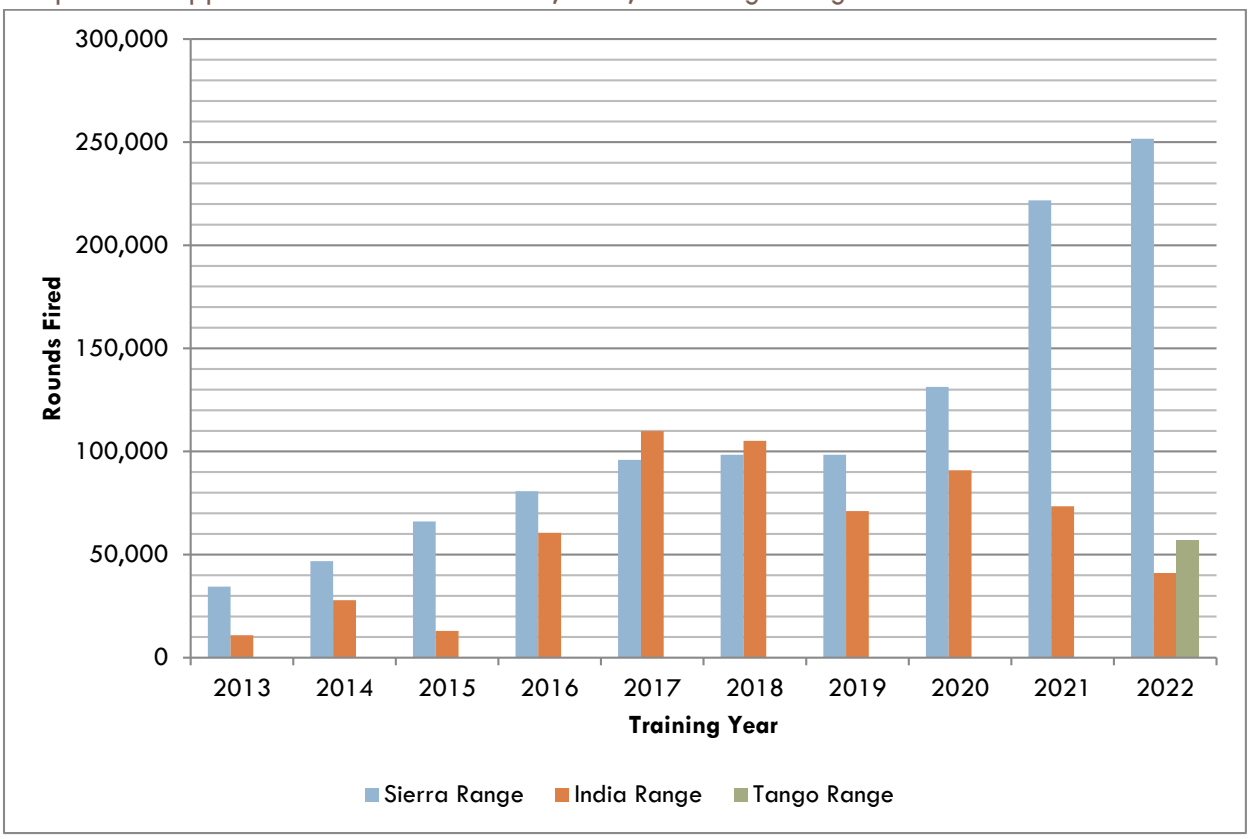
A total of 11,641 M781 40mm Training Rounds have been fired at Lima Range since its use was approved. Graph 2-4 provides information on the number of M781 40mm Training Rounds fired at Lima Range. The graph reflects the cyclic requirement for qualification for grenadiers. Units that have grenadiers only have one to two soldiers with that requirement in the unit; not every soldier uses this weapon.

Since TY 2019, a total of 148,564 rounds of 9mm lead ammunition has been fired at Echo Range. Graph 2-5 shows the number of 9mm rounds of lead ammunition fired on Echo Range. Information on lead ammunition fired from TY 2007 through TY 2022, including amounts and types, is provided in Appendix C.

The was no civilian use of the small arms ranges during TY 2022.

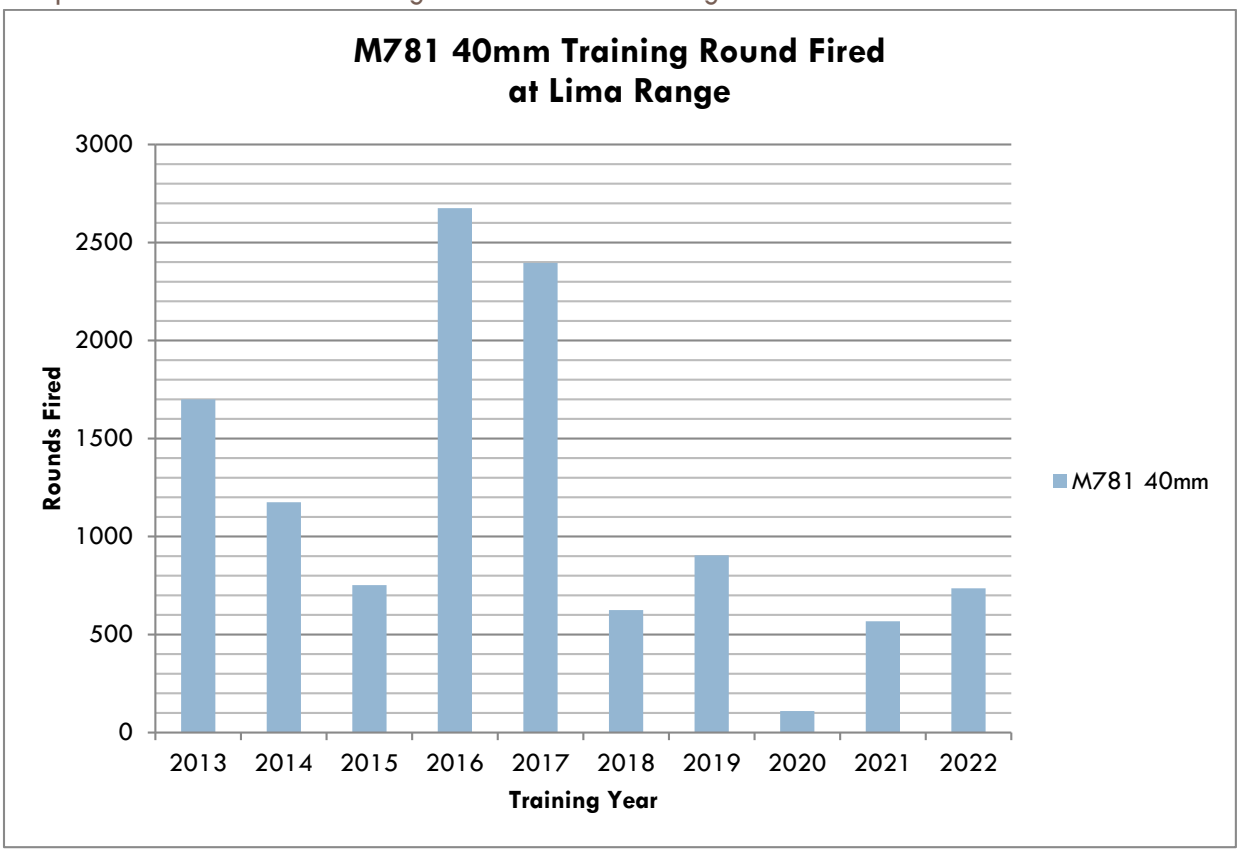
During TY 2022, some type of weapons firing was conducted on at least one of the ranges on 76 calendar days.

Graph 2-3 Copper Ammunition Use – Sierra, India, and Tango Ranges

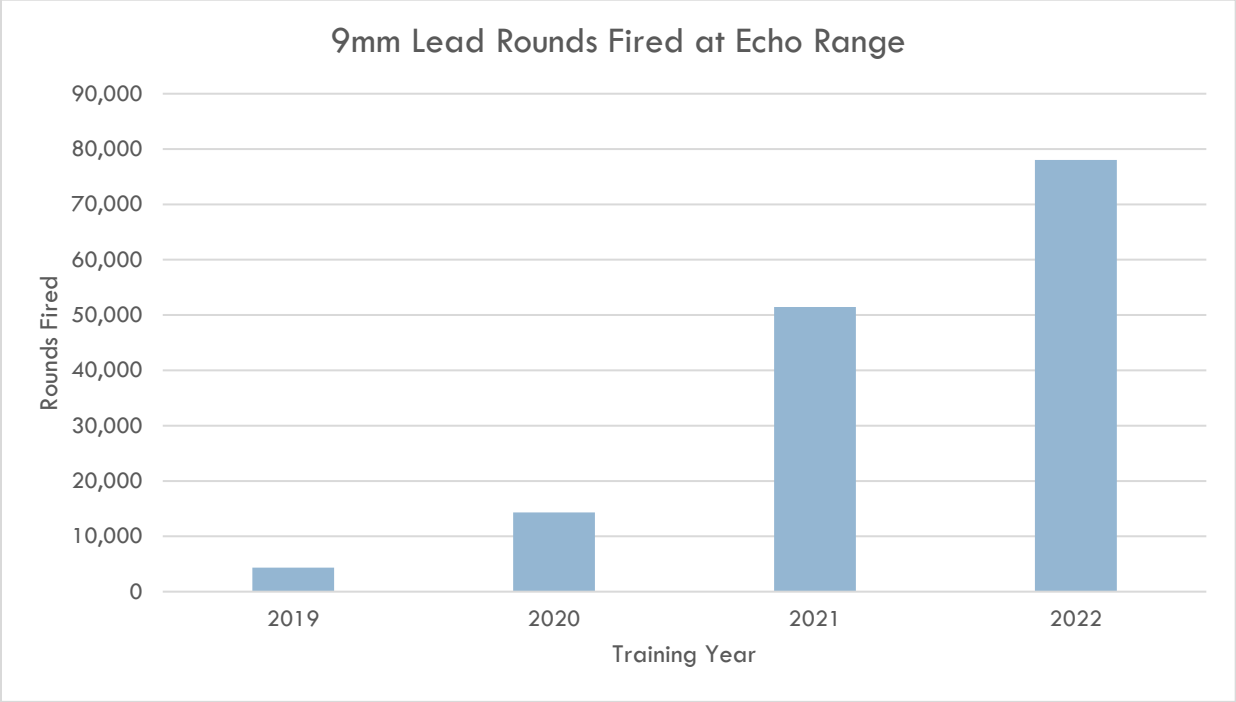


Note: Tango Range became operational during TY 2022.

Graph 2-4 M781 40MM Training Round Use – Lima Range



Graph 2-5 9mm Lead Ammunition Round Use – Echo Range



In accordance with the OMMP for each range, the MANG is required to capture, contain, and recover bullets/projectiles to the greatest extent practical. Recovery of projectiles is based on usage, time, and projectile density. The OMMPs define when this is required for each range.

2.10.1 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, driver (day and night) training, and Reserve Officer Training Corps (ROTC) training.

Photograph 2-1 A soldier in the Training Area/Reserve during the Combined Arms Exercise held in Summer 2022.

Information on utilization of the training areas and major locations within them during TY 2022 is provided in Table 2-3. 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 2022, some type of training was conducted in at least one of the training areas on 189 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 Training Area/Reserve during the deer and turkey seasons are not tracked as they move through the various training areas. During TY 2022, hunter days in the Training Area/Reserve accounted for around 1.8 percent of the usage, and approximately 70% of the Training Area/Reserve was available to hunters during the deer hunting season. 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 2022 included the US Army, the US Army Reserve, the US Coast Guard, the US Coast Guard Reserve, the US Air Force, the US Navy, the US Marine Corp, Massachusetts ANG, and Army National Guard units from New York, Connecticut, Maine, and Vermont.

Civilian organizations using the training areas during TY 2022 included BAE Systems, the Brookline Special Response Team, Federal Bureau of Investigation-Boston, the Massachusetts Institute of Technology-Lincoln Lab, and environmental remediation and restoration contractors.

TABLE 2-3 TRAINING AREA USE - TY 2022

Location	Training Days	Personnel		Vehicles (Wheeled) #	Vehicles (Tracked) #
		Military	Civilian		
SVL-OBJ 1	48	1,166	332	0	0
SVL-OBJ 2	9	236	36	0	0
SVL-OBJ 3	7	110	0	0	0
SVL-OBJ 4	15	411	0	0	0
OP 1	8	340	0	0	0
OP 2	5	250	0	0	0
OP 9	4	24	0	0	0
OP 10	4	30	0	0	0
BP 2	21	456	50	0	0
BP 7	3	46	0	0	0
BP 12	7	167	0	0	0
BP 14	14	259	0	0	0
BP 16	14	256	0	0	0
BP 20	10	231	0	0	0
BP 24	9	370	0	0	0
BP 27	4	600	0	0	0
NBC 01	11	609	0	0	0
NBC 02	4	305	0	0	0
NBC 03	4	305	0	0	0
NBC 04	4	305	0	0	0
NBC 05	4	305	0	0	0
Training Roads	46	7,029	0	9	0
A 1	18	1,879	0	0	0
A 2	44	3,032	0	0	0
A 3	40	1,588	0	0	0
A 4	34	1,436	0	0	0
A 5	23	748	0	0	0
A 6	45	1,939	0	0	0
B 7	30	1,662	0	0	0
B 10	37	1,503	0	0	0
B 11	39	1,685	0	0	0
B 12	20	776	0	0	0
BA 1	31	1,092	0	0	0
BA 3	36	2,903	0	0	0
BA 4	22	709	0	0	0
BA 5	13	614	0	0	0

TABLE 2-3 TRAINING AREA USE - TY 2022, cont'd

Location	Training Days	Personnel		Vehicles (Wheeled) #	Vehicles (Tracked) #
		Military	Civilian		
BA 6	21	1,599	0	0	0
BA 7	41	1,821	0	0	0
C 13	41	2,351	0	0	0
C 14	38	1,692	108	0	0
C 15 Trenchline	4	97	0	0	0
C 15	41	1,733	0	0	0
C 16	30	1,167	0	0	0
Wheelock Hill	3	65	0	0	0
Land Nav 1	21	1,194	0	0	0
Land Nav 2	28	1,574	0	0	0
Land Nav 3	29	1,502	0	0	0
Land Nav 4 Alpha	16	606	0	0	0
Land Nav 4 Bravo	14	546	0	0	0
Land Nav 4 Charlie	22	979	0	0	0
Dig Site 1	14	1,319	0	0	0
Dig Site 2	23	1,918	0	0	0
Dig Site 3	15	707	0	0	0
Total	**1,088**	**56,246**	**562**	**9**	**0**

TABLE 2-4 TRAINING AREA USE HISTORY

Training Year	Training Days/Events	Personnel		Vehicles (Wheeled)	Vehicles (Tracked)
		Military	Civilian		
TY 2022	1,088	56,246	562	9	0
TY 2021	1,277	66,374	502	36	0
TY 2020	898	59,994	294	110	0
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
TOTAL	**7,667**	**452,324**	**9,178**	**13,163**	**31**

2.10.2 Vehicle Use, Fueling and Maintenance

Vehicle use in the training areas during TY 2022 was nine 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 Training Area/Reserve has been prohibited by the EPSs since 2002. 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. Exemptions to the EPS 15.3.3, Fuel Management, have been granted to the MAARNG by the EMC Environmental Officer to refuel

in the Training Area/Reserve for training events and restoration work. Refueling activities in the Training Area/Reserve during these exemptions were all completed with no adverse environmental impacts.

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.

2.10.3 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 2022. Overall historical use of the TSA for the past 10 training years is included in Table 2-6. Figure 2-8 shows TSA locations in the Cantonment Area. 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 TSA in the Cantonment Area of Camp Edwards during TY 2022 included Allied Universal Security, Barnstable County Sheriff's Department, Brookline SRT, Cape Cod Police Academy, Cape Cod Regional Law Enforcement Council SWAT Team, Civil Air Patrol, Eversource, FBI Boston, the Massachusetts State Police, Massachusetts Emergency Management Agency, Southeastern Massachusetts Technical Rescue Team, the Sea Cadets, the United States Geological Survey, and the US Postal Service Inspector General, Northeast.

TABLE 2-5 TRAINING SUPPORT AREA USE - TY 2022

Training Support Area	Training Days/Events	Personnel	
		Military	Civilian
1100 Training Area (Drivers Training)	52	7,650	0
3400 Training Area/Rail Load Ramp	16	1,240	0
3500 Training Area	14	170	0
ACFT Running Track	58	10,550	0
Asymmetric Threat Classroom	5	105	0
Battle Simulation Ctr - Bldg 1206	137	9,783	1,400
Battle Simulation Ctr - Rear Offices	117	876	110
Battle Simulation - Bldg 1213, 1st Floor	68	2,627	500
Battle Simulation - Bldg 1213, 2nd Floor	79	3,391	500
Battle Simulation - TOC Pads	35	3,110	0
Bldg 3499 - IWQ	26	1,962	0
Calero MOUT	61	2,045	479
Call for Fire Trainer II 1:30	56	1,548	0
VBS3 Classroom - Bldg 3494	27	1,139	0
Connery Field	41	5,810	0

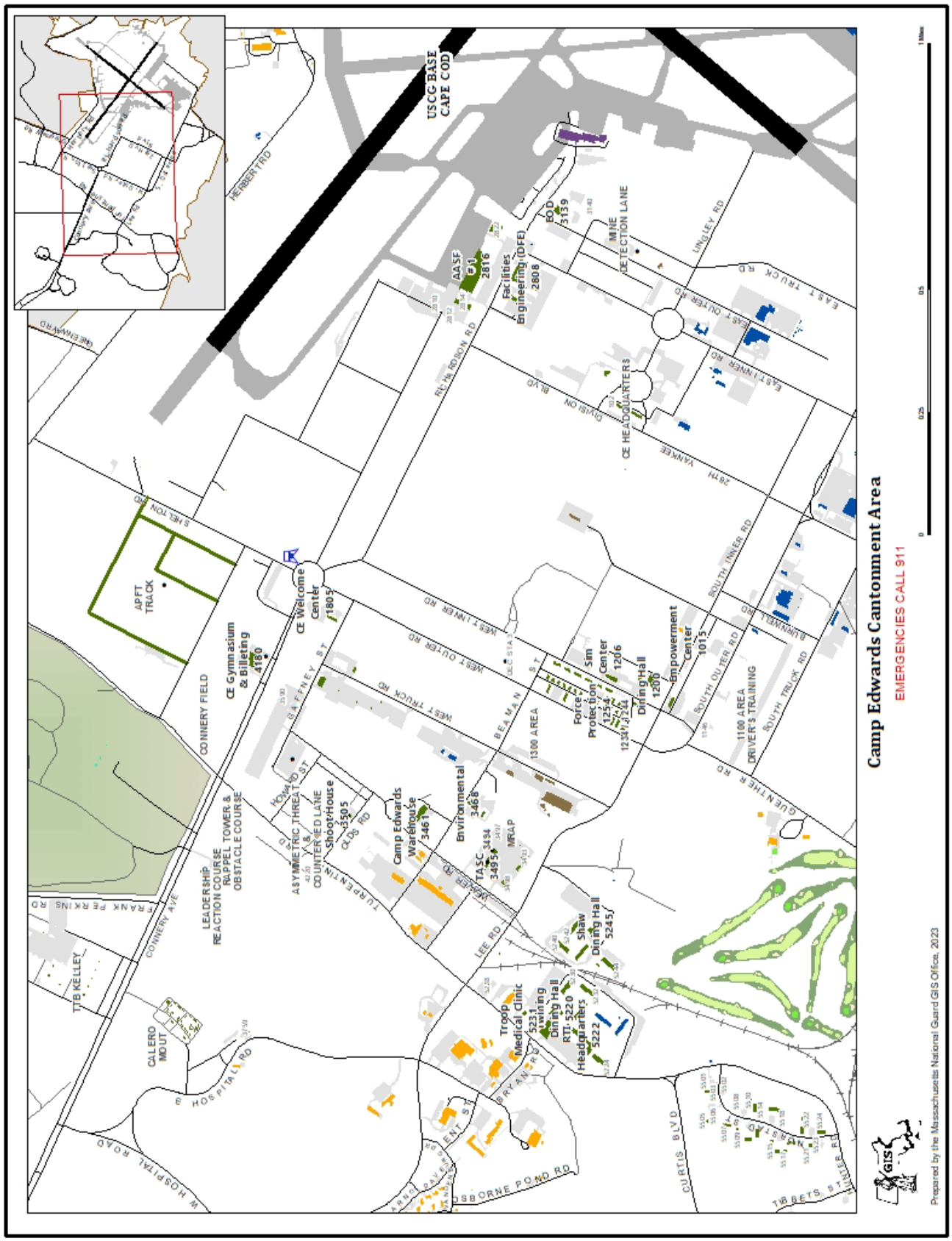
TABLE 2-5 TRAINING SUPPORT AREA USE - TY 2022, cont'd

Training Support Area	Training Days/Events	Personnel	
		Military	Civilian
Counter IED Visual Indicator Lane	6	457	0
Counter IED Search House (HME)/Site Exploitation	2	192	0
Engagement Skill Trainer 2000 - A	132	778	0
Engagement Skill Trainer 2000 - B	204	3,556	116
Engagement Skill Trainer 2000 - C	162	3,188	0
1243-High Risk Entry Facility-Control	25	451	250
1244-High Risk Entry Facility	25	451	250
Lee Parade Field	8	730	1,250
Leadership Reaction Course	28	794	304
Obstacle Course	30	889	274
Shaw Field	23	2,805	0
Unstabilized Gunnery	6	29	0
Vault 1 - TSC	142	440	0
Vault 2 - TSC	363	726	0
Vault 3 - TSC	363	726	0
Virtual Convoy Operations Trainer #98 (VCOT - TSC)	9	76	0
Weapons Cleaning - Bldg 3498	26	467	0
Welcome Center	108	3,100	457
YD Memorial Park	17	926	300
5219 - JBCC Theater	148	10,712	5,223
Structural Collapse Site	6	0	138
TY 2022 Total	**2,625**	**83,499**	**11,551**

TABLE 2-6 TRAINING SUPPORT AREA USE HISTORY

Training Year	Training Days/Events	Personnel		
		Military	Civilian	Total
TY 2022	2,625	83,499	11,551	95,050
TY 2021	2,484	94,055	5,305	99,306
TY 2020	1,931	71,586	5,833	77,419
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
TOTAL	**15,365**	**669,741**	**42,201**	**714,755**

Figure 2-8 Training Support Areas



2.11 OFF-SITE TRAINING

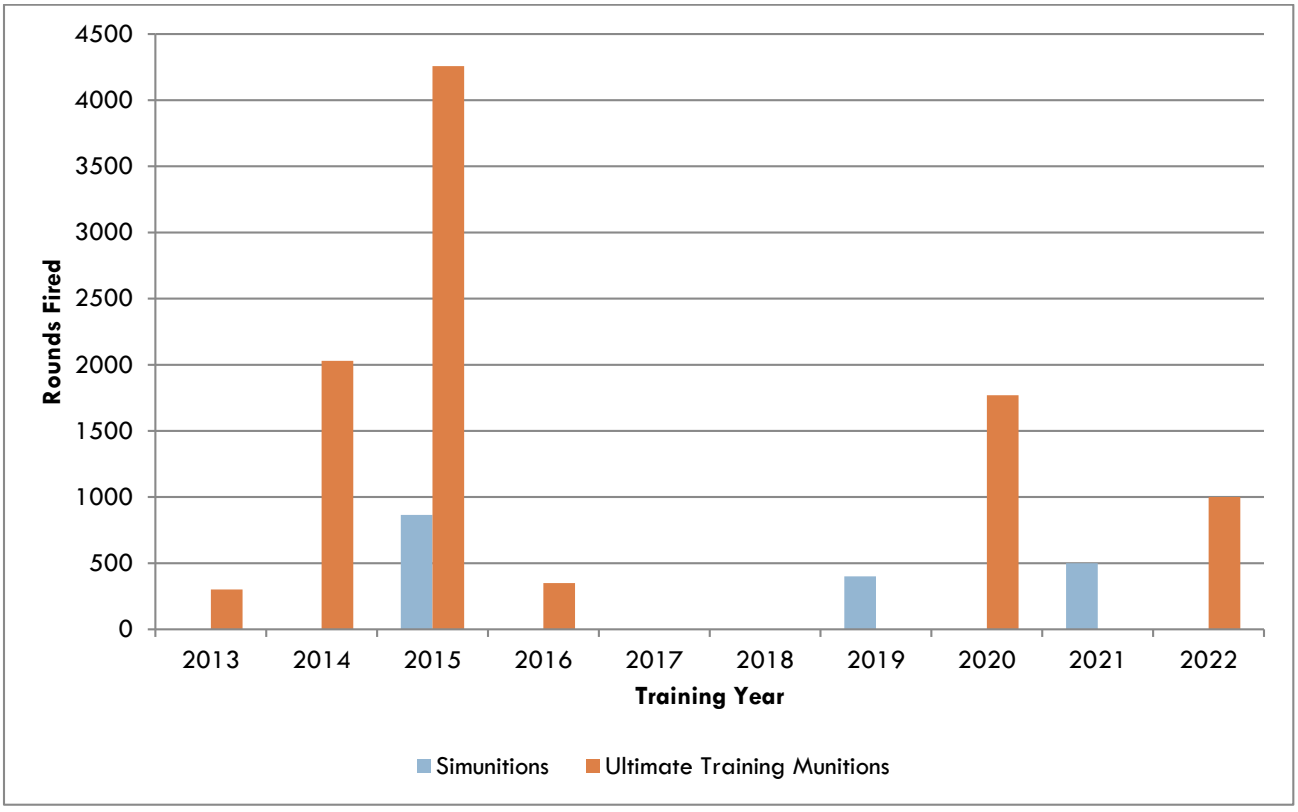
During TY 2022, the MAARNG had 79 units conduct their annual two-week training cycle. Of these, 61 units trained in Massachusetts, 32 of which trained solely at Camp Edwards (approximately 1,152 Soldiers). Six units trained in New York, four units trained in New Jersey, one unit trained in Iowa, one unit trained in Vermont, one unit trained in Michigan, one unit trained in Connecticut, one unit trained in California, and one unit trained in Canada. Seven units were mobilized and deployed in support of contingency operations; all seven units deployed overseas.

The total number of Massachusetts Soldiers trained during annual training for TY 2022 was 3,460 out of 5,789. Twenty-one units conducted year-round annual training consisting of 502 Soldiers, while 306 served on Title 32 orders for the Covid-19, busing mission, or operational support in lieu of annual training. The number of MAARNG Soldiers that completed a two-week annual training cycle by general geographical locations is: 2587 in Massachusetts, 689 in other states, and 184 in Canada

2.12 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 availability 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. The UTM Man Marker Round and the Simunitions FX Marking Round are on the Camp Edwards Approved Munitions List. Graph 2-6 provides the number of UTM and Simunitions FX Marking Rounds fired in the Training Area/Reserve since 2013.

Graph 2-6 Simulated Munitions Use



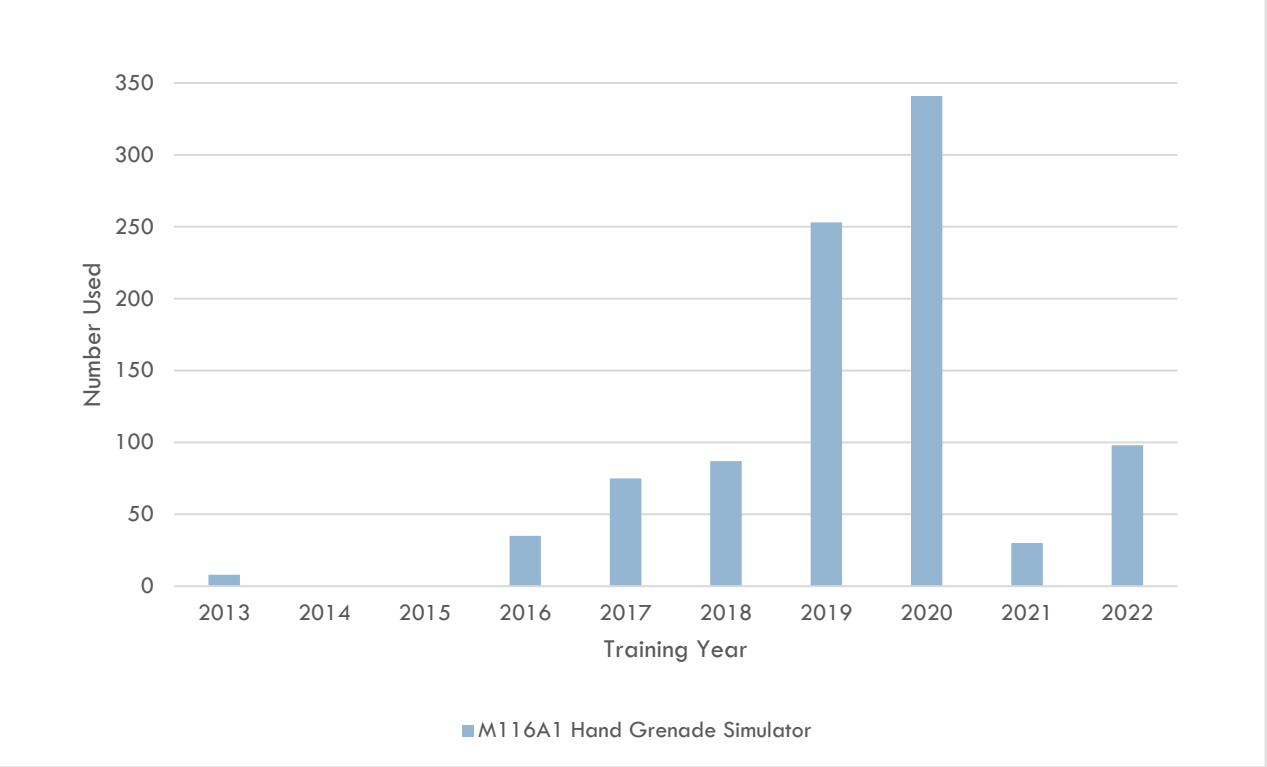
2.13 PYROTECHNICS

Military pyrotechnics are used to simulate battlefield noises and effects during troop maneuvers and training. Use of these devices is to prepare soldiers for the rigors of combat by simulating the stress and confusion of war. Currently the M116A1 and M69 Hand Grenade Simulators are approved for training use at Camp Edwards and are on the Camp Edwards Approved Munitions List.

2.13.1 M116A1 HAND GRENADE SIMULATOR

The M116A1 Hand Grenade Simulator was approved for use at Camp Edwards in March 2010. Ninety-eight were used in the Training Area/Reserve during TY 2022. Graph 2-7 shows the number used each training year since TY 2013. M116A1 hand grenade simulator use increased because the MAARNG has been conducting more collective training versus individual unit training. The M116A1 is used primarily during collective unit training and is used to simulate battlefield conditions during training events. M116A1 use was higher during TY 2022 than during TY 2021.

Graph 2-7 M116A1 Hand Grenade Simulator Use



2.13.2 M69 HAND GRENADE SIMULATOR

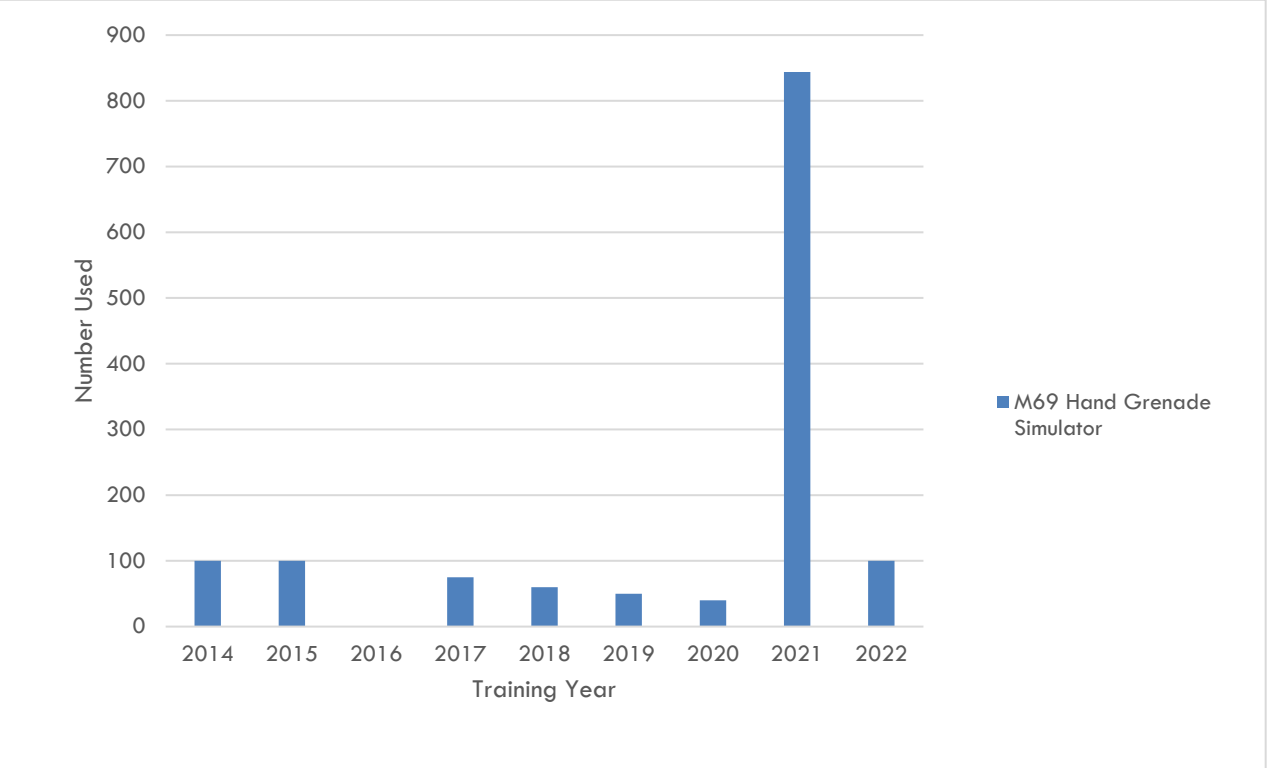
In 2013, EPA Region 1 and the EMC approved the use of the M69 Hand Grenade Simulator on Camp Edwards.

The M69 provides realistic training and familiarizes soldiers with the functioning of a fragmentation hand grenade. 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. One hundred were used in the Training Area/Reserve in TY 2022. Graph 2-8 shows the number of M69 Hand Grenade Simulators used since TY 2014. M69 Hand Grenade Simulator use showed a decrease during TY 2022. The nature of required M69 grenade training is cyclical; however, if there is a collective training event, the usage numbers will go up.

Graph 2-8 M69 Hand Grenade Simulator Use



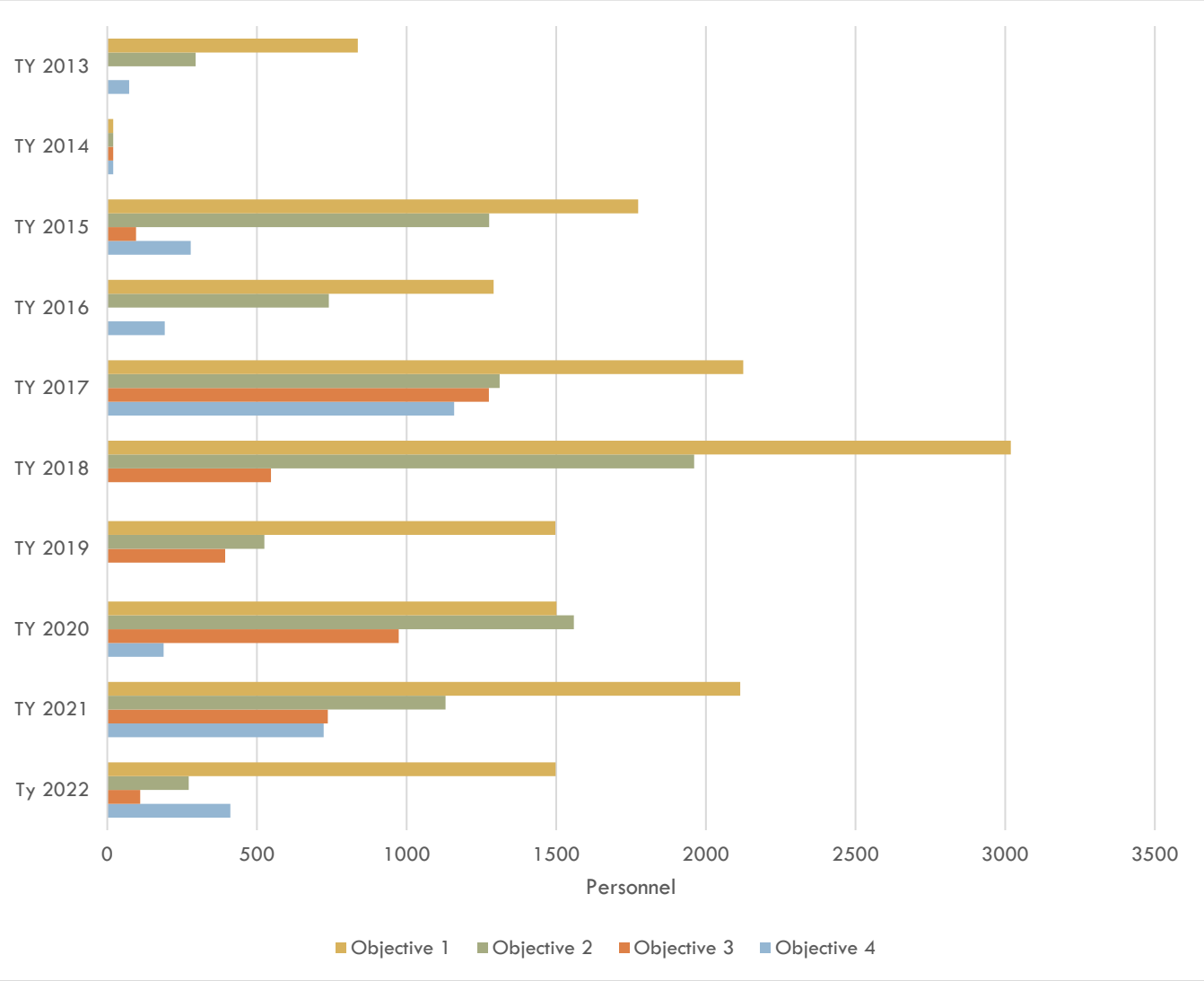
2.15 SOLDIER VALIDATION LANE

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 locations including training and bivouac sites within the Training Area. The ability to periodically reconfigure the portable training aides 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.

Four SVL locations (called objectives) were used during TY 2022 to meet military training needs: Objective 1 in Training Area A-4; Objective 2 in Training Area BA 4; Objective 3 in Training Area B 11, and Objective 4 in Training Area C-14. Graph 2-9 shows the use of all four SVL Objectives since TY 2013. The locations of the SVL Objectives are shown in Figure 2-9.

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 2022 is available in Appendix C.

Graph 2-9 SVL Use



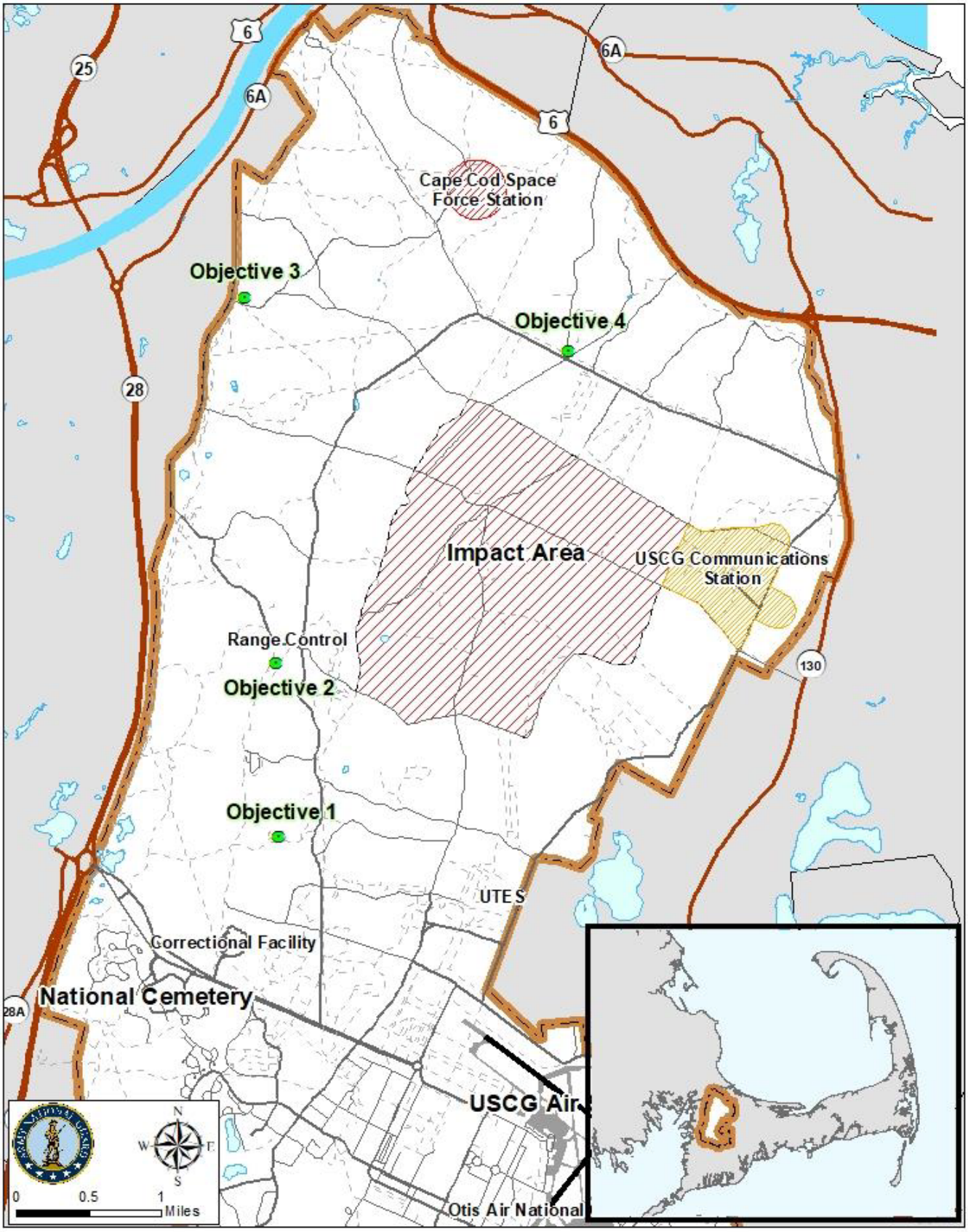
2.16 MULTI-PURPOSE MACHINE GUN RANGE

During TY 2015, the MAARNG's MILCON (Military Construction) project submission to construct a Multi-Purpose Machine Gun Range (MPMG) in 2020 on Camp Edwards at KD Range was funded by Congress. An MPMG is where soldiers train and qualify with automatic weapons. KD Range is an operational inactive range currently used for unmanned aerial vehicle training.

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).

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

Figure 2-9 SVL Objective Locations



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.

Over the past seven years, the MAARNG has coordinated with multiple state and Federal agencies including NHESP to ensure that adverse impacts to natural resources (including state-listed rare species) were avoided or mitigated.

For the MEPA process, a Notice of Project Change was filed in February 2020 with a 30-day public comment period. The Secretary of the Executive Office of Energy and Environmental Affairs determined that a Supplemental Environmental Impact Report (SEIR) should be completed. The MAARNG submitted the SEIR on June 11, 2020, with a 30-day comment period. The MAARNG received a certificate signed by the Secretary on July 17, 2020, which determined the SEIR submitted for the project adequately and properly complies with MEPA and its implementing regulations.

For the NEPA process, the Environmental Assessment was completed in August 2020 and a 30-day public comment period was held from August 8, 2020 to September 7, 2020. Approximately 367 comment letters, with approximately 917 comments and questions, were received from state and local agencies, environmental groups, and members of the public. The primary concerns from these comment letters were: why is the range needed; will the range cause increased traffic; will the range cause noise issues; was habitat, rare species and carbon sequestration considered; and will the range impact groundwater. In April 2021, the MAARNG provided responses to those comments in the "*Public Comment Summary Report for the Multi-Purpose Machine Gun Range at the Known Distance Range Environmental Assessment*." After comprehensive review of the project, on April 30, 2021, National Guard Bureau determined the Environmental Assessment met the "Finding of No Significant Impact." The Public Comment Summary Report and the "Finding of No Significant Impact" are both available on the publications page of the E&RC's website: https://www.massnationalguard.org/ERC/publications.htm.

In August 2021, the EPA elected to conduct a Sole Source Aquifer review of the proposed MPMG range. EPA is evaluating information related to the project and plans to release a draft determination in early 2023 to include opportunity for public comment and a public hearing.

In addition to environmental review under MEPA and NEPA, the MAARNG must receive the EMC's approval for both the MPMG range design and its OMMP.

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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 Training Area/Reserve and to report on activities associated with the EPSs for the Training Area/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 Training Area/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 2013, when available, or longer when appropriate to illustrate long-term trends. Additional information on environmental management activities performed in the Training Area/Reserve can be found on the Publications page of the E&RC web site at: https://www.massnationalguard.org/ERC/publications.htm

During TY 2022, seven Records of Environmental Consideration (RECs) were reviewed for natural and cultural resources for proposed actions in the Training Area/Reserve. RECs are an internal environmental review document based on NEPA. The RECs reviewed were for road repair, firebreak maintenance, and the Combined Arms Training Exercise training event.

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

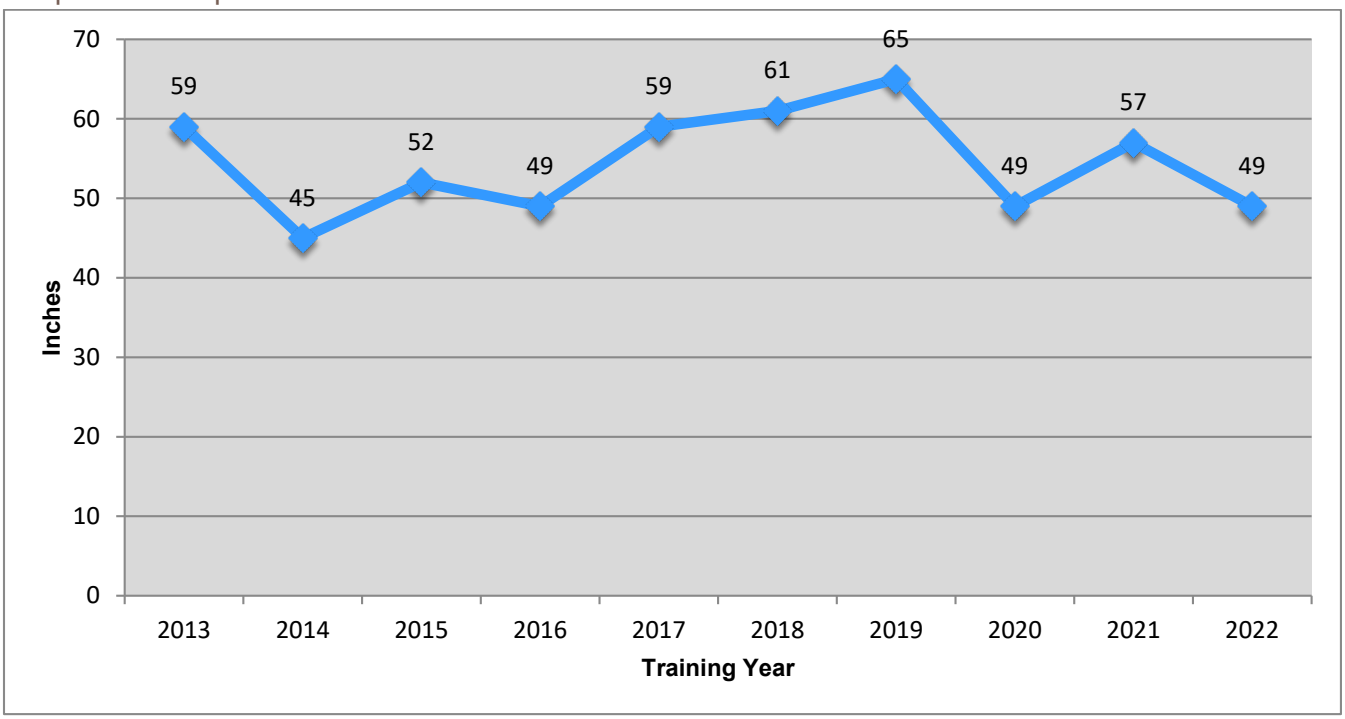
3.1 GROUNDWATER RESOURCES MANAGEMENT

The MAARNG complied with the Groundwater Environmental Performance Standard during TY 2022. 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 Regional Water Supply Cooperative continues to have fencing around its three water supply wells and appropriate signage around the each of the well's 400-foot radius in the Training Area/Reserve. Both the Upper Cape Regional 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 Training Area/Reserve that is part of its overall water supply system. Groundwater quality reports for the 102nd Intelligence Wing and the Bourne Water District and the Upper Cape Regional Water Supply Cooperative's Long-Range Monitoring Report are available in Appendix E. The JBCC Groundwater Protection Policy is available on the Publications page of the E&RC website at https://www.massnationalguard.org/ERC/publications.htm

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 49.32 inches of precipitation for TY 2022 (Graph 3-1). Barnstable County experienced drought conditions in 2022.

Graph 3-1 Precipitation Recorded



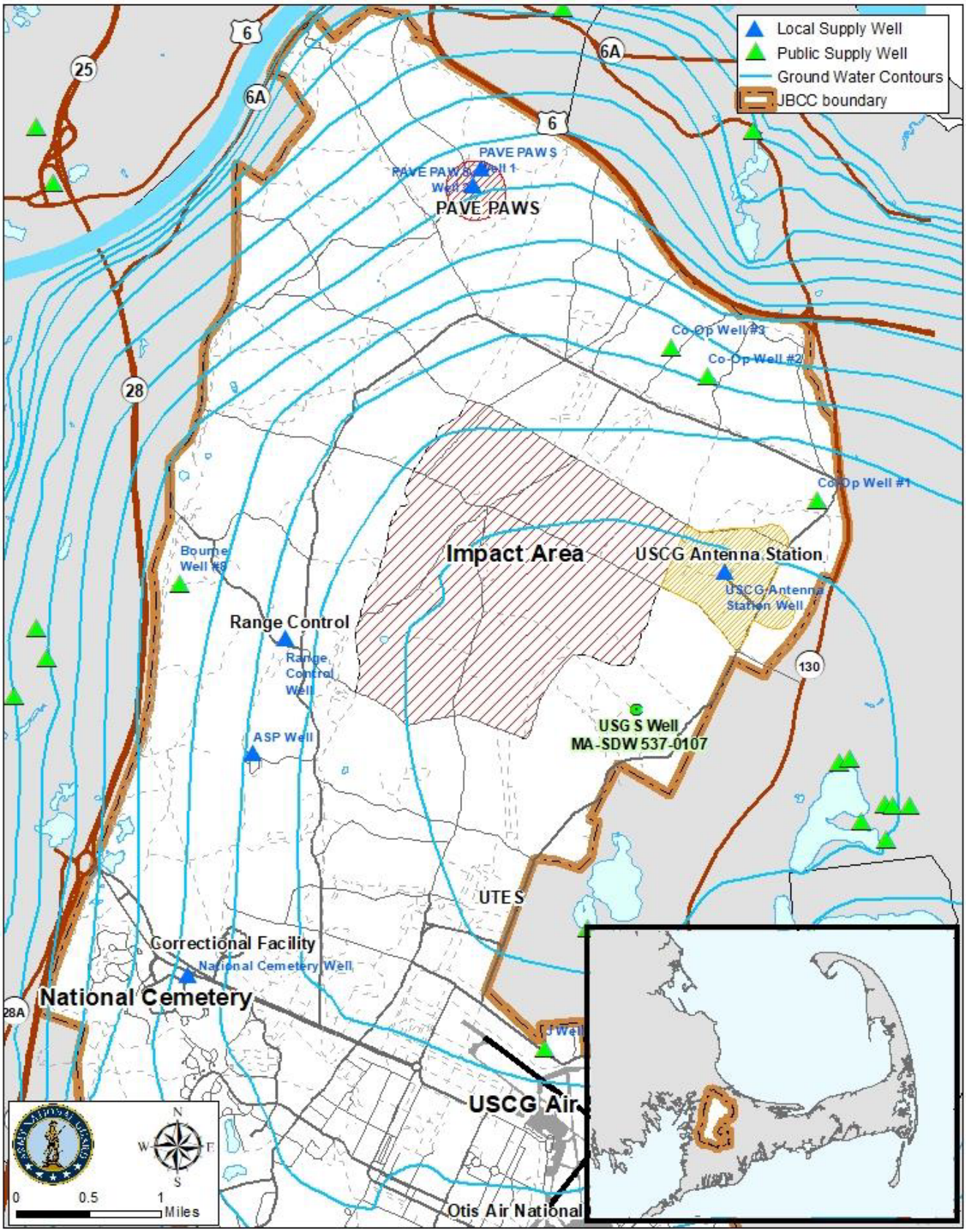
3.1.2 Groundwater Level

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.

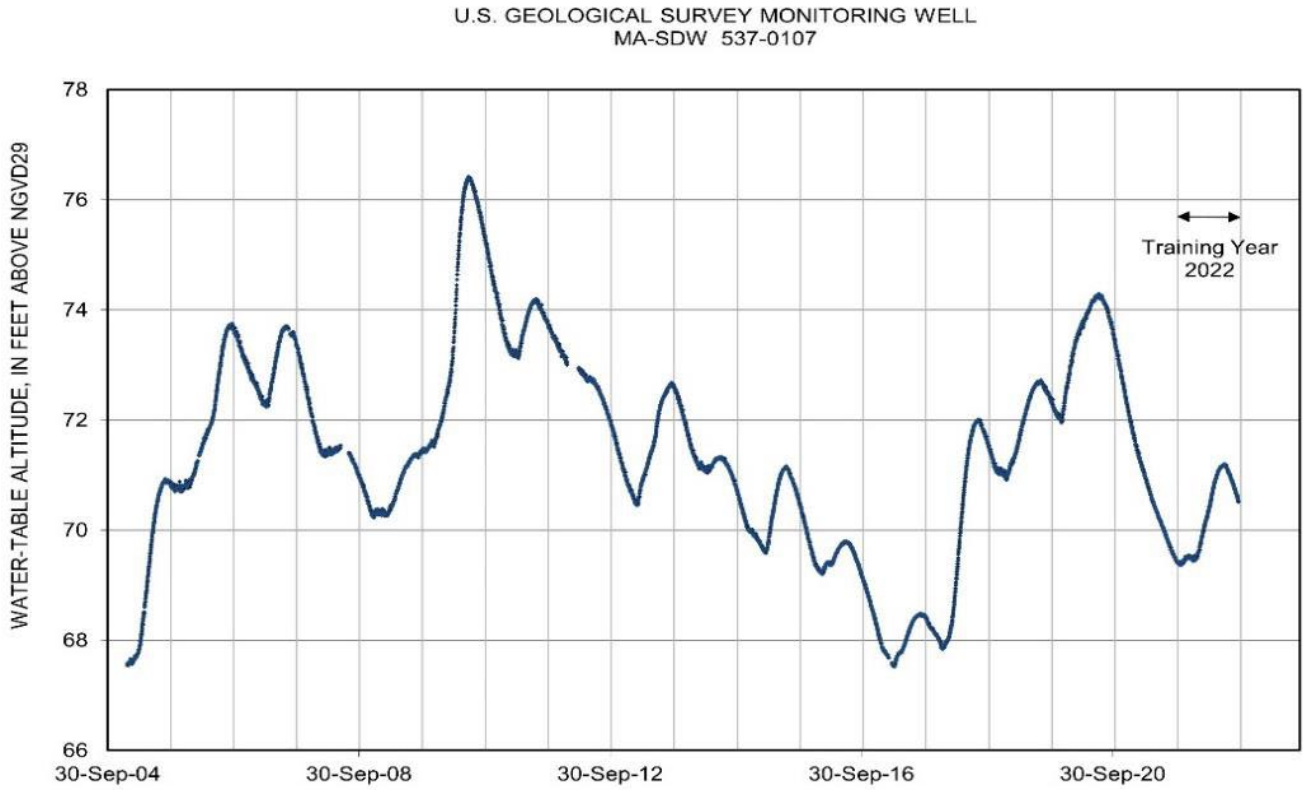
The pattern of water-level changes observed at the monitoring well is caused by natural seasonal and year-to-year variations in recharge from precipitation. Graph 3-2 shows the trend in the water-table altitude at the USGS monitoring well for the 2005-2022 training years. The water-table altitude rose about 1.7 feet between October 2021 and July 2022, then declined about 0.7 feet between July and October 2022. Similar trends in groundwater levels were observed this year elsewhere on Cape Cod and in southeastern Massachusetts (https://www.usgs.gov/centers/new-england-water/data-tools).

The IAGWSP provides part of the funding for the operation of the monitoring well because the water-level data are used in that program. The well became operational in January 2005. Information about the well and the observed groundwater levels are publicly available on the following USGS website: https://waterdata.usgs.gov/monitoring-location/414159070310501/

Figure 3-1 Well Locations



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 393,633,000 gallons of water (a daily average of 1,078,447) from its three wells to the six public water supply systems it services during TY 2022: 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 2013. 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. No long-term monitoring sampling of the sentry wells was conducted by the Cooperative in Calendar Year 2022.

Otis ANGB Public Water Supply System

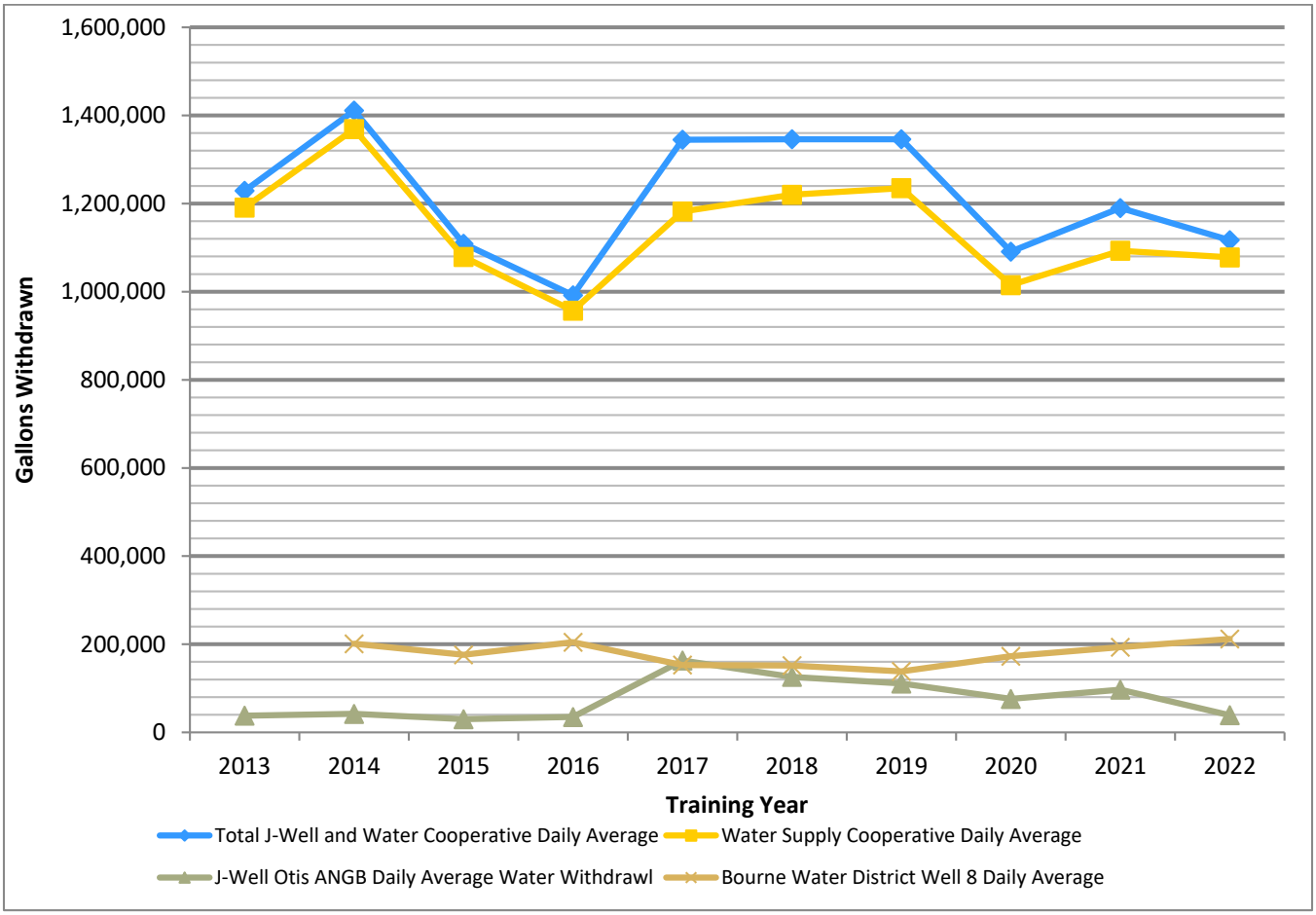
The Otis ANGB system pumped an average of 39,304 gallons of water per day and a total of 14,376,000 gallons of water from its well, known as J-Well (located in the Cantonment Area), during TY 2022. It also received 31,149,000 gallons from the Cooperative during TY 2022; a daily average of 85,340 gallons. Graph 3-3 shows the daily average pumping rate of the Otis system since TY 2013.

A copy of the calendar year 2021 Consumer Confidence Report for Otis ANGB is provided in Appendix E.

Bourne Water District Water Supply Well

During TY 2022, Bourne Water District Well 8 pumped a total of 77,378,100 gallons, with a daily average of 211,995 gallons pumped. Graph 3-3 shows the daily average pumping rate of Well 8 for TY 2014 through TY 2022. The well's location is shown in Figure 3-1. A copy of the calendar year 2021 Bourne Water District's Consumer Confidence Report is provided in Appendix E.

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



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

Other Water Wells

There are two water supply wells located within the boundary of the Training Area/Reserve. These are located at Cape Cod SFS (PWS# 4036008) and the USCG Communications Station. Further information on water supply wells is available on MassDEP's website: https://www.mass.gov/service-details/well-database.

3.2 WETLANDS AND SURFACE WATER MANAGEMENT

The MAARNG did not take any actions during TY 2022 that resulted in the loss of any wetland resources or their 100-foot buffer areas. No new bivouac areas were created in the Training Area/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. Consistent with EPS 2.7, in TY 2022 trails and roads listed within 500 feet of wetlands were closed to vehicle access from February 15 to May 15 to protect migrating and breeding amphibians. Environmental Program representatives routinely attended coordination meetings held by various parties (e.g., Camp Edwards, IAGWSP) to stay abreast of the activities in the Training Area/Reserve and to ensure appropriate coordination occurred and impacts were avoided or permitted.

In TY 2021, MAARNG amended the 2018-issued Conservation and Management Plan (CMP) for Agassiz's Clam Shrimp (*Eulimnadia agassizii*), a state listed endangered species that is documented primarily in roadway puddles. The amendment provides a long-term process that allows for necessary road maintenance and repair of road puddles in the training area while preserving suitable puddle habitat for clam shrimp populations. Details on the CMP amendment and mitigation and monitoring carried out during TY 2022 are in Section 3.3.4 and Appendix F.

3.2.1 Vernal Pools

In TY 2021, the Natural Resources Office contracted SWCA Environmental Consultants to locate sites in the training area, using GIS analysis and field verification, for vernal pool creation and to provide construction plans and specifications for a handful of locations. SWCA is full-service company experienced with creating vernal pools in Massachusetts. Key staff assigned to this project included a certified wildlife biologist with specialty in vernal pool amphibians, a landscape architect, GIS specialist, and wetland restoration expert who is also the company Principal and Senior Scientist. Budgeting for this project came from the funds set aside in the event the Town of Bourne Conservation Office had required mitigation in the form of vernal pool creation for the filling of three road puddles on Jefferson and Orchard Road that were attracting breeding vernal pool amphibians. The Bourne Conservation Office did not apply wetland jurisdiction to the road puddles and therefore mitigation was not needed, thus this project, in good faith, seeks to create habitat that is overall in short supply on the base. This project is expected to be completed with a final report and design plans in the fall 2022. This contract does not include construction that would be carried out by MAARNG and would only be completed if the puddle locations are found not to interfere with the military mission.

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 2022. The office and their contractors observed 17 species and is reporting the sightings to NHESP in early TY 2023 (Table 3-1). One field technician hired for TY 2022 and the Field Crew Leader were primarily involved in observing and reporting these rare floral and faunal species in the Training Area/Reserve with supplementary observations from others. The Natural Resources Office is also reporting observations of "Tracking List" species to NHESP as a standard condition of scientific collection permits for reptiles and amphibians. Perhaps most notably, one new listed species, Sandplain Heterocampa (*Heterocampa varia*) was collected in a light trap by GZA, a Natural Resources-ITAM contractor. This may be the first of this species collected on mainland Massachusetts (awaiting confirmation from specialists), with previous collections being on Martha's Vineyard and Nantucket.

The Natural Resources Office formally and informally reviewed proposed military and civilian activities in the Training Area/Reserve to ensure that adverse impacts to natural resources (including state-listed endangered species) were avoided or mitigated. No projects required informal or formal consultation with the US Fish and Wildlife Service under Section 7 of the Endangered Species Act. Under MESA, consultation and coordination was primarily limited to ongoing project planning and support under the existing Conservation and Management Permits discussed in more detail in Appendix F. This included implementation and completion of the Tango Range redevelopment and completion of the Eversource switching station soil stockpile. One natural resources and training lands habitat restoration project was reviewed through the Forest Cutting Act process and approved by NHESP, which is continuation of a kettle hole frost bottom restoration in Training Area E-3.

Multiple contracts were developed or continued in TY 2022 for surveying and managing rare species. See Section 3.3.2 and Section 3.3.5 for information on TY 2022 contracts and other in-house work regarding State and Federally Listed bats and Eastern Box Turtles, respectively. In FY 2022, technicians also checked snake cover

boards in the Training Area/Reserve to opportunistically document species on the site, particularly looking for the state listed Eastern hognose snake.

The Smithsonian Conservation Biology Institute received a DoD Legacy grant to conduct a status assessment of spotted turtles, a species under review for federal listing, at nine military installations. Camp Edwards, along with Camp Curtis Guild, was among the sites chosen for sampling in 2021. Results from Camp Edwards and other military installations were analyzed together to better inform best management practices for spotted turtles on military sites. The Natural Resources Office facilitated this effort through project coordination, technician help in the field, and the collection of blood samples by a veterinary student. The Natural Resources Office is awaiting the final report on this effort.

Photograph 3-1 Unexpected Cycnia Moth (*Cycnia collaris*) caterpillar feeding on Butterfly Milkweed (*Asclepias tuberosa*) in the northern training area. This state-listed species is a milkweed obligate found both in the grasslands and Training Area/Reserve.

In TY 2022, the Natural Resources Program initiated a contract with EA Engineering and Botanist Bryan Connolly to survey for potential-to-occur rare and special status plant species within the Camp Edwards managed grasslands. Field surveys are planned for the 2023 growing season. This project includes a limited survey in the central Impact Area, taking advantage of transects established by the IAGWSP in which vegetation cleared to find and remove source material has created conditions that may be suitable for certain rare plant species. Two high profile target plants, not recorded on Camp Edwards, are Sandplain Gerardia (*Agalinis acuta*) and American Chaffseed (*Schwalbea americana*). Both are State- and Federally-listed Endangered.

Results from the study, contracted in TY 2020, that investigates the taxonomic identity of the population of *Triosteum* on the base are being worked up into a publishable manuscript. This is an interesting study with significant findings. See Section 3.3.1 for more on the study's results of the state-listed plant *Triosteum perfoliatum*.

Although three field crew positions were funded for the summer, only one position was filled due to others declining based on a lack of housing. This lack of field staff meant that some efforts could not be implemented. It also meant less staff in the field opportunistically observing rare species. The Natural Resources-ITAM office compensated for some of this lack of staff by contracting Davey Resource Group to complete vegetation surveys for mitigation monitoring, contracting SWCA for clam shrimp monitoring, working with University of Massachusetts (UMass) interns to perform Monarch caterpillar surveys, and having a graduate researcher on site studying and documenting Eastern box turtles.

3.3.1 Rare Species Reporting

Table 3-1 identifies the rare species sightings reported to NHESP for the past five years (See Appendix G 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, including formal surveys and casual encounters.

TABLE 3-1 State-listed Species Reported to NHESP

Quantities shown[1] are not simply results of standardized surveys and do not represent population trends. Only observed species are listed[2].

			Individuals Reported				
Common/Scientific Names	**Fed Status[3]**	**State Status[4]**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**	**TY 2022**
			BIRDS				
Grasshopper Sparrow[5] *(Ammodramus savannarum)*	-	T	16	20	34	36	29
Northern Harrier[6] *(Circus cyaneus)*	-	T	Wintering	Wintering	Wintering	Wintering	Wintering
Upland Sandpiper[5] *(Bartramia longicauda)*	-	E	7	12	6	2	1
Eastern Meadowlark[5,7] *(Sturnella magna)*	-	SC	2	7	14	17	9
Whip-poor-will *(Antrostomus vociferous)*	-	SC	110	53	99	136	137
			REPTILES and AMPHIBIANS				
Eastern Box Turtle *(Terrapene carolina carolina)*	-	SC	43	58	45	83	62
Eastern Hog-nosed Snake *(Heterodon platirhinos)*	-	SC	8	9	1	2	6
			PLANTS				
Adder's Tongue Fern[8] *(Ophioglossum pusillum)*	-	T	0	25	646	N/A	225
Spring Ladies Tresses *(Spiranthes vernalis)*	-	T	0	0	0	3	0
Broad Tinker's Weed[8] *(Triosteum perfoliatum)*	-	E	0	200	6	N/A	1883
			BEES				
Walsh's Anthophora[9] *(Anthophora walshii)*	-	E	0	32 (9)	4	N/A	1
			BUTTERFLIES and MOTHS[10]				
Buck Moth (*Hemileuca maia*)	-	SC	0	4	2	74	133
Pine Barrens Speranza *(Speranza exonerata)*	-	SC	0	0	0	0	4

Sandplain Euchlaena *(Euchlaena madusaria)*	-	SC	0	0	1	0	0
Melsheimer's Sack Bearer *(Cicinnus melsheimeri)*	-	T	0	0	7	0	0
Gerhard's Underwing *(Catocala herodias)*	-	SC	0	0	2	0	35
Sandplain Heterocampa *(Heterocampa varia)*	-	T	N/A	N/A	N/A	N/A	1
Chain-dotted Geometer *(Cingilia catenaria)*	-	SC	0	1	0	0	0
Pink Streak *(Dargida rubripennis)*	-	T	0	0	3	1	1
Collared Cycnia *(Cycnia collaris)*	-	T	0	11	33	200	7
Frosted Elfin *(Callophrys irus)*	-	SC	5	TBD[11]	25	57	13
Slender Clearwing Sphinx *(Hemaris gracilis)*	-	SC	0	0	5	3	26
ODONATES							
Scarlet Bluet *(Enallagma pictum)*			N/A	N/A	N/A	N/A	6
CRUSTACEANS							
Agassiz's Clam Shrimp[12] *(Eulimnadia agassizii)*	-	E	38	9	3	5	12
American Clam Shrimp[12] *(Limnadia lenticularis)*	-	SC	0	0	0	3	0
MAMMALS							
Northern Long-Eared Bat[13] *(Myotis septentionalis)*	T	E	1	3	1	TBD	N/A
Little Brown Bat[7] *(Myotis lucifugus)*	UR	E	2	6	2	TBD	N/A
Tricolored Bat[7] (Perimyotis subflavus)	UR	E	2	3	1	TBD	N/A
Eastern Small-Footed Bat[13] *(Myotis leibii)*	UR	E	0	1	1	TBD	N/A

[1] Reported quantities are variable dependent upon survey effort, area/species of focus in a given year, opportunistic observations, and other influences. MAARNG reports all state-listed species observations consistent with the Environmental Performance Standards, with some caveats noted below.

[2] A full state-listed species list is included in the INRMP.

[3] Federal Status: E = Endangered, T = Threatened, UR = Under Review (status assessment or listing determination ongoing)

[4] State Status: E = Endangered, T = Threatened, SC = Special Concern

[5] Grassland bird numbers represent individual territories observed in a given year rather than the total number of birds observed throughout repeated surveys as was reported in past years (prior to the TY 2019 SOTRR). Upland Sandpiper counts exclude known females, but include unknown birds. Also, the numbers reported in annual reports TY 2015 and earlier included birds found on the Coast Guard airfield, which is not reported by MAARNG Natural Resources. Due to these changes, past year quantities may be different from prior versions of Appendix F, but now reflect the population more accurately.

[6] 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).

[7] Species added to MA Endangered Species List in TY 2020. Observation quantities included for prior years, but would not have been officially reported to NHESP.

[8] In 2018 only sites with historic records and no recent records were surveyed.

[9] MAARNG contracted a targeted survey for *Anthophora walshii* in 2019 after an exploratory bee survey in 2017. The first number represents the number of flying/foraging records, and in parentheses the records of nesting activity. Unconfirmed nests were not counted.

[10] Caterpillar clusters are reported as a single observation. Barrens Buckmoths received dedicated flight count attention in 2021 and 2022, thus the large increase in reported observations. Caterpillar clusters are reported as a single observation. Barrens Buckmoths received dedicated flight count attention in 2021 and 2022, thus the large increase in reported observations.

[11] 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.

[12] Numbers represent occupied locations with confirmed identification.

[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 confirmed through manual call vetting. Numbers are reported to NHESP, but not tracked by them due to current uncertainty in using acoustic identifications. TY 2020 data is still being processed, these numbers are to be determined at a later date (TBD).

The data currently reported in the table are gross observations only and not interpretable for trends. However, significant progress has been made 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. For example, population trends for bird Species of Greatest Conservation Need are reported in Section 3.5.3. The Lepidoptera Monitoring Plan, completed in TY 2022, provides a robust statistical framework for monitoring trends in state listed Lepidoptera in response to habitat management by combining vegetation and moth surveys. 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 (Section 3.3.7). Likewise, bird monitoring standardization allows for long-term trends analysis (Section 3.5.3) and better integration with broader conservation initiatives. Trends analysis requires years of data collection to account for interannual variability (i.e. drought versus wet years) and sampling occasion covariates (i.e. low temperatures, wind, noise, etc.) to prevent normal variability for being mistaken for true trends. At regular intervals, the Natural Resources Office plans to interpret trend data with different species or groups being examined each year. The Natural Resources Program staff are also working with statewide and regional efforts to coordinate monitoring, including participating in the annual Northeastern Nightjar Survey, the Monarch Larva Monitoring Project, the Frosted Elfin Habitat and Butterfly Survey Protocol, and regional monitoring plots for New England cottontail.

State-listed plant surveys annually focus on *Ophioglossum pusillum* and *Triosteum perfoliatum* at Camp Edwards. Based on concerns for separation of the latter species from its congener, *T. aurantiacum*, the Natural Resources Office contracted a genetic and hybridization study, which started in TY 2020. The study was led by Dr. Bryan Connolly, Assistant Professor in the Department of Biology at Eastern Connecticut State University (ECSU) and who previously held the position of Massachusetts State Botanist. Mr. Connolly collaborated with colleagues from ECSU as well as the University of Tennessee and the Flanders Research Institute for Agriculture, Fisheries and Food in Belgium to process and analyze plant samples from Camp Edwards as well as two other Massachusetts sites for comparison and to develop a publishable manuscript. The manuscript is in a near final stage and will be submitted for publishing to a peer-reviewed scientific journal. Among other interesting results, the study shows that the *Triosteum* population at Camp Edwards is more closely related to *T. perfoliatum* than to *T. aurantiacum* and the authors conclude that the plants are likely *T. perfoliatum* and should be regulated in Massachusetts as a population of the rare species. Given the current evidence, annual plant surveys for *Triosteum* at the base will no longer separate *Triosteum* individuals based on morphological features. This means that the existing *T. perfoliatum* population covers a somewhat larger range (i.e., additional rare plant sites or kettle holes) with, in most cases, more individuals counted at known *T. perfoliatum* sites.

Six rare plant sites were surveyed for *T. perfoliatum* in TY 2022 following the protocol for previous years except that all *Triosteum* individuals, regardless of morphological features, are now counted as the rare species, T.

perfoliatum. As expected, *T. perfoliatum* counts were higher within rare plant sites than past years with a total of 1,883 stems counted across five of the six sites. Triosteum was not confirmed on one of the sites called RP06a. Triosteum had been observed at RP06a in small numbers in 2016 and 2019 but at the time, the plants were identified as T. *aurantiacum*. Four rare plant sites were surveyed for *O. pusillum* in TY 2022. Field technicians carrying out the surveys counted a total of 225 plants which were all observed from one rare plant site. *Ophioglossum pusillum* was not observed at three of the sites. Natural Resources biologists will continue communication with State Botanists regarding the population status and management of this small-statured and easily overlooked plant. In TY 2022, MAARNG staff installed a game camera for the second growing season at the rare plant site (RP05) that was experimentally fortified with buck fencing in TY 2021 to exclude previously observed deer browse on *T. perfoliatum* and *O. pusillum*. There were no observations of deer browse on rare plants at RP05 or observations of deer within the exclosure.

3.3.2 State and Federally Listed Bats

In TY 2022, both the Northern Long-eared Bat (currently federally listed as threatened) and the Tricolored bat (under status review) have been proposed by US Fish and Wildlife Service (USFWS) for listing as federally endangered species. The Northern Long-eared Bat (NLEB) was federally listed as threatened in May 2015 and proposed for listing as endangered in March 2022. The Tricolored bat (*Perimyotis subflavus*) was proposed for listing as endangered in September 2022. These listings are primarily due to the severe population crashes (estimated greater than 95% for NLEB and greater than 90% for Tricolored bats in the areas where a fungus has impacted hibernating bat colonies) 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. The change from threatened to endangered for the NLEB will take away the 4 (d) rule, which allowed for many of the current habitat management and some training activities on Camp Edwards. With a change to endangered status, formal consultation will be required for these activities. The Army and National Guard levels are currently exploring formal consultation for regular training and habitat management activities on installations throughout the range of these species, which could apply to activities on Camp Edwards. The Natural Resources Office is monitoring progress of consultations closely and will proceed with a MAARNG consultation if necessary. Consultation at any of the levels will include mitigation and avoidance measures. The seven years of acoustic data collection, multiple mist netting and telemetry projects, and the current contract to summarize bat activity (more details below) on base will aid in forming a Biological Assessment that is both protective of the species while providing ample training opportunities and beneficial habitat management.

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 2014, the Natural Resources Office began acoustic monitoring on base and continued into 2021. All acoustic data through 2020 were vetted for any Myotis (includes NLEB, Little brown bats, and Eastern small-footed bats) or Perimyotis (Tricolored bats) calls. In TY 2019-2020 and part of TY 2021, microphones were placed above the tree canopy at two sites to specifically target Perimyotis, which is a high-flying species. Perimyotis and NLEB were each recorded at 3 of the 19 acoustic sites monitored in TY 2019, including one site where they were both found, site 15_35, along the southeastern boundary of the Training Area/Reserve. Perimyotis was recorded at one of the two sites targeting the species in TY 2019, though equipment and insect noise issues were prevalent. In 2020, of the four sites monitored, site 15_35 had all the Myotis species and Perimyotis. One other site had little

brown bat and calls that could only be identified to the genus Myotis level. Both sites are along the eastern base boundary. The two sites targeting Perimyotis did not get any Myotis or Perimyotis calls and were more interior.

In TY 2022, acoustic monitoring was not conducted to prioritize analysis of past data. Tetra Tech has been organizing the TY 2021 acoustic data and beginning to vet data; the report on this data is expected in early TY 2023. Confirmed detections will be reported to NHESP. The results of the power analysis completed in TY 2021 was used this year to contract WEST Inc. to analyze the past data for spatial and temporal trends and occupancy analysis. This contract will also provide recommendations for future work that comes from looking at the whole data set. All vetted bat data from 2014-2020 was entered by Natural Resources staff into the federal database, NABat, to inform the USFWS status assessments of *Myotis lucifugus, M. septentrionalis,* and *Perimyotis subflavus*.

BRI was contracted to identify a bat roosting in a bunker on Knot Hollow Road in early February 2021. They identified the bat as a silver haired bat (*Lasionycteris noctivagans*), which is not a state or federally listed species. Federal biologists indicated that this is likely the first record of the species hibernating in New England. BRI also vetted past acoustic data and determined this species has been active on base and in Mashpee during the 2017-2018 winter season. Their report and a manuscript for publication, currently in draft, will be completed in early TY 2023.

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. Investment in equipment, personnel training, and collaboration continued in TY 2022 to address concerns both over avoiding impacts to bats and minimizing bat impacts on ongoing actions such as pine barrens habitat management.

AFCEC and Cape Cod Space Force Station manage two 1.5 megawatt (MW) and two 1.68 MW wind turbines in the Training Area/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 observed bat or bird strikes during TY 2022. Equipment maintenance personnel are the primary observers and perform weekly operations and maintenance checks. Acoustic surveys conducted at Cape Cod Space Force Station, including turbine sites, found relatively low levels of activity, which was dominated by Big Brown Bat and consistent with results in surrounding areas.

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 in suitable scrub oak or dense shrub habitat along powerlines on Camp Edwards.

In 2015, the USFWS removed New England cottontail from the federal candidate list. The finding was 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, contracted wildlife detection dogs readily found pellets at off-base locations and at two on-base sites located along power lines. At several sites on base that had previously had rabbits, the dogs did not find rabbit sign or not in all repeated surveys at the site. This data could suggest a lower density of rabbits and/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 and 2018. The low diversity of food resources at interior base sites with more native vegetation may be limiting the density of rabbits on base. 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. In TY 2020, the graduate student completed his thesis (available here: https://dash.harvard.edu/handle/1/37365622).

In TY 2021, the Natural Resources Office contracted the USFWS working with the University of Rhode Island to perform statistical analysis and reporting for the New England cottontail data compiled thus far. The USFWS has contributed additional funding to analyze their data from Mashpee National Wildlife Refuge as a larger data set to have more applicability for all of Cape Cod. The University of Rhode Island is wrapping up compiling and organizing data from both sites and will continue with data analysis and reporting in TY 2023.

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. The Natural Resources Office performed pellet searches in TY 2022 in regional plots, in areas with previous management history, and along roads in the Impact Area. In TY 2022, the Natural Resources Office also began collaborating with the State University of New York College of Environmental Science and Forestry and USFWS for experimental management plots to be implemented this winter and subsequent monitoring for New England cottontail and bat utilization of the plots.

3.3.4 Agassiz's Clam Shrimp

Roadway puddles in the Training Area/Reserve provide habitat for two state-listed clam shrimp species. Agassiz's Clam Shrimp (*Eulimnadia agassizii*, [AgCS]) were discovered in roadway puddles on base in TY 2015 during an effort to resurvey past records older than 15 years. In this case, an observation and collection made on Camp Edwards in 1999. American Clam Shrimp (*Limnadia lenticularis*, [AmCS]) were identified by Natural Resources staff in TY 2021. A non-listed species, the Mattox Clam Shrimp (*Cyzicus gynecea*) also inhabits roadway puddles on the base.

Roadway puddles are most often heavily trafficked, unvegetated puddles created by roadway compaction. In TY 2018 when several puddles along Herbert and Cat roads had become large enough to impede use for training, the Natural Resources Office worked with NHESP and Oxbow Associates to create a Conservation and Management Plan (CMP) to address the necessary road repairs and provide net benefit for the species. The plan included several components: habitat creation, experimental treatments, and monitoring. Requirements and activities specific to the CMP, including new puddle creation, *in-situ* modification to improve puddles, relocation of egg-bearing sediment, and three years of monitoring, were completed in TY 2020. A fourth year of monitoring, not required, was completed in TY 2021 to compensate for 2020 drought conditions that resulted in often dry puddles with fewer opportunities to observe clam shrimp and because clam shrimp are of strong focal conservation interest for MAARNG. Despite the drought and lack of favorable conditions, AgCS were still found in three of the 11 puddles monitored in 2020. Surveys in TY 2020 also documented for the first time AgCS and Mattox Clam Shrimp existing in the same pool at the same time.

In TY 2021, Natural Resources staff coordinated with MassWildlife to amend the CMP permit to allow for long term road repairs. The CMP amendment, called Clam Shrimp Conservation and Roadway Maintenance Plan, borrows on elements from the original CMP, such as habitat creation and improvement and annual monitoring, brings in new elements, such as road category designations and their associated treatments, and provides for a net

Photograph 3-2 Conducting clam shrimp surveys at road puddle habitat along a powerline right-of-way in the Training Area/Reserve. Photo: Natural Resource Office/Erin Hilley

conservation benefit to AgCS. The original CMP allowed for location specific improvements to training roads and clam shrimp puddles. The amended permit establishes a long-term protocol that allows for regular road maintenance and repair of road puddles in the Camp Edwards training area while preserving a network of suitable and available puddle habitat for clam shrimp populations.

In TY 2022, as part of the CMP Amendment, annual clam shrimp monitoring resumed for the fifth consecutive year, however, to alleviate seasonal field technician shortages, SWCA Environmental Consultants was contracted to carry out clam shrimp monitoring and rare species reporting. SWCA is in the process of compiling the results from their eight monitoring visits spread out from mid-May to mid-October. The Natural Resources Office expects to receive the monitoring results from SWCA this fall and will update the Rare Species Table at that time. Clam shrimp samples collected by SWCA will be submitted to the MassWildlife Aquatic Ecologist and positive observations of state-listed clam shrimp will be submitted by SWCA to MassWildlife using their online reporting system, Heritage Hub, under their issued collection permit. The Natural Resources Office also received a collection permit, which has been renewed annually, to sample clam shrimp on MAARNG lands or any lawfully entered lands in Massachusetts.

A significant component of the Clam Shrimp Conservation and Roadway Maintenance Plan is the submission of annual road work plans developed by MAARNG for MassWildlife review and approval. This involves planning meetings and coordination with participants from Natural Resources-ITAM, IAGWSP, Camp Edwards troop labor projects, and Facilities and Engineering. Potential impacts to clam shrimp and clam shrimp habitat, as well as other wildlife and natural resources concerns, are evaluated by Natural Resources staff. Required and voluntary mitigation, based on evaluated impacts and a Net Benefit standard, is proposed and included in the road work plan. The first Road Work Plan proposal was submitted for MassWildlife review concurrently with the CMP amendment request. The approved Road Work Plan was specifically for necessary repairs to severely degraded Impact Area perimeter roads. This included the boundary portion of Jefferson and Barlow Road and impacted 12 puddles with occupied status, meaning AgCS had been documented in previous years. Approved mitigation for this work was carried out in TY 2021 and included relocation of adult clam shrimp and/or transfer of egg-bearing sediment from the impacted puddles to existing surrounding puddles not known to contain clam shrimp. A report of Final Conditions for the impact area roadwork and clam shrimp mitigation was submitted and approved by NHESP in January 2022.

In December 2021, the Natural Resources Office submitted the second Road Work Plan. This plan was submitted to MassWildlife and approved by the end of TY 2021. This Plan includes projects that range from routine grading of Gibbs and Burgoyne Road, repairs to sloped rutted sections of Wheelock Road, and a puddle improvement project. FRED puddle, a large and nearly impassable puddle on Fredrickson Road, is habitat for AgCS. Using techniques approved and carried out as part of the original CMP, Natural Resources Program plans to raise the elevation and reduce the size of the puddle so that it still provides AgCS habitat but is also passable by vehicles. This plan was amended in July 2022 to include two additional projects, one, an IAGWSP grading project on a

section of Barlow Road and two, a necessary puddle improvement project on Pocasset Road. Neither project impact known clam shrimp puddles. Work approved under this plan is in various stages from complete, to underway, to not started. The Natural Resources Office will submit a Final Conditions Report to NHESP by the end of the calendar year. The Natural Resources-ITAM Office will coordinate with the IAGWSP, Camp Edwards troop labor officials, and Facilities and Engineering to develop a Road Work Plan for the coming year. The Natural Resources Office submitted a Final Conditions Report to NHESP on February 9, 2023 for projects completed.

3.3.5 Eastern Box Turtle

3.3.5.1 Turtle Protection

In support of the MPMG proposed project, AECOM was contracted to create an Eastern Box Turtle Construction Period Monitoring and Protection Plan (CPMPP) and to complete initial canine-assisted surveys around the MPMG range in fall 2019. Once NHESP approved the plan, the plan implementation was contracted to AECOM to provide canine-assisted pre-construction turtle surveys and construction period monitoring, including tracking turtles around the project area using radiotelemetry. The CPMPP included silt fence installation followed by the required hours of turtle surveys inside the wildlife barrier completed before October 31. The construction contract was not awarded in TY 2020, which meant the silt fence could not be installed. The agreed upon survey hours and turtle tracking was still completed. A report on all efforts was submitted to NHESP on February 2, 2021, and additional survey effort in 2021 was proposed to account for surveys inside the silt fence once installed. Due to permitting delays, the silt fence was not installed in 2021. In August 2021, the Natural Resources Office submitted "Addeundum: Turtle Protection Pre-surveys Camp Edwards Multipurpose Machine Gun Range" to NHESP to complete the agreed upon survey hours in an open system, to track turtles prior to hibernation, and to relocate turtles to a known hibernation location near the project area. This plan provided protection for turtles during winter silt fence installation and tree removal activities. However, the silt fence was not installed in the winter of 2021-2022 due to delays in project approvals. The Natural Resources Office and their contractor, AECOM, submitted a report and subsequent updates from the fall and spring activities in TY 2021. The report included plans for silt fence installation in the active or inactive season to accommodate work when approvals are obtained.

In TY 2022, the Natural Resources Office took over the turtle protection project started by Eversource at Dig Site 3. The Dig Site is being used as a stockpiling site for soil that will be used on future construction projects on base. The site was enclosed with silt fence until spring 2022 when it was taken down since major construction projects have been delayed. Approvals for this process and reporting on this process was completed with NHESP. Prior to the start of major construction projects requiring material removal, the silt fence will be installed again and maintained for turtle protection

Natural Resources Office staff provided education to equipment operators, monitoring of transmittered turtles, and sweeps prior to the start of work on a troop labor project completed at Tango Range. All this work was completed in collaboration and approval from NHESP.

Oxbow Associates, the contractor for Eversource, coordinated with the Natural Resources Office on their activities on base including at the substation and along the powerline paralleling Gibbs Road. The Natural Resources Office shared transmitter frequencies for turtles along the powerlines to facilitate turtle protection during pole replacement work this fall. Oxbow Associates has also provided information on the health of turtles they find on base.

3.3.5.2 Monitoring and Research

Photograph 3-3 Collaborative, interagency training on box turtle natural history, survey technique, conservation, and protection hosted at Camp Edwards. This event included MassWildlife, DCR, US Coast Guard, AECOM, Inc., and MAARNG.

In TY 2021, the Natural Resources Office contracted AECOM to perform detection dog-assisted surveys to find box turtles and place radio transmitters on them in a variety of habitats on base. This broad landscape level approach will allow monitoring of turtles in management areas receiving a variety of treatments. Periodic monitoring of these turtles over time will provide a broad-scale look at impacts from both the range development activities and mitigation activities on base. This contract will contribute towards the long-term box turtle monitoring requirement in the CMP for the MPMG range. Turtle searches will be completed in October 2022, and reporting on this project is expected in the spring of TY 2023.

In-house turtle telemetry efforts focused on tracking tagged turtles during spring emergence and in the fall. Turtles were assessed for the presence of fly larvae when found above ground. Tagged turtles are mostly in C-14, Sierra and Tango ranges and around the MPMG, which are areas with future construction projects or areas with previously tagged turtles. Other turtles from the canine-assisted surveys are also tracked in mitigation areas and forest retention areas. Sixty-four turtles were being tracked by the end of the fiscal year.

In TY 2021, the Natural Resources Office contracted the University of Illinois' Wildlife Epidemiology Lab to conduct health assessments, take blood samples and swabs to explore the impacts from the larval infestations that had been observed in previous years and potential causes. A veterinary student spent 12 weeks on base taking 109 samples from Eastern box turtles. She also took samples from Spotted turtles and painted turtles that were captured during a Legacy funded effort. Blood samples for lead were taken from painted turtles in the Rod and Gun wetlands and other wetlands for comparison given the history of skeet shooting and planned clean up by AFCEC at that site. The veterinarian from the Wildlife Epidemiology Lab also spent a day on base examining the Dipteran larval infestations. In TY 2022, the Wildlife Epidemiology Lab provided results and a report on the findings. The findings were also presented at the American Association of Zoo Veterinarians (AAZV) conference in September 2022 (presentation on box turtle findings and a poster on spotted and painted turtle findings). In TY 2023, the Wildlife Epidemiology Lab is planning to submit two manuscripts for publication in the Journal of Zoo and Wildlife Medicine entitled "Prevalence of cutaneous myiasis during disease surveillance of eastern box turtles (*Terrapene carolina carolina*) in Cape Cod, Massachusetts" and "Health assessment of spotted (*Clemmys guttata*) and painted (*Chrysemys picata*) turtles in Cape Cod, Massachusetts."

Dipteran larval infestations were again observed in TY 2022. The Natural Resources Office facilitated a UMass Amherst graduate student's research on dipteran larval infestations in Eastern box turtles on Camp Edwards. Since past efforts have placed transmitters on a large number of turtles on base, the graduate student and two

interns were able to track turtles, monitor their condition and monitor their movements. This data will be supplemented with information gathered by Natural Resources staff in the spring and fall of this year. The graduate students will compare the movements of healthy and infected turtles to determine potential impacts on mobility from larval infestations. The graduate student also plans to identify the species of fly infesting box turtles and gather information from other researchers across the range on the distribution and prevalence. This project included inputs and collaboration from USFWS, USGS, and NHESP. The Natural Resources Office staff are continuing to coordinate with the State Herpetologist, the veterinarian at Tufts, and the University of Illinois' Wildlife Epidemiology Lab on this potential threat to turtles as well.

Photograph 3-4 New signage at main entrances to the northern training area. Photo: Natural Resources Office/Nicole Madden

The Natural Resources Office is also collaborating with researchers from the University of Massachusetts Amherst, USGS, and the state Herpetologist to facilitate a PhD research project on Camp Edwards focused on prescribed fire and Eastern box turtle populations. In TY 2022, the Natural Resources Office collaborated with the researchers to define objectives and hosted the selected graduate student for two weeks to familiarize him with the base, the ecological context, and the study species. In 2023, the graduate student will begin the first of multiple years of research on base.

3.3.5.3 Education and Awareness

In response to five road mortalities and one mower mortality observed in 2021, the Natural Resources Office, Range Control, and others made efforts to increase awareness and education. In 2022, no road mortalities were documented. To minimize the potential for unintentional impacts to Eastern box turtles and snakes on base, Roads and Grounds installed permanent wildlife crossing signs displaying a turtle and snake on them at all the likely entrances to the training areas. In TY 2022, the Natural Resources Office conducted three trainings on box turtles. Two trainings were for personnel working on base: the Roads and Grounds crew and IAGWSP contractors. The third training was at the request of and in collaboration with NHESP and included attendance from DCR and US Coast Guard personnel. The Range Control Office also regularly briefs units on box turtles. Each year, Range Control personnel consistently report Eastern box turtle sightings to the Natural Resources Office, which are often tagged with transmitters.

USFWS and MassWildlife asked the Natural Resources-ITAM office to host and participate in an "Every Turtle Counts" PSA about keeping turtles in the wild due to increased collections for the pet trade. USFWS posted the video on their Facebook page in August 2022 (https://www.facebook.com/USFWS/videos/619037636620623). USFWS also plans to create a longer video with more details on Eastern box turtle research on base.

3.3.6 Lepidoptera

The creation of the MPMG, the associated fire control measures, and the required pine barrens management will increase the amount of fire on the landscape. Many of the Lepidoptera species on base are expected to greatly benefit from the reintroduction and increased frequency of fire. The monitoring component of the CMP requires long-term Lepidoptera surveys. The monitoring component needs to evaluate effects of the overall range development, the fire hazard reduction actions, and mitigation actions (short and long term) on the Lepidoptera

Photograph 3-5 Pink Streak Moth (Dargida rubripennis) photographed at Camp Edwards. This Switchgrass obligate was documented in both the grasslands and northern training area in TY 2022. Photo by Teá Montana.

community. Monitoring of moth and butterfly species will guide adaptive management for the use of fire (e.g., seasonality, intensity, return interval). The Natural Resources Office contracted WEST Inc. to provide a robust analysis of sampling designs to make the most use of the monitoring data.

In TY 2021, the Natural Resources Office worked with WEST to develop protocols to monitor Lepidoptera populations on base. After consulting the state's invertebrate biologist, the team decided to broadly sample sites using a vegetation protocol to monitor for improved habitat conditions, a UV light trapping protocol to monitor moths at a smaller subset of sites, and a daytime caterpillar survey protocol to sample Barrens buckmoth, a species believed to indicate improved conditions for state listed moths on base. The development of these protocols was completed in early TY 2022, and the vegetation sampling protocol was implemented at 20 sites in TY 2021.

In TY 2022, The Natural Resources Office contracted Davey Resource Group to implement the vegetation sampling at 30 sites and contracted GZA (two-year contract) to implement UV light trap sampling for night flying moths at 7 sites 4 times spaced out during the flight periods for target species. The first 3 sampling events captured 4 state listed species, including a new species for the site, Heterocampa varia. This may be the first individual documented on the mainland in Massachusetts, with previous findings of the species on Martha's Vineyard and Nantucket. This will be explored further in the report from all sampling events, expected in spring 2023.

In TY 2019-2022 the Natural Resources Office collaborated with a PhD student from the University of Massachusetts Boston Stevenson Lab in monitoring Lepidopteran diversity at Camp Edwards. The focus of the student's research is Lepidopteran diversity across urban/rural gradients, and the Training Area/Reserve fits the rural category. While a general moth expert, the student also specializes in the Sphingidae, a declining group. Her studies have expanded our knowledge of Sphingid moths at Camp Edwards and has added to our list of moth species found at Camp Edwards. She introduced staff to multiple surveys methods with notable results and renewed emphasis on moth documentation. Her work in TY 2022 continued to document Frosted Elfin, Slender Clearwing, and Pink Streak (*Dargida rubripennis*). Natural Resources staff also performed additional night surveys using UV flashlights to search for Frosted Elfin and Slender clearwing sphinx moth catepillars in areas of known past occurrences. Discoveries from these surveys and incidental findings (i.e. buck moth (*Hemileuca maia*), Unexpected cycnia (*Cycnia inopinatus*)) will be reported to NHESP.

The USFWS "Frosted Elfin Habitat and Butterfly Survey Protocol" was implemented at three locations on Camp Edwards with an abundance of their host plant (Wild Indigo, *Baptisia tinctoria*). Adults of this species were detected at each survey location and one location was followed by supplemental caterpillar surveys mentioned above. Data from this survey will be submitted to USFWS to aid in their regional survey efforts in support of a range-wide status assessment and federal listing evaluation.

UMass interns completed Monarch surveys in two sites for larval Monarchs using the Monarch Larva Monitoring Project protocol developed through a partnership of the Monarch Joint Venture and the University of Wisconsin-Madison Arboretum. This data will be entered into their online database. Their effort was extremely helpful to supplement short staffing and continue monitoring this at-risk species.

3.3.7 Eastern Whip-poor-will

Annual implementation of the Northeastern Nightjar Survey, as mentioned above, facilitates the evaluation of population trends throughout Camp Edwards and the Training Area/Reserve using a standardized protocol implemented throughout the eastern United States. A subset of 10 points originally set by MassWildlife has been surveyed annually since 2013 and an average of over 34 sites has been surveyed along three routes starting in 2014 providing a site-wide assessment. The Eastern Whip-poor-will is likely a strong indicator of pine barrens habitat health and management condition given its sensitivity and decline throughout the region and close association with dense, but open woodland and shrubland habitat condition that is important to the vast majority of species of conservation concern in southeastern Massachusetts.

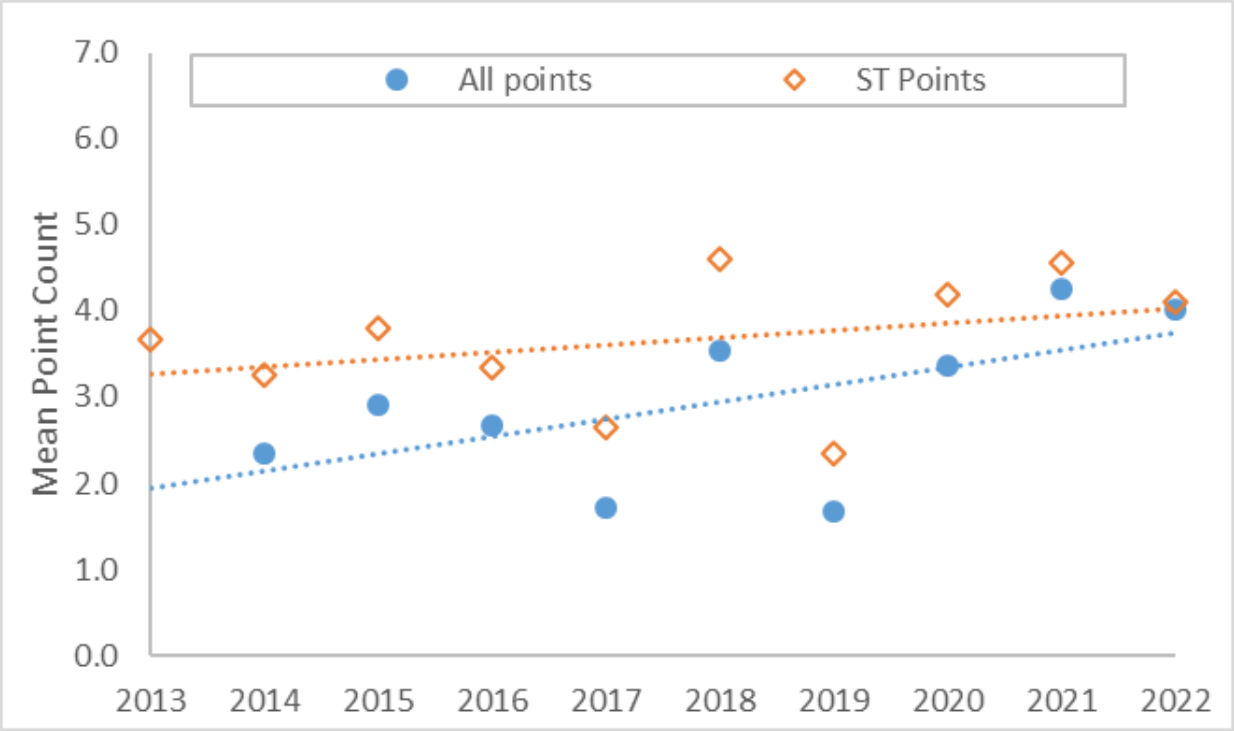
The TY 2022 Whip-poor-will surveys were completed on May 15, 2022 following two nights of shorter point-counts following the same protocol to provide background context and greater confidence in formal survey night results compared to prior years. The TY 2022 surveys documented Whip-poor-wills at all 32 survey locations for an occupancy rate of 100% and a mean count of 4.0 birds per point. This is compared to the long-term mean of 2.9 birds per point. Overall, Whip-poor-wills show an increasing trend for abundance, which is significant at a 90% confidence level ($p=0.09$ F-test for the slope coefficient). Trends in occupancy are stable due to near saturation and a long-term mean of 0.919 (91.9%) for occupancy. Graph 3-4 presents the summary annual mean counts and trend lines. Given that the state assigned points are placed at higher quality habitat than the more randomly assigned site-wide points, the state (ST) points have consistently higher mean count of birds per point, but the subset and overall set are highly consistent through time.

The lower count years in 2017 and 2019 are likely outliers based on survey conditions and attempting to find a quality survey night meeting the restrictive protocol while meeting other program priorities (e.g., prescribed fire, nocturnal research efforts, etc.). As mentioned above, the Natural Resources Office accounted for this in TY 2021 by implementing more opportunistic surveys prior to the formal survey night focusing on the very brief calling period displayed by Whip-poor-wills in lower lunar illumination. This first year's effort found very consistent results between the preliminary efforts and the formal survey as a quality night for combining lunar and weather conditions was available in TY 2021. In TY 2022, preliminary surveys revealed that surveys before the 10^{th} have lower detectability due to increased amphibian noise and decreased Whip-poor-will activity. The preliminary surveys still provides within year context, redundancy for instances of poor conditions on the formal surveys, and increased opportunities to record Chuck-will's-widow and Northern Saw-whet Owl. In successive years it is hoped that when staffing is available to complete these preliminary surveys they may help identify if low count results are consistent and indicate a representative result or an artifact of survey night conditions.

Both focal research efforts (previous migration studies in the Training Area/Reserve) and longer-term trends from annual monitoring suggest that the overall population is healthy at Camp Edwards. Likewise, the response to management actions including prescribed burning and mechanical forestry appears to be overall positive from targeted research, long-term monitoring, and anecdotal observation.

Prior to TY 2016, Whip-poor-will numbers shown in Table 3-1 and in Appendix G have included multiple surveys, and likely repeated counts. From TY 2016 onward, the number 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).

Graph 3-4 Camp Edwards Site-wide Eastern Whip-poor-will Monitoring



Graph 3-4: Annual results of Camp Edwards Whip-poor-will monitoring using the Northeastern Nightjar Survey protocol. The orange (ST) points are a subset of 10 points originally set by MassWildlife based on habitat associations and the blue points are the overall site-wide monitoring points (mean 34 count sites per year).

3.4 SOIL CONSERVATION MANAGEMENT

All military and civilian uses and activities in the Training Area/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 Training Area/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. An Army National Guard Engineering unit graded and used gravel to repair 2,500 feet of Wheelock Road, stretching from Frank Perkins Road to Battle Position 24, and 1,400 feet of Fredrikson Road, extending south from Wheelock Road. The IAGWSP contracted work to gravel significantly degraded lengths of Wood, Jefferson, Crowell, and Turpentine Roads, with work completed in January 2022. Later in TY 2022, IAGWSP again coordinated with Natural Resources for a road improvement (grading and graveling) project on the section of Barlow Road between Wood Road and Jefferson Road. All repairs were coordinated with the EMC's Environmental Officer. All projects were also coordinated closely with Natural Resources to follow the Conservation and Management Permit for Agassiz's Clam Shrimp that ensures conservation of that species while supporting critical operations through road maintenance.

3.4.1 Erosion

During September, 2022, the base experienced two severe rain events that caused widespread erosion damage on roads in the training area. The ITAM program worked with Camp Edwards Facilities Engineering to identify the most severely impacted roads and set repair requirements. These rain events are indicators that the base will need to prioritize road maintenance and repairs in upcoming years to account for climate change-driven weather severity.

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 military training site 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. However, overall ecosystem management with a diversity of habitat maturity and composition is important to habitat management and climate resilience efforts.

Mechanical restoration, prescribed fire, resource monitoring, invasive plant management and others are important tools used within the Reserve to manage habitats, including mature woodland. During TY 2022, two larger restoration projects were implemented along with several smaller, focal projects – all of which are discussed in much greater detail in Section 3.5.6. Table 3-2 provides an overview list of the projects. A project in training area BA-3 combined mastication (mechanically mowing/mulching) and whole tree harvesting to restore understory and create a large woodland opening that will support soldier training and a native grass/forb natural community. Another project used whole tree harvesting to restore functionality to a frost bottom depression in training area E-3. One training area and three helicopter landing zones received in-house mastication treatment to clear midstory vegetation and reestablish lines of sight and maneuverability while improving habitat conditions. Prescribed burns implemented for habitat and vegetation management are discussed in Section 3.6.1.

Table 3-2 Training Area Management Projects

Training Area	Acres Treated	Primary Objective	Treatment Method
BA-3	68	Training site rehabilitation	Mastication of vegetation ≤ 6" DBH
BA-3	18	Training site rehabilitation/ habitat restoration	Whole tree harvest to thin understory and canopy coverage
E-3	27	Frost bottom restoration	Whole tree harvest

Management and conservation planning for holistic ecosystem health are fundamental to Department of Defense conservation and efforts at Camp Edwards within and outside the Training Area/Reserve. Rare species habitat management integrates climate resilience, carbon sequestration, risk minimization (e.g., fire and southern pine beetle), military training objectives, habitat diversity, and other considerations. Monitoring and research continue to develop and support informed management and integration of these multiple objectives. Rigorous vegetation and moth study designs were developed in TY 2021 for long-term monitoring supporting the master development plan Conservation and Management Permit. Breeding bird surveys continue to show positive or stable trends for Species of Greatest Conservation Need while more targeted efforts such as Eastern Whip-poor-will monitoring and research continue to show a strong association with both small arms range areas and habitat management zones. Climate resilience planning and assessment is ongoing for Camp Edwards with the Woodwell Climate Research Center. A critical outreach element for TY 2021 and 2022 was communicating through public tours and other venues that the entirety of Camp Edwards, especially within the Upper Cape Water Supply Reserve, is managed for wildlife habitat – including small arms ranges and other military training venues that provide critical open field habitat for a wide variety of pollinators and other fauna within the greater pine barrens mosaic.

3.5.1 Vegetation Surveys

Primary effort for vegetation surveys in TY 2021 was focused on vegetation composition and structure pilot surveys linked to the long-term moth monitoring protocol. This long-term effort will provide valuable response and trend data for a variety of habitat to inform management activities and strengthen interpretation of faunal

survey results. In TY 2022, vegetation surveys for the long-term moth monitoring project were carried out for the second year. See Section 3.3.6 for more details.

3.5.2 Invasive and Nuisance Vegetation Management

Invasive plants are 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. Invasive species are primarily from the Massachusetts Invasive Plants Advisory Group (MIPAG) lists, but also include emerging invasive species as coordinated with partner agencies.

Nuisance species are more selectively or situationally defined and may include native plants under certain conditions. Several native species have displayed such aggressive establishment and regeneration that they require targeted management in order to preserve the training and preferred habitat value of some training venues. Although not exotic, these species, under certain conditions, can display the same dominant and disruptive characteristics normally associated with invasive species. Pitch pine in particular has historically taken advantage of neglected training sites to create impenetrably dense, overstocked monocultures that exclude nearly all other species of plants and animals, produce unhealthy trees, present significant fire hazard, and prevent training. Other native, desirable species that may situationally present a nuisance condition from a habitat perspective include bayberry and sweetfern due to tendencies towards monoculture through chemical defenses.

Exotic invasive plants are a management concern both in the Training Area and within the Cantonment area. Effective management of these species, primarily 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 conducted in-house herbicide treatment to control the spread of *Calamagrostis epigejos*, an aggressive and exotic invasive grass. Crew used a backpack sprayer and a motorized UTV-mounted pump to spray a Glyphosate solution on clumps of the grass along Richardson Road, in Demo 2, on Sierra Range, and in Training Area BA-6. All spraying was precisely targeted with wands rather than boom or broadcast spraying. A total of 3.3 pounds of active ingredient were applied across these sites, over the course of the summer and a total area of less than one acre. ITAM also conducted hand pulling to remove spotted knapweed (*Centauria stoebe*) from restored training sites on BP-1, Demo-2, and Wheelock Overlook, covering 7 acres.

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 was 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 from 2019-2021. Invasive plants do not appear to be a current threat at sites where rare plants exist, but several of the sites where rare plants have disappeared over the years and where they exist now still have some invasive plants and some of these sites have seen more and more encroachment of woody trees and shrubs which precludes suitable growing conditions for the rare plants. The Natural Resources-ITAM Office plans to remedy this through continued invasive plant monitoring and removal and targeted tree removal in TY 2023 and beyond in order to return frost bottom effects to these unique kettle hole depressions.

3.5.3 Bird Surveys

This is the tenth year that point counts were conducted along a bird survey route through the Training Area/Reserve 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 facilitate eventual analysis of detection probability and determination of effective indicator species. These analyses have yet to be completed, but with the completion of ten years of surveys with consistent protocol, the Natural Resources Office has been evaluating trend data, prioritizing species of significant conservation interest (e.g., Species of Greatest Conservation Need as defined in the State Wildlife Action Plan). The State Wildlife Action Plan is available at https://www.mass.gov/service-details/state-wildlife-action-plan-swap. The 2013-2022 survey efforts also follow the long-term effort from 1994-2013 with annual point count surveys at an average of about 30 points per year. The two combined provide a very robust data set for evaluating species and guild trends through time and in response to changes in habitat.

Photograph 3-6 American Woodcock, a Species of Greatest Conservation Need, found with nestlings near Sierra Range during an interagency box turtle training. While this species is not well monitored by typical daytime point counts, targeted surveys and opportunistic observations have found them thriving at Camp Edwards, especially in areas with a patchy barrens mosaic, including openings such as battle positions and ranges. Photo: Jake McCumber

Outside the primary scope of this report, but still relevant is that for the eighth year, a point-count methodology was implemented in continuation of a state-wide survey of grassland birds coordinated with the DFW and Mass Audubon, which has been incorporated into the overall bird survey effort. This method is intended to be continued to evaluate trends in grassland bird populations and response to management. State-listed species will be reported to NHESP (Table 3-1), including Grasshopper Sparrows (*Ammodramus savannarum*) and Upland Sandpipers (*Bartramia longicauda*). The Eastern Meadowlark (*Sturnella magna*) was also listed as a Species of Special Concern in TY 2020 and will now be reported in Table 3-1. The initial year of this effort focused only on target species, but all subsequent years have followed the standard point-count survey protocol for Camp Edwards.

Nineteen Species of Greatest Conservation Need (SGCN), as categorized by the State Wildlife Action Plan, were observed during breeding bird point counts in TY 2022 (See Table 3-3). Three species were not included due to the birds being flyovers not using habitat (Great Black-backed Gull, Common Loon, Herring Gull). Some SGCN are frequently observed at Camp Edwards, but are not readily detected through diurnal point counts, including American Woodcock (occasional focal surveys conducted) and Eastern Whip-poor-will (discussed above, annual targeted survey conducted). Many of the SGCN reported below are notable in their degree of occupancy (survey sites with detection) at Camp Edwards and several show significantly positive response to habitat management, including Brown Thrasher and Field Sparrow, but also species such as Scarlet Tanager. A total of 74 species were recorded during breeding bird point counts at Camp Edwards.

The overall proportion of occupied survey sites (occupancy) is shown in Table 3-3, but most of the species are distinctly associated with the habitat(s) of either the Training Area/Reserve or cantonment grasslands and are both shown and calculated separately within those subsets. A total of 65 training site points and 14 grassland sites were surveyed in TY 2022. More widespread species are shown as sitewide species with the full set of 79 points and many of these require a mosaic of habitats such as that provided in a variety of conditions at Camp Edwards.

Table 3-3 also presents the mean for 2022, mean for all survey years, and trends for abundance of the Species of Greatest Conservation Need breeding at Camp Edwards. Evaluation of both occupancy and abundance (average count at a survey point) helps better understand ecological and management response and evaluate the health of a population. Many of our SGCN are both increasing in occupancy and abundance demonstrating that the increases in distribution (occupied sites) is not at the loss of birds elsewhere, but due to increasing populations. Based on the species and both trends this is strongly suggestive as a positive response to the program of habitat restoration and maintenance focusing on providing a healthy pine barrens mosaic of habitat with diversity of habitat and species composition at multiple scales. The increases of species across a variety of habitats in response to fire and forestry is expected based on the condition of unmanaged stands that are often stunted and overcrowded based on long-term land use history. The restoration of a fire regime and conservation-minded forestry to restore diverse woodland conditions and openings supports an overall healthy ecosystem for which birds are a useful indicator of conditions based on detectability and variety of food and habitat needs.

It is notable that some species are demonstrating declines. The Upland Sandpiper and Horned Lark results are somewhat artificial and based on the survey area. Consistency in management regimes (mowing area and timing) at the Coast Guard airfield has proved to well support both of these species, which continue to be observed within the airfield. The declines shown below are based more on habitat selection between grassland conditions than the actual population at JBCC. Our program will work to collaborate with the Coast Guard on data analysis for these species to better evaluate populations for Joint Base Cape Cod as a whole. The Black-billed Cuckoo is consistently uncommon but has had somewhat stochastic counts through the years with moderate numbers in most years but very low counts in 2013, 2018, and 2022. This warrants investigation into literature of population dynamics for this species. Purple Finch has had a somewhat similar pattern.

TABLE 3-3 BREEDING BIRD POINT COUNTS – SPECIES OF GREATEST CONSERVATION NEED

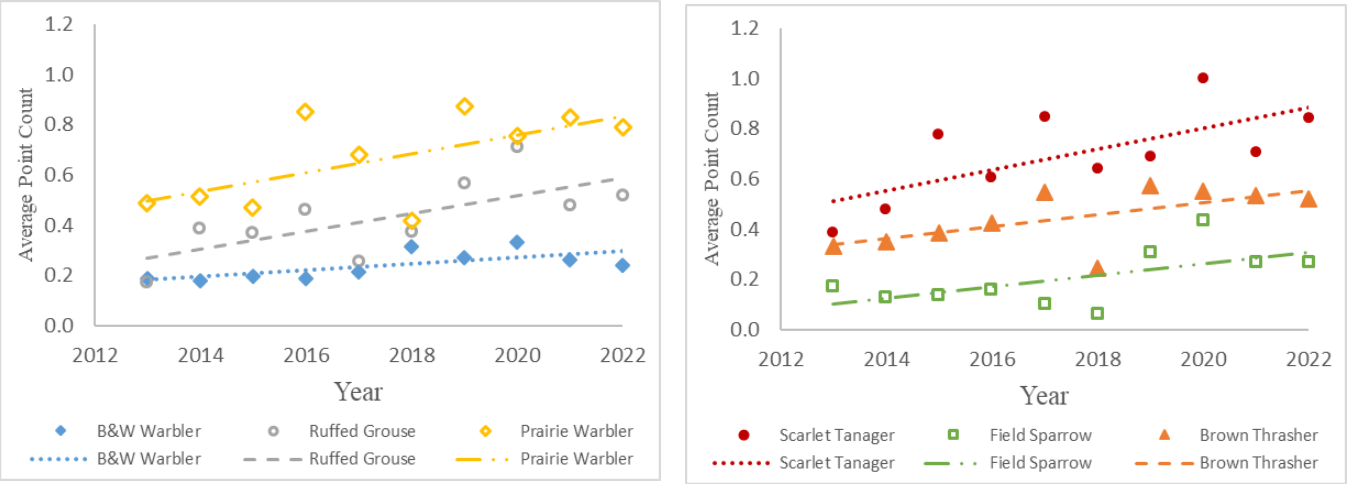
		Occupancy			Abundance		
			2013-2022			2013-2022	
	Species	2022	Mean	Trend	2022	Mean	Trend
Grassland Subset (14 points)	American Kestrel	0.286	0.332	-0.010	0.095	0.174	-0.014
	Eastern Meadowlark	0.643	0.506	0.090**	1.262	0.393	0.189**
	Grasshopper Sparrow	0.857	0.796	0.027	1.810	1.599	0.075
	Horned Lark	0.000	0.038	-0.013	0.000	0.018	-0.006
	Upland Sandpiper	0.071	0.394	-0.042	0.024	0.397	-0.054*
Sitewide Species (79 points)	Brown Thrasher	0.671	0.594	0.019*	0.519	0.426	0.024**
	Chimney Swift	0.038	0.035	0.003	0.034	0.017	0.003
	Eastern Towhee	1.0	0.961	0.005	6.502	4.247	0.192
	Field Sparrow	0.367	0.285	0.020*	0.270	0.188	0.023*
	Prairie Warbler	0.633	0.510	0.022**	0.789	0.631	0.037**
	Purple Finch	0.114	0.163	-0.010	0.042	0.075	-0.005

TABLE 3-3 BREEDING BIRD POINT COUNTS – SPECIES OF GREATEST CONSERVATION NEED, cont'd

		Occupancy			Abundance		
			2013-2022			2013-2022	
	Species	2022	Mean	Trend	2022	Mean	Trend
Training Area Subset (65 points)	Black-and-white Warbler	0.400	0.394	0.013	0.241	0.239	0.013**
	Black-billed Cuckoo	0.046	0.178	-0.007	0.015	0.077	-0.001
	Eastern Whip-poor-will[1]	1.000	0.910	0.009	4.000	2.947	0.203*
	Ruffed Grouse	0.846	0.706	0.031	0.518	0.428	0.036**
	Scarlet Tanager	0.923	0.777	0.021	0.841	0.697	0.042**

This table presents results from 2013-2022 annual bird surveys, though grassland points were not started until 2015. Occupancy is the proportion of sampled sites (point count locations) where a species was detected, which demonstrates overall distribution or how widespread a species is in the survey area measured from 0 (absent at all sites) to 1 (present at all sites). Abundance is the actual count of individual birds at a survey point, presented here as the average count per point for the reporting period (TY 2022) or annual average count per point for the survey period (2013 or 2015 through 2022). Trends were calculated in Microsoft Excel and the slope coefficient was evaluated with an F-test statistic. Trends reported with a single asterisk (*) are significantly different from zero with a p-value less than 0.10 and a double asterisk (**) has a p-value less than 0.05. [1]Note for Eastern Whip-poor-will that the sample set is 32 points as reported elsewhere, but they are included in this table for comparison with other trends.

Graph 3-5 Abundance Trends for Select Species of Greatest Conservation Need



The above plots (Graph 3-5) show the abundance trends for select Species of Greatest Conservation Need based on relevance within the Upper Cape Water Supply Reserve (e.g., excluding grassland obligate species). Fitted trendlines match the reported slope values provided in the table above. All six of these species have statistically significant abundance (i.e., count) increases despite a variety of habitat affinities from mature forest/woodland (Scarlet Tanager, Black-and-white Warbler), to open shrubland or shrub savannah (Field Sparrow, Brown Thrasher), and species with more complex mosaic habitat selection (Ruffed Grouse, Prairie Warbler).

The calculation of detection probabilities for species of survey concern were not completed in TY 2022 due to other priorities; although the data were provided to a graduate student at the University of Massachusetts for potential future analysis. Past annual reports have set targets for reporting detection probabilities. However,

presenting and evaluating populations trends, as done here and in previous years, are more relevant and informative, especially with the longevity of the current dataset. Detection probabilities will be informative if observers or survey protocol changes (e.g., number of visits to a survey site). Going forward bird population trend information will be updated every two to three years with annual discussion of any notable positive or negative results.

The population trends described above and for the greater species assemblage of birds provides excellent information for habitat management and well demonstrates both the wildlife habitat protection within the Upper Cape Water Supply Reserve and the compatibility of military training with supporting healthy populations of birds of significant conservation concern, which themselves are dependent on a healthy diversity of flora and fauna for feeding, nesting, etc. The trends reported for the 2013-2022 survey protocol well match and continue occupancy trends calculated for the 1994-2013 dataset and show a long-term success for growing and conserving the overall bird community and ecosystem.

3.5.4 Deer Hunt

There was a deer hunting season in the Training Area/Reserve during TY 2022 in which 58 deer were taken during 877 hunter days. The Natural Resources 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. Browse surveys have been conducted every few to several years. DFW primarily relies on the biological data collected at the deer check to adjust the number of tags that are available each year. The 2017 browse survey indicated little to no browse pressure.

The Natural Resources 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 2022 included a three-day hunt by paraplegic sportsmen (October 28-30, 2021), a one-day youth hunt (October 2, 2021), a two-day opening for archery scouting (November 8-9, 2021), a three-day archery season (November 11-13, 2021), a one-day hunt for military sportsmen (December 4, 2021), a six-day shotgun season (December 6-11, 2021), and a two-day primitive (muzzleloader) season (December 16-17, 2021). Graph 3-6 shows the hunter days and deer harvest ratio since TY 2013.

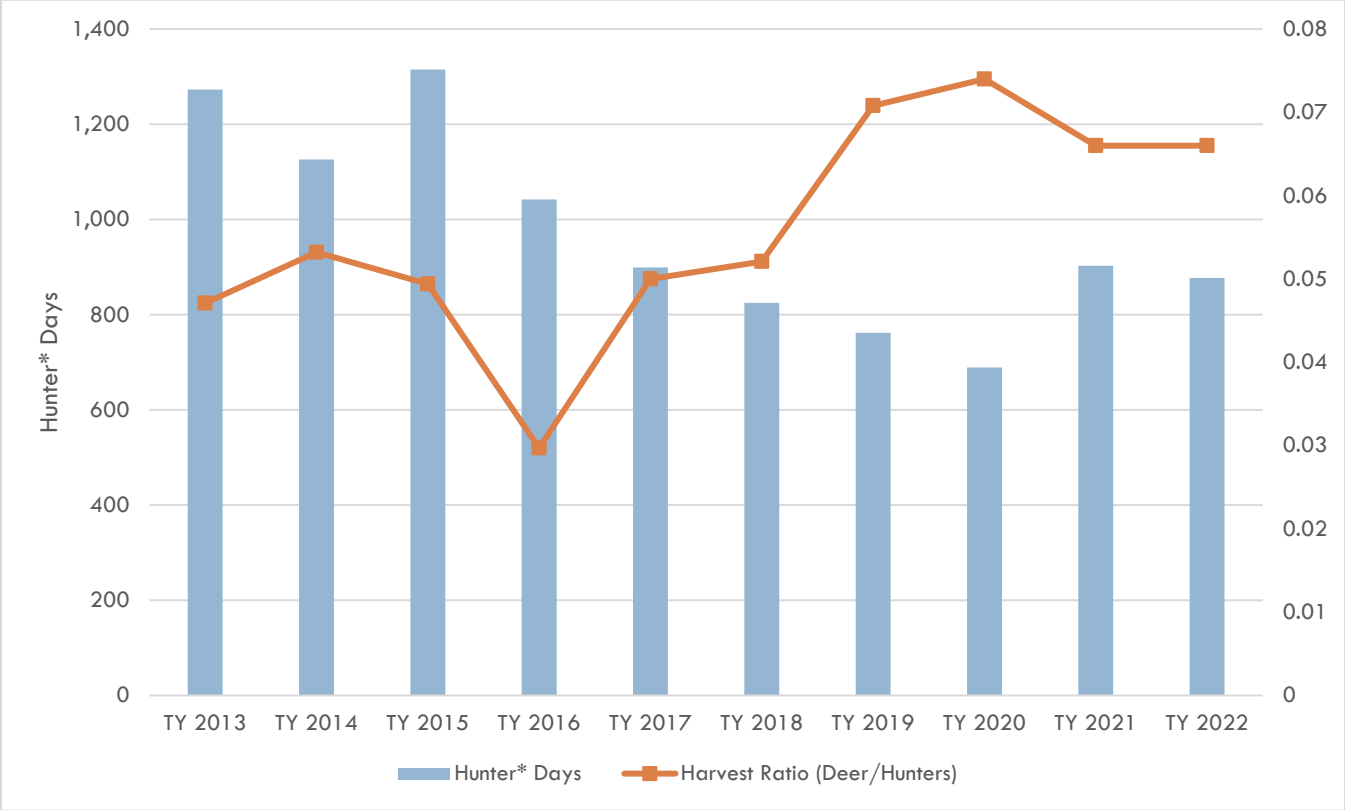
During TY 2020, the Natural Resources Office and the Division of Fisheries and Wildlife conducted hunter surveys to determine hunter preferences, to better respond to queries and requests from hunters, and to determine the success of our advertising efforts. The hunter surveys were not conducted in TY 2022 due to safety protocols to prevent the spread of Covid-19. The hunter surveys are planned to continue in TY 2023.

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. Deer harvests on base have been close to the 60 deer per year goal. Casual observations of browse on site do not indicate excessive browsing, except on specific species. These species are being preferentially browsed and are often state-listed plants. The Natural Resources Office has begun efforts to exclude deer from sites where this species-specific browse has been observed. The Natural Resources Office, Range Control, and the DFW Southeast District have continued to make as many days and acres available to hunting as is possible given safety concerns and staff resources. Efforts to advertise the hunt were also aimed at increasing harvest as well as recreational use of the site.

3.5.5 Wild Turkey Hunt

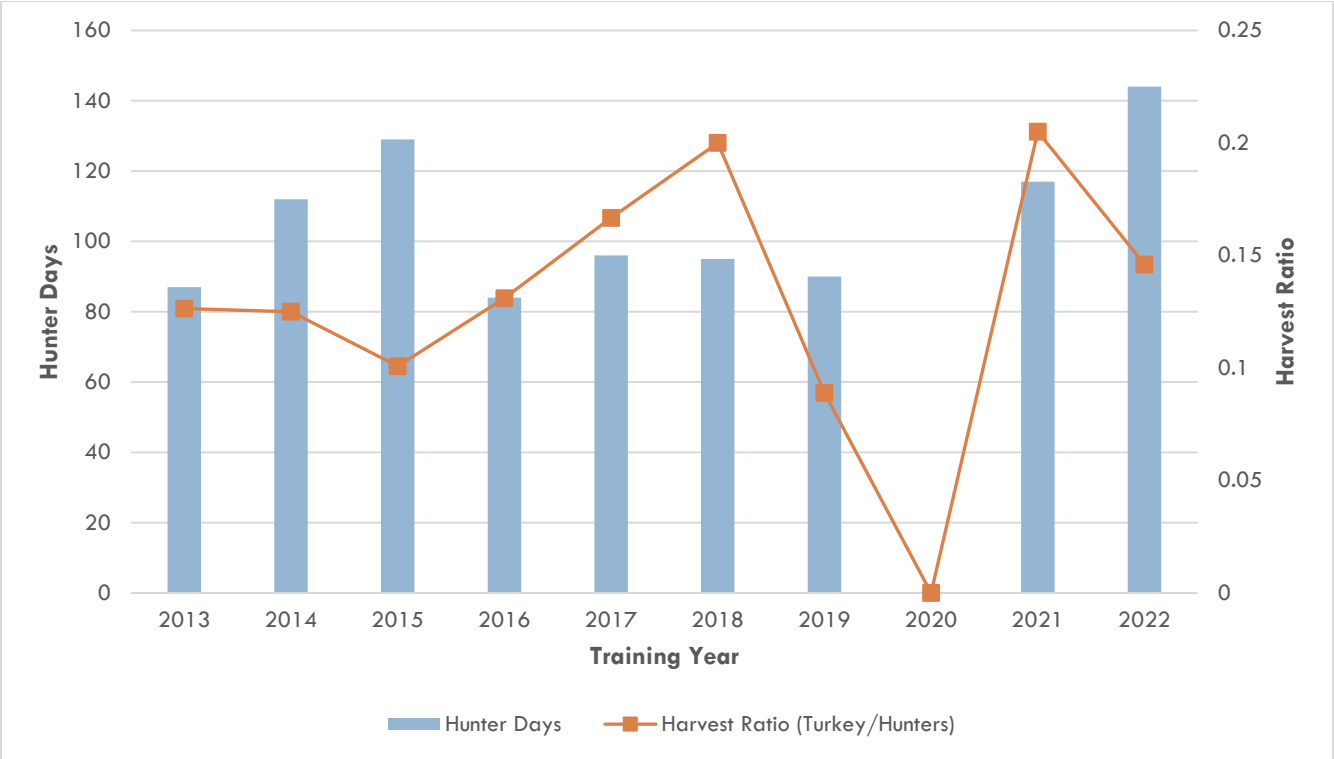
There was a five-day wild turkey hunting season in the Training Area/Reserve from May 2-7, 2022, during which 140 hunters took 19 turkeys. In addition, a one-day youth turkey hunt was held on April 23, 2021, in which four youths participated with two turkeys taken. Graph 3-7 provides information on the wild turkey hunts conducted in the spring since TY 2012.

Graph 3-6 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 3-7 Camp Edwards Turkey Harvest



Note: Hunter Days is the sum of the number of hunters each day for each day of the annual hunt. In TY 2020, the turkey hunt was canceled due to the statewide shutdown for the Covid-19 pandemic.

3.5.6 Restoration Activities

The Natural Resources/ITAM Program completed significant restoration work on two training areas. These projects were conducted in Training Areas BA-3 and E-7 (Please see the map on Page 206, Appendix F).

3.5.6.1 – BA-3 Training Area Management

ITAM conducted a project devised in accordance with military requests for an accessible and level training area with sufficient space to conduct Table IV qualifications for an Artillery Battery, which has specific requirements for spacing between guns, orientation and sufficient area for trucks to maneuver towed guns. Before the project, there was no existing training site on Camp Edwards that provided the required conditions. In order to provide this required space, this project completely cleared seven acres of overgrown and impenetrable regenerated pitch pine and scrub oak. This portion of the project executed a 100% whole tree harvest and full stump removal, with the intent of removing all resulting debris from the base. In-house efforts cleaned any remaining debris to provide the best possible conditions for reseeding with a proprietary mix of native species of grasses and pollinator host plants. Once established, this site will provide grass/forb early successional habitat bounded by savannah-like conditions with newly reinvigorated understory.

In order to connect the artillery clearing to a suitable access road, this project cleared all trees and stumps on a path connecting to Howe Road to the north. The project included 11 acres of stand thinning on either side of this trail. This work was intended to increase solar exposure to stimulate the understory, to reduce the number of trees that could fall across the trail, and to increase lines of site and access to increase training opportunities (such as ambushes from the newly accessible ridgeline to the west). Per the project's prescription, the contractor removed 50% of all trees ≥ 10" diameter at breast height (DBH) and 50% of all vegetation 4-10" DBH.

For the final portion of the project, the contractor masticated all standing and dead vegetation ≤ 6" DBH (diameter at breast height) in 68 acres surrounding the current perimeter of the site. All material resulting from this project

Photograph 3-7 Northeastern corner of Training Area BA-3 before (July 2021) and after (October 2022) treatment by thinning of small trees and prescribed fire. Note remaining substantial woodland canopy with increased solar exposure to the dense regeneration of scrub oak, blueberry, and other

was left on the ground for future consumption by prescribed fire. The project did not impact mature trees and opened the midstory to permit vision into and out of the site for visibility and dismounted maneuver around the artillery training clearing (in part to facilitate perimeter defense training). This project area was also impenetrably

overgrown, with an alarming amount of ladder fuels and standing dead trees. This was determined to pose an unacceptable wildfire risk, especially with concerns about potential fire and smoke impacts on the Barnstable County Correctional Facility 1,000 feet to the west.

Following this treatment and future prescribed fire, this treatment will approach stand conditions more similar to 20 or 30 years ago, based on past forestry assessment, vegetation structure (e.g., very high density of small diameter trees in the understory and midstory), and anecdotal tree ring assessment. The structure of this stand and known fire history show more open, spaced overstory of comparatively robust trees heavily encroached by young trees moving into the midstory and shading out understory conditions for wildlife such as Eastern Whip-poor-will and plants such as Lowbush Blueberry. Understory mastication of brush and young trees facilitates further management with fire and restores previously more healthy ecosystem conditions and stand resilience.

Photograph 3-8 Barrens Buckmoth (*Hemileuca maia*) ovipositing (laying eggs) on a fresh scrub oak (*Queruc ilicifolia*) sprout in the BA-3 restoration area, October 2022. Understory mastication followed by prescribed fire led to the desired outcome of vigorous sprouting of scrub oak and heath (blueberry, huckleberry), actively supporting a diverse insect assemblage, including rare species, that in turn supports much of the rest of the natural community. Photo: Jake McCumber

3.5.6.2 – Range Area West 3 (RAW3) Frost Bottom Management

Natural Resources conducted a selective whole tree harvest in Training Area E-7 (also called RAW3 for fire planning purposes). The intent of the project was to restore functionality to a naturally occurring frost bottom. Vegetation within and surrounding the central depression was so overgrown that it was hindering air flow and venting, thus preventing frost from occurring during a wider range of the year, a mechanism that creates a pocket of rare early-successional habitat in this part of the base.

The project harvested all standing trees 4-22” DBH within the eight acres of the central depression. In addition, it harvested 100% of all trees ≥ 10” DBH and 40% of all trees 4-10” DBH in 14 acres around the depression. This thinning allows cold air to flow into the frost bottom, stimulates understory regeneration, significantly reduces wildland fire fuel loads next to the impact area, and ties into another harvest conducted in 2017, expanding a contiguous patch of savannah-like habitat conditions in the central training area.

3.5.6.3 – In-House Management

ITAM conducted limited in-house mastication of regenerating pitch pine in Battle Positions 9 and 10 as well as the following helicopter landing zones: Deep Bottom Pond, Ox Pond and Pinnacle. This landing zone maintenance work was chiefly driven by pilots’ concerns that encroaching vegetation was risking damage to the bellies of their aircraft as well as increasing the risk of rotor strikes. The work at BPs 9 and 10 was motivated by concern about densely stocked regenerating pitch pine and its potential for severe torching in case of fire. The total area affected was less than five acres. All material generated by these efforts was left on the ground for decomposition or future consumption by prescribed fire.

ITAM conducted some in-house tree thinning on Battle Position 1, in Training Area BA-3. This work continued a TY 2021 effort to thin an impenetrable wall of regen pine to reduce torching risk and create a more natural transition from the BP to the surrounding bivouac area. The total area affected was less than one acre. All material generated by this project was consumed in a pile burn.

3.5.6.4 – Pending Projects for Fiscal Year 2023

The following two projects were developed and funded in TY 2022 but are scheduled for execution in TY 2023.

C-14 Coppice Thinning

Following a successful 2018 forest thinning harvest in Training Area C-14, hardwood stumps are regenerating at an aggressive rate, overstocking the unit with bushy coppices which shade out the understory, block line of sight, hinder dismounted maneuver, complicate future prescribed fire operations, and are unlikely to provide our desired distribution of standalone oaks with strong central leaders and sufficient canopy spacing. The long-term habitat management goal for the area is an open, patchily distributed pitch pine - oak woodland with scrub oak understory. The woodland condition is dominated by widely spaced, large and relatively old pitch pine with historic fires periodically resetting the oak midstory.

This project takes a small in-house strategy to manage this regeneration and refines and applies it on a 30-acre scale. Contractors with hand-held equipment will cut the regenerating stems and, in some cases, apply herbicide directly to the resulting stumps. For 75% of the coppices in this unit, contractors will cut all stems and apply a triclopyr solution directly to the stems. For the remaining 25%, contractors will select the strongest stem for retention and cut all other stems. No herbicide will be applied to any stumps on coppices selected for retention. All cut stems will be left in place for future consumption by prescribed fire. The project also targets a widespread infestation of Black Locust (*Robinia pseudoacacia*) for 100% cut and spray.

This project will slow the total rate of regeneration on the site, preserving the military training benefits that motivated the original 2018 project. By removing this aggressive regeneration, we aim to reduce competition for nutrients and sunlight, increasing the productivity and success rates of understory species and the vigorous central leaders selected for retention. Additionally, by cutting and spraying stumps, we aim to use less herbicide and reduce the risk of off-target impacts that can occur with traditional foliar spraying.

Photograph 3-9 Young, native Sundial Lupine (*Lupinus perennis*) that is part of a "headstart" and resilience program for early successional rare species at Camp Edwards that can be incorporated into managed woodland openings and other appropriate habitats. Photo: Jake McCumber

RAW3 Forest Thinning

This project will continue the work described in section 3.5.6.2. of this report. The goal of this project is to continue to thin the overstocked woods surrounding the newly restored frost bottom in Training Area E-7 (RAW3). This project will thin 49 acres of pitch pine/hardwood forest. The project has been divided into two stands, both of which bound previously harvested sites.

Stand 1: 31 acres. This treatment is meant to provide a habitat gradient connecting to more densely stocked surrounding forest units while facilitating airflow to the newly restored frost bottom to the east. Our post-harvest goal for this unit is 60 trees per acre, preferentially preserving hardwoods and mostly distributed in clumps of 5-15 trees with open spaces and scattered trees between. To achieve this, we will remove 40% of pine trees ≥ 10" DBH and 70% of pine trees 4-9" DBH.

Stand 2: 18 acres. This treatment is primarily intended to reduce fuel loads alongside the impact area. Our post-harvest goal for this unit is 80 trees per acre, mostly distributed in clumps of 5-15 trees with open spaces and

scattered trees between. To achieve this, we will remove 60% of all trees <12" DBH. All material is removed from the site by the contractor.

3.6 FIRE MANAGEMENT

3.6.1 Prescribed Fire

The Natural Resources Office utilizes prescribed fire to manage habitat, reduce fuel loads and help prevent wildfires. The prescribed burns are targeted to meet the multiple objectives of fuel reduction, habitat improvement, firefighter training, and soldier training support. The mix of those targets changes by operation, but each is met to varying degrees. The program is outlined in the Camp Edwards Fire Management Plan which is available on the E&RC's website: https://www.massnationalguard.org/ERC/publications.htm. The Camp Edwards smoke management permit (#4F02008) was renewed August 16, 2022 and is valid through December 31, 2024.

Photograph 3-10 Ignition team briefing before finishing a 42-acre prescribed burn in April, 2022. This woodland, dormant season burn was a second entry with prescribed fire in five years – a critical step in returning healthy function and a natural fire regime. Adjacent to Frank Perkins Road, this burn was an exceptional illustration during public tours of rapid, vigorous recovery in a fire adapted habitat. Photo: Joel Carlson

A goal of 25 operational burn days, with an average burn size of 25 acres, totaling 600 to 1,000 acres for TY 2022, was set. A total of 13 operational burn days that averaged 26 acres per burn day, for a total of 332 acres, was achieved in TY 2022. While the actual burn days, average acres burned per day, and total acres burned were less than what was targeted, the total burn days were almost double what has been accomplished in the past, in a twelve-month period. The short fall on the goals was primarily a result of weather and climatic conditions. Fall 2021 did not have any burn days due to weather. One of the worst drought periods on record occurred between June and August 2022, followed by extensive precipitation in late August and into September. The ten-year prescribed fire accomplishment within the Training Area/Reserve is shown in Graph 3-8.

Prescribed fire goals for TY 2023 are to again attempt to conduct 25 operational burn days, with an average burn size of 25 acres, totaling 600 to 1,000 of pine barrens (550+ acres) and grassland habitat (40-60 acres). This is a well-rounded balance of objectives that will meet primary habitat and training lands management objectives while building capacity, experience, and programmatic structure. 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 has recently been weather/climate with more extreme fluctuations in conditions (e.g., extended drought broken by extreme rain events). TY 2023 may be impacted by the pending listing of several bat species, with particular impact on June, which is a key month for pine barrens prescribed fire.

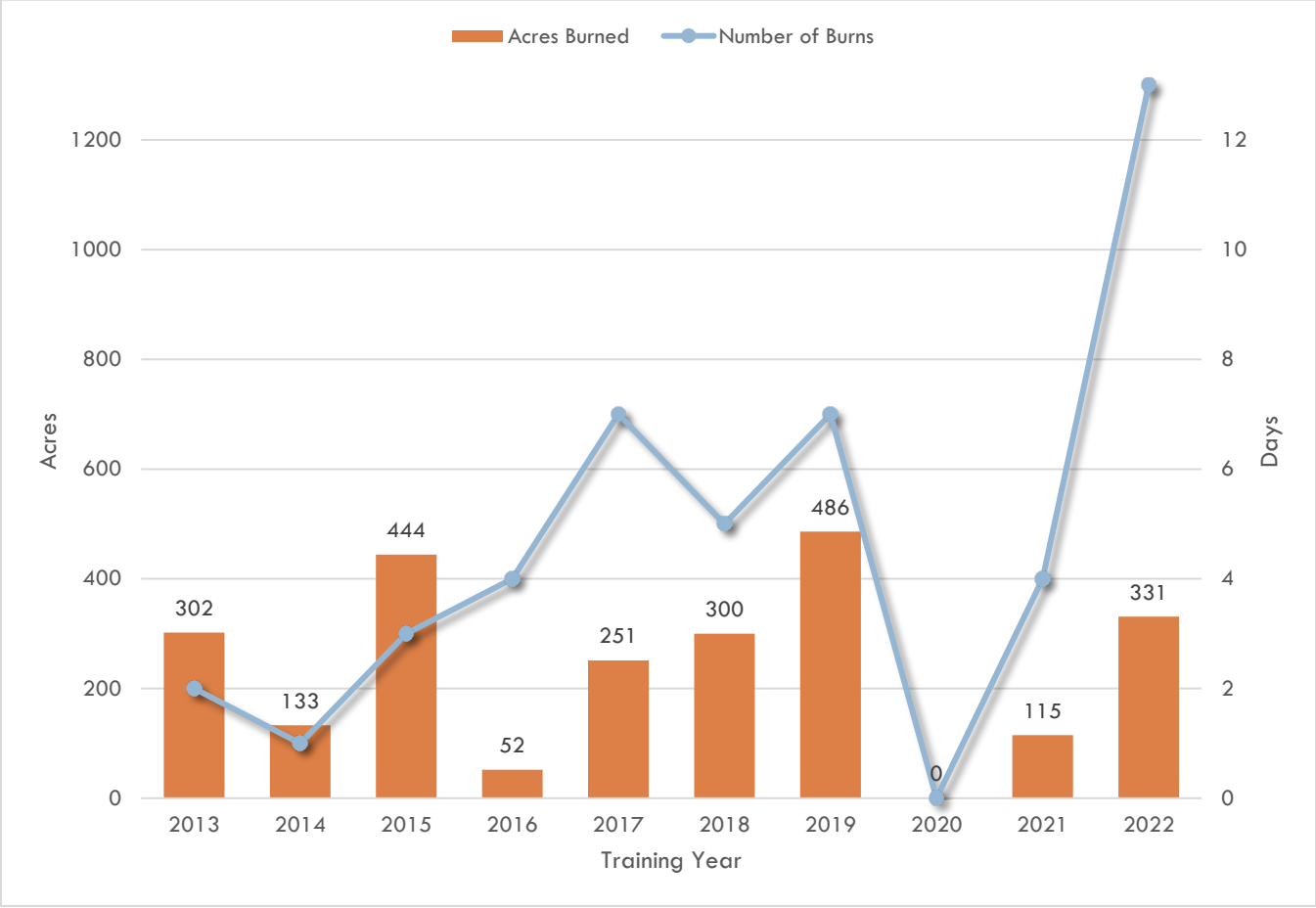
3.6.2 Fire Management Planning

The update of the 2007 Camp Edwards Integrated Wildland Fire Management Plan (IWFMP), which is under contract with Colorado State University, is in the final stages of being drafted for review. The IWFMP update will be prepared in a format consistent with the March 15, 2021, Army Installation Wildland Fire Program Implementation Guidance Memorandum. The final version of the IWFMP is expected to be complete in the spring of 2023.

3.6.3 Fire Management Training

Wildland fire training remains a critical component of natural resources management and interagency partnerships. During TY 2022 no formal training academy took place due to budget constraints. However, multiple trainings were held to maintain and improve qualifications of MAARNG and partner crews. TY 2022 trainings included RT-130 annual wildland fire safety refresher (classroom and field) and phase two situational exercises were conducted to complete an interagency Firefighter Type-1 training at Camp Edwards. Additionally, extensive informal, on the job, and performance-based National Wildfire Coordinating Group (NWCG) Position Task Book

Graph 3-8 Prescribed Fire Accomplishment within the Training Area/Reserve TY 2013-TY 2022



Note: Training Year acreage is graphed on the left and the number of burns is graphed on the right axis. In TY 2020, no prescribed burns were conducted due to weather conditions in the fall and the Covid-19 pandemic in the spring.

evaluation and trainings occurred in TY 2022. More than ten individuals from the Army National Guard and its partner agencies actively worked on or were certified on multiple Position Task Books that included Fire Effects

Monitor, Firefighter Type 1/Squad Boss, Incident Commander Type 5, Prescribed Fire Burn Boss Type 3, Engine Boss/Single Resource, and Firing Boss/Single Resource. Adhering to NWCG training and qualification standards ensures increased experience and uniformity of wildland fire credentials across agencies, all of which increases safety and MAARNG capacity to conduct wildland fire operations.

Classroom trainings and performance-based trainings will continue to be high priority in building internal and external partner agency wildland fire management capacity. Trainings will be critical in meeting the National Wildfire Coordinating Group training and qualification standards that the Department of the Army and the National Guard Bureau have recently adopted and are working on becoming compliant with. Planning has begun for a 2023 wildland fire training academy to be held at Camp Edwards.

3.7 PEST MANAGEMENT

During TY 2022, Natural Resources and ITAM conducted limited in-house herbicide applications, with an emphasis on the following species: spotted knapweed (*Centaurea stoebe*), oriental bittersweet (*Celastrus orbiculatus*), invasive phragmites (*Phragmites australis*), and *Calamagrostis epigejos*, an aggressive and exotic invasive grass. Crew used a backpack sprayer and a motorized UTV-mounted pump to spray a Glyphosate solution on clumps of the grass along Richardson Road, Howe Road, in Demo 2, on Sierra Range, and in Training Area BA-6. The crew also sprayed knapweed and bittersweet along the Hesco walls around the TTB Kelly Landing Zone, the old UTES staging area, and the Range Control Building. All Glyphosate spraying was precisely targeted with wands rather than boom or broadcast spraying. A total of 46.4 pounds of active ingredient were applied across these sites, over the course of the growing season.

ITAM also conducted a winter application of Krenite (active ingredient Fosamine) to determine its suitability for limiting pitch pine regeneration in training areas and potentially managed grasslands. This application was conducted in Battle Positions 1 and 8. Krenite is a selective herbicide that only affects conifers and leafed out broadleaf plants. Our application was conducted via boom sprayer but occurred in February when off-target impacts were minimal if any. A total of 10 pounds of active ingredient were used in this application.

ITAM also conducted hand pulling to remove spotted knapweed (*Centauria stoebe*) from restored training sites on BP-1, Demo-2, and Wheelock Overlook, covering 7 acres.

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); therefore, Camp Edwards does not require an air quality control permit for stationary source emissions under the provisions of the Clean Air Act (CAA) or to measure and report actual emissions from its stationary sources.

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 16, 2022. The permit is valid through December 31, 2024.

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 March 31, 2021 using calendar year 2020 data.

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

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 detonation of unexploded ordnance in place and for other unusual noise events.

3.10 STORMWATER MANAGEMENT

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

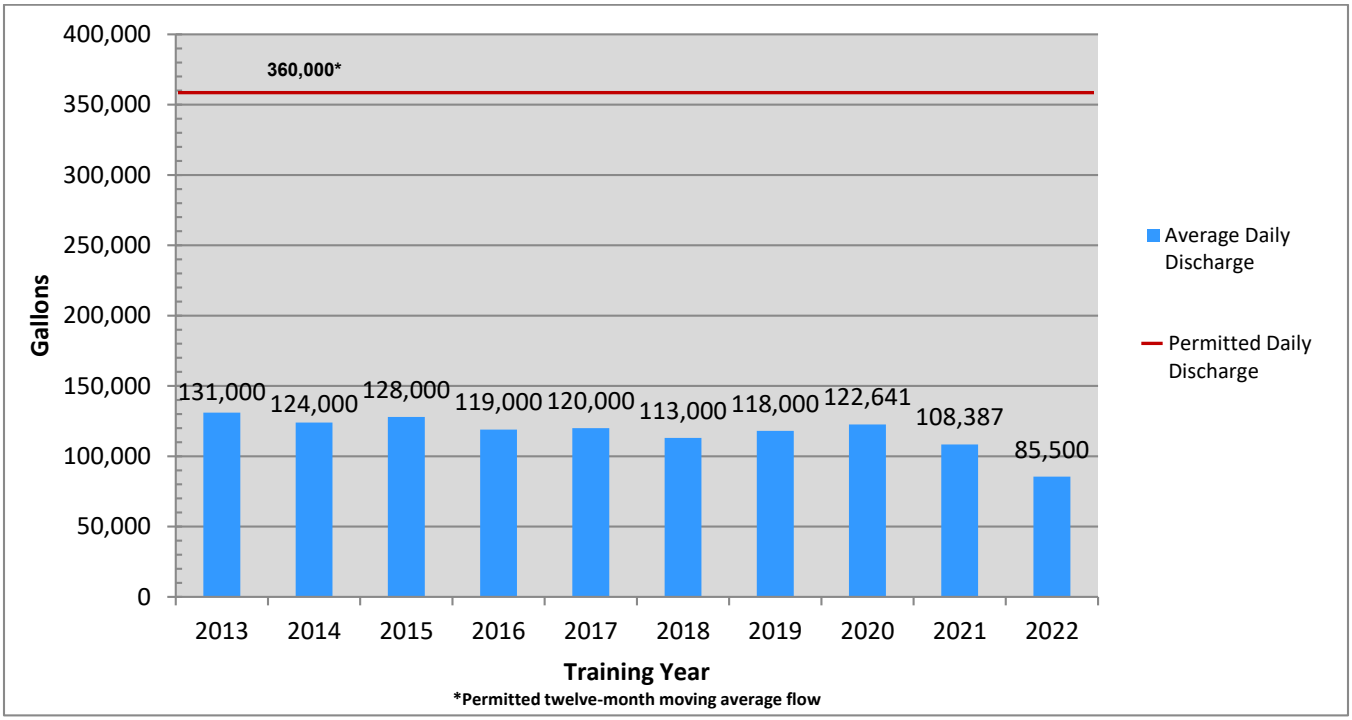
3.11 WASTEWATER MANAGEMENT

Depending on the location of facilities, wastewater and sewage from MAARNG training activities in the Training Area/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 Training Area/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 Training Area/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 2022. The plant discharged 31,207,507 gallons of sewage into the sand filtration beds in the Training Area/Reserve; a daily average of 85,500 gallons versus its permitted twelve-month moving average flow of 360,000 gallons. Graph 3-9 shows the daily average pumping rate of the Otis system since TY 2013.

Graph 3-9 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 2022. 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 in accordance with the Camp's Spill Prevention, Control and Countermeasure plan and/or Massachusetts Contingency Plan (310 CMR 40.00) if applicable. The EMC EO is notified of all reported spills in accordance with Chapter 47 of the Acts of 2002. 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 immediately report spills and/or releases of any size to Range Control.

There was one small spill in the Training Area/Reserve during TY 2022 below the reporting levels established in the Massachusetts Contingency Plan. Approximately three gallons of Diesel fuel spilled when a backhoe loader rolled onto its side at Dig Site 3. The spill was 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

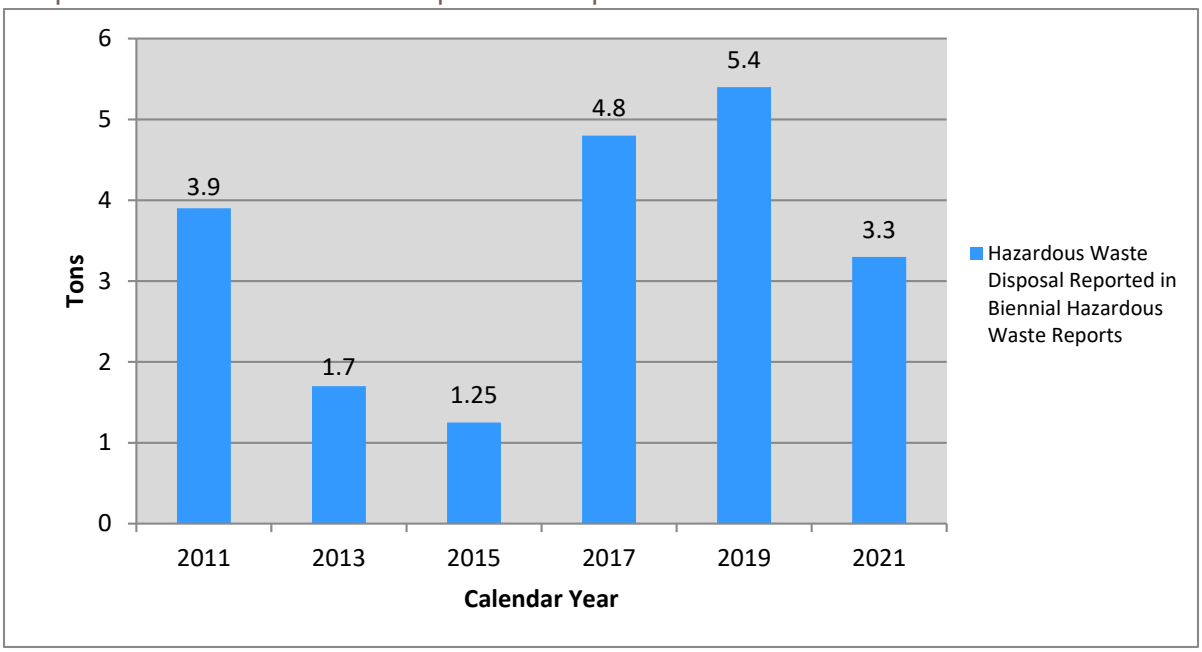
The MAARNG complied with its policy of not performing maintenance activities on military vehicles in the Training Area/Reserve throughout the year. Thus, hazardous wastes normally associated with vehicle maintenance and repair facilities were not generated or stored in the Training Area/Reserve. Vehicle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

Wastes generated within the Training Area/Reserve are managed within the existing accumulation area located at UTES, which is located outside of the Training Area/Reserve.

3.14.1 Hazardous Waste Disposal and Reporting

A biennial Hazardous Waste Report must be prepared and submitted to the 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 March 2022 for hazardous waste disposed of during calendar year 2021. Graph 3-10 provides information on the volumes of hazardous waste disposal reported for the past six biennial reports. In general, the majority of the reported waste is generated from the repair and maintenance of military vehicles, aircraft, and equipment. These wastes include vehicle fuels, oils, antifreeze and associated rags and clean-up materials. The quantities of waste disposed of will fluctuate year to year based on the operational tempo of the MAARNG within that year. 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.

Graph 3-10 Hazardous Waste Disposal – Camp Edwards



3.15 VEHICLE MANAGEMENT

Unauthorized All Terrain Vehicle (ATV), dirt bike, bicycle, and e bicycle access to the Training Area continued to be a problem in TY 2022. 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 including sign posting, cameras, Camp Edwards Range Control inspections and Environmental and State Police patrols, have seemed to slow the illegal use of the Training Area/Reserve for ATV and dirt bike riding. However, this will be an ongoing effort. The entire Training Area/Reserve 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

Public access to Camp Edwards is limited; however, under certain circumstances public access to Camp Edwards may be available such as hunting during the deer and turkey seasons (See Section 3.5.4 and 3.5.5).

3.17 CULTURAL RESOURCES MANAGEMENT

All MAARNG actions in the Training Area/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 Wampanoag Tribe of Gay Head (Aquinnah) and the Mashpee Wampanoag Tribe on undertakings that may affect historic properties that the Tribe has attached religious and cultural significance.

3.18 EPS VIOLATIONS

On March 31, 2022, the MAARNG reported to the EMC a noncompliance with the General Performance Standard, specifically "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." During the Best Warrior Competition on March 26, there was unauthorized use of yellow and white smoke grenades outside of the approved non-standard training plan. White smoke grenades were not approved for use, and yellow smoke grenades were used in an unapproved location in the C15 training area.

Corrective actions included counseling the full-time Range Control and civilian staff on their failure to follow established processes for the consultation and approval for any non-standard training event through Camp Edwards's Plans and Training Officer. The staff were also directed that only written non-standard training plans signed by the EMC EO and the MAARNG will be executed; and no verbal authorizations will be authorized. Refresher training was conducted with part-time staff to ensure compliance.

In a letter dated May 16, 2022, the EMC determined the MAARNG was not in compliance "with one or more laws, regulations, orders, licenses, permits, or approvals enforced by the EMC" and that corrective actions were necessary for compliance with the requirements of Chapter 47 of the Acts of 2002, the EPSs and range specific standard operating procedures and/or OMMPs. In its letter, the EMC concurred that the corrective actions identified by Camp Edwards were appropriate and determined that no additional actions by the MAARNG were necessary.

Appendix H lists violations reported since TY 2013.

3.19 MITIGATION

Details of mitigation requirements and actions for TY 2022 are discussed in the *Conservation and Management Permit Compliance and Mitigation Actions,* which is available in Appendix F.

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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 Training Area/Reserve during TY 2022.

4.1 INVESTIGATION AND REMEDIATION PROGRAMS

There are two independent cleanup programs operating at JBCC: the Installation Restoration Program and the Impact Area Groundwater Study Program.

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 Training Area/Reserve: Chemical Spill-19 (CS-19) and Fuel Spill-12 (FS-12) and three Military Munitions Response Program (MMRP) sites: Old K Range, former Mock Village, and former Otis Gun Club. The MMRP addresses potential threats to human health and the environment from munitions and munitions constituents in non-operational range areas.

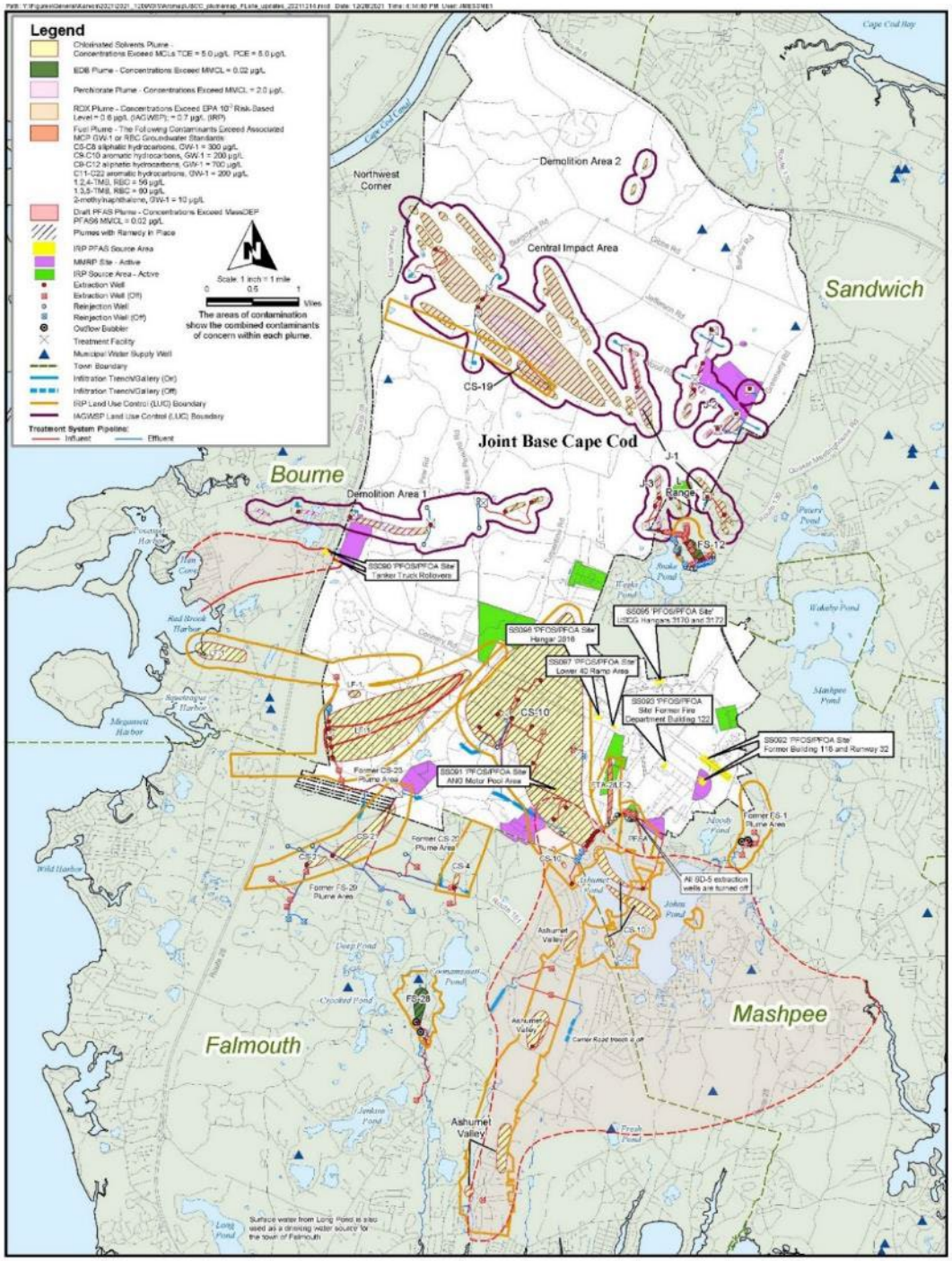
The IAGWSP is being managed by the Army National Guard. Investigation of the environmental impacts of legacy training in the upper 14,886 acres of JBCC began in 1996 and cleanup of groundwater contamination began in 2004. Seventeen treatment systems are currently operating on seven groundwater plumes to clean more than 3.8 million gallons of groundwater per day. More than 17.7 billion gallons of groundwater have been treated to date. While no public or private drinking water supplies are currently 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 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 Training Area/Reserve. The map in Figure 4-1 is available at http://jbcc-iagwsp.org/community/facts/jbcc_plume_map_121421.pdf

Figure 4-1 JBCC Groundwater Plume Map



The map is available at http://jbcc-iagwsp.org/community/facts/jbcc_plume_map_121421.pdf

4.2 INSTALLATION RESTORATION PROGRAM ACTIVITIES IN THE TRAINING AREA/RESERVE

In TY 2021, 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 Training Area/Reserve. A Streamlined Remedial Investigation/Feasibility Study (RI/FS) was prepared for the former World War II-era Mock Village and has been finalized. A RI was completed in TY 2019 at the World War II-era Old K Range and an FS was drafted and submitted for review in TY 2021. 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 is currently off limits and ordnance warning signage was placed around the perimeter of the site. A RI was also completed for the former Otis Gun Club and an FS was drafted but identified data gaps; therefore, a Supplemental RI is planned to collect additional data. In addition to the MMRP sites, AFCEC manages two groundwater plumes in the Training Area/Reserve: CS-19 and FS-12.

In TY 2022, 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 one of three monitoring wells sampled. The highest RDX concentration was 1.3 µg/L.

AFCEC also manages three 1.5 MW wind turbines at JBCC, two of which are located in the Training Area/Reserve. The turbines offset the energy use in the IRP by 100% (approximately $1.5 million per year). 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 2022.

4.3 IMPACT AREA GROUNDWATER STUDY PROGRAM ACTIVITIES

During TY 2022, the IAGWSP operated groundwater treatment systems for plumes associated with the former Demolition Area 1, former J-3 Range, former J-2 Range (northern and eastern), the former J-1 Range (southern and northern), and the former Central Impact Area (CIA). These systems are treating approximately 3.8 million gallons of water per day.

Removal of munitions and explosives from the source of the CIA groundwater plume continued in TY 2022. Work on Phase IV Area 2 (ten acres) of the CIA long-term source area response continued throughout the year. In the Central Impact Area, 103 acres have been cleared of munitions and explosives of concern 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 conducted sampling at the former J-2 and J-3 Ranges as follow-up to detections from previous sampling done to evaluate whether Per- and polyfluoroalkyl substances (PFAS) are present in the groundwater from sites where former open burning/open detonation is known to have occurred. Groundwater sampling conducted in TY 2022 was conducted as follow-up to detections from 2021 PFAS sampling. Review of the data is ongoing and recommendations for sampling of additional wells and further investigations has been developed for Agency review and approval. IAGWSP will continue to collect groundwater samples at the J-2 and J-3 Ranges to determine the nature and extent of PFAS in these areas. The program is also installing new monitoring wells to assist in the investigations.

Juliet and Kilo Ranges are now in operational inactive status. For 2023, monitoring of these ranges will be conducted by the IAGWSP and reported as required.

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SECTION 5
MISCELLANEOUS MILITARY AND CIVILIAN ACTIVITIES AND ENVIRONMENTAL PROGRAM PRIORITIES

5.0 MISCELLANEOUS MILITARY ACTIVITIES

5.0.1 Camp Edwards Tours and Community Involvement

Camp Edwards hosted six tours of the training area open to community members from April to October. MAARNG soldier training venues, including simulated training, small arms ranges, the Natural Resources Program, and groundwater treatment conducted by IAGWSP were the subjects of the tours. MAARNG training requirements, habitat conservation and mitigation efforts were among the items discussed by the tour leaders. The tours were advertised in the Enterprise newspapers and on the E&RC's website. Approximately 175 members of the community attended the tours. Camp Edwards also conducted numerous tours, presentations and briefings to Cape Cod-area community groups, non-profit organizations, and elected officials. In addition, the Natural Resource Office hosted five grassland bird tours in the grasslands of Camp Edwards in 2022 with approximately 20 individuals per tour.

5.1 JOINT BASE CAPE COD EXECUTIVE DIRECTOR

The primary roles of the JBCC Executive Director 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 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 (ret) Christopher Faux was appointed JBCC Executive Director in June 2018.

5.2 MISCELLANEOUS CIVILIAN ACTIVITIES

5.2.1 Eversource Projects

As part of the Mid Cape Reliability Project, Eversource is upgrading an existing Eversource switching station (Bourne Switching Station #917) located on an easement in the Training Area/Reserve (Figure 5-1). Eversource evaluated several sites for minimal loss of training land and impact to state priority habitat. Eversource has sited 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 Training Area/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 Chapter 216 of the Acts of 2018 (https://malegislature.gov/Laws/SessionLaws/Acts/2018/Chapter216) to change its use in August 2018. Eversource submitted an Environmental Notification Form (EEA# 15952) to the MEPA office on December 17, 2018. For this project, all review and permitting is complete. Completion of the project is anticipated for 2023.

Figure 5-1 Eversource Switching Station Area

Over the last 10 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 TY 2019, Eversource came 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.

5.2.2 Cape Cod Canal Area Transportation Improvement Program and the Cape Cod Bridges Program

The Canal Area Transportation Improvement Program, led by the Massachusetts Department of Transportation (MassDOT), covers areas in Bourne and Sandwich and west along Route 25 into Wareham. According to presentations given by MassDOT, the program will include replacing the Bourne Bridge and Sagamore Bridge, improvements to the approach roadway network, multimodal improvements, and utility relocations. Some changes could have potential impacts to JBCC and specifically the Camp Edwards Training Site. Information regarding this effort can be found at: https://www.capecodcommission.org/our-work/cape-cod-canal-study-resources.

MassDOT is addressing the Bourne and Sagamore Bridges through the Cape Cod Bridges Program. In November 2022, several potential bridge types were presented to the public during MassDOT's public outreach meetings. Items presented during these meetings included the draft Program Purpose and Need, funding and grant applications being pursued by the US Army Corps of Engineers, and updates on data collection and analysis. MassDOT plans an additional round of public outreach in 2023. Information related to the program may be found at: https://www.mass.gov/info-details/the-cape-cod-bridges-program-details#your-opinion-matters-.

5.3 ENVIRONMENTAL PROGRAM PRIORITIES

5.3.1 TY 2022 Environmental Program Priorities

The following subsections provide a list of the environmental program priorities established for TY 2022 as published in the TY 2021 Annual Report for its activities associated with the Training Area/Reserve and the status of achieving them.

Natural Resources and ITAM Management

- Implement projects and planning identified in the Conservation and Management Permit that established an onsite mitigation bank and long-term habitat management and resource monitoring requirements. Annual and ongoing for TY 2022 with primary emphasis on prescribed burning and monitoring/research.
    - Completed effectively for TY 2022 with reporting above and in the supplemental mitigation report.
- Continue to address potential federal status changes to species at Camp Edwards through interagency consultation, planning, and partnership. Ongoing with particular emphasis on the proposed change of the Northern Long-eared Bat from Threatened to Endangered under the Federal Endangered Species Act.
    - Moderate action on this objective with continued interagency coordination but needed consultation. Army is developing programmatic consultation in support of installations, and the Natural Resources Program will see what supplemental consultation needs to occur to support training and conservation actions at Camp Edwards.
- Further develop supplemental plans for Natural Resources/ITAM long-term budgets and implementation, including invasive species, wildland fire, and land rehabilitation. Ongoing with particular emphasis on growing prescribed fire implementation.
    - Strong progress with ongoing development of the IWFMP, monthly wildland fire working group meetings, and a Camp Edwards Community Risk Assessment reviewing fire response preparedness.
- Continue implementation and refinement of management focused monitoring of rare species, habitat management, and training capabilities. Ongoing with TY 2022 emphasis on continuing long-term efforts and initiating the robust moth and vegetation long-term monitoring effort.
    - Development and refinement continues with fielding of long-term moth monitoring protocol, detailed data analysis of bird monitoring data, etc.
- Continue to update wildland fire planning and program opportunities after hiring dedicated Wildland Fire Program Coordinator, including updating Integrated Wildland Fire Management Plan and planning for increased range usage. Ongoing with Integrated Wildland Fire Management Plan completion planned for this year.

  - Ongoing planning update as described above combined with very intentional programmatic goals for TY 2022 provided for successful fire implementation and program development. The 25 burn days averaging 25 acres per burn goal was intentionally set to identify strength and growth areas for the program constructively. This provided for improved planning and operational preparedness, including communication.

- Continue upscaling of habitat and land management actions, including mechanical work and prescribed burning, through internal actions and partnerships, to increase long-term ecosystem health and resilience. Ongoing with emphasis on strengthening prescribed fire program and monitoring of habitat effects.
  - This objective was met through ecological focus on both forestry and fire implementation informed by resource monitoring; results of which continue to demonstrate population level benefits of a variety of taxa in response to woodland mosaic management and climate resilience implementation.
- Develop water feature conservation plans that provide for ephemeral features (e.g., vernal pools) while minimizing impacts to wildlife and training. Ongoing with emphasis on more detailed planning of two new vernal pools based on ongoing siting plan.
  - Plan still ongoing through contract with likely need for cultural resources coordination prior to finalization and implementation.
- 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. Ongoing.
  - Partnership continues to be a major focus and element of successful conservation planning and implementation.

Cultural Resources Management

- Conduct applicable reviews of all IAGWSP, IRP and MAARNG proposed activities in the Training Area/Reserve for potential cultural resources impacts. (Ongoing)
- Document any new occurrences of identified cultural resources. (Ongoing)

Other E&RC Environmental Management Programs

- Coordinate required soil, lysimeter and groundwater sampling at operational active small arms 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 Training Area/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 Training Area/Reserve. (Accomplished)
- Provide information on environmental program activities regarding the Training Area/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 2021 *State of the Reservation Report.* (Accomplished)

5.3.2 TY 2023 Environmental Program Priorities

The following subsections provide a list of environmental program priorities for Camp Edwards for activities associated with the Training Area/Reserve in TY 2023.

Natural Resources and ITAM Management

- Implement projects and planning identified in the Conservation and Management Permit that established an onsite mitigation bank and long-term habitat management and resource monitoring requirements. The majority of these actions are on an annual and ongoing basis, including monitoring efforts and prescribed burning. Annual targets are for at least 100 acres of pine barrens habitat restoration/maintenance and 50 acres of grassland habitat restoration/maintenance. Monitoring efforts are outlined in the text.
- Continue to address potential federal status changes to species at Camp Edwards through interagency consultation, planning, and partnership. This effort is ongoing with particular emphasis on the proposed change of the Northern Long-eared Bat from Threatened to Endangered under the Federal Endangered Species Act.
- Further develop supplemental plans for Natural Resources/ITAM long-term budgets and implementation, including invasive species, wildland fire, and land rehabilitation. This effort is ongoing with the continued update of the Integrated Wildland Fire Management Plan and Integrated Pest Management Plan, and development by the Woodwell Climate Research Center of a Climate Resilience Plan that will be appended to the INRMP.
- Continue implementation and refinement of management focused monitoring of rare species, habitat management, and training capabilities. These are ongoing efforts with TY 2023 emphasis on continuing long-term efforts and informing future work (e.g., bats, cottontails) through long-term data analysis.
- Continue to develop wildland fire capabilities and capacity through program and personnel development and increasing available fire windows by addressing barriers to fire. Key barriers include listed species consultation and permitting (federal ESA) and fuels management. Increasing capacity and implementation of prescribed fire is consistent with the habitat management priorities, supported by long-term monitoring of flora and fauna, and essential to reducing wildfire hazard. These are also ongoing efforts consistent with above reporting and management plans.
- Continue upscaling of habitat and land management actions, including mechanical work and prescribed burning, through internal actions and partnerships, to increase long-term ecosystem health and resilience. Ongoing with emphasis on strengthening prescribed fire program and monitoring of habitat effects.
- Develop water feature conservation plans that provide for ephemeral features (e.g., vernal pools) while minimizing impacts to wildlife and training. Ongoing with emphasis on more detailed planning of two new vernal pools based on ongoing siting plan.
- 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. Ongoing.

Other E&RC Environmental Management Programs

- Coordinate required soil, lysimeter and groundwater sampling at operational active small arms 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 Training Area/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 Training Area/Reserve.
- Provide information on environmental program activities regarding the Training Area/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 2022 *State of the Reservation Report.*