CONSERVATION AND MANAGEMENT PERMIT APPLICATION

Multi-Purpose Machine Gun (MPMG) Range
Camp Edwards
Sandwich, Massachusetts

2020

Prepared for:
Massachusetts Army National Guard

CONSERVATION AND MANAGEMENT PERMIT APPLICATION
Multi-Purpose Machine Gun (MPMG) Range
Camp Edwards
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List of Tables

List of Figures

List of Appendices [only Appendix A included in this draft]

Acronyms and Abbreviations

ACUB ..... Army Compatible Use Buffer
ANG ..... Army National Guard
ASP ..... Ammunition Supply Point
ARF ..... Automatic Record Fire
Camp Edwards ... Camp Edwards Training Area
CMP ..... Conservation and Management Permit
Crane WMA ..... Frances Crane Wildlife Management Area
DCR ..... Department of Conservation and Recreation
DFG ..... Massachusetts Department of Fish and Game
DoD ..... Department of Defense
E ..... Endangered
EEA ..... Executive Office of Energy and Environmental Affairs
EO ..... Executive Order
EPS ..... Environmental Performance Standards
ESA ..... Federal Endangered Species Act
FCRA ..... Forest Canopy Reserve Areas
FY ..... Fiscal Year
INRMP ..... Integrated Natural Resources Management Plan
ITAM ..... Integrated Training Area Management
JBCC ..... Joint Base Cape Cod
LCTA ..... Land Condition Trend Analysis
LRAM ..... Land Rehabilitation and Maintenance
MA ANG ..... Massachusetts Air National Guard
MAARNG ..... Massachusetts Army National Guard
MACOM ..... Major Army Commands
MassGIS ..... Massachusetts GIS
MassWildlife ..... Massachusetts Division of Fisheries and Wildlife
MEPA ..... Massachusetts Environmental Policy Act
MG ..... Managed Grassland
MILCON ..... Military Construction
MMR ..... Massachusetts Military Reservation
NHESP ..... Natural Heritage and Endangered Species Program
NLEB ..... Northern Long-Eared Bat
OANGB ..... Otis Air National Guard Base
PPOF ..... Pitch Pine Oak Forest
PPSO ..... Pitch Pine Scrub Oak
The Reserve ..... Upper Cape Water Supply Reserve
ROCA ..... Range Operations Control Area
SAR ..... Small Arms Range
SC ..... Special Concern
SDZs ..... Surface Danger Zones
SMRC ..... Special Military Reservation Commission
SOS ..... Scrub Oak Shrubland
SRA ..... Sustainable Range Awareness
T ..... Threatened
TAG ..... The Adjutant General
TRI ..... Training Requirements Integration
USEPA ..... U.S. Environmental Protection Agency
USFWS ..... U.S. Fish and Wildlife Service
USCG ..... U.S. Coast Guard
WL ..... Watch List

Summary Table and Definitions

Terms	Acres	Description
Joint Base Cape Cod (JBCC)	20,554	Full scale, joint-use base home to five military commands training for missions at home and overseas, conducting airborne search and rescue missions, and intelligence command and control.
Camp Edwards	15,000	Camp Edwards makes up the majority of JBCC and includes multiple training areas most of which is located within the Upper Cape Water Supply Reserve.
Camp Edwards Northern Training Area	14,410	Major training area for National Guard soldiers in the northeast where they practice maneuvering exercises, bivouacking, and use the small arms ranges.
Upper Cape Water Supply Reserve	13,352	Established by Chapter 47 of the Acts of 2002 as public conservation land dedicated to: water supply and wildlife habitat protection; the development and construction of public water supply systems, and, use and training of military forces of the Commonwealth; provided that, military use and training is compatible with natural resource purposes of water supply and wildlife habitat protection..
Cantonment Area	5,000	The southern developed area of the JBCC with roads, utilities, office and classroom buildings, training support areas, and housing. Numerous Federal, State, and county entities are located here as well as the airfield.
Impact Area	2,200	Formal off-limits designation due to unexploded ordnance safety regulations. Area surrounds the Central Impact Area (below). An additional 1,600 acres are off-limits due to ordnance hazard, but not officially designated Impact Area.
Central Impact Area	330	This areas is located within the Impact Area and was the primary target area for artillery, mortar, and other firing activities from the early 1900s to 1997.
KD Range	38.5	Existing inactive range where the MPMG Range is proposed comprised of 36.0 acres of Managed Grasslands (previous mitigation for rare species impacts from another project) and 2.5 acres of ROCA.
MPMG Range Footprint	199.0	MPMG Range including 800 meter and 1,500 meter lanes and the ROCA.
MPMG Range-Specific Firebreak Footprint	10.0	Firebreaks to be constructed associated with the MPMG Range; including new roads and expansion of existing roads.
Total Project Footprint	209.0	MPMG Range Footprint plus MPMG Range-Specific Firebreak Footprint
Range Operations Control Area (ROCA) Footprint	2.5	Contains the Range Control Tower, Ammunition Storage Building, Covered Bleachers, other support features and disturbed areas (included in MPMG Range Footprint).
MPMG Range Take Footprint	206.5	Total Project Footprint minus the ROCA acreage
MPMG Range Managed Grassland Take Footprint	36.0	Existing 36.0 acres of Managed Grassland at KD Range
MPMG Range Pine Barrens Take Footprint	170.5	MPMG Range Take Footprint minus MPMG Range Managed Grassland Take Footprint

CONSERVATION AND MANAGEMENT PERMIT APPLICATION
MULTI-PURPOSE MACHINE GUN (MPMG) RANGE
MASSACHUSETTS ARMY NATIONAL GUARD
CAMP EDWARDS
Sandwich, Massachusetts

1.0 Introduction

This Conservation and Management Permit (CMP) Application (Application) is being submitted to the Massachusetts Natural Heritage and Endangered Species Program (NHESP) by the Massachusetts Army National Guard (MAARNG) in order to obtain a Conservation and Management Permit (NHESP Tracking #18-37434) for impacts to State-listed rare species in connection with the proposed construction and operation of a Multi-Purpose Machine Gun (MPMG) Range at Camp Edwards located in Sandwich, Massachusetts (see **Figures 1-1**). This Application is being made in accordance with the Massachusetts Endangered Species Act (MESA; MGL c. 131A) and implementing regulations (321 CMR 10.00).

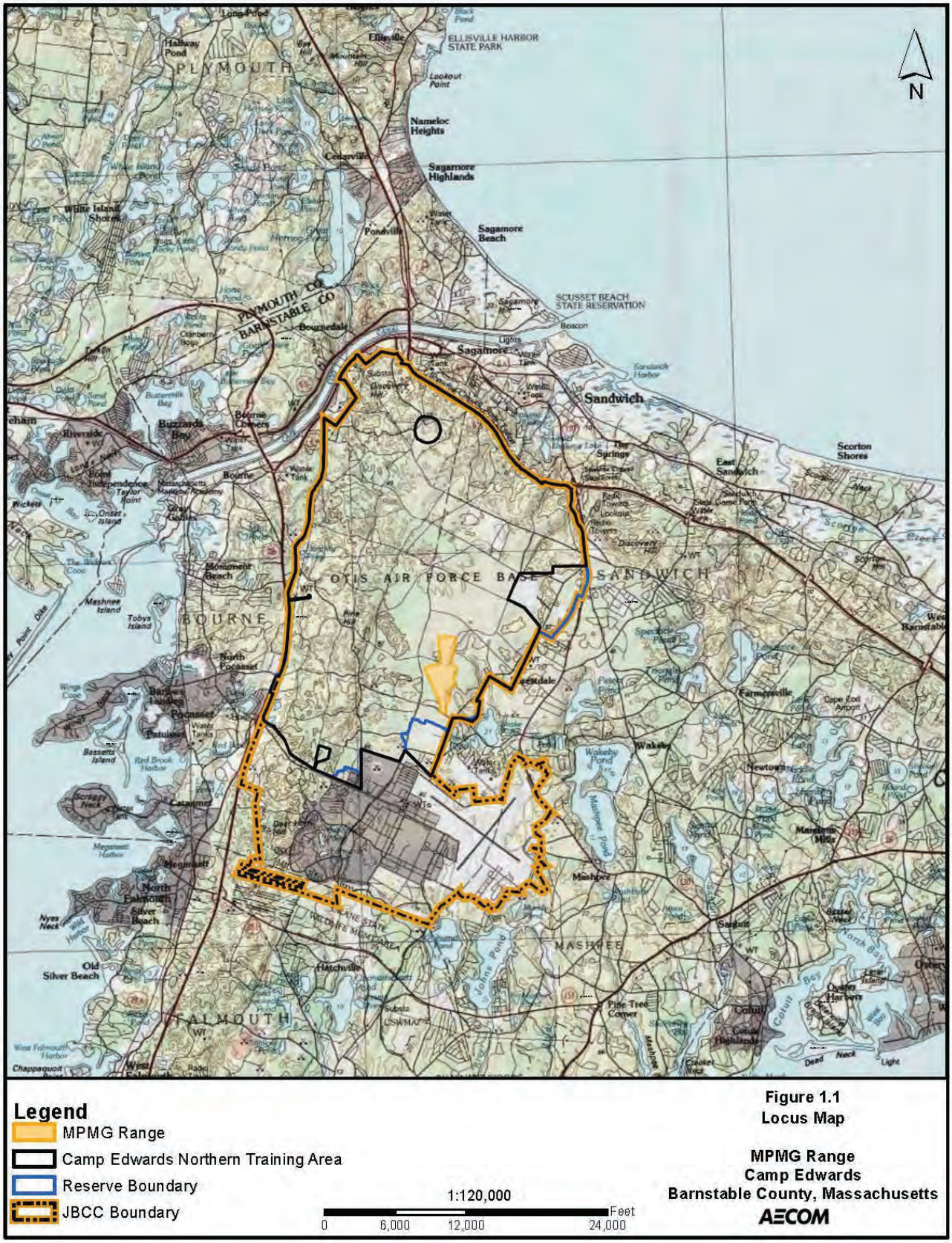
1.1 Project Site

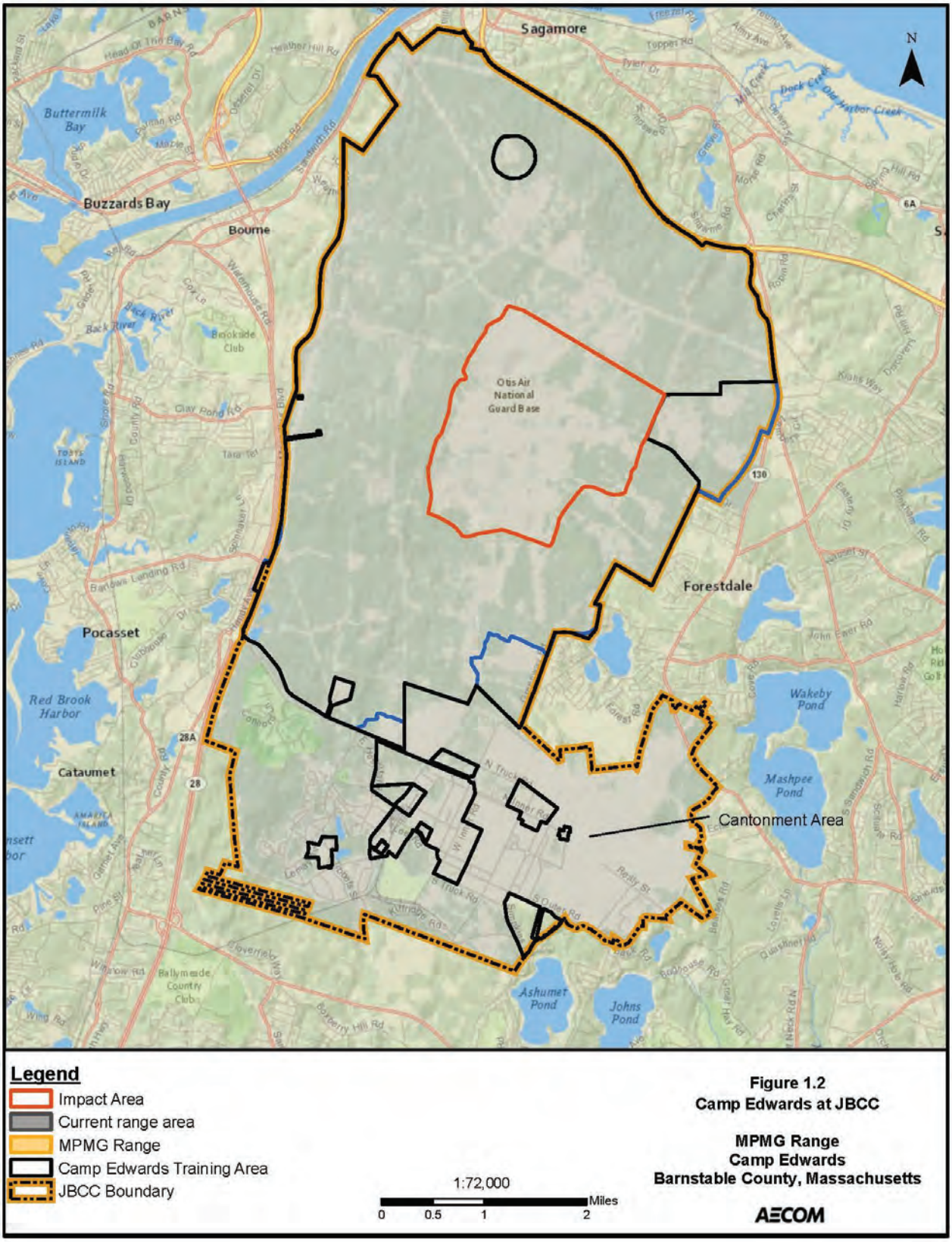
Camp Edwards encompasses approximately 15,000 acres of the approximately 20,554-acre Joint Base Cape Cod (JBCC) (see **Figures 1-1 and 1-2**) formerly called the Massachusetts Military Reservation or MMR. Within the JBCC are five military commands including: the MAARNG at Camp Edwards; the Massachusetts Air National Guard (MA ANG) at Otis Air National Guard Base; the U.S. Air Force (USAF) at Cape Cod Air Force Station; and the U.S. Coast Guard (USCG) at Air Station Cape Cod. Although the JBCC is situated within four towns, Bourne, Sandwich, Falmouth, and Mashpee, Camp Edwards lies only within the boundaries of Bourne and Sandwich.

The land that currently comprises Camp Edwards is owned by the Commonwealth of Massachusetts and is in custody of Massachusetts Department of Fish and Game, Division of Fisheries and Wildlife (MassWildlife), which has leased the property to the Department of the Army. In turn, the Army licensed the land to the MAARNG for training. The current lease held by the Army expires in the year 2051. The proposed MPMG Range will be constructed on State-owned land leased to the Federal government.

JBCC is divided into two major sections. The southern section is comprised of approximately 5,000 acres of Cantonment Area, which is the industrialized portion of the JBCC where administrative buildings, barracks, vehicle and equipment maintenance shops, housing, and runways are located. The northern training area encompasses approximately 14,410 acres and is a largely wooded area with rolling topography, trails, and paved roads and includes training areas and ranges where small arms firing and maneuver training occur. The Impact Area is a 2,200-acre area that has a formal off-limits designation due to unexploded ordnance safety regulations. It includes the 330 acre-Central Impact Area which was the primary target area for artillery, mortar, and other firing activities from the early 1900s to 1997.

In the northern portion of Camp Edwards, 13,352 acres has been identified as the Upper Cape Water Supply Reserve (the Reserve) created by Chapter 47, Acts of 2002. Chapter 47 also transferred the care, custody, and control of the Reserve from the Special Military Reservation Commission (SMRC) to the MassWildlife. The Reserve is designated public conservation land dedicated to three primary purposes:


N
PLYMOUTH
ELLISVILLE HARBOR STATE PARK
Nameloc Heights
Sagamore Highlands
Sagamore Beach
SCUSSET BEACH STATE RESERVATION
PLYMOUTH CO.
BARNSTABLE CO.
Bournedale
Sagamore
Sandwich
Buzzards Bay
Bourne
Monument Beach
OTIS AIR FORCE BASE
SANDWICH
BOURNE
East Sandwich
Scorton Shores
Falmouth
Waquoit
Mashpee
MASHPEE
FALMOUTH
Old Silver Beach
North Falmouth
Silver Beach
Hatchville
Pine Tree Corner
Cotuit
Cotuit Highlands
Legend
MPMG Range
Camp Edwards Northern Training Area
Reserve Boundary
JBCC Boundary
1:120,000
0 6,000 12,000 24,000 Feet
Figure 1.1
Locus Map
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM


Sagamore
Buzzards Bay
Bourne
Otis Air National Guard Base
Forestdale
Pocasset
Cataumet
Red Brook Harbor
Wakeby Pond
Mashpee Pond
Ashumet Pond
Johns Pond
Cantonment Area
N
Legend
Impact Area
Current range area
MPMG Range
Camp Edwards Training Area
JBCC Boundary
1:72,000
0 0.5 1 2 Miles
Figure 1.2
Camp Edwards at JBCC
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

- Water supply and wildlife habitat protection,
- Development and construction of public water supply systems, and
- 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.

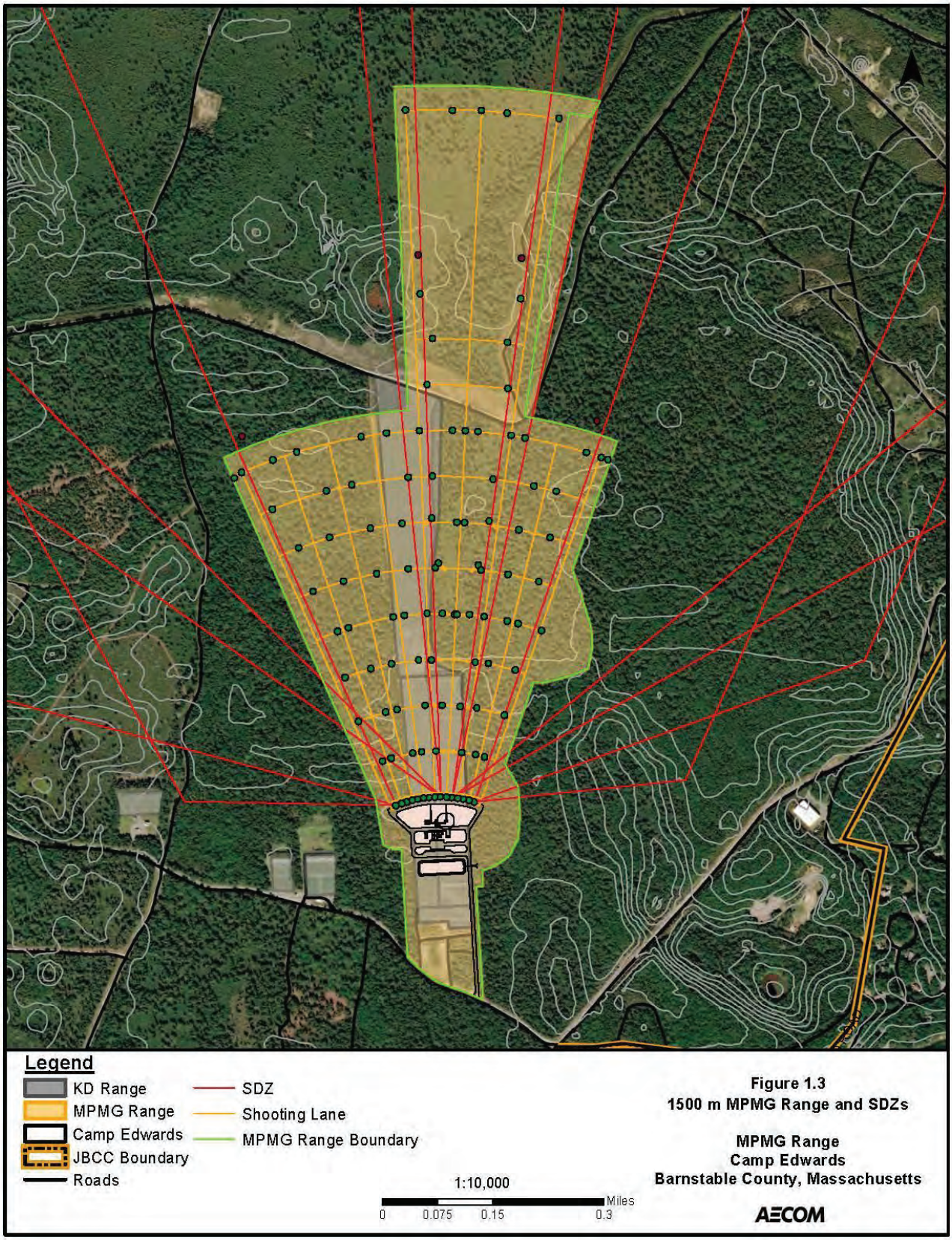
1.2 Project Description

The MPMG Range is proposed to be constructed at the existing location of a combined Known Distance (KD) Range (38.5 acres) (see **Figure 1-3**), which was previously used for past ranges and training including disturbed areas that due to inactivity of the range are comprised of grassland habitat and immature pitch pine in the northern portion of the eastern side of the KD Range. The proposed MPMG Range improvements would require approximately 160.5 acres of additional land to accommodate the range footprint and Range Operations Control Area (ROCA) which includes a Range Control Tower, Ammunition Storage Building, Covered Bleachers, and other support features. The total footprint of the MPMG Range is 199.0 acres. See **Section 3.0** for a full description of the proposed range.

An additional 10.0 acres of strategic firebreaks are proposed to be constructed along the exterior of the MPMG Range which increases the Total MPMG Range Footprint to 209.0 acres. This work will be performed as part of the firebreak project involving the construction and maintenance of firebreaks throughout Camp Edwards to reduce the risk of a large wildfire and assist in managing the fighting of fires. Firebreak and fuels management involves the alteration of fuels to reduce the likelihood of a fire starting or to reduce its effects if one does start. These techniques may improve access for fire apparatus, increase water resources available on-site, adjust target placement, and provide buffer or safety zones. Range use at Camp Edwards introduces significant wildfire hazard into unmanaged and high risk fuels conditions through the use of tracers and ammunition. Tracers are forms of ammunition that include a small pyrotechnic charge which makes the trajectory of the ammunition visible in the day time and night time.

Surface Danger Zones (SDZs) are required for all ranges, but are administrative areas closures. The MPMG Range SDZ area is 5,197 acres. No work is proposed within the SDZs but these are maintained and controlled for the safety of personnel on Camp Edwards. The SDZ is a safety zone representing the area of potential hazard (accounting for straight fire and ricochet) based on the projectiles fired and weapon system used at the range. The SDZ has specific dimensions for the expected caliber or the weapon being fired, so that all projectile fragments are contained in this area. The existing KD Range is not presently used for live fire training but is used for other training operations like unmanned aerial vehicle (UAV) flying. The MPMG Range is a programmed Fiscal Year (FY) 2020 Military Construction (MILCON) project.

The Preferred Alternative will be constructed in two phases as shown on **Table 1-1**. Phase 1 will be the Reduced-Scale Alternative, that is, eight lanes constructed at 800 meters in length. Phase 2 will add the extension of two lanes to a length of 1,500 meters to accommodate 0.50 caliber training. The acreages and estimated rare species impacts are provided below by phase. The Project is being phased to correspond with the MILCON (Military Construction) funding. Both phases are included for approval in this CMP Application. When Phase 2 is constructed, the MAARNG will work with NHESP to reduce impacts from grading and access roads to the scrub oak shrubland as the 0.50 caliber lanes would extend into this habitat near to the frost bottom.


Legend
KD Range
MPMG Range
Camp Edwards
JBCC Boundary
Roads
SDZ
Shooting Lane
MPMG Range Boundary
1:10,000
Miles
0
0.075
0.15
0.3
Figure 1.3
1500 m MPMG Range and SDZs
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

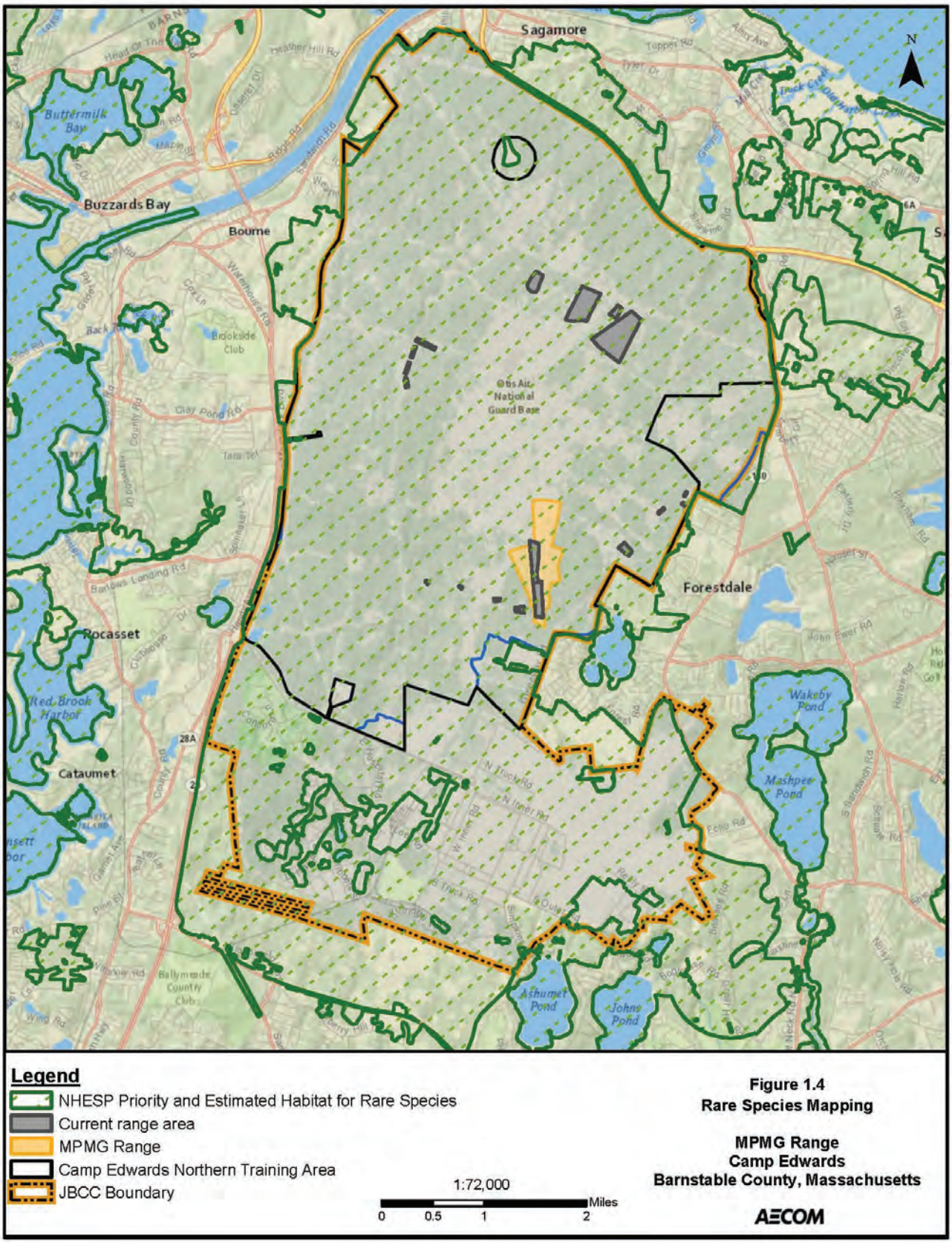

Sagamore
Buzzards Bay
Bourne
Otis Air National Guard Base
Forestdale
Rocasset
Cataumet
Wakeby Pond
Mashpee Pond
Ashumet Pond
Johns Pond
Buttermilk Bay
Red Brook Harbor
Brookside Club
Ballymeade Country Club
N
Legend
NHESP Priority and Estimated Habitat for Rare Species
Current range area
MPMG Range
Camp Edwards Northern Training Area
JBCC Boundary
1:72,000
0 0.5 1 2 Miles
Figure 1.4
Rare Species Mapping
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

Table 1-1: MPMG Range Phased Construction

Phase	Alternative	800 Meter Lanes	1,500 Meter Lanes	Total Acreage *	Rare Species Impacts
Phase 1	Reduced-Scale Alternative	8	0	133.0	94.5
Phase 2	Construction of 1,500 Meter Lanes	0	2	76.0	76.0
TOTAL	Preferred Alternative (Project)	8	2	209.0	170.5

* With approximately 5.0 acres of firebreaks included in each phase

1.3 Goals and Objectives

While this Application focuses on the MPMG Range, in order to properly analyze impacts to rare species at Camp Edwards, other projects proposed in the JBCC, (including possible associated impacts and mitigation), proposed, will be discussed. This Application is intended to provide a framework for JBCC-wide rare species mitigation measures focusing on MAARNG activities. MAARNG proposes sufficient mitigation proactively to support existing and conceptual MAARNG projects in the near future (1 to 8 years) assuming that a "take" of rare species would be likely to occur as approximately 98 percent of the JBCC and Camp Edwards are mapped by NHESP as both Priority and Estimated Habitats of Rare Species (see **Figure 1.4**). This CMP Application is intended to proactively establish a framework and implement actions to achieve net benefit for State-listed species and streamline review processes for all stakeholders for all MAARNG projects at Camp Edwards.

Other projects that may be proposed include the following: Gym Expansion (see **Section 4.1**), Transient Troop Headquarters (TTHQ) (see **Section 4.2**), Tango Range Expansion (see **Section 4.3**), Sierra Range Expansion (see **Section 4.4**), and Infantry Squad Battle Course (ISBC) (see **Section 4.5**). The MPMG Range, the TTHQ, and the Tango Range Expansion are considered the primary projects that are more likely to be constructed first.

Accordingly, in order to provide a long-term net benefit to the impacted species, the MAARNG proposes to use a combination of land transfers (i.e., "land protection") and establishment of a mitigation bank comprised of approximately 3,400 acres for pine barrens habitat, approximately 1,180 acres for forest cover retention, 150 acres of intensive management, and a reserve of approximately 250 acres for potential sandplain grassland creation. The combination of parcel transfers and habitat management or conversion within mitigation bank focal areas will provide for net benefit of all impacted State-listed species while also establishing a framework for proactively mitigating impacts of future projects. The management areas are described in **Section 4.0**. This combination of mitigation strategies will allow MAARNG to establish a robust mitigation bank and overall strategy for success to facilitate implementation of long-term planning efforts including modernization of the range complex and infrastructure, thereby maximizing positive impacts. Monitoring of select species and management effects will inform success of the planning included here. The details of the MPMG Range impact analysis is described in **Section 3.0**. Impacts from other projects are described in **Section 4.0** and proposed mitigation are further described in **Section 5.0**.

The MAARNG and other agencies at the JBCC have been working with NHESP to obtain approvals to transfer excess land at the JBCC to MassWildlife as a primary mitigation measure for rare species impacts. This occurred recently relative to the Capped Landfill Solar Array project located in the Cantonment Area. Based on previous and ongoing discussions and coordination efforts with MassWildlife, MassWildlife will provide mitigation credit for excess parcels already transferred to the Commonwealth (MassWildlife), parcels to be transferred, and possible parcels to be transferred in the future. MassWildlife has agreed that land previously transferred for mitigation by Massachusetts Air National Guard (MAANG), MAARNG, and

SMRC, specifically, may be used for credit for different projects in the same habitat type if the original project was cancelled.

The MAARNG is also proposing continued management and maintenance of rare species habitat such as pine barrens (through fire and forestry management strategies) and grasslands (through active creation and management) associated with several State-listed rare species including moths, birds, and turtles. Description of each species is provided in **Section 2.0**.

The intent of this Application, although specific to the MPMG Range, is to provide a variety of mitigation strategies for existing and proposed projects and through mitigation banking and implementation of habitat improvements and management. In addition, the information in this Application is intended to be used as a baseline for future mitigation efforts including the identification of mitigation parcels that may be used for existing and upcoming projects. Future projects at JBCC may include, but not be limited to: Gym Expansion, Transient Troop Headquarters, Infantry Squad Battle Course, Firebreak Installation, and Sierra and Tango Range expansions (see **Section 3.0** for more detail on these other projects). The impact determination noted below by NHESP has been made specific to the MPMG Range project and not the other projects identified in this document and is beyond the scope of this CMP.

1.4 Massachusetts Endangered Species Act

NHESP has determined that, as a result of the construction and operation of the MPMG Range, there will be a "take" of several State-listed lepidopterans (moths and butterfly) species identified on the Site, and that there could potentially be a "take" of Eastern Box Turtle (*Terrapene carolina*), Eastern Whip-poor-will (*Caprimulgus vociferus*), and sandplain grassland bird species.

Under MESA, projects or activities which occur within mapped Priority Habitat require review by NHESP to determine whether a take will occur as a result of the project or activity. A take is defined by MESA (in reference to animals) means to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding or migratory activity or attempt to engage in any such conduct, or to assist such conduct. In reference to plants, means to collect, pick, kill, transplant, cut or process or attempt to engage or to assist in any such conduct. Disruption of nesting, breeding, feeding or migratory activity may result from, but is not limited to, the modification, degradation or destruction of habitat. If it is determined that the take of a State-listed species will occur as a result of the project or activity, then the take may be permitted for conservation and management purposes if there will be a long-term net benefit to the conservation of the impacted species.

The Cape Cod ecoregion where the MPMG Range would be located has the highest number and one of the highest densities of State-listed rare plant and animal species within the 13 ecoregions in Massachusetts. The State-listing includes Endangered (E), Threatened (T), Special Concern (SC), and Watch-List (WL) species. Camp Edwards is home to 39 State-listed species including 32 species of wildlife shown in **Table 2-3** and the seven species of plants shown in **Table 2-1**.

Pursuant to MESA, a CMP may be issued by NHESP for a project provided that an applicant has provided the following three items:

1. Adequately assesses alternatives to both temporary and permanent impacts to State-listed species.

   MAARNG has adequately assessed alternatives to both temporary and permanent impacts to State-listed species as described in **Sections 3.0** for the MPMG Range and **Section 4.0** for other proposed projects with a summary of alternatives analysis, avoidance, and minimization summarized at **Section 5.4**;

2. Demonstrates that the activities will result in an insignificant impact to the local populations of the affected species.

   An insignificant portion of the local population would be impacted by the proposed MPMG Range with comprehensive mitigation as described in **Section 5.0**.

3. Carries out a Conservation and Management Plan that provides a long-term net benefit to the conservation of the State-listed species affected by the proposed Project which on or off-site permanent habitat protection, management or restoration of State-listed species habitat, and/or conservation research designed to benefit the species affected by a given project.

   MAARNG agrees to carry out a Conservation and Management Plan that provides a long-term net benefit to the conservation of State-listed species. MAARNG proposes various options for "net benefit" as described in **Section 5.0**.

Under 321 CMR 10.23, in determining the appropriate nature and scope of mitigation necessary to achieve the long-term net benefit performance standard, the following areal habitat mitigation ratios are required based on the category of State-listed species as identified in the MESA Regulations at 321 CMR 10.23(7)(a):

- **Endangered Species:** 3:1 (i.e., protection of three times the amount of areal habitat of the affected Endangered Species that is impacted by the Project or Activity);
- **Threatened Species:** 2:1 (i.e., protection of two times the amount of areal habitat of the affected Threatened Species that is impacted by the Project or Activity).
- **Special Concern Species:** 1.5:1 (i.e., protection of one and one half times the amount of areal habitat of the affected Species of Special Concern that is impacted by the Project or Activity).

In accordance with 321 CMR 10.23(7)(b), NHESP reserves the right to require, on a permit-by-permit basis, an areal habitat mitigation ratio or an alternative mitigation approach that differs from the ratios noted above. As impacts resulting from the proposed MPMG Range will only impact Threatened and Special Concern species, the MAARNG is proposing land preservation at the required 2:1 ratio for this Project. As discussed at the Site inspection held on 3 August 2019 with NHESP representatives, MAARNG has offered to double the acreage needed to ensure net benefit and that the long-term or perpetual component of mitigation will be addressed through the INRMP. That is, management of any habitat will be performed at a 4:1 ratio for impacts to Threatened species. The outline of these ratios as they relate to the MPMG Range Project are described more fully in **Section 3.4.**

1.5 Conservation and Management Permit

This Application describes the Camp Edwards existing conditions (**Section 2.0**), proposed MPMG Range conditions (**Section 3.0**), other projects and associated impact analysis (**Section 4.0**), and mitigation measures proposed (**Section 5.0**) and Fire Management (**Section 6.0**). **Section 5.0** is comprised of the Conservation and Management Plan (CMP Plan) associated with this CMP Application.

In accordance with NHESP guidelines for a CMP, in order to meet the MESA permitting standards outlined in **Section 1.4**, the MAARNG proposes the following measures to minimize rare species impacts and proposes other mitigation measures that will provide a long-term net benefit to the impacted species and species-specific mitigation as described in **Section 5.0** of this report:

- Land Preservation
  - Land Preservation by Transfer of Parcels to MassWildlife
  - Land Preservation with Management (Parcel H – Unit K)

    - Pine Barrens Forest Canopy Reserve Areas (FCRA)
- Management of existing habitat with Mitigation Focal Areas
    - Pine Barrens Mitigation Focal Areas
    - Grasslands Mitigation Focal Areas
- Monitoring and research of rare species
- Avoidance and minimization
- Cost of management

Detailed information on rare species impact minimization and net benefit mitigation consistent with that listed above is submitted as part of this Application in support of the issuance of a CMP. The mitigation measures detailed in **Section 5.0** outlines an approach to the MPMG Range project and other projects that ties specific species habitat mitigation commitments to each project with flexibility built in to determine the best mitigation for that project depending on habitat impacted. The CMP Plan also outlines the long-term habitat management plan and addresses mechanisms to ensure long-term implementation.

In accordance with the guidelines for preparing CMP applications, site photographs have been included in **Appendix A**, reduced scale site plans are provided in **Appendix B.** A compact disc (CD) has been included with copies of this Application, figures, and appendices in a map pocket at the back of this document. A full scale plan of the existing range conditions is included in a second map pocket. As MassWildlife owns the property where the projects are proposed and due to the complexity of the land ownership at Camp Edwards, a copy of the property deed(s) is not included with this Application.

1.6 Rare Species Mapping

According to the Massachusetts GIS (MassGIS) Online Mapping Tool “Oliver” and mapping conducted by the NHESP, the Site is located within Priority Habitat (PH 490) and Estimated Habitat (EH 435) as shown on **Figure 1-4**. The natural vegetative communities have been mapped by MAARNG for the JBCC as shown on **Figure 2-1**. The mapping of these communities include the various pine barren cover types and the managed or cultural grasslands have been used to determine the impacts from the MPMG Range and other projects proposed as described in **Sections 3.0** and **4.0**. Camp Edwards contains a unique diversity of natural vegetative communities that support State-listed rare species. The predominant communities include: Pitch pine oak forest (PPOF) woodlands, Pitch pine scrub oak (PPSO), Scrub oak shrubland (SOS), and Cultural or managed sandplain grasslands (MG) as described in **Section 2.0**.

1.7 Other Regulatory Requirements

In addition to MESA, projects and activities proposed at Camp Edwards require review under the Massachusetts Environmental Policy Act (MEPA), and are subject to the Federal Endangered Species Act, Camp Edwards Environmental Performance Standards, and other MAARNG natural resources programs as described below.

1.7.1 Massachusetts Environmental Policy Act

The Project requires filing with the Massachusetts Environmental Policy Act (MEPA) with the Executive Office of Energy and Environmental Affairs (EOEEA) as the Project exceeds the following MEPA thresholds and requires one State permit (the CMP):

- 301 CMR 11.03(1)(a)1. (Land) Direct alteration of 50 or more acres of land.
- 301 CMR 11.03(2)(b)2. (Rare Species) Greater than two acres of disturbance in designated priority habitat that results in a take of State-listed Endangered or Threatened species or Species of Special Concern.

- 301 CMR 11.01(2)(a)2. The MAARNG is an Agency of the Commonwealth. As such, MEPA jurisdiction is broad as the Project will be undertaken by an Agency of the Commonwealth in accordance with 301 CMR 11.01(2)(a)1. In addition, Camp Edwards is located on State-owned land leased to the Federal government and licensed back to the MAARNG.

Certain project and activities at Camp Edwards are subject to a Special Review Procedure (SRP) created and jointly executed by EOEEA and MAARNG so that the process under MEPA could be used more efficiently for the long-term use of Camp Edwards. A Notice of Project Change (NPC) is being submitted in accordance with the requirements of the Certificate on the Final Area-Wide Environmental Impact Report (EIR) for the MMR Master Plan issued by MEPA on 16 July 2001.

As part of the MMR Master Plan, Camp Edwards was set aside for permanent protection of water supplies, wildlife habitat, and open space, while allowing compatible military training. The MMR Master Plan was submitted to MEPA as a NPC in 1997 and subsequently work at MMR was designated as a "major and complicated" project. The SRP was further detailed in the Certificate on the NPC and the Major and Complicated Procedure issued on 10 July 1997.

For MAARNG projects at Camp Edwards, the SRP includes "lowered thresholds" for MEPA reviews (in addition to the stand-alone MEPA thresholds at 301 CMR 11.03) including impervious areas (more than 0.5 acres), vegetative clearing (more than two acres), and any new building or structure (more than 500 s.f.) The Project, as proposed, does not exceed the lowered threshold for impervious area as approximately 0.9 acres of impervious areas presently exists at the KD Range and the proposed MPMG Range will have approximately 0.8 acres of impervious areas, a reduction of 0.1 acres. The Project, as proposed, does exceed the lowered threshold for vegetative clearing (approximately 170.5 acres of clearing is proposed), and new buildings and structures of more than 500 s.f. (six structures are proposed, five of which are greater than 500 s.f., totaling approximately 3,595 s.f. of new construction). All Project activities are proposed within mapped Priority Habitat of Rare Species. In addition to the lowered thresholds, the SRP allows proposed actions to be reviewed using NPCs to be submitted under EOEEA #5834 and also provides expedited time frames.

1.7.2 Federal Endangered Species Act

The U.S. Fish and Wildlife Service (USFWS) administers the Federal Endangered Species Act (ESA) of 1973, as amended. The ESA protects listed species against killing, harming, harassing, or any action that may damage their habitat. An endangered species is in danger of extinction throughout all or a significant portion of its range, and a threatened species is likely to become an endangered species within the foreseeable future. Only one Federally-listed species, has been observed at the JBCC. The northern long-eared bat (*Myotis septentrionalis*) is listed as Threatened by the USFWS under the ESA. The MAARNG continues to work closely with the USFWS regarding the survey and monitoring of bats at Camp Edwards.

The New England cottontail (*Sylvilagus transitionalis*) which occurs on Camp Edwards was previously a candidate for listing under the ESA but due to successful conservation efforts, this species has not been listed. The MAARNG Natural Resource Office continues to work with partner agencies to implement the recovery plan to avoid Federal listing through habitat management and monitoring.

1.7.3 Environmental Performance Standards

The Environmental Performance Standards (EPS) are a list of requirements, or standards for performance, that guide both military and civilian users in the protection of Camp Edwards' natural and cultural resources and the groundwater beneath the Upper Cape Water Supply Reserve Area (the Reserve). during conduct of compatible military training and civilian use activities, such as hunting. These standards apply to the Reserve. The EPS are based in large part on already existing Federal, State, and Department of Defense

(DoD) regulations. In some cases, the protections offered by the EPS are more stringent than those offered by other regulations. Section 3 of the EPS provides the following Rare Species Performance Standards:

3.1 As the NHESP of MassWildlife has identified the entire MMR, (now JBCC), as State Priority Habitat for State-listed species, all activities and uses must comply with the MESA and its regulations.

3.2 Where activities and uses are not specifically regulated under the Camp Edwards Training Area Range and Environmental Regulations, including these EPS, the Environmental and Readiness Center (E&RC) must review the activities for conformance with the Integrated Natural Resource Management Plan (INRMP), and shall consult with the NHESP regarding potential impacts to State-listed species.

3.3 All activities impacting rare species habitat must be designed to preserve or enhance that habitat as determined by the E&RC in consultation with the NHESP

3.4 Users are prohibited from interfering with State and Federal-listed species.

3.5 Users will report all sightings of recognized listed species (e.g., box turtles), within any area of the JBCC.

The EPS provide for the protection and management of the vegetation of the Camp Edwards Training Area for focus on the following:

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

The EPS provide for the Adaptive Ecosystem Management approach to management of the Camp Edwards properties including:

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

Additional performance standards are included in the EPS for Habitat Management, Wildlife Management, Fire Management, and Range Performance Standards. All the standards and guidance provided in the EPS are incorporated into the Application and the mitigation measures included as part of the CMP Plan in **Section 5.0** and a copy is included in **Appendix C**.

1.7.4 Environmental Management Commission

The Environmental Management Commission (EMC) was created by Chapter 47 of the Acts of 2002 and Executive Order (EO) 443. The purpose of the EMC is to provide permanent protection of the drinking water supply and wildlife habitat of the Upper Cape Water Supply Reserve (the Reserve), created as public conservation land by Chapter 47 of the Acts of 2002, by oversight, monitoring and evaluation of all military and other activities on the reserve to ensure they are consistent with this purpose. The EMC oversees compliance with and enforcement of the EPS.

The MAARNG has presented information regarding the proposed MPMG Range location and design to the EMC and its advisory councils, the Science Advisory Council (SAC) and the Community Advisory Council (CAC). The CAC assists the EMC by providing advice on issues related to the protection of the water supply and wildlife habitat on the reserve; and the SAC assists the EMC by providing scientific and technical advice relating to the protection of the drinking water supply and wildlife habitat on the Reserve. Finally, the EMC has participated in meetings with the MAARNG and MassWildlife to establish a mitigation bank and overall strategy to facilitate implementation of long-term planning efforts including modernization of the Camp Edwards range complex and infrastructure. EMC approval of the Project will be required.

1.7.5 Natural Resources Management Programs

MAARNG has a combined Natural Resources Conservation Program and Integrated Training Area Management (ITAM) Program which is responsible for maintaining MAARNG land to help the Army meet its training requirements while ensuring healthy and sustainable habitats and ecosystems. The E&RC Natural Resource Office is responsible for the land management within Camp Edwards. A major objective of the ITAM Program is to ensure sustainability of MAARNG training with the natural resources of Camp Edwards by achieving the following goals:

- Integrate environmental planning procedures into all operations;
- Protect natural and cultural resources;
- Ensure compliance with existing statutory regulations;
- Monitor and research land condition and natural resources, and
- Actively implement habitat and landscape management for the benefit of native plants and animals, surrounding communities, and soldier training.

The ITAM portion of the program relies on its four components including the following:

- Training Requirements Integration (TRI);
- Range and Training Land Assessment (RTLA);
- Land Rehabilitation and Maintenance (LRAM); and
- Sustainable Range Awareness (SRA).

These components combine to provide the means to understand how the Army's training requirements impact land management practices, what the impact of training is on the land, how to mitigate and repair the impact, and communicate the ITAM Program message to soldiers and the public. Together, the ITAM Program and natural resource management ensures sustainable use of training lands as well as taking into consideration the surrounding environment and public concern. It is critical and required by Army regulation that land conservation result in no net loss of soldier training at Camp Edwards and that land management ensures the highest quality training to support a ready force. The ITAM Program integrates the training mission with landscape conservation to ensure mutual benefit for all stakeholders, which requires intensive planning, monitoring, and land management action.

1.8 Camp Edwards Mitigation Standards

MESA requires high level of Priority Habitat mitigation to provide net benefit to State-listed species. The number and breadth of impacted State-listed species results in a mitigation plan to provide for overall positive benefit for pine barrens and grassland associates of both open and closed forest conditions. The MAARNG has developed the following mitigation standards or actions for management at Camp Edwards which can be applied to proposed projects. In order to develop a Camp Edwards-wide approach to mitigation, percentages and associated acreages have been provided as a guide where appropriate.

- Standard #1 Mechanical Forestry (Pine Barrens)
- Standard #2 Prescribed Burns (Pine Barrens)
- Standard #3 Continued Management and Management (Pine Barrens)
- Standard #4 Manage Grasslands
- Standard #5 Monitoring and Research

Mitigation parcels are described in detail in **Section 5.0**. When determining mitigation for rare species impacts, the initial step is to determine if land preservation is possible. At Camp Edwards, land preservation can take three different forms: land transfer, land transfer with management of grasslands (under Standard #4), and Forest Canopy Reserve Areas. Management in pine barrens would be performed in accordance with Standards #1 through #3 as described below. Monitoring and research would be performed in all parcels except for those transferred as noted in **Table 1-1** below.

Standards #1 through #3 are specific to the pine barrens guild. All standards are proposed to be implemented over an eight year period starting in federal FY 2019. relative to the MPMG Range. Eight years is proposed for the primary mitigation effort so that a finite timeframe is established for mitigation implementations and expectations. At the end of the eight years, the primary mitigation effort can be reviewed to determine effectiveness on the rare species at Camp Edwards. Mitigation efforts using Standards #1, #2, and #4 were initiated in FY 2019 and are quantified in **Section 5.5.** Timelines may be adjusted through annual coordination if mutual agreement is reached. It is also intended that this mitigation framework will continue beyond the eight years as long as it is found to be providing the expected benefit to State-listed species and other resources.

Accordingly, in order to provide a long-term net benefit to the impacted species, the MAARNG proposes to use a combination of land transfers (i.e., “land protection”) and establishment of a “Mitigation Bank” comprised of approximately 3,400 acres for pine barrens habitat, approximately 1,180 acres for forest cover retention, 150 acres of intensive management, and a reserve of approximately 250 acres for potential sandplain grassland creation. The combination of parcel transfers and habitat management or conversion within mitigation bank focal areas will provide for net benefit of all impacted State-listed species while also establishing a framework for proactively mitigating impacts of future projects.

Table 1-2: Mitigation Parcels and Mitigation Standards

Mitigation Parcel/ Standards	Land Preservation	#1 Mechanical Forestry Pine Barrens	#2 Prescribed Fire Pine Barrens	#3 Continued Management Pine Barrens	#4 Grassland Management	#5 Monitoring and Research
Land Preservation: Transfer of Parcels						
Tracts 1-4	y					
Tract 5	y					
Land Preservation: Land Transfer with Management of Grasslands						
Parcel H - Unit K	y				y	y
Land Preservation: Forest Canopy Reserve Area						
Primary FCRA	y					y
Secondary FCRA	y					y
Management: Pine Barrens Mitigation Focal Area						
Northern Unit		y	y	y		y
Western unit		y	y	y		y
Southern Unit		y	y	y		y
MPMG Zone		y	y	y		y

When determining acres of mitigation, there are two concepts to take into consideration. “Mitigation acres” refers to those acres of land preservation required based on acres of take multiplied by the rare species ratio as described in **Section 1.4**.

“Acres being mitigated” refers to those acres where management of the habitat will occur to create and/or manage high-quality habitat for rare species. As describe in **Section 1.4**, MAARNG is proposing a habitat management ratio of 4:1, double what is required for land protection.

1.8.1 Standard #1: Mechanical Forestry (Pine Barrens)

In any management year, an estimated 30% (minimum of 20%, maximum of 40%) of pine barrens habitat mitigation acres required for a specific project, will be in the form of mechanical timber harvesting by thinning stands and significantly increasing solar exposure to the shrub layer and encourage scrub oak and heath understory and resulting in the enhancement of moth habitat. A range is provided as in any year, factors could affect the amount of mitigation work performed including but not limited to weather conditions, funding, monitoring of species, etc. According to Mello (2017), the majority of State-listed moths at Camp Edwards require open canopy SOS (less than 50% pine canopy cover) and requiring/tolerating frequent fire (see Standard #2). This work will primarily benefit the following State-listed species:

- State-listed species lepidoptera
- Eastern Whip-poor-will
- Northern harrier *(Circus cyaneus)*
- Broad Tinker’s Weed *(Triosteum perfoliatum)*

Specifications for this standard include increasing tree stem spacing to approximately 20 feet or more, on average, for a stand. This may include actions such as creating and maintaining shaded fuel breaks at the MPMG Range or large shrub savanna restorations at Wheelock Overlook, one of the Pine Barrens Mitigation Focal Areas discussed in **Section 5.2.2**. A shrub savanna, for purposes of this CMP, is comprised of sparse tree canopy shrubland. This standard can be applied to any of the four Pine Barrens Focal Mitigation Areas.

1.8.2 Standard #2: Prescribed Fire (Pine Barrens)

In any management year, an estimated 70% (minimum of 60%, maximum of 80%) of pine barrens habitat mitigation acres required for a specific project, will be in the form of prescribed fire to improve pine barrens habitat by reinvigorating understory (forbs, shrubs), reduce fuels, increase solar exposure, etc. Standard #2 is critical to supporting pine barrens species of flora and fauna. Prescribed fires (or burns) as mitigation and/or management includes standard wildland fire tactics and the creation of fire breaks (typically mowed understory) as further described in **Section 6.0.** Prescribed firebreaks are mowed lines that are either allowed to fully regenerate or receive occasional re-mowing (e.g., every two years) depending upon the burn unit and planned burns. Areas where Standard #2 will be implemented include Pine Barren Focal Areas and burn units that have not been burned within the preceding 10 years. See **Section 6.0** for locations of burn units and fire management descriptions.

Prescribed burns will be implemented as able throughout the year to achieve a mosaic of fire effects and habitat. Burns will be planned and implemented to improve open pine barrens conditions for dependent species, including improvement of frost bottom functioning where relevant. Continued management within the Pine Barrens Mitigation Focal Areas is anticipated over the long-term to maintain mitigation benefit. A total of 832 acres over the next eight years is anticipated as direct mitigation for the MPMG range habitat impacts. This standard can be applied to any of the four Pine Barrens Focal Mitigation Areas.

1.8.3 Standard #3: Continued Management and Maintenance (Pine Barrens)

Standard #3 provides for the continued management within Pine Barrens Mitigation Focal Areas (see **Section 5.2.2**) to ensure the mitigation benefit is carried forward and to address any concerns about habitat maintenance. Areas will be managed either with mechanical forestry or prescribed burns to be used as maintenance (e.g., re-entry burns, burning harvested sites) or improvement of new locations with forestry or fire with equivalent benefit. Continued management and maintenance acres may be applied at previously managed sites in Focal Areas (e.g., maintenance) or new locations within these Focal Areas to expand on managed areas and overall habitat benefit.

1.8.4 Standard #4: Manage Grasslands

Standard #4 allows for managing existing grasslands and the continued conversion of the former parade field (Parcel H - Unit K) back to sandplain grassland habitat over eight years. This work would include a combination of targeted herbicide treatment of invading woody plants, mowing, tree harvesting, and prescribed fire. Typically, less than 30% of available grassland habitat will be impacted within a six-month period with any of the methods noted here. Both habitat effects and species monitoring have demonstrated the best results are achieved through a combination of restoration techniques within the six-month period as opposed to broader use of a single method. The priority and focus of grassland mitigation will be to manage the 150-acre transferred parcel for MassWildlife with agreed-upon standards and annual coordination for a period of eight years. MAARNG proposes to manage this area at approximately 27 acres each year for eight years.

Mitigation credit would not be applied by MassWildlife for the transfer/protection of 150 acres until the habitat was fully converted to MG. However, the conversion and management over the eight-year period will mitigate the primary projects in this Plan (MPMG Range, TTHQ) and will provide capacity for additional projects that may arise in the future (e.g., solar).

The primary projects requiring grassland mitigation are the MPMG Range (36 acres at 1:1) and TTHQ (18 acres at 4:1 = 72 acres) for a total required mitigation of 108 acres. The proposed management of the 150-acre Parcel H – Unit K for conversion and long-term maintenance provides significant net benefit compared to the unoccupied (MPMG Range, TTB L2[1]) or minimally occupied (TTHQ, 1300 area) habitat. Surveys have documented indicator plants suggesting the core of the 150 acres was never plowed so a longer term conversion and maintenance is proposed to minimize soil disturbance and maintain occupancy by current rare species (e.g., Grasshopper Sparrow, Frosted Elfin). A minimum of 20 acres per year will be managed with a target of 27 acres per year at this parcel. Some years, as in 2019, significantly more management may be accomplished (e.g., 127 acres) while both avoiding the 30% threshold target and not precluding annual conversion or maintenance. The annual target of 27 acres per year of management over 8 years (for a total of 216 acres) would fully mitigate for not only the MPMG Range but also for the TTHQ.

As an emergency backup for robust planning, we have identified grassland mitigation sites for potential conversion from pine barrens to sandplain grasslands (see **Section 5.2.3)** similar to what has been done at Crane WMA (see **Figure 5-1).** However, maximum conservation benefit can be realized through significant improvement within the existing grasslands rather than isolated clearings to the west. Botanical surveys within PU found multiple indicator species showing plowing and other soil disturbance never occurred within the wooded areas within PU. Proposed grassland mitigation focus on maximum net benefit which will come from converting all of PU to sandplain grassland condition. The grassland mitigation focus areas will only be used as part of this mitigation strategy in the event that unforeseen circumstances rule out the above-

[1] Tactical Training Base (TTB) Helicopter Landing Zone (LZ)

described plans for PU. This conversion of the grassland focal areas (purple) would require extraction of trees and shrubs, harrowing, and extensive seeding.

1.8.5 Standard #5: Monitoring and Research

Standard #5 allows for monitoring and research of rare species (and other species) as mitigation pursuant to MESA which requires a baseline level of monitoring of State-listed species to evaluate the impacts of both the mitigation actions and the range development/use. Monitoring plans are still in development by MAARNG, but include continued long-term grassland bird monitoring, box turtle monitoring, and lepidopteran surveys. See **Section 2.13** for more monitoring and research information that has been completed, is ongoing, and is proposed.

1.9 MAARNG Mission and History of Camp Edwards

Camp Edwards is the primary military training facility for Army National Guard (ARNG) soldiers throughout New England and serves as the primary pre-mobilization training site for the MAARNG and Reserve Component units in the northeast U.S. The training range requirements for Camp Edwards have increased dramatically due to State and Federal mission statements. Camp Edwards' primary mission is to prepare Soldiers for combat missions overseas as well as missions to serve and protect the homeland stateside. The Federal Mission is "…to provide well-equipped, well-trained Soldiers to support National Security Objectives and interests." The State Mission is to provide the Governor of Massachusetts with trained, equipped, and organized units to assist civil authorities in the preservation of life and property.

The MPMG Range is a programmed FY 2020 Military Construction (MILCON) project and is part of the Camp Edwards Range Complex Master Plan. There are no National Guard equivalent ranges anywhere within reasonable commuting distance. The three closest MPMG ranges include Camp Ethan Allen in Jericho, Vermont located over 270 miles away, Fort Dix in Ocean County, New Jersey located over 300 miles away, and Fort Drum located in Jefferson County, New York located over 370 miles away. The following MAARNG Units would utilize the proposed MPMG Range: 164 Transportation Battalion, 126 Support Battalion, 1st Battalion 181st Infantry Regiment, 101st Engineer Battalion, 1st Battalion 101st Field Artillery Regiment, 3rd Battalion, 126th Aviation Regiment, 1st Battalion, 182nd Infantry Regiment, 211th MP Battalion, 1st Battalion 150th Aviation Regiment and their supporting companies. A total of 103,864 man-days of training occurred at Camp Edwards for military personnel in TY (Training Year) 2018. The MAARNG has approximately 5,880 soldiers who train on average one weekend per month and one two-week cycle during a training year.

Records indicate that the earliest general usage for the small arms ranges (SARs) at JBCC was in the World War II period starting around 1940. A variety of small arms used at these ranges included pistols, rifles, shotguns, sub-machine guns and machine guns including small arms ammunition ranging from 5.56 ball rounds to .50 caliber machine gun rounds. A number of the small arms ranges have undergone multiple uses since World War II, including conversion between use as pistol ranges and use as rifle and/or machine gun ranges. Except for a period from the 1980s to the present, historical information concerning the numbers of rounds of specific types of ammunition used at each range is largely unavailable.

From 1994 to 2005, Camp Edwards training records indicate that the SARs were not being used to their design capacities. Use of the ranges had declined significantly since 1997 when lead ammunition was no longer allowed. A comparison of current range configurations with standard Army range designs found in TC 25-8 revealed that many of the Camp Edwards SARs are non-standard ranges, meaning they do not meet the requirements for SARs set out in the TC. Typically, the Camp Edwards SARs do not have the required number of targets nor the types of targets required to meet the standard range designs. Also, the Camp Edwards ranges typically do not provide the required distances between firing points and targets to meet the

most stringent qualification standards. As such, the MAARNG implemented the SAR-IP upgrades to ranges. To date, six ranges have been updated.

The U.S. Environmental Protection Agency (USEPA) banned live fire at Camp Edwards in 1997 due to concerns about contaminated water supplies from lead ammunition through the issuance of Administrative Order 1 (AO1) and 2 (AO2). Since that time, the MAARNG has worked with State and Federal agencies to resume the use of live fire through the SAR Improvement Project and pursuant to AR 350-19 (The Army Sustainable Range Program). The SAR Improvement Project allows MAARNG to continue with the resumption and improvement of small arms weapons training at Camp Edwards to military standards in a manner that protects both human health and the environment (particularly groundwater). The MPMG Range was envisioned as one of those improvement projects at the KD Range.

2.0 Existing Conditions

This section of the Application describes existing site conditions, current and abutting land uses, natural communities and guilds, State-listed species, previous natural resource surveys which have been performed at Camp Edwards that have helped to describe the natural communities and identify rare species.

2.1 Existing Site Conditions

Camp Edwards contains a unique diversity of natural vegetative communities that support State-listed rare species (see **Figure 2-1**). The predominant communities include:

- Pitch pine oak forest (PPOF) woodlands
- Pitch pine scrub oak (PPSO)
- Scrub oak shrubland (SOS)
- Cultural or managed sandplain grasslands (MG)

These communities are described in **Section 2.3**. Native grassland communities comprise a relatively small portion of Camp Edwards but provide important habitat for State-listed rare species and are managed to support an Atlantic coastal sandplain grassland community. Few wetland communities exist on Camp Edwards and are all classified as palustrine. Rare species inhabiting Camp Edwards are found in four broad vegetation groups:

- Species that require large unfragmented sections of forest, such as the Eastern Box Turtle
- Species that are pine and scrub oak barrens specialists, such as most of the rare moths
- Species that occur in wetland areas, such as Torrey's beak Sedge (*Rhynchospora torreyana*)
- Species that require grasslands, such as the Upland Sandpiper (*Bartramia longicauda*)

2.2 Current and Abutting Land Use

Camp Edwards is one of the largest undeveloped tracts of land over 10,000 acres, along the coast, from Maine to New Jersey comprised of large tracks of woodlands surrounded by highways, residential communities, and business development. The Shawme-Crowell State Forest, used for recreational purposes, borders the northern boundary of Camp Edwards and the Frances Crane Wildlife Management Area (Crane WMA) borders the JBCC along the southern boundary, also used for recreation and wildlife habitat.

Although the upper portion of Cape Cod was sparsely populated in the 1930s when Camp Edwards was first established, the residential population has exhibited one of the fastest rates of growth in the U.S. Approximately 70 percent of the perimeter of Camp Edwards is surrounded by residential development. In these areas, residential development is within one half mile of the boundary of Camp Edwards and often directly adjacent to the fences. The Cantonment Area in the southern portion of Camp Edwards adjoins the remainder of the JBCC, which includes OANGB, the Veteran's Administration Cemetery, USCG Housing, and the USCG Golf Course. The Coast Guard transmitter station is adjacent to Camp Edwards at its eastern border. The USAF PAVE PAWS Radar station is located within the northern portion of Camp Edwards.

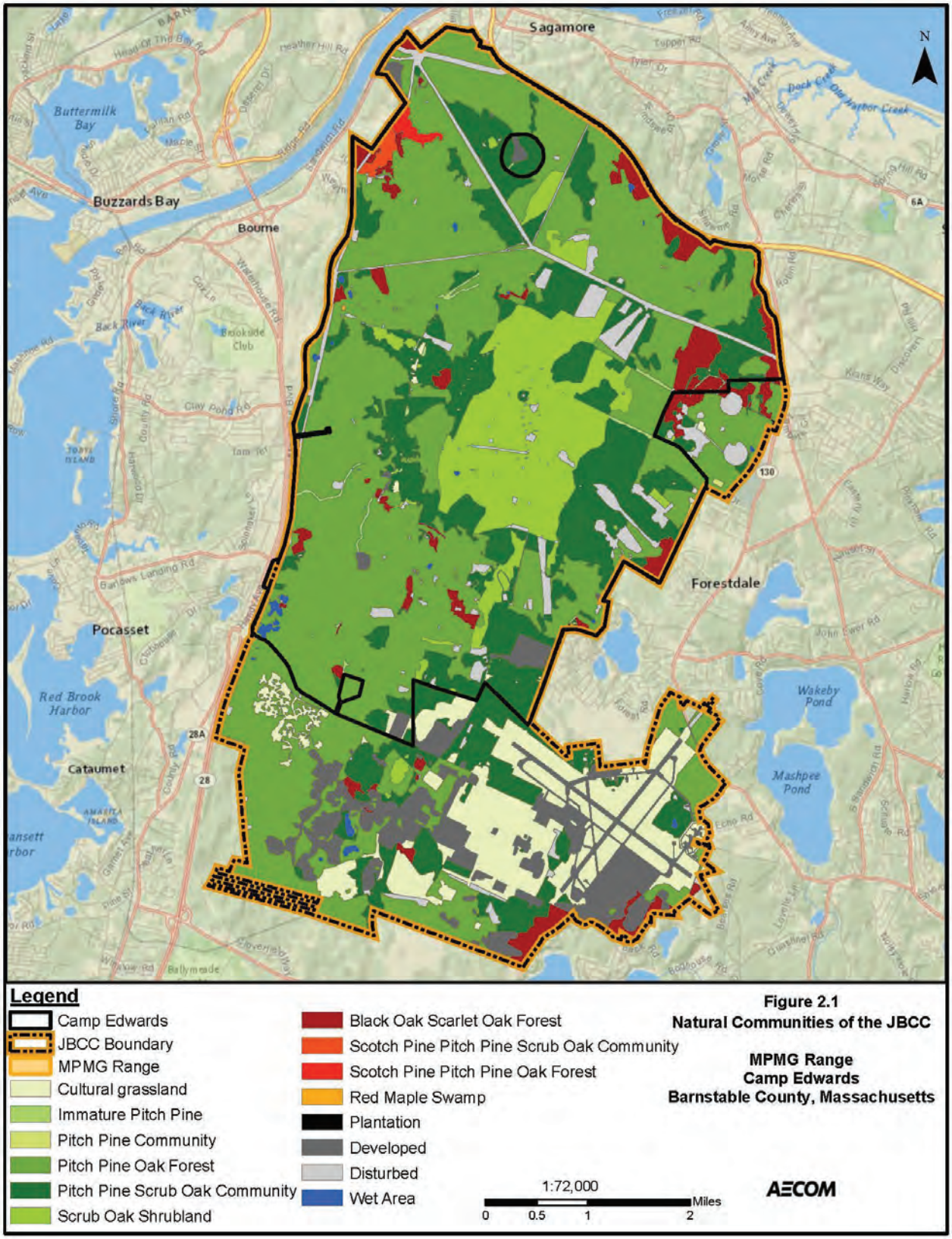


Figure 2.1
Natural Communities of the JBCC

MPMG Range
Camp Edwards
Barnstable County, Massachusetts

The only parts of Camp Edwards that are not directly bordered by development are at the northern and southern ends of the perimeter. The far northern end of Camp Edwards is adjacent to the Cape Cod Canal. Although no development currently exists in this area, the land is highly sought after for residential homes. The northeastern corner of Camp Edwards abuts Shawme-Crowell State Forest. Although the state forest is only 742 acres in size, it is the most highly used state forest in southeastern Massachusetts.

2.3 Natural Communities

The following are descriptions of the natural communities of Camp Edwards as per the Classification of Natural Communities (Swain and Kearsely 2001) that are located in and adjacent to the MPMG Range and at the other projects locations

- Pitch Pine-Oak Forest/Woodland (PPOF)
- Pitch Pine-Scrub Oak Community (PPSO)
- Scrub Oak Shrubland/Frost Bottoms (SOS)
- Cultural or Managed Grasslands (MG)
- Wetlands

2.3.1 Pitch Pine-Oak Forest/Woodland (PPOF)

The pitch pine-oak forest woodland (PPOF) of Camp Edwards varies with degree of maturity. The structure of the forest ranges from a low canopy with a dense shrub layer to a taller canopy with a sparser shrub layer. In general, the plant community is in a mid-successional state where trees and shrubs are increasing in number, while forbs and grasses are becoming less abundant. The woodlands in the northern area of Camp Edwards tend to have a higher and denser canopy than the other forest communities. This may be due to less historic disturbance, resulting in a more mature forest.

The pitch pine-oak forest woodland of Camp Edwards has a low canopy of pitch pine (*Pinus rigida*) and tree oaks (black oak (*Quercus velutina*), scarlet oak (*Q. coccinea*), and white oak (*Q. alba*) and a moderately continuous shrub layer of blueberry (*Vaccinium* spp.), black huckleberry (*Gaylussacia baccata*), sheep laurel (*Kalmia angustifolia*), and scrub oak (*Q. ilicifolia*). The sparse forb layer consists of bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), and Pennsylvania sedge (*Carex pensylvanica*), The low forest canopy, about 10-15 m tall, indicates a relatively young forest of no more than 100 years old and site-wide forest assessments in 1997 and 2003 indicate nearly all of this community dates to the mid-1950s or newer, which is consistent with historic photos and aerial imagery. PPOF near the MPMG Range and other project sites has a high percentage of scrub oak in the understory and is functionally lumped in with PPSO.

2.3.2 Pitch Pine-Scrub Oak Community (PPSO)

In areas of significant past disturbance and/or much of the moraine, the overstory community is almost entirely pitch pine with an understory of sometimes very dense scrub oak which creates the pitch pine-scrub oak (PPSO) community. Other tree species that are present but not common to the community are scotch pine (*Pinus sylvestris*), white oak, and black/scarlet oak. Scotch pine was likely introduced to Camp Edwards in the late 1920s and the early 1930s as plantations in Shawme-Crowell State Forest. The prevalent shrub species of this community are black huckleberry (*Gaylussacia baccata*) and blueberry which are commonly interspersed among the more dominant scrub oak. The structure of the pitch pine-scrub oak communities varies greatly with age. Younger stands are short, dense thickets of immature pitch pine associated with significant recent disturbance. White oak is increasing significantly in understory where fire has been excluded and threatens to convert the community.

A smaller portion of the PPSO community is comprised of immature pitch pine, is relatively low in plant diversity, and often occurs along roads, old firebreaks, or other previously disturbed areas. As the pitch pine

matures, the forest has a more closed canopy, which ultimately out competes scrub oak and nearly all other species for sunlight. However, in areas where pitch pine has been cleared, scrub oak often grows in extremely dense patches. In the pitch pine-scrub oak community trees, and shrubs in general, are growing at a rate greater than in any other plant community, indicating a somewhat young, but rapidly maturing forest. The diversity of the pitch pine-scrub oak community, 51 plant species, is about average for the plant communities of Camp Edwards. However, pitch pine and scrub oak are the dominant and most productive species in the community. This is an extremely fire prone plant community and present an extreme wildlife hazard as it matures and scrub oak meets canopy.

2.3.3 Scrub Oak Shrubland (SOS)

Much of Upper Cape Cod has been dominated by pitch pine and scrub oak shrublands or barrens (SOS) since the period of colonial settlement. The area has been maintained in an early successional state as a result of intensive timber harvesting and successive catastrophic fires. Fire and frost effects typically suppress the growth of pitch pine and other tree species while promoting the growth of scrub oak creating frost bottoms. Fire scarring causes scrub oak acorns to germinate more readily and terminal buds to die, resulting in the growth of lateral branches. Frequent late spring frosts result in chronic dieback of developing leaves, slow growth rates, and reduced stem height which promotes shrub growth. Eventually, large herds of sheep were grazed throughout the Upper Cape, which limited tree growth and promoted the establishment of the scrub oak barren habitats.

The SOS covers 2,107 acres, or 15 percent of Camp Edwards, mostly within the Impact Area. This plant community represents one of the earliest states of vegetative succession on Camp Edwards and consists primarily of scrub oak with essentially no pitch pine. Other common plants in the scrub oak barrens include black huckleberry, blueberry, cat brier (*Smilax glauca*), and wintergreen. The majority of SOS at Camp Edwards is at significant risk of loss due to forest (pitch pine) encroachment due to lack of fire from artillery and historic sources. Efforts to provide this habitat outside the Impact Area are underway.

2.3.4 Cultural or Managed Grasslands (MG)

Cultural or Managed Grasslands (MG) are human created and maintained open communities dominated by grasses. Mowing is the typical maintenance, however on Camp Edwards; fire has played and is playing a more important role. Only 175 acres of MG are located on Camp Edwards in portions of the Cantonment Area. The remainder of the grasslands of the JBCC are managed by other military services. MG were historically cleared for use as parade grounds, barracks areas, and airfield during World War II. The existing MG and management area is shown in **Figure 2-2**.

The cultural grasslands are one of the least diverse plant communities on Camp Edwards, with only 37 identified species during a floristic inventory. The community is dominated by grass species including little bluestem (*Schizachyrium scoparium*), big bluestem (Andropogon gerardii), switchgrass (*Panicum virgatum*), hairgrass (*Deschampsia flexuosa*), redtop (*Agrostis gigantea*), poverty grass (*Danthonia spiccata*), and Pennsylvania sedge (*Carex pensylvanica*). The only common tree species is immature pitch pine and red cedar. Sweetfern (*Comptonia peregrina*) was found in dense thickets less than a meter in height, whereas bayberry (*Myrica pensylavanica*), blueberry, and scrub oak were present, but less common. Many nonnative species such as honeysuckle (*Lonicera* spp.), Asiatic bittersweet (*Celastrus orbiculata*), autumn olive (*Elaeagnus umbellata*), and spotted knapweed (*Centaurea maculosa*) occur in the cultural grasslands of Camp Edwards and the JBCC. However, intensive management effort is focused on increasing plant diversity and reducing invasive plants. Best effect has been found in concentrating a combination of herbicide, fire, and mowing within an individual unit as opposed to broader treatments with a single method.

2.3.5 Wetlands

The ponds and wetlands at Camp Edwards, which comprise only 55 acres, or less than one percent, are the most diverse plant community on the installation. A total of 67 plant species were documented in the wetlands. There are six different types of wetlands based on the "Classification of Natural Communities in Massachusetts". They are Ponds, Coastal Plain Pond Shore, Kettlehole Level Bogs, Red Maple Swamps, Highbush Blueberry Thickets, and Woodland Vernal Pools. In addition, there are other types of bogs which are unique and not found in large acreages such as a Sphagnum Moss (*Sphagnum* spp.) Bogs comprised primarily of sphagnum moss and cranberry (*Vaccinium macrocarpon*) and Woodland Vernal Pools, and Highbush Blueberry Thickets that lack standing water for much of the year.

The MPMG Range and the majority of the other proposed projects do not include any wetlands within the project footprint. Additional details on these wetland resource area can be found in the 2009 INRMP. Range and other project designs will specifically avoid impacting wetlands and will comply with the Massachusetts Wetlands Protection Act and town bylaws.

2.3.6 Invasive Species

Although not a cover type, invasive species deserve a mention as they may impact mitigation efforts. As mentioned above, many nonnative and invasive species such as honeysuckle (*Lonicera* spp.), Asiatic bittersweet (*Celastrus orbiculata*), barberry (*Berberis thunbergii*), autumn olive, and spotted knapweed occur in the grassland area. There are ongoing management efforts to remove these exotic, invasive plant species. Some exotic and invasive plant species benefit from disturbance which tend to out-compete native species and proliferate in disturbed systems. One example of such a proliferation is that of knapweed (*Centaurea maculosa*) in the Cantonment Area which quickly establishes and out-competes native species in disturbed areas. It should be noted however, that the knapweed is slowly displaced by native bluestem grasses over a period of several years. Areas surrounding the existing KD Range, especially adjacent to parking and firing lines have particular abundance of some nonnative invasive plants including barberry, honeysuckle, and bittersweet.

2.4 Guilds

In addition to the vegetative communities described above, "guilds" have been identified at Camp Edwards to use for mitigation efforts. A guild is a grouping of species that may utilize similar natural resources such as vegetation cover types. For Camp Edwards, there are four vegetative guilds and three guilds based on a specific State-listed species (i.e., Eastern Box Turtle, Eastern Whip-poor-will, and Northern Harrier). In order to determine the mitigation ratios for projects impacts (as described in **Section 1.4**), we assigned the highest level of protection for species within that natural community or guild as shown in **Table 2-1** according to those species known to exist within these communities at Camp Edwards.

Table 2-1: Natural Communities and Guilds at Camp Edwards

Guild Associations	Natural Communities	Mitigation Level
Pine Barrens Guild	PPOF, PPSO, SOS	Threatened (2:1)
Grassland Bird Guild	MG	Threatened (3:1)
Frost Bottom Plant Guild	SOS Frost Bottoms	Endangered (3:1)
Wetlands	Wetlands	Endangered (3:1)
Eastern Whip-poor-will	PPOF, PPSO, SOS	Species of Special Concern (1.5:1)
Eastern Box Turtle	PPOF, PPSO, SOS	Species of Special Concern (1.5:1)
Northern Harrier	MG	Threatened (2:1)
Bats	PPOF, PPSO, SOS	Endangered (3:1)

2.5 State-Listed Species

Based on existing records and extensive surveys, State-listed plant and wildlife species at Camp Edwards are summarized in the following tables. **Table 2-2** includes the State-listed plants that have been identified at Camp Edwards. **Table 2-3** includes a summary of all State-listed species identified at Camp Edwards by rank. **Table 2-4** includes the State-listed wildlife observed at Camp Edwards. Based on surveys and observations made at Camp Edwards, earlier successional habitats (e.g., frost bottoms, SOS, sandplain grassland) are being lost to forest encroachment – especially within the Impact Area and other unexploded ordnance (UXO) hazard areas where the MAARNG is unable to implement management projects. The primary driver behind declines in some of the State-listed moths at Camp Edwards is a lack of fire in SOS and the dramatic incursion of pitch pines into shrublands and frost bottoms after the secession of artillery fires in the Impact Area.

Table 2-2: State-Listed Plant Species at or Near Camp Edwards

Scientific Name	Common Name	State Status	Federal Status	Habitat
Eleocharis ovata	Ovate Spike-sedge	E	-	Wetlands
Juncus debilis	Weak Rush	E	-	Wetlands
Malaxis bayardii	Bayard's Green Adder's Mouth	E	-	PPSO, MG
Ophioglossum pusillum	Adder's Tongue Fern	T	-	Wetlands
Rhynchospora torreyana	Torrey's Beak Sedge	E	-	SOS Frost Bottoms
Scleria pauciflora	Papillose Nut Sedge	E	-	PPSO, MG, Powerlines
Triosteum perfoliatum	Broad Tinker's Weed	E	-	SOS Frost Bottoms

Source: NHESP letter dated 16 August 2019
E = Endangered, T = Threatened, SC = Special Concern

Table 2-3: Summary of State-Listed Rare Species Documented at Camp Edwards

Taxon	Special Concern	Threatened	Endangered	Total
Birds	1	3	1	**5**
Reptiles/amphibians	1	1	0	**2**
Odonates	0	1	0	**1**
Moths and Butterflies	12	6	0	**18**
Beetles	1	0	0	**1**
Crustacea	0	0	1	**1**
Mammals		0	4	**0**
Subtotal	**15**	**11**	**6**	**32**
Plants	0	1	6	**7**
Total	**15**	**12**	**12**	**39**

Table 2-4: State-Listed Rare Species at Camp Edwards

Scientific Name	Common Name	State Status	Federal Status
Birds			
Ammodramus savannarum	Grasshopper sparrow	T	-
Bartramia longicauda	Upland sandpiper	E	-
Caprimulgus vociferus	Eastern Whip-poor-will	SC	
Circus cyaneus	Northern harrier	T	-
Pooecetes gramineus	Vesper sparrow	T	-
Reptiles and Amphibians			
Scaphiopus holbrookii	Eastern spadefoot	T	-
Terrapene carolina	Eastern box turtle	SC	-
Odonates			
Enallagma recurvatum	Pine Barrens bluet	T	-
Moths and Butterflies			
Abagrotis nefascia	Coastal heathland cutworm	SC	-
Acronicta albarufa	Barrens daggermoth	T	-
Callophrys irus	Frosted elfin	SC	-
Catocala herodias gerhardi	Gerhard's underwing moth	SC	-
Chaetaglaea cerata	Waxed sallow moth	SC	-
Cicinnus melsheimeri	Melsheimer's sack bearer	T	-
Cingilia catenaria	Chain dot geometer	SC	-
Cycnia inopinatus	Unexpected cycnia	T	-
Euchlaena madusaria	Sandplain euchlaena	SC	-
Dargida rubripennis	The Pink streak	T	-
Hemaris gracilis	Slender Clearwing Sphinx	SC	-
Hemileuca maia	Barrens buckmoth	SC	-
Lycia ypsilon	Pine barrens lycia	T	-
Metarranthis pilosaria	Coastal swamp metarranthis	SC	-
Papaipema sulphurata	Water-willow stem borer	T	-
Psectraglaea carnosa	Pink sallow moth	SC	-
Speranza exonerata	Pine barrens speranza	SC	-
Zale lunifera	Pine barrens zale	SC	-
Beetles			
Cincindela purpurea	Purple tiger beetle	SC	-
Crustacea			
Eulimnadia agassizii	Agassiz's clam shrimp	E	-
Mammals			
Myotis septentrionalis *	Northern long-eared bat	E	T
Myotis leibii *	Small-footed myotis	E	-
Myotis lucifugus *	Little brown bat	E	-
Perimyotis subflavus *	Tri-colored bat	E	-

Source: NHESP letter dated 16 August 2019 * From surveys performed at Camp Edwards
E = Endangered, T = Threatened, SC = Special Concern

2.6 State-listed Bird Species

2.6.1 Grasshopper Sparrow

The Grasshopper Sparrow (*Ammodramus savannarum)* is listed as Threatened by NHESP. On Camp Edwards, this bird is associated with MG. Grassland bird surveys have occurred annually since at least 1994, supplemented by targeted research projects including mist-netting, color-banding, and geolocators to evaluate Grasshopper Sparrow migration and habitat use. Grasshoppers Sparrows have responded positively to the increased level of management and resultant habitat at JBCC and Crane WMA.

2.6.2 Upland Sandpiper

The Upland Sandpiper (*Bartramia longicauda)* is listed as Endangered by NHESP. On Camp Edwards, this bird is associated with MG. Grassland bird surveys have occurred annually since at least 1994, supplemented by targeted research projects including netting and use of satellite and GPS tags to research Upland Sandpiper migration and habitat use. Upland Sandpipers are remaining relatively stable at JBCC, though apparently increasing on the airfield and capped landfill.

2.6.3 Eastern Whip-poor-will

The Eastern Whip-poor-will (*Caprimulgus vociferous)* is listed as species of Special Concern by NHESP. On Camp Edwards, this bird is associated with PPSO, SOS, and PPOF. Intensive telemetry studies were conducted to evaluate habitat use, nesting, and home ranges of whip-poor-wills at Camp Edwards from 2005 through 2009. Whip-poor-wills were primarily found to prefer habitat edges nearer training roads, bivouacs, and similar sites. Whip-poor-will monitoring has been occurring at Camp Edwards since the late ‘1990s and has been annual since 2010 with significantly increased effort since 2014. Whip-poor-wills are generally stable throughout Camp Edwards, but based on challenging survey conditions results fluctuate year to year. Next year, 2020, will be the final year of an intensive migratory study of whip-poor-wills in a partnership between MAARNG, MassWildlife, and Worcester Polytechnic Institute, though annual monitoring will continue.

2.6.4 Northern Harrier

The Northern Harrier (*Circus cyaneus*) is listed as a Threatened species by NHESP. Northern Harriers establish nesting and feeding territories in wet meadows, grasslands, abandoned field, and coastal and inland marshes, mostly along the coast. In Massachusetts most Harriers that do not migrate south spend the winter in coastal marshes and the offshore islands. After the young have fledged, they may hunt together with their parents through the remainder of the summer, until they disperse on their own or are driven off. In Massachusetts Harrier’s diet primarily consists of voles and there is a direct correlation between the breeding success of the Harrier and the number of voles found in their territory. On Camp Edwards, this bird is associated with SOS.

2.6.5 Vesper Sparrow

The Vesper Sparrow (*Pooecetes gramineus)* is listed as Threatened by NHESP. On Camp Edwards, this bird is associated with MG. Despite active management and monitoring Vesper Sparrows have declined to the point where they have not been detected the last few years during annual grassland bird and site-wide bird monitoring at Camp Edwards and JBCC.

2.7 State-listed Reptiles and Amphibians

2.7.1 Eastern Spadefoot

The Eastern Spadefoot Toad (*Scaphiopus holbrookii*) is listed as Threatened by NHESP. These toads require dry sandy loams characteristic of pine barrens and can burrow up to eight feet deep during cold temperatures or if weather conditions are dry. On Camp Edwards, this toad has never been encountered despite intensive surveys (including acoustic surveys) in vernal pools, road puddles, and wetlands. There has been one observation at the National Cemetery.

2.7.2 Eastern Box Turtle

The Eastern Box Turtle (*Terrapene carolina)* is listed as a Species of Special Concern by NHESP. Box turtles are habitat generalists, but PPOF and PPSO woodlands are generally considered to be their optimum habitat. On Camp Edwards, this turtle is associated with all cover types. The eastern box turtle has been observed in nearly every natural community on Camp Edwards, including grasslands, forests, and disturbed areas (e.g., bivouacs, powerline easements, lawns). The species is common to the forests and scrub oak barrens. These turtles are not considered habitat limited and may be limited by roads and road mortality.

Eastern Box Turtles have been sighted over the past 20 years on Camp Edwards and have occurred throughout the entire installation. As of the 2009 INRMP, approximately 170 individuals have been recorded, 46 of which were marked. Each individual that was marked was also measured (i.e., carapace length and width), weighed, sexed, and aged. As a result of the relatively high incidence of eastern box turtle sightings, the Natural Resource Office attached transmitters to 10 individuals to monitor their movements and habitat use each year for five years. Preliminary analysis of the data indicates that, in general, Eastern Box Turtles are ubiquitous within the ecosystem of Camp Edwards. Home ranges of Eastern Box Turtles vary in size from 3.2-84.4 acres (mean=20.4 acres) and do not vary much between years.

Management efforts are focused on maintaining large un-fragmented tracts of land on Camp Edwards and when possible increasing the size of theses tracts. Also, through a proactive fire management program habitat diversities will be maintained which appears to be essential to maintaining healthy populations of eastern box turtles. A major threat to the Eastern Box Turtle is habitat loss due to fragmentation. Therefore, the impact of land clearing relative to the MPMG Range project and other projects is analyzed closely.

A proactive educational plan has been implemented at Camp Edwards beginning in 1998 to educate Camp Edwards land users to the importance of this species and so that notification is made to the Camp Edwards Natural Resource Office when Eastern Box Turtles are found on site. Wanted posters asking to report all eastern box turtle sightings have been placed throughout Camp Edwards. All reports are filed with the NHESP at the end of the field season. Approximately 90% of the sightings of Eastern Box Turtles on Camp Edwards are from soldiers and personnel training or working on the installation. Increased awareness of the species on Camp Edwards will contribute to the survival of the species. Only two eastern box turtle road kills were documented between 1994 and 2006. The relatively frequent sightings and few road kills of eastern box turtles on the roads of Camp Edwards suggests that soldiers and other personnel are aware of the turtles and their status as a State-listed rare species, and avoid them. However, in August 2019, there were three road mortalities during a period of high training activity and extremely dusty road conditions. One 2019 road mortality was in a puddle, an issue MAARNG has been working to address through education and signage with users of Camp Edwards while still providing habitat for the clam shrimp (see **Section 2.11**).

There are still concerns for Eastern Box Turtles at Camp Edwards and throughout the region. There has been an increase over the last few years of box turtles found with apparent predator damage (e.g., broken shells) as well as various infections, lesions, and parasites. It is uncertain what is leading to this apparent

increase, though MAARNG has been reporting and communicating with MassWildlife. Presumably this is due to combined stressors from climate change and other anthropogenic shifts (meso-predators, habitat degradation), which the landmass of Camp Edwards is insufficient to protect against. It would be hoped that more widespread habitat management will help ecosystem balance and provide resilience against such impacts. However, restoring forest and pine barrens conditions introduces new risks to Eastern Box Turtles. While Eastern Box Turtles are adapted to wildland fire they likely are not adapted to the current levels of fuel loading seen through most of their range. Forests and barrens are consistently overgrown throughout the region due to a lack of fire and even prescribed restoration burns have significant fire intensity. Discussions are ongoing relative to minimizing box turtle impacts while ensuring continued and necessary increases to the scale of barrens and forest restoration and habitat management.

Recent efforts with the Eastern Box Turtle have mostly been opportunistic. More juveniles have been discovered in the last two years than normal which have been tracked in coordination with MassWildlife. Efforts for the MPMG Range have begun with dogs.

2.8 State-listed Odonates

The Pine Barrens Bluet (*Enallagma recurvatum*) is listed as Threatened by NHESP and is the only State-listed dragonfly or damselfly observed at Camp Edwards. This species appear to be restricted to coastal plain ponds including shallow sandy shores with vegetation. As there are no wetland resource areas in or near to the MPMG Range, it is unlikely that this species will be impacted by the proposed work.

2.9 State-listed Lepidoptera

There are presently 18 species of State-listed lepidoptera (17 moths and one butterfly) identified at JBCC as shown **in Table 2-3** and are likely to be found within Camp Edwards.[2] According to Mello, the habitats at Camp Edwards appear to be supporting a high diversity of State-listed species although five species which are affiliated with early successional vegetation species have declined in population. Because early successional habitats are essential for nearly all of the State-listed species, management practices that involve prescribed burns are essential. In addition, as only a small percentage of the landscape is burned at any given time, this management strategy is unlikely to cause the extirpation of any of the noted species.

Prescribed burn return intervals are necessary to avoid extreme hazard conditions adjacent to the MPMG Range and are being studied at this time and it will likely be necessary to have less than a 5-year return interval. Monitoring of moth and butterfly species will guide adaptive management for the use of fire. Information obtained from monitoring will allow the MAARNG to react accordingly, if reasonable. Adaptive management will also allow the MAARNG to mitigate unanticipated negative effects. All monitoring will be reported to the State annual including actions taken, action proposed, monitoring of resources, and assessment of management and treatment regimes.

2.9.1 Coastal Heathland Cutworm

The Coastal Heathland Cutworm (*Abagrotis nefascia*) is listed as a Species of Special Concern by NHESP. This species utilizes xeric and open coastal habitats on sandy soil, including sandplain grasslands, dunes and bluffs, coastal heathlands or other maritime shrublands, and occasionally open pitch pine/scrub oak barrens. The larvae of this species overwinter partially grown, and resume feeding in spring. Host plants in Massachusetts are undocumented, but probably consist of a variety of low-growing shrubs. On Camp Edwards, this moth is associated with PPSO and SOS.

[2] Mello, Mark J. January 2018. Two-year survey of Lepidoptera and other insects of conservation concern focusing on species listed in the Massachusetts Endangered Species Act at Camp Edwards, MA Army National Guard.

2.9.2 Barrens Dagger Moth

The Barrens Dagger Moth (*Acronicta albarufa*) is listed as a Threatened species by NHESP. This species is associated with xeric, open PPSO barrens and scrub oak thickets on sandy soil. In Massachusetts the moth flies from mid-June through mid-August. Larvae feed from summer into early fall, and pupae overwinter. In Massachusetts the primary host plant is scrub oak (*Quercus ilicifolia*). On Camp Edwards, this moth is associated with PPSO and SOS and is a scrub oak feeding species occurring in xeric, open canopy scrub oak barrens including those that have been recently burned.

2.9.3 Frosted Elfin

The Frosted Elfin (*Callophrys irus*) is listed as a Species of Special Concern by NHESP. This species utilizes xeric and open, disturbed habitats on sandy and occasionally rocky soil, especially heath/grassy openings in pitch pine-scrub oak barrens. This species also utilizes similar anthropogenic habitats such as utility line rights-of-way, railways, old sand/gravel pits, and airports. The adult flies from mid-April through mid-June. Larvae feed on either wild indigo (*Baptisia tinctoria*) or lupine (*Lupinus perennis*) in May and June, and pupate by early July. On Camp Edwards, this butterfly is associated with MG and *Baptisia tinctoria.* Albanese (2008 identified that this butterfly needs moderate, clumped tree cover, putting it in a transition zone between pine barrens and MG.

2.9.4 Gerhard's Underwing

The Gerhard's Underwing (*Catocala herodias gerhardi*) is listed as a Species of Special Concern by NHESP. This species utilizes scrub oak barrens with an open pitch pine overstory including a range of pine barrens habitats from early successional scrub oak thickets to mid successional pitch pine woodlands (Mello Codes 1 to 4). The larvae of this species feed primarily on scrub oak. Larvae pupate in June and emerge as moths in July and August. Eggs overwinter on the scrub oak hatching in early spring. On Camp Edwards, this moth is associated with PPSO and SOS and is found in both open and partially closed habitats with scrub oak understory.

2.9.5 Waxed Sallow Moth

The Waxed Sallow Moth (*Chaetaglaea cerata*) is listed as a species of Special Concern by NHESP. This species inhabits PPSO barrens, heathlands on sandplains, and forests with heath understories. Adults fly mainly in Octobers and eggs overwinter hatching in the spring. Larvae feed on huckleberry and lowbush blueberries and possibly scrub oak.

2.9.6 Melsheimer's Sack Bearer

The Melsheimer's Sack Bearer (*Cincinnus melsheimeri*) is listed as a Threatened species by NHESP. This species utilizes PPSO, especially SOS thickets. It may also be found in shrubby grasslands and heathlands with a component of scrub oak. Adult moths fly in June and early July, with the peak flight in late June. Larvae feed on scrub oak from summer through fall. The larvae construct a portable, protective shelter ("sack") out of leaves and silk and overwinter and pupate in the spring. On Camp Edwards, this moth is associated with PPSO and SOS found in open to partial canopy habitats dominated by scrub oak. As the eggs, larvae, and pupae are on vegetation most of the year, it may be more susceptible to fire than other scrub oak-feeding species.

2.9.7 Chain Dot Geometer

The Chain Dot Geometer (*Cingilia catenaria*) is listed as a Species of Special Concern by NHESP. This species inhabits coastal plain shrublands, including sandplain grasslands and heathlands, dunes, bluffs, and

maritime shrublands and occasional open pitch pine/scrub oak barrens. Adult moths fly in September and early October, with the peak flight in late September. Eggs overwinter and hatch in the spring. Larvae feed from late June through early August on a variety of shrubs including huckleberry, blueberry, bayberry, and sweet gale (*Myrica gale*). On Camp Edwards, this moth is associated with PPSO, SOS, and MG, and is considered a fire-affiliated species.

2.9.8 Unexpected Cycnia

Unexpected Cycnia (*Cycnia inopinatus*) is listed as Threatened by NHESP. This species was recorded for the first time at JBCC during 2017. The larvae feed and lay eggs on butterfly weed (*Asclepias tuberosa*) which occurs sporadically both at JBCC and Crane WMA. Adult moths fly in late spring and summer. On Camp Edwards, this moth is associated with MG and heathlands.

2.9.9 Sandplain Euchlaena

The Sandplain Euchlaena (*Euchlaena madusaria*) is listed as a Species of Special Concern by NHESP. This species' larval hostplant is scrub oak and possibly blueberry. Individuals have been documented at Camp Edwards in oak-dominated understory in open to pitch pine-dominated canopy habitats. Adult moths fly in late spring and again in August. On Camp Edwards, this species was observed within scrub oak-dominated understory in open to pitch pine dominated canopy habitats.

2.9.10 The Pink Streak

The Pink Streak (*Dargida rubripennis*) is listed as Threatened by NHESP. The species inhabits sandplain grasslands at Camp Edwards and was found on the larval host plant, switch grass (*Panicum virgatum*). The pupa overwinter beneath the surface of the soil.

2.9.11 Slender Clearwing Sphinx

The Slender Clearwing Sphinx (*Hemaris gracilis*) is listed as a Species of Special Concern by NHESP. This species inhabits PPSO barrens and heathlands on sandplains or rocky summits and ridges, as well as acidic bogs and swamps. Adult moths fly in May and June. The adults are diurnal and hover to nectar at flowers, especially blueberry. Larvae feed on lowbush blueberry (*Vaccinium pallidum*), and probably other blueberry species, from June until pupation in July. Pupae overwinter. On Camp Edwards, this moth is associated with disturbed lands within utilitiy rights-of-way.

2.9.12 Barrens Buckmoth

The Pine Barrens Buckmoth (*Hemileuca maia*) is listed as a Species of Special Concern by NHESP. This species utilizes early successional SOS thickets. The larvae of this species feed on oak species with a preference for scrub oak. Larvae pupate in July and August in the soil emerging as moths in October. Eggs overwinter on the scrub oak hatching in May and June. On Camp Edwards, this moth is associated with PPSO and SOS.

2.9.13 Pine Barrens Lycia

The Pine Barrens Lycia (*Lycia ypsilon*) is listed as a Threatened species by NHESP. This species utilizes open, shrubby areas within SOS barrens. The male moths fly in May. Females ascend shrub and tree trunks and emit pheromone, waiting for males to find them by scent. Pupae overwinter and larvae are fully grown by July. On Camp Edwards, this moth is associated with PPSO and SOS and is restricted to open canopy scrub oak habitat including that maintained by fire.

2.9.14 Coastal Swamp Metarranthis

The Coastal Swamp Metarranthis (*Metarranthis pilosaria*) is listed as a Species of Special Concern by NHESP. This species utilizes acidic peatlands located in pine barrens habitat and ericaceous coastal heathlands. Although this species primarily inhabits ericaceous wetlands, it also utilizes blueberry thicket patches within early successional scrub oak thickets. The larvae of this species feed on various ericaceous plants. Larvae pupate in September, overwinter, and emerge as moths in June and July. Eggs hatch in early summer. On Camp Edwards, this moth is associated with PPSO and SOS. As it is generally found in higher numbers in wetlands, the presence of this moth in xeric heathland and shrubland habitats may possibly represent an alternate use of sub-optimal habitat.

2.9.15 Water-willow Stem Borer

The Water-willow Stem Borer (*Papaipema sulphurata*) is listed as Threatened by NHESP. This species inhabits shallow portions of coastal plain wetlands. The larvae of this species feed in the stems of water-willow (*Decodon verticillatus*), and the adults are seldom found far from wetlands containing this hostplant. Water-willow is found in only a few wetlands at Camp Edwards. Adult moths fly in September and early October.

2.9.16 Pink Sallow Moth

The Pink Sallow Moth (*Psectraglaea carnosa)* is listed as a Species of Special Concern by NHESP. This species inhabits PPSO, heathlands with ericaceous plants. Adult moths fly in late September and October. Eggs overwinter and hatch in the spring. Larvae feed on lowbush blueberries and *Prunus* species.

2.9.17 Pine Barrens Speranza

The Pine Barrens Speranza (*Speranza exonerata*) is listed as a Species of Special Concern by NHESP. This species utilizes PPSO barrens on sandplains and rocky summits and ridges. The moths fly from mid-June through mid-July, with stragglers into late July. Eggs overwinter and hatch in early spring. Larvae feed on catkins and new leaves of scrub oak and completing development and pupating by early June. On Camp Edwards, this moth is associated with PPSO and SOS and is considered an obligate on open scrub oak habitat maintained by fire.

2.9.18 Pine Barrens Zale

The Pine Barrens Zale (*Zale lunifera*) is listed as a Species of Special Concern by NHESP. This species utilizes early successional scrub oak thickets and mid successional PPSO woodlands. The larvae of this species feed on scrub oak. Larvae pupate in July and August, overwinter, and emerge as moths in late May and early June. On Camp Edwards, this moth is associated with PPSO and SOS and found in both open and pitch pine canopy habitats dominated by scrub oak.

2.10 State-listed Beetles

The Purple Tiger Beetle (*Cincindela purpurea*) is listed as a Species of Special Concern and is the only State-listed beetle identified at or near Camp Edwards. This species inhabits areas with sandplain soils with patchy vegetation like sandplain grasslands and heathlands and in PPSO. Adults emerge in late summer and early autumn. Tiger beetles were surveyed in 2017 and no Purple Tiger Beetles were encountered.

2.11 State-listed Crustaceans

The Agassiz's Clam Shrimp (*Eulimnadia agassizii*) is listed as Endangered by NHESP. This species has been found in ephemeral pools including pools in dirt roads at Camp Edwards and appears primarily in the late spring and early summer following large storm events. Adults begin to die as the shallow pools dry up. Eggs can remain dormant in this condition until conditions resume, even years later.

Extensive work has been done at Camp Edwards over the last four years to document the species occurrence and natural history on and off site. Indications are that the species is much more widespread and stable than previously known. It is extremely challenging to survey being both ephemeral and seemingly going through boom and bust cycles. While vernal pools are intensively monitored in New England, the spring amphibian monitoring is unlikely to observe late season invertebrates.

2.12 State-listed Mammals

The only State-listed mammals at Camp Edwards are bats. There are potentially four species of State-listed bats documented in or near the Project area. However, none of them have suitable roosting habitat within the Project area which is dominated by very dense pine-shrub habitat. Intensive acoustic monitoring has suggested activity is limited to edge foraging. A combination of year-round acoustic monitoring and mist netting has found bat activity to be focused outside of the Project area in a limited area of high activity east of the Project area along the eastern boundary of Camp Edwards and predominantly in surrounding neighborhoods. Surveys in 2019 are ongoing.

Based on extensive coordination with the NHESP and the USFWS, impacts to bats (i.e., impacts to roosts and hibernacula) will not occur as a result of the MPMG Range Project, therefore, not take of any bat species will occur.

2.12.1 Northern Long-Eared Bat

The Northern Long-Eared Bat (NLEB) (*Myotis septentrionalis*) is listed as Endangered by NHESP and Threatened by the USFWS. The NLEB and its habitat were identified at Camp Edwards as two roost sites were confirmed. The NLEB have had their population's devastated by White Nose Syndrome throughout the eastern U.S. In the U.S. the bat's range includes much of the eastern and north central portions of the country. They hibernate in various sized caved or mines with constant temperatures and are found most often in small crevices or cracks though they have been using basements and crawl spaces in southern New England. During the summer months, NLEB, roots singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags. U.S. colonies have been reduced by greater than 90 percent due to White Nose Syndrome. Intensive survey efforts have been conducted at the Camp Edwards and will continue to identify the bat's habitat use to improve conservation efforts and minimize impacts at training areas. The NLEB has been confirmed through mist netting and telemetry studies which found that nearly all roost sites occurring in or on buildings and the majority of those being off-site (e.g., houses).

2.12.2 Small-footed Myotis

The small-footed myotis (*Myotis leibii*) is listed as Endangered by NHESP. This species can be found in buildings in warmer months and caves and mines in colder months. They can be found in higher elevations amongst hemlock, spruce and white cedar.

2.12.3 Little Brown Bat

The little brown bat (*Myotis lucifugus*) is listed as Endangered by NHESP. This species roots in caves, buildings, trees, under rocks, and woodpiles. They can be found foraging in the evening along roads and

trails in forest-dominated landscapes. Populations have been impacted by the White Nose Syndrome. Bat surveys in 2019 are expected to encounter low levels of Little Brown Bats.

2.12.4 Tri-colored Bat

The tri-colored bat (*Perimyotis subflavus*) is listed as Endangered by NHESP. This bat can be found in barns, buildings, caves, and trees. They typically occupy deciduous trees in the warmer months. Maternity colonies are found in dead needles of living pine trees. They avoid deep woods and open fields and prefer partly open country with large trees, over water courses, and at forest-field edges. Populations have been impacted by the White Nose Syndrome.

2.13 State-listed Rare Plants

The following State-listed plants have been identified by MAARNG and NHESP at Camp Edwards.

2.13.1 Ovate Spike-sedge

The Ovate Spike-sedge (*Eleocharis ovata*) is listed as Endangered by NHESP. The Ovate Spike-sedge is a low-growing, tufted, annual herb with straight, ascending, deep-green stems. The fruit of the Ovate Spike-sedge matures in mid to late summer and is olive to light brown to dark brown in color. The Ovate Spike-sedge can be found growing on sandy freshwater margins, including lake, pond and river shores. It is unlikely to be found within the MPMG Range due to the lack of wetland habitats present.

2.13.2 Weak Rush

The Weak Rush (*Juncus debilis*) is listed as Endangered by NHESP. The Weak Rush is a small, perennial herb that produces erect tufts of round stems, with round maroon or dark green leaves. The small, brownish flowers of this plant are produced in clusters near the tops of the stems and the fruit of this plant matures in mid to late summer. The Weak Rush has typically been found in open, unshaded habitat in seasonally wet, sandy, peaty or mucky substrate along the coastal plain, especially in boggy depressions that are inundated in spring but may dry out later in the season. It is unlikely to be found within the MPMG Range due to the lack of wetland habitats present. An effort to relocate the one known/reported population in 2016 was unsuccessful.

2.13.3 Bayard's Green Adder's Mouth

Bayard's Green Adder's-mouth (*Malaxis bayardii*) is listed as Endangered by NHESP. The Bayard's Green Adder's-mouth is a small, pale green orchid that can be found in dry open woodlands, pine barrens, and similar habitats. This orchid has up to 70 tiny flowers which are visible in July and August, and typically one bright green stem leaf. Bayard's Green Adder's-mouth inhabits open to partially shaded sites of disturbance-dependent habitats, such as grassland sandplains, PPSO, and dry open woodland edges that contain dry sandy soil or clay soil. It has not been identified at Camp Edwards, but could occur based on nearby observations and suitable habitat.

2.13.4 Adder's Tongue Fern

Adder's Tongue Fern (*Ophioglossum pusillum)* is listed as Threatened by NHESP. Adder's Tongue Fern is a small, terrestrial fern, consisting of a single green stalk bearing a simple leaf and a fertile spike. This fern is typically present in June and generally is associated with wet habitats. However, at Camp Edwards, this species is closely tied to dry frost bottom kettle holes and is typically found with Triosteum perfoliatum. The two northern lanes will be on the edge of the large kettle hole with suitable habitat, but unsurveyed as it is in

the Impact Area. It is unlikely to be found within the MPMG Range due to the lack of wetland habitats present.

2.13.5 Torrey's Beak Sedge

Torrey's Beak-sedge (*Rhynchospora torreyana*) is listed as Endangered by NHESP. Torrey's Beak-sedge is a tufted perennial sedge with slender leaves and a chestnut-colored inflorescence with several stems arising from clumps of very slender basal leaves. The dark brown fruits are small and generally present from August to early October. Torrey's Beak-sedge typically grows along the seasonally wet, sandy to peaty soils of low-nutrient, acidic wetlands that are primarily located along coastal plain pond shores. It prefers full sun and does not compete well with shrubs; therefore, fluctuating water levels are important for the persistence of this species at a site. It is unlikely to be found within the MPMG Range due to the lack of wetland habitats present. However, at JBCC, the only know location of this species (not on Camp Edwards) is a frost bottom kettle hole. While not found during intensive annual surveys on Camp Edwards the two northern lanes of the MPMG Range are adjacent to a large frost bottom that is unsurveyed as it is in the Impact Area.

2.13.6 Papillose Nut Sedge

Papillose Nut-sedge (*Scleria pauciflora*) is listed as Endangered by NHESP. Papillose Nut-sedge is a slender, perennial species in the Sedge family which has stems that arise from short, branched, knotty rhizomes with fibrous roots. The plant forms small clumps which develop into numerous bluish-green leaves and flowering culms which appear in June. The fruits of this plant are small, white and mature in mid to late summer. Papillose Nut-sedge inhabits the dry to moist sandy soils of maritime grasslands, pine and oak barrens, disturbed forest openings, and powerline rights-of-way. While not yet identified on Camp Edwards, it is found adjacent to JBCC and suitable habitat does occur on site.

2.13.7 Broad Tinker's Weed

Broad Tinker's-weed (*Triosteum perfoliatum*) is listed as Endangered by NHESP. Broad Tinker's-weed is a coarse herb which grows up to four feet tall. Purplish brown or greenish flowers grow in groups of one to four from each axil and the slight fleshy fruit is greenish orange to orange-red and visible from midsummer to fall. Broad Tinker's-weed is generally found in dry, open woods or thickets, usually avoiding dense shade. At Camp Edwards, it is closely tied to frost bottom kettle holes. The northern lanes of the MPMG Range will be adjacent to a frost bottom that is unsurveyed as it is in the Impact Area.

2.14 Previous Natural Resources Surveys

The following is a partial list of Camp Edwards specific natural resources surveys which have been performed to date with additional surveys proposed being for 2019 and beyond. In the past, researchers affiliated with state universities, non-profit organizations, as well as State and Federal environmental agencies have conducted surveys and research projects on Camp Edwards, either as contractors or independently. Based on all the studies performed to date, MAARNG has developed a comprehensive list of flora and fauna including state-listed species. All monitoring associated with this CMP Plan will be reported to the State annually including actions taken, action proposed, monitoring of resources, and assessment of management and treatment regimes. Accomplishments are presented in the State of the Reservation Report annually. Proposed monitoring and research is discussed in **Section 5.3**.

Table 2-5: Completed Surveys at Camp Edwards

Taxon	Species	Study/Survey	Location	Comments
Birds	Eastern Whip-poor-will	Monitoring and Surveys		2010 to present
Birds	Eastern Whip-poor-will	Nesting telemetry study		2002-2009
Birds	Grassland Birds			Vermont Center for EcoStudies, 2015-2017
Birds	Grassland Birds	point counts		1985 to present
Birds	Bird Surveys	bird monitoring point counts	Training Area and Grassland and Site-wide	1994 to present
Birds	Owls			2015-2016
Reptiles and Amphibians	Eastern Box Turtle	home range studies and monitoring		1999-2009
Reptiles and Amphibians	Eastern Box Turtle	Initial dog assisted surveys in MPMG Range and mitigation areas		2019
Reptiles and Amphibians		Amphibian and vernal pool monitoring		Annual
Reptiles and Amphibians	Snakes	fungal disease study		partner on Legacy project
Reptiles and Amphibians	State watch-list snake	surveys (capture, tagging, etc.)		
Reptiles and Amphibians	Eastern spadefoot	Acoustic call classifier		partner with Mass Audubon
Reptiles and Amphibians	Eastern spadefoot	Passive acoustic survey of potential sites 216-2018		
Reptiles and Amphibians		Drift fence surveys		2002-2010 (pitfall traps)
Odonates	Dragonflies and damselflies			1995 to 2014
Moths and Butterflies	Frosted Elfin	Survey	Cantonment Area	2017 to present
Moths and Butterflies		Two year study	Camp Edwards	Mello, 2017
Moths and Butterflies	Diurnal species	Opportunistic surveys of diurnal moths and butterflies		2010-present
Beetles	Southern Pine beetle	trapping		MA Southern Pine Beetle Response Plan
Crustacea	Agassiz's Clam Shrimp	intensive surveys and monitoring	On-site	2015-2019
Crustacea	Agassiz's Clam Shrimp	regional surveys	Off-site	2018
Mammals	Bats	Intensive acoustic monitoring	site wide	2014 to present
Mammals	Bats	database for acoustic data		
Mammals	Bats	mist netting		1999, 2000, 2001, 2015, 2016
Mammals	New England Cottontails	Trapping and telemetry	on and off site	2009-2018
Mammals	New England Cottontails	research and monitoring		2006 to present
Mammals	New England Cottontails	pellet sampling for DNA analysis	Regional and site specific	
Mammals	New England Cottontails	Diet analysis of pellets		
State-listed Plants	Rare plants	Annual Survey		
State-listed Plants		Vegetation Management Plan	Frost Bottoms	Invasive species treatment
Invasive plants		habitat management/restoration areas	In-house	
Invasive Plants		Invasive plant surveys and mapping		
Watch-listed Plants	butterfly milkweed, wild lupine, etc.	Seed collection, establishment of satellite populations		
Watch-listed Plants		growing watchlist plant species from CE		Bristol Agricultural High School
Bees	General			2013, 2014
Bees	*Anthophora walshii*			2019
Bumblebees				2017

3.0 Proposed Multipurpose Machine Gun (MPMG) Range

3.1 Project Description

The MPMG Range is proposed to be constructed partially within the existing KD Range (see **Figure 3-1**), which was previously used for past ranges and training and encompasses approximately 38.5 acres. The proposed MPMG Range improvements would require approximately 160.5 acres of additional land to accommodate the MPMG Range Footprint of 199.0 acres, and the ROCA which includes a Range Control Tower, Ammunition Storage Building, Covered Bleachers, and other support features. The core elements of the MPMG Range project includes the construction of an eight lane MPMG Range with six lanes 800 meters long with a width of 25 meters at the firing line and a width of 100 meters at a distance of 800 meters. The two middle lanes (Lanes 5 and 6) will extend an additional 700 meters to a distance of 1,500 meters long to accommodate .50 caliber rifles with a width of 330 meters at the northernmost end. The entire project has an approximate 199.0 acre construction and maintenance footprint. An additional 10.0 acres of firebreaks are proposed specific to the MPMG Range, therefore, the Total Project Footprint is 209.0 acres. Site photographs are provided in **Appendix A** and in **Figure 3-1**.

The existing KD Range is comprised of 38.5 acres of which 36.0 acres is MG from previous mitigation for rare species impacts as described in **Section 3.2.3**. and 2.5 acres of which is comprised of the existing ROCA. See **Table 3-2** for summary of acreages.

Figure 3.1: Existing KD Range looking North

The proposed design already represents minimization from the standard MPMG Range design guide which calls for 10-800 meter lanes and 4-1,500 meter extended lanes. The Preferred Alternative has eight-800 meter lanes and two-1,500 meter lanes which is approximately 85 acres less in footprint than the standard design. A more detailed alternatives analysis is provided in **Section 3.5**.

The existing KD Range is not presently used for live fire training but is used for other training operations like drone flying. The MPMG Range is a programmed FY 2020 Military Construction (MILCON) project. The Project will be phased over the next few years with the 800 meter range being constructed first. Once funded, the additional 700m will be constructed for the two .50 caliber lanes to a length of 1,500 meters. Prior to construction, the area must be managed for UXO removal before any work can be done. Implementation of the firebreak construction is anticipated for 2021-2025.

3.1.1 Range Floor and Firing Lanes

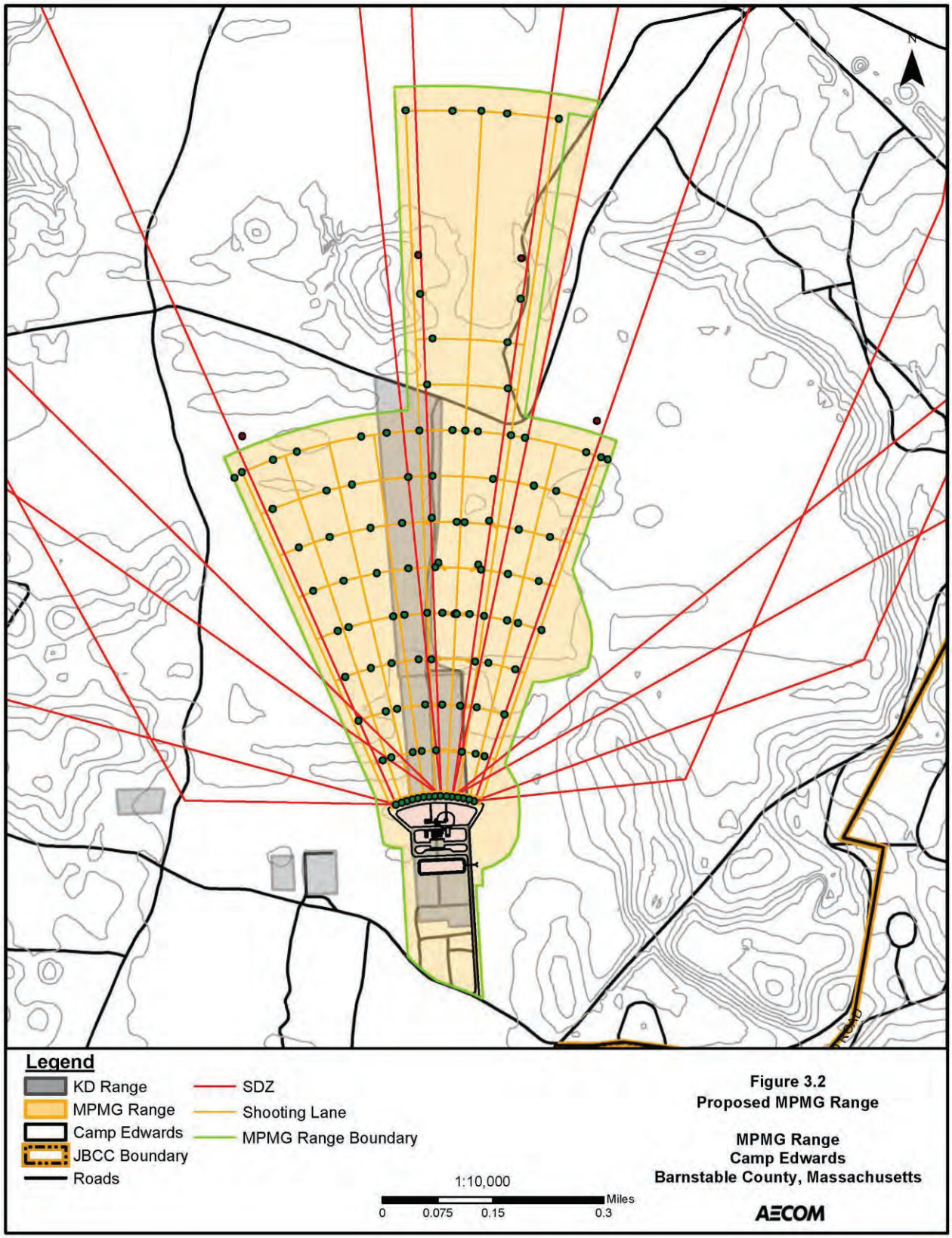
The firing line of the MPMG Range is proposed approximately 100 meters north of where the southernmost KD Range firing line is located. Stationary Infantry Targets (SITs) would be emplaced at approximately 100-meter intervals from the firing position at 100, 200, and 300 meters from the firing line. Moving Infantry Targets (MITs) would be emplaced in the center lanes between 100 and 600 meters. Widened Stationary Infantry Targets (WSITs) and Double Target Arms (DTAs) would be emplaced at between 400 and 800 meters. Individual Movement Techniques (IMTs) would be emplaced between 800 and 900 meters. Stationary Armor Targets (SATs) would be emplaced between 1,000 and 1,500 meters from the firing line within the two extended lanes. This range configuration is shown on **Figure 3-2**. Design plans are also provided in **Appendix B**.

3.1.2 Range Operations and Control Areas

The ROCA is the center for overall control and operation of the range, training exercises, administrative services, and support facilities. The ROCA includes the area for target control, range safety, and training evaluation, generally the Range Control Tower. There is an area for range maintenance, centered at the Operations and Storage Facility. There is an area for pre- and post-training instruction, centered at the Classroom or After-Action Review (AAR) and the Bleacher Enclosure. Ranges also have areas for non-training support including the Covered Mess Shelter. ROCA facilities that directly support the live-fire function of the range include the Ammunition Breakdown Building, the unit staging area, and the vehicle instrumentation dock.

3.1.3 Surface Danger Zones

SDZs are required for all ranges, but are administrative areas closures. The MPMG Range SDZ area is 5,197 acres. No work is proposed within the SDZs but these are maintained and controlled for the safety of personnel on Camp Edwards. The SDZ is a safety zone representing the area of potential hazard (accounting for straight fire and ricochet) based on the projectiles fired and weapon system used. The SDZ has specific dimensions for the expected caliber or the weapon being fired, so that all projectile fragments are contained in this area. The existing KD Range is not presently used for live fire training but is used for other training operations like UAV flying.


N
ROAD
Legend
KD Range
MPMG Range
Camp Edwards
JBCC Boundary
Roads
SDZ
Shooting Lane
MPMG Range Boundary
1:10,000
0 0.075 0.15 0.3 Miles
Figure 3.2
Proposed MPMG Range
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

3.1.4 Firebreaks

An additional 10.0 acres of strategic firebreaks are proposed to be constructed along the exterior of the MPMG Range. This work will be performed as part of the firebreak project involving the construction and maintenance of firebreaks throughout Camp Edwards to reduce the risk of a large wildfire and assist in managing the fighting of fires. Firebreak and fuels management involves the alteration of fuels to reduce the likelihood of a fire starting or to reduce its effects if one does start. These techniques may improve access for fire apparatus, increase water resources available on-site, adjust target placement, and provide buffer or safety zones. Range use at Camp Edwards introduces significant wildfire hazard into unmanaged and high risk fuels conditions through the use of tracers and ammunition. Tracers are forms of ammunition that include a small pyrotechnic charge which makes the trajectory of the ammunition visible in the day time and night time.

The 10 acres of impact is primarily from the construction of new roadways or expansion of existing roadways. This equates to roughly 4.5 miles of roadway relative to the MPMG Range fire protection work. The 10 acres are included in the take calculations for the MPMG Range impacts. In addition, there will be 77 acres of new mowed roadway edge associated with the new or expanded roadways which will not be considered as a take by NHESP and is further described in **Section 6.1.2.**

3.1.5 Lighting

Temporary and permanent lighting proposed for the Project would be designed and installed so as not to interfere with State-listed species, specifically moths. This range would be available for limited night fire operations in accordance with existing Camp Edwards Range Regulations. Lighting would be designed to minimize the potential for lighting adjacent off-range areas and contained within the confines of the MPMG Range by directing light onto the range and minimize uplighting. Sodium lights or lights within the yellow/red range (3000 Kelvin) are proposed as moths are more attracted to lights in the blue range (i.e., mercury vapor lights) which will be avoided. Additional light impact reduction will be based on behavior controls in range use SOPs (e.g., lights off when range not in use). Control of the flood lighting would be via manual switching which is typically located at the control building and would not be used during live-fire exercises. Flood lighting would be used for pre- and post- live firing operations to assist with set up and breakdown activities. In addition to the flood lighting, the site will also require red night lighting that is used to provide low level lighting for night live-fire exercises when the Soldiers are using night vision equipment.

3.2 Existing Conditions

The habitat surrounding the KD Range and the MPMG Range Footprint can be described as being primarily PPOF with scrub oak understory, with pockets of PPSO, SOS, and MG as shown on **Figure 3-3** and summarized in **Table 3-1;** habitat that could support rare moths. The Eastern Box Turtle occurs throughout this area as does the Eastern Whip-poor-will. However, due to ordnance concerns from previous site uses the habitat has not been managed and is not in an overall good condition for any of the State-listed species based upon understory and overstory conditions.

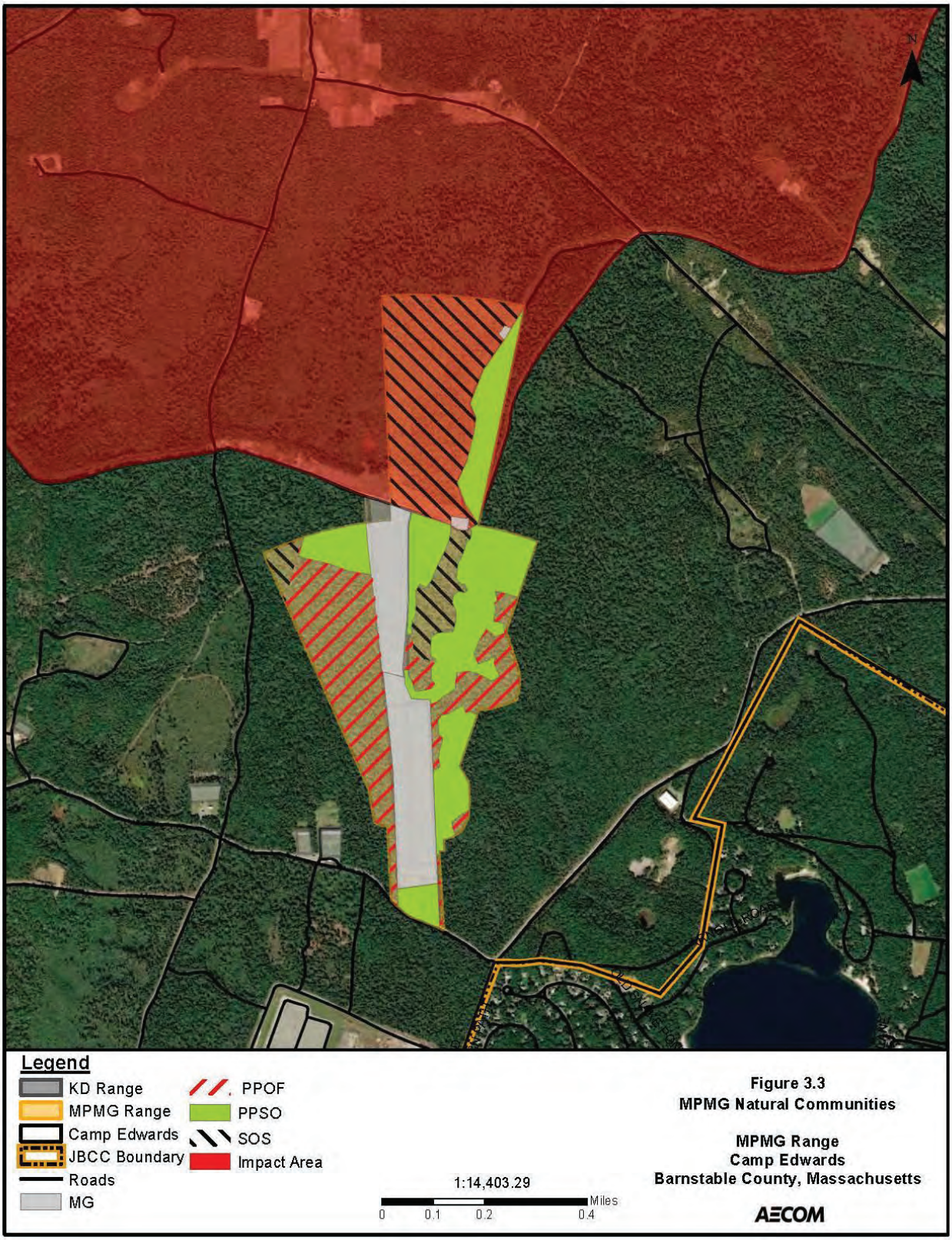

N
Legend
KD Range
MPMG Range
Camp Edwards
JBCC Boundary
Roads
MG
PPOF
PPSO
SOS
Impact Area
1:14,403.29
0 0.1 0.2 0.4
Miles
Figure 3.3
MPMG Natural Communities
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

Table 3-1: Proposed MPMG Range Footprint by Cover Type

Cover Type	MPMG Range Footprint	MPMG Range-Specific Firebreak Footprint	Total Project Footprint
PPOF	47.0	4.0	51.0
PPSO	51.0	3.0	54.0
SOS	62.5	3.0	65.5
MG	36.0	--	36.0
ROCA	2.5	-	2.5
Total Acres	**199.0**	**10.0**	**209.0**

3.2.1 PPOF/PPSO

The PPOF and PPSO at the Site is densely overgrown with very high tree density and an extremely dense and tall understory shrub layer of heath and scrub oak. Use of site by Eastern Box Turtles and Eastern Whip-poor-will has been confirmed through surveys. The site is or could be (with management) suitable habitat for most of the State-listed moths, but is generally in an overgrown and currently unsuitable condition. NLEB have been recorded acoustically but mist netting at nearby locations was unsuccessful and acoustic results indicate low levels of foraging activity only. The Project will result in the removal of approximately 98.0 acres of moderate quality habitat (51.0 acres of PPOF, 54.0 acres of PPSO) habitat in the MPMG Range Footprint and 7.0 acres of firebreaks for a total impact of 105.0 acres within this habitat.

3.2.2 SOS

The SOS at the Site is being encroached upon by the growth of pitch pine. Without management, the SOS would continue to convert to a different cover type with the loss of the rare SOS habitat (**See Figure 3-4).** No management is presently being performed on the SOS in the Impact Area being lost due to UXO issues. As a result, there is no opportunity to manage this resource for ecosystem improvement and expansion opportunities. Use of the SOS in the Impact Area within the Project Footprint by rare species has not been surveyed due to UXO issues. It is presumed that this area is habitat for pine barrens moths, the Eastern Whip-poor-will, and the Eastern Box Turtle. The Project will result in the impact of approximately 62.5 acres of SOS for the MPMG Range and 3.0 acres of firebreaks for a total impact of 65.5 acres within this habitat.

3.2.3 MG

The MG at the Site is in overall poor condition. The existing 36.0 acres of MG is isolated from other MG habitat and therefore has limited impact ecologically. This cover type is presumed to have habitat value to the Eastern Whip-poor-will, and the Eastern Box Turtle. The NLEB has been documented foraging on the edges of this habitat. The Project will result in the impact of 36.0 acres of MG for the MPMG Range Footprint a total impact of 36.0 acres within this habitat.

3.2.4 Previous Mitigation at KD Range

Prior to and/or coincident with rare species impacts associated with the Former Guard Dog Site area (3600 area – Tactical Training Base (TTB) Helicopter Landing Zone (LZ), the MAARNG designated open areas as grassland mitigation at the KD Range (NHESP Tracking #07-22766). The loss of grassland habitat found in the 25-acre 3600 area was mitigated through the restoration of 36.0 acres on the KD Range which had been mowed occasionally, stimulating warm season grasses and forbs. However, the restored area has not

supported (nor did the TTB LZ area location) State-listed grassland birds. The original filing with NHESP indicated that this area may be used for future training needs and mitigation would be revisited as needed.

Figure 3.4: Pine Encroachment on Scrub Oak Depression (KD Range)

3.3 Proposed Project Impacts

The following section describes the Project impacts to State-listed species including rare moths and Eastern Box Turtle. In addition, this section describes avoidance and minimization efforts to reduce impacts to these and other species. Mitigation efforts are described in **Section 5.0**. The MPMG Range Footprint is 199.0 which includes the 38.5 acres of the KD Range. In addition to the MPMG Range, an additional 10.0 acres of range specific firebreaks are proposed for a Total Project Footprint of 209.0 acres. Of the 209.0 acres, approximately 2.5 acres of the southern part of the KD Range the houses the previously existing ROCA is not considered as rare species habitat. Based on the presence of PPOF, PPSO, SOS, and MG, it is presumed that all remaining acreage within the Total Project Footprint is considered as rare species habitat. In order to determine the mitigation to impacts of rare species for the MPMG Range Project, the following steps were taken. These steps will also be used for determining rare species impacts for future projects.

- Determine if project can be designed to avoid or minimize impacts to rare species habitat
- Determine vegetative communities impacts by acreage within project footprint
- Determine which State-listed species will be impacted based on vegetative community
- Apply mitigation ratios (as described in **Section 1.4**) under MESA based on State ranking to determine required mitigation acreage
- Assess mitigation methodologies to required mitigation acreage for habitat improvement
- Identify land preservation or mitigation parcels
- Identify other mitigation or minimization actions

Table 3-2 provides proposed impacts by of the MPMG Range including required and proposed mitigation.

Table 3-2: MPMG Range Impacts and Mitigation

Impacts	
199.0	MPMG Range Footprint
10.0	MPMG Range-Specific Firebreak Footprint
209.0	Total Project Footprint
209.0	Total Project Footprint
2.5	ROCA Footprint
206.5	MPMG Range Take Footprint
206.5	Total MPMG Range Take Footprint
36.0	MPMG Range Managed Grassland Take Footprint
170.5	MPMG Range Pine Barrens Take Footprint
Mitigation *(numbers have been rounded to nearest whole number)*	
171	MPMG Range Pine Barrens Take Footprint
2:1	2:1 mitigation ratio for Pine Barrens
341	Pine Barrens Mitigation Required
341	Pine Barrens Mitigation Required
133	Land Preservation Tract 5
208	Remaining Mitigation Acres Needed
208	Remaining Mitigation Acres Needed
2:1	Double Mitigation Acres Needed proposed by MAARNG (total of 4:1 mitigation ratio)
416	Acres to be Managed
125	30% of 416 (Standard #1 Mechanical Forestry)
291	70% of 416 (Standard #2 Prescribed Burn)
416	Acres to be managed (at 4:1 ratio)
416	Acres to be Managed (Standard #3 Continued Management and Maintenance)
2:1	Additional Mitigation proposed
832	Acres to be Managed (at 8:1 ratio)

Table 3-3: Sierra Range Expansion Impacts by Guild

Guild Associations	Mitigation Required Per MESA	Acres of Impact	Total Mitigation Acreage Required
Pine Barrens Guild	2:1 (Threatened)	171	342
Managed Grasslands	1:1 (previous mitigation)	36	36
Eastern Box Turtle	1.5:1 (Species of Special Concern)	207[1]	310

[1] Pine Barrens Guild + Managed Grasslands

3.4 Proposed Project Mitigation

Impacts from the MPMG Range will be mitigated through a combination of mitigation methods which are described more fully in **Section 5.0**. Mitigation for the MPMG Range has already occurred during 2019 and additional actions will occur in subsequent years. The Project consists of significant mitigation measures related to impacts to the Site's rare species habitat. To address potential impacts to the Eastern Box Turtle, the Whip-poor-will, rare moth and grassland species, MAARNG proposes a number of mitigation strategies including land transfers, land preservation, and land management. The following table provide a summary of the different mitigation actions including acreages based on the five mitigation standards and land preservation actions.

The following table provides the proposed actions and mitigation standards which have been completed or are proposed to be completed as part of the MPMG Range mitigation. Acreages for completed actions show more than needed and account for mitigation credits that can be applied to other projects as described in **Section 4.0**. Also, annual projects may have lower or higher acreage in a certain year due to unforeseen circumstances like weather but are expected to balance out. As shown in **Table 3-3**, 310 acres of land preservation will be set aside either through land transfer (Tract 5) or protection of FCRA units. **Table 3-4** provides an estimated timeline for construction of the MPMG Range and associated mitigation actions.

Table 3-4: MPMG Range Mitigation

Mitigation Standard	Location	2019	2020	2021	Other years	Acres of Mitigation	
						Target	Provided
Land Preservation	Tract 5	133				310	310
Land Preservation	Primary Forest Canopy Reserve Area - Northern Unit (for Eastern Box Turtle)	177					
Total Land Preservation		**310**				**310**	**310**
#1 Mechanical Forestry	Pine Barrens Mitigation Focal Areas - Western Unit	50				125 (30% of 416)	125
#1 Mechanical Forestry	Pine Barrens Mitigation Focal Areas - Western Unit		40				
#1 Mechanical Forestry	Pine Barrens Mitigation Focal Areas (TBD)			35			
#2 Prescribed Burn	Pine Barrens Mitigation Focal Areas - Northern Unit	47				291 (70% of 416)	291
#2 Prescribed Burn	Pine Barrens Mitigation Focal Areas - Western Unit (Total burn = 399, remainder 145 for other projects)	244					
#3 Continued Management	Pine Barrens Mitigation Focal Areas		50	150	216	416	416
Total Pine Barrens Management		**341**	**90**	**185**	**216**	**832**	**832**
#4 Manage Grasslands	Grassland Mitigation Focal Area Parcel H – Unit K fire (Total burn = 42, remaining 6 for other projects)	36				36	36
#4 Manage Grasslands	Grassland Mitigation Focal Area Parcel H – Unit K herbicide						
#4 Manage Grasslands [1]	Grassland Mitigation Focal Area Parcel H – Unit K mowing (Total mow = 80, remaining 44 for other projects)		36				
Total Grasslands Management		**36**				**36**	**36**

[1] Parcel H – Unit K managed for other projects (see **Section 5.1.2**)

3.4.1 Fire Management of MPMG Zone

Fire management within the area around the MPMG Range will be initiated following firebreaks and UXO removal (as needed) (see **Section 6.0).** In addition, as part of the MPMG Range project, there are an additional 1,060 acres of very high priority PPSO and SOS that need to be managed to address severe fuel loading hazard and detrimental pitch pine encroachment impacting habitat quality and potential high hazard condition from MPMG Range development identified as the "MPMG Zone". The overarching goal for this area is to maintain or improve PPSO and SOS conditions while reducing wildfire hazard from tracers and other ignition sources.

3.4.2 Construction Phase

Mitigation for temporary impacts to the Eastern Box Turtle will include the preparation of a Construction Plan which may include turtle monitors on-site, use of silt fencing to prevent turtles from entering the active portion of the site, monitoring of individual turtles with transmitters, and sweeps prior to construction to see if any turtles are in the area. If any individuals are found, transmitters may be placed on these individuals before they are removed from the site and placed in safer habitat. A more specific Eastern Box Turtle construction plan is in development in support of this CMP.

Table 3-5: MPMG Range Construction and Mitigation Schedule

Action Proposed	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Construction Phase										
Clear and construct primary range area (0-800 meters; ROCA)	x									
Clear UXO and mechanical removal of trees as needed		x	x	x	x	x				
Create shaded fuel breaks with mechanical forestry and UXO clearing			x	x	x					
Construct two lanes north from 800 to 1,500 meters			x	x	x	x				
Introduce fire into MPMG Zone				x						
Mitigation Phase										
Parcel H – Unit K Grassland improvement	x	x	x	x	x	x	x	x		
Frequent prescribed burns in MPMG Zone (2-3 year return interval)			x	x	x	x	x			
Maintenance burns on 3-year interval in MPMG Zone								x	x	x

Best Management Practices will be implemented during the construction phase of the Project in order to minimize impacts to rare species, primarily the Eastern Box Turtle. Components of the construction phase elements include, but are not limited to, employee and construction phase education. Turtle surveys were conducted in 2019 which identified individual turtles and places transmitters on them for future tracking during construction. Once construction begins, oversight with radio-telemetry and additional surveys in advance of tree clearing and ground clearing would occur. It is anticipated that a construction plan will be required as part of the CMP. The following bullets are general BMPs that may be incorporated into this plan.

- Avoidance measures such as turtle sweeps prior to each work day with or without dogs.

- Identify location of individuals that have been outfitted with transmitters.
- Relocate individuals if found within the construction area, depending on the season.
- If hibernating turtles are found, avoid construction in this area until a later date if possible.
- Perform post-construction monitoring including the development of a Turtle Protection Plan see **Appendix E**, presently being drafted).
- Create bare patches and early succession vegetation and ephemeral puddles if possible
- Due to the size of the construction area, use of silt fence to prevent movement of turtles is impractical. Nonetheless, there may be specific area where this can be used (i.e., construction of the ROCA).

3.4.3 Range Floor Management

Once constructed, the range floor would be lightly seeded with a temporary cover crop and a mix of native grasses and forbs. The range floor is presently mowed on an as needed basis. The range floor expansion would be maintained with monthly mowing within the primary range footprint during the training season.

Management of the MPMG Range floor will be the same as other active range floors once constructed. All ranges are managed under specific range plans and Operations, Maintenance, and Monitoring Plan (OMMPs) including BMPs. Regular mowing of the range floor will continue from April through September and will likely be on a monthly basis. The mowing will be performed to minimize flashy fuels (e.g., tall grass), minimize line of site issues, and minimize wildlife impacts by keeping out most nesting birds. The regular mowing will improve the ability of the mowers to observe animals that do occur through visual observations and movement in order to avoid wildlife (e.g., killdeer nests, box turtles). The mowing will also provide a matrix of diverse forbs and low native grasses (e.g., *Pityopsis falcata* and *Deschampsia flexuosa*).

3.5 Alternatives Analysis

The proposed MPMG Range design already represents minimization from the standard MPMG Range design guide which calls for 10-800 meter lanes and 4-1,500 meter extended lanes. The Preferred Alternative as described in this section has eight-800 meter lanes and two-1,500 meter lanes which is approximately 85 acres less in footprint than the standard design. A brief discussion of alternatives no longer under consideration including the reasons for no longer considering these alternatives is also provided.

3.5.1 Alternatives Development (Screening Criteria)

The MAARNG developed and applied the following 13 criteria to screen and evaluate possible alternatives for the Project. The MAARNG identified that a suitable site would meet the following requirements:

1. **Sufficient Land Area**: The proposed range should be located within a MAARNG-controlled training area in Massachusetts of sufficient size to accommodate the proposed range and its associated SDZs.
2. **Reduce Travel Times**: The proposed range should avoid excessive travel times and costs for MAARNG units by minimizing travel in and out of state to meet mission and training requirements.
3. **Minimize Conflicts with Other Existing Ranges and Training Areas**: The proposed range should be sited so as to minimize conflicts with other, existing ranges and other training uses, thereby allowing multiple training ranges and facilities to be utilized concurrently and maximizing training efficiency.
4. **Maximize Co-Location with Existing Impact Areas**: The proposed range should be sited in a way that maximizes the use of existing impact areas. Such a layout would avoid the creation of new

impact areas, avoid consuming additional training land, and reduce the area of potential hazard across Camp Edwards.

5. **Proximity to Existing Utilities**: The proposed range should be sited in close proximity to existing utility services (i.e., electric, telecommunications) in order to minimize construction costs and the need for new or extended utilities.
6. **Proximity to Existing Roads**: The proposed range should be sited in close proximity to existing access roads in order to minimize construction costs and the need for new roads.
7. **Minimize Environmental Concerns**: The proposed range should be sited in an area and layout that would minimize potential effects to existing onsite environmental concerns, including cultural resources and rare species.
8. **Minimize Need for New Ground Disturbance**: The proposed range should be sited in previously disturbed areas to minimize the need for new ground disturbance. This would minimize the potential for new and additional impacts to onsite soils, water, biological, and cultural resources.
9. **Central Location to Minimize Offsite Impacts**: The proposed range should be sited in a central location within a MAARNG-controlled training area in order to minimize potential impacts (i.e., dust, noise, lighting) to off-site areas, including residents and sensitive receptors.
10. **Meet Training Requirements:** The proposed range should allow the MAARNG units to meet all required training provided by a MPMG Range.
11. **Meet ARRM Requirements:** The proposed range should meet current ARRM data requirements regarding the number and types of ranges needed to meet MAARNG training requirements.
12. **Compliance with Regulatory and Planning Requirements:** The proposed range should be in compliance with applicable regulations and planning documents developed.
13. **No Net Loss of Training Capacity**: The proposed range should be constructed to ensure no net loss in the capacity of the MAARNG or Camp Edwards to support the military missions and conduct training operations.

Through application of the first two screening criteria and the evaluation process provided in this section, it became readily apparent to the MAARNG that locating the MPMG Range at Camp Edwards was the only alternative capable of meeting these screening criteria. Therefore, the subsequent 11 screening criteria were used to identify the Project location within Camp Edwards. Where possible, similar training facilities were co-located or grouped to increase usage of common areas and infrastructure components and to further reduce overall development needs and costs. Numerous range and facility layouts and sites within Camp Edwards were investigated and eliminated from further consideration due to conflicts with other training uses, location of existing utilities, lack of overall land area, existing environmental constraints surrounding residential areas, or other limiting factors.

3.5.2 Evaluated Alternatives

The selection standards described above were applied to available alternatives to determine which alternative(s) would fulfill the purpose and need for action including the No Action Alternative to assess any environmental consequences that may occur if the Project is not implemented. The No Action Alternative also provides a baseline against which the Project can be compared. The following discussion provides a description of the Preferred Alternative (Project), the Reduced-Scale Alternative, and the No Action Alternative. Alternatives eliminated from further consideration are described in **Section 3.3**.

The following table summarizes the primary alternatives and associated rare species impacts. The footprints of these alternatives are shown on **Figure 3.1**.

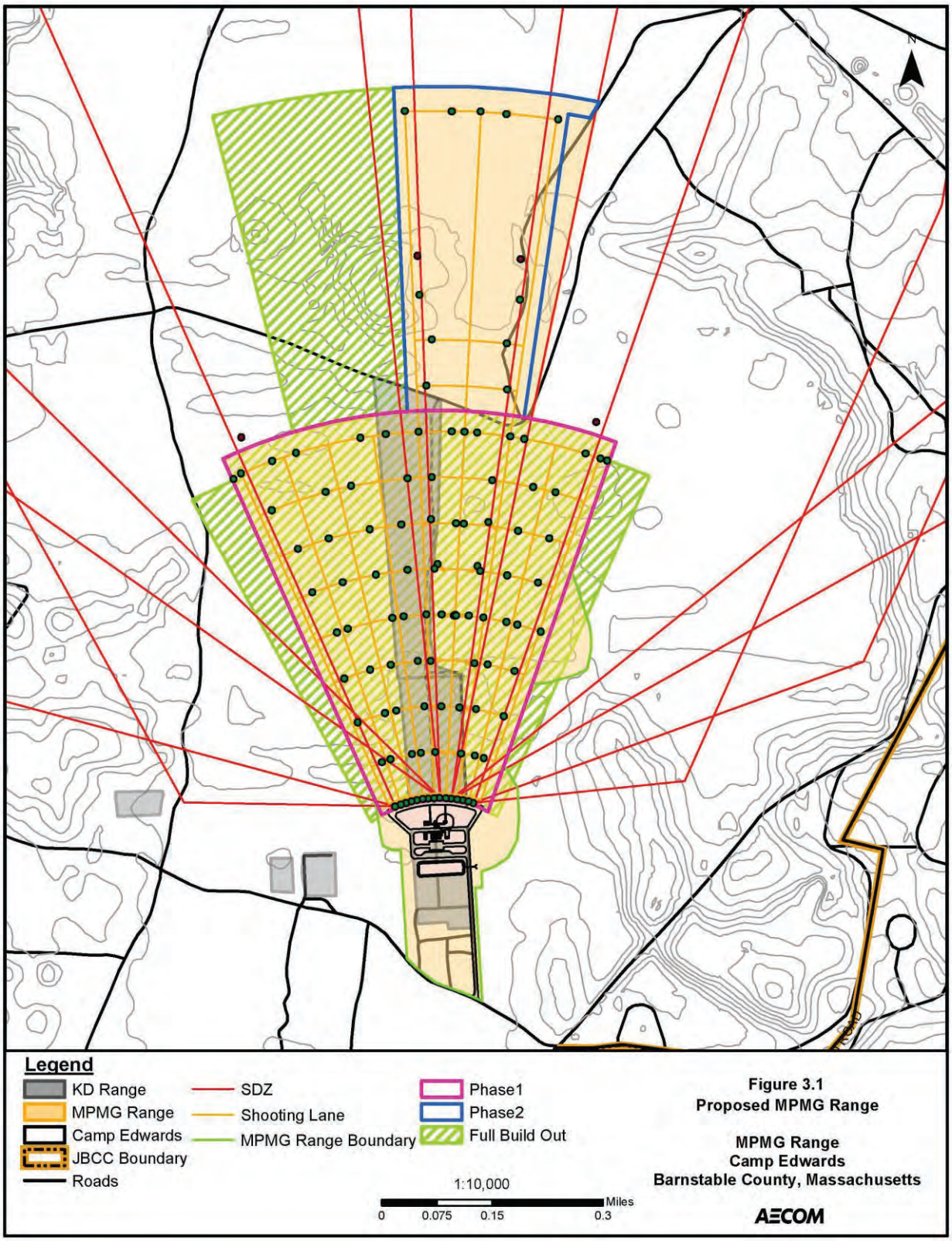

N
Legend
KD Range
MPMG Range
Camp Edwards
JBCC Boundary
Roads
SDZ
Shooting Lane
MPMG Range Boundary
Phase1
Phase2
Full Build Out
1:10,000
0 0.075 0.15 0.3 Miles
Figure 3.1
Proposed MPMG Range
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

Table 3-6: Impacts by Alternative

Alternative	800 meter lanes	1500 meter lanes	MPMG Range (acres)	Firebreak (acres)	Total Footprint (acres)	Tree clearing (acres)
Full Standard Build	10	4	294	12	306	267.5
Preferred Alternative	8	2	199	10	209	170.5
Reduced-Scale Alternative	8	0	128	10	138	99.5

** Without action, there will be an incremental loss of scrub oak shrubland habitat as described in **Section 4.6.1.3**.

3.5.3 Preferred Alternative

Under the Preferred Alternative (Project), the MPMG Range would be constructed and operated by constructing the MPMG Range at the KD Range with the construction of an eight lane MPMG Range with six lanes 800 meters long with a width of 25 meters at the firing line and a width of 100 meters at a distance of 800 meters. The two middle lanes (Lanes 5 and 6) will extend an additional 700 meters to a distance of 1,500 meters long to accommodate .50 caliber rifles. The construction of the Project will fulfill the assigned mission and training requirements to have a machine gun range available within Massachusetts. The firing line would be located approximately 200 meters north of the existing firing line.

This design already represents minimization from the standard MPMG Range design guide which calls for 10-800 meter lanes and 4-1,500 meter extended lanes. The Preferred Alternative has eight-800 meter lanes and two-1,500 meter lanes which is approximately 85 acres less in footprint than the standard design.

Due to the presence of the Impact Area which is not accessible for habitat management and fire management, the scrub oak shrublands (SOS) have become overgrown. The primary driver behind declines in some of the State-listed moths at Camp Edwards is a lack of fire in SOS and the dramatic incursion of pitch pines into shrublands and frost bottoms after the secession of artillery fires in the Impact Area. The extension of the two 1500m lanes into this habitat will allow for management and enhancement of the SOS which is a globally rare habitat.

This is the MAARNG's Preferred Alternative because it best meets the screening criteria set forth in **Section 3.1**. It effectively provides the best combination of land and resources to sustain quality military training and to maintain and improve MAARNG's readiness posture. This alternative provides many advantages:

- Located within an existing MAARNG facility, and therefore, no land acquisition costs.
- Eliminates the need for MAARNG units to travel out of state to meet mission and training requirements.
- Provides ample space/acreage for the required facilities.
- Located on previously disturbed land.
- Located near existing infrastructure and available utility connections.
- Places noise-producing facilities further away from noise-sensitive areas within and adjacent to Camp Edwards.

3.5.4 Reduced-Scale Alternative

The Reduced-Scale Alternative would implement the Project without the two extended .50 caliber use middle lanes. All lanes would be constructed to a distance of 800 meters. This alternative would allow for

the same usage as the Preferred Alternative with the exception of the M2 machine gun and the M82 sniper rifle which utilize .50 caliber ammunition, thus reducing training capabilities of this range. This alternative would have a footprint of about 128 acres reducing the amount tree clearing by 71 acres. Nonetheless, this alternative would not allow the management of the SOS frost bottom located north of the KD Range maintaining the dramatic incursion of the pitch pines into this significant habitat.

3.5.5 No Action Alternative

Under this alternative, the Project would not be implemented and the existing training activities and operations would continue at the installation. Units would travel to either New York, New Jersey, or Vermont to qualify on the nearest MPMG Range. This alternative would limit the capability of the MAARNG to carry out its assigned mission to provide adequate training facilities, and would not meet the purpose of or need for the Project. The No Action Alternative reflects the status quo and serves as a benchmark against which the effects of the Project (i.e., Preferred Alternative) can be evaluated.

Under the No Action Alternative, Camp Edwards full training potential would continue to be limited and the facilities necessary to accommodate the MAARNG's mission and training requirements would continue to be unavailable in the state. Required training would continue to be conducted by the MAARNG at out-of-state installations where the necessary ranges and training facilities are available. This would continue to cause MAARNG units to risk not meeting readiness requirements, and to use excessive training time for travel, potentially resulting in a decreased ability to meet training proficiency standards.

3.5.6 Alternatives Eliminated from Further Consideration

Alternatives that were eliminated from detailed study are identified along with a brief discussion of the reasons for eliminating them. For purposes of analysis, an alternative was considered "unreasonable" if it would not enable the MAARNG to meet the purpose of and need for the Project. The MAARNG considered the following alternatives:

- Southern Location
- New Training Site Alternative
- New Undisturbed Range Site Alternative
- Different Existing Range Alternative
- Standard-Size MPMG Range

These alternatives were eliminated from further consideration because they did not meet one or more of the screening criteria included in **Section 3.1**.

3.5.6.1 Southern Location Alternative

This alternative would implement the Project at a more southerly location which would shift the entire MPMG Range south approximately 100 meters. The firing line of this alternative would be located approximately 100 meters north of the existing firing line at the KD Range. The construction would fulfill the assigned missions but would result in greater impacts, specifically with noise**.** This alternative does not meet Screening Criteria #7, #9, and #10.

3.5.6.2 New Training Site Alternative

Acquire a completely new training site for the construction and operation of the proposed MPMG Range, off-site of Camp Edwards. This alternative was examined but eliminated due to the fact that, as a primary component of Base Realignment and Closure (BRAC), the DoD is eliminating and/or consolidating many installations throughout the U.S. and other sufficient land area is not available. As sufficient land area is

available at Camp Edwards to accommodate the required range and training facilities, the MAARNG determined that, in accordance with DoD directives and vision, establishment of a new training site in-state but off-site of Camp Edwards was neither feasible nor necessary. This alternative does not meet Screening Criteria #7 and #8.

3.5.6.3 New Undisturbed Range Alternative

Construct and operate the proposed MPMG Range on a previously undisturbed portion of Camp Edwards. This alternative was examined but eliminated due to the fact that it would likely impact more rare species habitat resulting in more fragmentation of the rare habitats present at Camp Edwards than siting the range at the already cleared KD Range. This alternative does not meet Screening Criteria #3, #4, #7, and #8.

3.5.6.4 Different Existing Range Alternative

Construct and operate the proposed MPMG Range on either the A (Alpha) Range or the existing S (Sierra) Range (or a different range at Camp Edwards). During the range siting process, additional range configurations were evaluated, but were eliminated due to various land constraints and existing usage at other ranges. Given the large amount of land this range requires (including the SDZs) and the available land at Camp Edwards that was already altered but did not have existing uses, siting options were limited for this range. Alpha Range was previously a .50 caliber machine gun range but guns were required to have a restraint bar to prevent the barrel from moving too far to the side. Substantial funding was spent upgrading this range in 2011-2012 to a Modified Record Fire (MRF) Range. In order for this alternative to work, the MRF range would have to be dismantled and constructed elsewhere on the base resulting in additional substantial costs. This alternative does not meet Screening Criteria #3, #7, and #12.

3.5.6.5 Standard-Size MPMG Range Alternative

Construct and operate a standard ten-lane MPMG Range with four extended 1,500 meter lanes in accordance with TC 25-8. Given the existing site and environmental conditions, a reduced-size MPMG Range with only eight lanes is proposed as approved by MILCON. Under the full-build alternative, additional impacts to rare species habitat would be unavoidable. In addition, a larger range would increase noise impacts on adjacent sensitive receptors. This alternative would have an increased footprint by 85 acres to approximately 284 acres. The SDZs for this alternative would reach a wider area and would be located partially off-base. This alternative does not meet Screening Criteria #1, #3, #7, #8, and #12.

3.6 Summary

Pursuant to MESA, a CMP may be issued by NHESP for a project provided that an applicant has provided the following three items:

1. Demonstrates that the activities will result in an insignificant impact to the local populations of the affected species.

   The entire MPMG Range Project represents approximately one percent of the land area within Camp Edwards. Impacts to rare species for this Project alone would be insignificant relative to the entire installation as the impacted habitat and species occurrence are not disproportionate at the Project site. Nonetheless, as there are direct impacts to rare species and indirect effects as a result of the operation of the MPMG Range, there is the possibility for greater impacts (i.e., wildland fire). Mitigation will allow MAARNG to manage the resources and operation of the MPMG Range in a way that would result in an insignificant impact to the location populations of the State-listed species. Implementation of this CMP Plan will provide net benefit across much more area of Camp

Edwards and will combine with ongoing site-wide management through the INRMP and additional habitat improvement beyond mitigation to support the MPMG Range use.

2. Adequately assesses alternatives to both temporary and permanent impacts to State-listed species.

   Temporary impacts may occur during the construction phase and the times when the MPMG Range will be active. Construction impacts will be mitigated as described above.. The majority of wildlife on DoD installations has been found to readily acclimate to military activities and noise, including birds and bats. Long-term use of the range is unlikely to negatively impact or exclude rare species from surrounding habitat as has been seen at active ranges at Camp Edwards (e.g., I Range, S Range). The most likely negative impact is wildlife, which should have reduced likelihood and severity under proposed management.

   To minimize potential impacts associated with vegetation removal, land clearing activities would be scheduled to occur, to the extent feasible, outside the breeding season or late in the breeding season, under guidance from the E&RC. Potential long-term, less-than-significant adverse effects to migratory birds could occur during land management operations (e.g., periodic mowing) and training activities. Proposed training activities at the range could have the potential to injure or kill birds or other species, but the likelihood of this occurring during operational activities is considered highly unlikely. Research shows wildlife desensitizes to range use. Eastern Whip-poor-wills on Camp Edwards have been found consistently surrounding I Range and S Range, both of which get much use and traffic. Other temporary potential stressors, may be the use of heavy machinery, vegetation removal, and increased noise. In the event that proposed training activities start a fire on the range with every effort and range design/management to facilitate suppression, the fire would be extinguished in accordance with existing range management rules before it reaches adjacent natural areas.

   This range would be available for limited night fire operations in accordance with existing Camp Edwards Range Regulations and permanent light proposed for the Project would be designed and installed so as not to interfere with State-listed species, specifically moths. Lighting would be designed to minimize the potential for lighting adjacent off-range areas and contained within the confines of the MPMG Range as described above.

3. Carries out a Conservation and Management Plan that provides a long-term net benefit to the conservation of the State-listed species affected by the proposed Project which on or off-site permanent habitat protection, management or restoration of State-listed species habitat, and/or conservation research designed to benefit the species affected by a given project.

   Section 5.0 of this Application provides the CMP Plan that outlines all of the efforts the MAARNG will be doing to reduce impacts to rare species. This CMP Plan includes specific discussions regarding land transfers, mitigation focal areas, monitoring and research, avoidance and minimization, management efforts, management methods, and associated costs and funding. Additional, these efforts are just a focused component of Site-wide conservation management focused on net benefit and long-term sustainability of rare species and the overall ecosystem. The INRMP and site-wide conservation are closely coordinated with partners and informed by monitoring, and both panned and implemented for long-term sustainability, ecosystem health and net benefit of rare and common flora and fauna.

   Specific to the MPMG Range, we have provided calculations of rare species impacts and addressed the mitigation of these impacts through land preservation and management of the habitat found elsewhere at Camp Edwards. As noted, the MAARNG is proposing a 4:1 ratio of

habitat mitigation acreage to impact acreage combined with an additional 4:1 ratio of longer term management/maintenance for an overall ratio of 8:1 for impacts not offset by real estate transfer. MAARNG believes that this CMP Plan and Mitigation Bank outline in this CMP Application provide the long-term net benefit required.

It should be noted that this CMP Plan is more protective of Eastern Whip-poor-wills and Northern Harriers as these two species are also included in the mitigation acreage for the pine barrens impacts although these species tend to utilize other habitats such as grasslands.

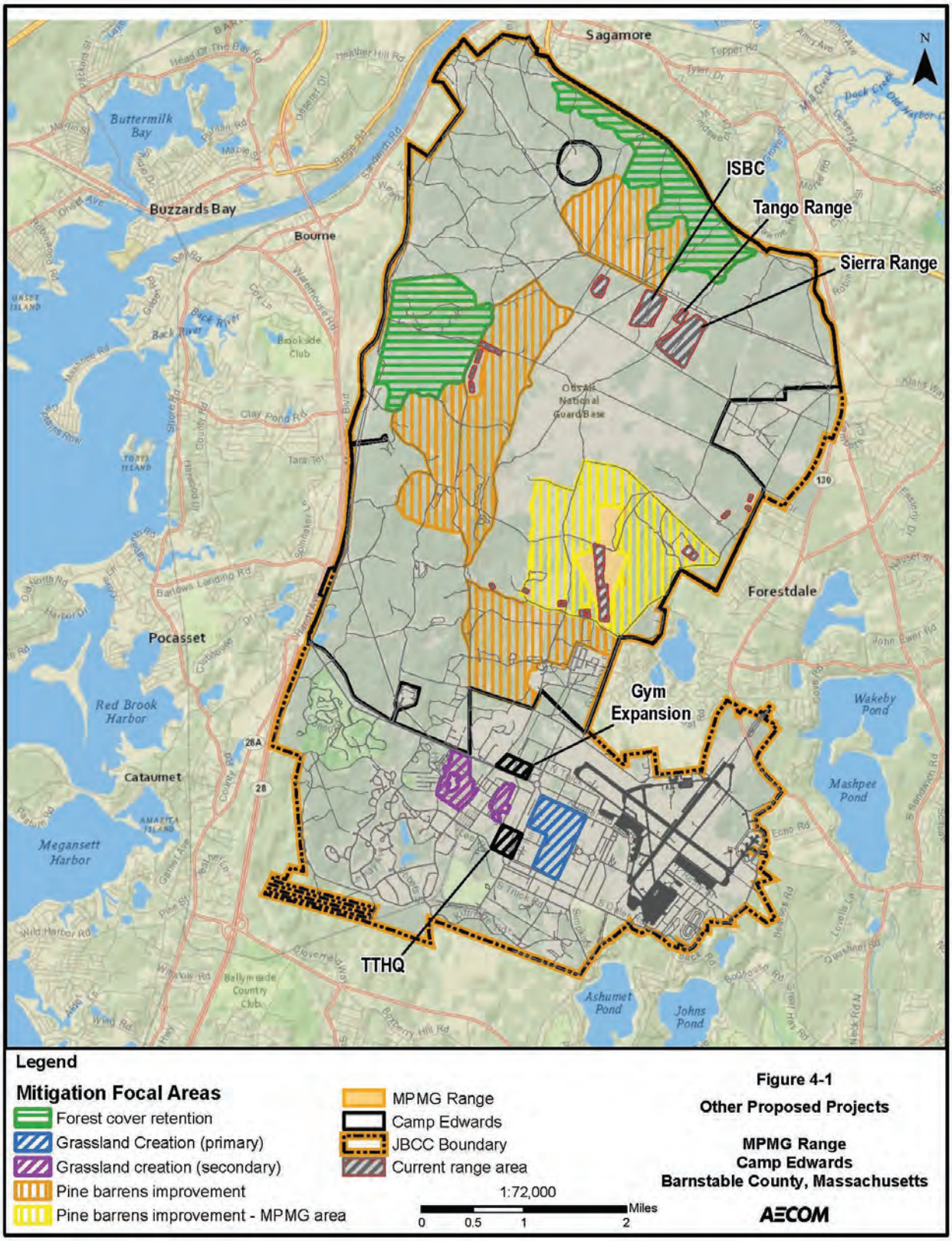
4.0 Proposed Projects at Camp Edwards

The following is a summary description of other projects proposed within Camp Edwards. This CMP Application provides detailed analyses for the MPMG Range project and also includes descriptions that, when actually proposed, will be evaluated for their compatibility with the descriptions included here and mitigation actions within the established mitigation framework for rare species impacts. Barring significant differences, separate filings for MESA and review will not be necessary. At this time, this information on the other projects is being provided as baseline for generally assessing rare species impacts and outlining potential mitigation solutions. Although the MPMG Range is a MAARNG project, the current need is to provide this level of planning to provide joint coverage for the MAARNG and the MAANG (i.e., Army and Air National Guard JBCC components).

There are many variables for these other projects, from site selection through project design and long-term maintenance. One goal of this comprehensive document is to ensure sufficient mitigation is available to cover all projects. In other words, this document is an attempt to identify and mitigate the overall development and habitat impacts at Camp Edwards through a mitigation banking strategy which will proactively implement habitat management and mitigation. It is anticipated that there will be significant ecosystem benefit to be achieved through this early planning effort and implementation and holistic net benefit strategies more fully described in **Section 5.0**. As such, project designs have not been completed, and impacts are liberally estimated to ensure sufficient mitigation implementation and design. Each project is described in this sections with locations shown on **Figure 4-1**.

This section describes the other proposed projects, the natural communities located within the boundaries of the projects, and impact analyses. The information included below is based on very early planning and not actual project designs. Potential impacts and acreages are intentionally liberal to ensure sufficient mitigation planning and implementation. As these projects are developed they will be linked to this CMP and evaluated for consistency. Projects included in this section are:

- Gym Expansion (see **Section 4.1**),
- Transient Troop Headquarters (TTHQ) (see **Section 4.2**),
- Tango Range Expansion (see **Section 4.3**),
- Sierra Range Expansion (see **Section 4.4**), and
- Infantry Squad Battle Course (ISBC) (see **Section 4.5**).


Sagamore
Buttermilk Bay
Buzzards Bay
Bourne
ISBC
Tango Range
Sierra Range
Otis Air National Guard Base
Forestdale
Pocasset
Gym Expansion
TTHQ
Red Brook Harbor
Cataumet
Megansett Harbor
Wakeby Pond
Mashpee Pond
Ashumet Pond
Johns Pond
Legend
Mitigation Focal Areas
Forest cover retention
Grassland Creation (primary)
Grassland creation (secondary)
Pine barrens improvement
Pine barrens improvement - MPMG area
MPMG Range
Camp Edwards
JBCC Boundary
Current range area
1:72,000
0 0.5 1 2 Miles
Figure 4-1
Other Proposed Projects
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

4.1 Gym Expansion

The Gym Expansion project involves the expansion of the existing parking area and construction of an outdoor running track, latrines, equipment shed, and maintenance of a landscape athletic field area. The existing gym site is currently occupied by an existing gymnasium, associated parking, and a baseball field as shown in **Figure 4-2**. The developed areas are surrounded by low quality PPSO and the playing field is maintained as lawn. The conceptual design incorporates expansion of existing facilities to address significant deficit of parking and infrastructure for Army training and physical fitness standards. Planned components include two to three acre parking expansion and three to five acre clearing for the additional facilities (i.e., running track, latrines, equipment shed, and athletic field). **Table 4-1** outlines the existing conditions and proposed impacts. The project will result in the loss of eight acres of PPSO. Seven acres of PPSO will remain on this site and the fields will continued to be maintained as lawn. As the PPSO is low quality and is likely only supporting the Eastern Box Turtle (which has not been confirmed at this site), the mitigation ratio used is 2:1 for mitigation acreage required. This site is not significant to Eastern Whip-poor-wills and the Eastern Box Turtle has not been found. However, it is marginally suitable for both and will be mitigated for both. **Table 4-2** provides details on proposed mitigation.

Table 4-1: Gym Expansion Impacts

Guild Associations	Mitigation Required Per MESA	Acres of Impact	Total Mitigation Acreage Required
Pine Barrens Guild	2:1 (Threatened)	8	16
Eastern Box Turtle	1.5:1 (Species of Special Concern)	8	12

Table 4-2: Gym Expansion Mitigation

Mitigation Standard	Location	Acres of Mitigation	Comments
Land Preservation	Tracts 1-4	16	2:1 ratio
Total Land Preservation		**16**	

Figure 4.2: Gym Expansion – Existing Conditions (looking NW)

Figure 4.3: Gym Expansion – Existing Conditions

4.2 Transient Troop Headquarters

The Transient Troop Headquarters (TTHQ) project involves the construction of three facilities to support non-stationed units of battalion size during annual training and similar events. Each facility contains three to five buildings and associated parking. Site selection has not yet been established though planning but includes the potential option of using the 1300 area which is presently managed as grasslands (see **Figure 4-4**). These grasslands are generally poor quality habitat but improving through management and occupied by Grasshopper Sparrows. The total project development will require conversion of 18 acres of managed grasslands to facility/infrastructure (e.g., building, parking area, and landscaping). The remaining area is already comprised of buildings or other disturbances. The first phase is anticipated to be planned in 2020/2021 for one facility and parking with a footprint of approximately six acres. **Figure 4-4** shows the potential full build out of the Transient Troop Headquarters. **Table 4-3** outlines the existing conditions and proposed impacts. The project will result in the loss of 18 acres of (low to moderate quality) MG. Two acres of MG will remain on site although the fragmentation of these two acres may reduce the value of this habitat and be counted as a Take. **Table 4-4** provides details on proposed mitigation.

Table 4-3: Transient Troop Headquarters Impacts

Guild Associations	Mitigation Required Per MESA	Acres of Impact	Total Mitigation Acreage Required
Grassland Guild	2:1 (Threatened)	18	36
Total		**18**	**36**

Table 4-4: Transient Troop Headquarters Mitigation

Mitigation Standard	Location	Acres of Mitigation	Comments
#4 Grassland Management	Grassland Mitigation Focal Area Parcel H – Unit K burn (Total burn=42, 36 to MPMG Range, remainder of 6)	6	completed in 2019
#4 Grassland Management	Grassland Mitigation Focal Area Parcel H – Unit K mowing (Total mow=80, 36 to MPMG Range, remainder of 44)	44	completed in 2019 FY 2020
#4 Grassland Management	Grassland Mitigation Focal Area Parcel H – Unit K continued management	108	18 acres treatment per year for remaining six years
Total		**144**	**8:1 provided**

Figure 4.4: Transient Troop Headquarters – Existing Conditions and Proposed Layout

4.3 Sierra Range Expansion

The Sierra Range Expansion project involves the expansion of the existing 300m range floor from 10 to 16 lanes to meet Army TC 25-8 standard for 300m Automatic Record Fire (ARF) Ranges including the expansion of the backstop (bullet capture) berm to the east (see **Figure 4-5**). The proposed expansion area was previously the former N Range which was abandoned in the 1950s and vegetation in this area has now succeeded into PPSO habitat. Once constructed, the range floor would be planted with a cover crop and light native grasses and forbs. The range floor is presently mowed at least twice a year during training season (spring through fall) and the range floor expansion would be maintained the same. The project footprint is comprised of 11 acres of PPSO which will be converted to range grasses and forbs for the additional lanes and maintenance buffers. The Sierra Range Expansion has been designed to avoid wetland impacts. Some work may be proposed within the 100-foot jurisdictional buffer zone to wetlands but will not have any direct or indirect impact on the wetlands. An Order of Conditions may be required for this work. **Table 4-5** outlines proposed impacts. **Table 4-6** provides details on proposed mitigation.

Table 4-5: Sierra Range Expansion Impacts by Guild

Guild Associations	Mitigation Required Per MESA	Acres of Impact	Total Mitigation Acreage Required
Pine Barrens Guild	2:1 (Threatened)	11	22
Eastern Box Turtle	1.5:1 (Species of Special Concern)	11	17 *

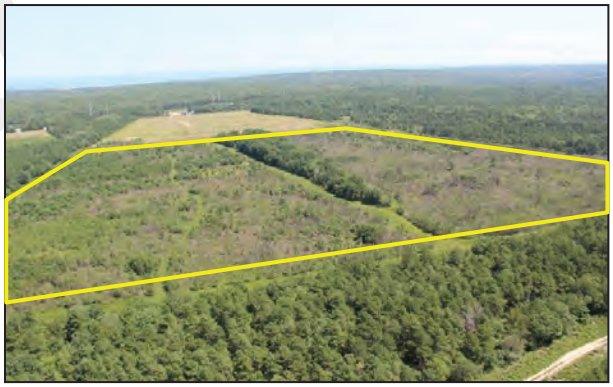
* number is rounded up

Table 4-6: Sierra Range Expansion Mitigation

Mitigation Standard	Location	Acres of Mitigation	Comments
Land Preservation	Forest Cover Retention Area (for Eastern Box Turtle)	17	1.5:1 ratio
Total Land Preservation		**17**	
#1 Mechanical Forestry	Pine Barrens Mitigation Focal Areas (154 acres available, remainder 110 for other projects)	13	30% of 44 (4:1); 2019
#2 Prescribed Burn	Pine Barrens Mitigation Focal Areas	31	70% of 44 (4:1), 2019
#3 Continued Management	Pine Barrens Mitigation Focal Areas	44	4:1 ratio; 2020-2022
Total Management		**88**	**8:1 provided**

Existing Sierra Range with additional six lanes proposed within red border. Mitigation area shown with yellow border.

Existing Sierra Range looking north with additional six lanes proposed within red border.



Existing Sierra Range looking northeast with 55-acre mitigation area following prescribed burn (2017) within yellow border.

Figure 4.5: Sierra Range Expansion Photographs

4.4 Tango Range Expansion

The Tango Range Expansion project proposes modernization and conversion of the Tango Range to serve as a "25-meter zero range" attached to the Sierra Automatic Record Fire 300m range (see **Figure 4-6).** This is proposed due to significant training needs and will allow units to zero and familiarize their weapons adjacent to the qualification range. Presently troops travel over seven miles away for this training. This project proposes clearing of PPSO. This work is recognized by NHESP to be a take by the MAARNG under MESA. This information was provided to NHESP in a MESA review letter dated 23 September 2019, prepared by BETA Group, Nover-Armstrong which is included as **Appendix D.**

This expansion will include increasing the firing range from 8 lanes to 32 lanes. Because the Tango Range is a 25m "zero" range, the design includes narrow (13± feet wide) firing lanes. The existing firing line and target line will be moved 126± feet to the north and the containment berm will be moved approximately 115 feet to the north. This shift will allow for concurrent use of the Tango Range and the Sierra Range (located to the east of Tango Range). Both the firing line berm and containment berm will be graded to drain water to the east and west of the range.

The project was designed to minimize clearing of mapped habitat, while still achieving the goals of the project. In total, the project will result in clearing 68,394 square feet (<1.6 acres) of PPSO habitat for the purposes of expanding the firing range, which includes material staging and laydown areas. For the purposes of this assessment, we have rounded the impact number up to 2.0 acres as shown in the table below.

To mitigate impacts to the state listed rare Lepidoptera (an order of insects that includes butterflies and moths) mapped within the site, the MAARNG is proposing to install downward facing, yellow-spectrum, low-wattage lights to replace the existing lights currently in use on the observation tower. No additional lighting, beyond what currently exists, is proposed for this range. Range lighting use will be limited to an as needed basis (e.g., night firing) to minimize impacts to moths and other vertebrate and invertebrate species. Long-term range maintenance will be consistent with the site's current condition and will involve vegetation mowing once or twice per month depending on vegetation growth. **Table 4-7** outlines proposed impacts. **Table 4-8** provides details on proposed mitigation.

Table 4-7: Tango Range Expansion Impacts

Guild Associations	Mitigation Required Per MESA	Acres of Impact	Total Mitigation Acreage Required
Pine Barrens Guild	2:1 (Threatened)	2	4
Eastern Box Turtle	1.5:1 (Species of Special Concern)	2	3

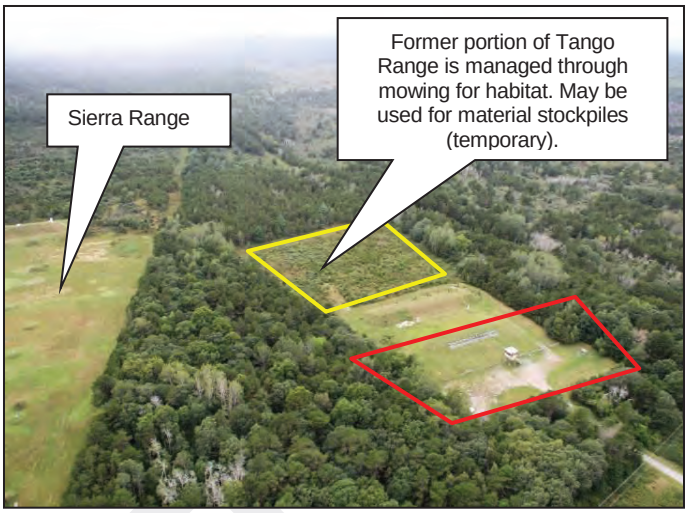
Table 4-8: Tango Range Expansion Mitigation

Mitigation Standard	Location	Acres of Mitigation	Comments
Land Preservation	Primary Forest Canopy Retention Area (for Eastern Box Turtle)	3	1:5:1 ratio
Total Land Preservation		**3**	
#1 Mechanical Forestry	Pine Barrens Mitigation Focal Area – Western Unit	2.5	30% of 8 (4:1); 2019
#2 Prescribed Burn	Pine Barrens Mitigation Focal Area – Western Unit (Total Burn = 399)	5.5	70% of 8 (4:1); 2019
#3 Continued Management	Pine Barrens Mitigation Focal Area – Western Unit	8	4:1 ratio
Total Management		**16**	**8:1 provided**

The Tango Range Expansion project will use the established mitigation bank to achieve net benefit through the following actions:

- **Standard #1 Mechanical Forestry**: 30% of impacts mitigated through mechanical forestry = 2.5 acres. Mitigation of 8.0 acres has already occurred.
- **Standard #2 Prescribed Burn**: 70% of impacts mitigated through prescribed fire = 5.5 acres. Mitigation has been provided from the 2019 burn of 399 acres.
- **Standard #3 Continued Management:** Continued management and maintenance through prescribed burns for 32.0 acres (years 3-9)
- **Standard #4 Manage Grasslands**: Regular mowing of the range floor will continue from April through September and will likely be on a monthly basis. Range floor will continued to be managed as grasslands.
- **Standard #5 Monitoring and Research**: Monitoring will be performed for the Eastern Box Turtle and pine barren moths including the following:
  - Construction phase BMPs to include Eastern Box Turtle searches and either exclusion barriers or radio-telemetry tracking of individuals. A plan is presently in development to support BMPs.
  - Extended monitoring of transmittered turtles (if used for specific projects)
  - Development of focal and statistically robust moth monitoring plan (contract and coordination with MassWildlife)
  - Implementation of moth monitoring plan to include Tango Range Expansion and associated mitigation
  - Continued monitoring of Eastern Whip-poor-will, support of MassWildlife Eastern Whip-poor-will research, and site-wide avian point count surveys.

Based on the above standards, a net benefit for the pine barrens habitat take will be achieved through 32.0 acres of mechanical forestry to restore PPSO with open canopy condition, 32.0 acres of initial prescribed burning, and 32.0 acres of prescribed burning as continued management of grasslands. Note that the acreages requires were all exceeded during 2019 through mitigation projects, planned, funded, and explicitly associated with this overall mitigation strategy. This strategy includes the Wheelock Overlook harvest and prescribed burning in burn unit RAW2, which is approximately one mile from the proposed Tango Range Expansion project.



View of Tango Range looking south with new range configuration (including expansion) within red border. Mitigation area shown with yellow border.

Existing Tango Range with new range configuration within red border. Expansion of berm and areas to be widened and maintained are not shown in this sketch.

Figure 4.6: Tango Range Expansion Photographs

4.5 Infantry Squad Battle Course

The Infantry Squad Battle Course (ISBC) involves the redevelopment and modernization of the existing ISBC area (formerly the Infantry Battle Course (IBC) Range) as the current design does not fully meet training requirements (see **Figure 4-7**). This area was mowed until 1997. In 2016, a wildfire (lightning strike) occurred at this site. The new range design would retain much of the vegetation cover which is a mosaic of PPSO and SOS. The project is designed to provide a live-fire range for squad move-and-shoot maneuvers with the intent to emplace targetry while maintaining woodland/shrubland natural setting to provide realistic maneuvers, concealment, and challenges. The development of this project will include five to six primary engagement (target) locations, eight-foot access dirt roads to targetry, and regular mowing and maintenance immediately surrounding targets. Understory mowing of movement corridors and engagement areas will be completed every other year. **Table 4-9** outlines proposed impacts. **Table 4-10** provides details on proposed mitigation. Although the design has not been completed, impacts are conservatively estimated at 40 acres of PPSO and 30 acres of SOS. Mowing of maintained areas should be less frequent than other ranges, but likely once or twice per training season to maintain equipment, infrastructure, and minimize wildlife impacts.

Table 4-9: ISBC Impacts

Guild Associations	Mitigation Required Per MESA	Acres of Impact	Total Mitigation Acreage Required
Pine Barrens Guild	2:1 (Threatened)	65	130
Eastern Box Turtle	1.5:1 (Species of Special Concern)	65	98 *

Table 4-10: ISBC Mitigation

Mitigation Standard	Location	Acres of Mitigation	Comments
Land Preservation	Primary Forest Canopy Retention Area (for Eastern Box Turtle)	98	1.5:1 ratio
Total Land Preservation		**98**	
#1 Mechanical Forestry	Pine Barrens Mitigation Focal Areas	78	30% of 260 (4:1); 2021, 2022
#2 Prescribed Burn	Pine Barrens Mitigation Focal Areas	182	70% of 260 (4:1); 2021, 2022
#3 Continued Management	Pine Barrens Mitigation Focal Areas	260	other years
Total Management		**520**	**8:1 provided**

* number is rounded up

ISBC aerial views (top two photos) and view looking south-southwest from above range tower.

Figure 4.7: Infantry Squad Battle Course Photographs

4.6 Capped Landfill Solar Array

The Capped Landfill Solar Array project involved the proposed construction of a 6 MW solar array on the capped L-F landfill within JBCC which would have altered existing high value MG habitat (see **Figure 4-7**). This project is not currently a central focus of this mitigation plan but is still a key consideration in evaluating and planning mitigation for the joint Air and Army National Guard. Even though the project is currently classified as terminated, the MAANG may coordinate a new solar array project and consider some portion of the capped landfill in site selection in the future. It is anticipated that additional site alternatives will be considered to reduce potential environmental impact (especially to State-listed fauna) for future solar energy development at JBCC. It is also anticipated that design constraints (e.g., acreage) will be considered to reduce impact and mitigation requirements. For example, conversion of existing habitat to a grassland in a "core" habitat area would improve conservation benefits rather than expanding into isolated patches. Nonetheless, this solar project is noted here as Tract 5 (132 acres) was transferred in 2017 from the SMRC to MassWildlife as mitigation for this project as was Parcel H – Unit K (completed in 2019). Please see **Section 5.0** for more details on the mitigation tracts and mitigation options.

Overall mutual benefit can be found, to include cost reduction and rare species management through clearing lower quality forest for solar development. The landfill is currently the best location in the region for Upland Sandpiper nesting, which would require extremely expensive mitigation. It will be much less expensive to clear low quality pine-oak forest for direct placement of solar rather than attempting to provide Upland Sandpiper habitat.

Figure 4.8: Capped Landfill Solar Array

5.0 Conservation and Management Plan

Under MESA, impacts to rare species may be permitted if a project has long-term net benefits to the affected rare species. In consultation with NHESP, MAARNG has developed this CMP Plan to provide a long-term net benefit to the conservation of the State-listed species that may be impacted from the construction and operation of the MPMG Range. Implementation of this Plan will provide net benefit across much more area of Camp Edwards and will combine with ongoing site-wide management through the INRMP and additional habitat improvement beyond mitigation to support the MPMG Range use. The INRMP provides effect mechanisms to ensure net benefit despite loss of habitat. The INRMP is presently being updated. In addition, this Plan will be memorialized, not only in the INRMP, but also in the required Annual Reports (State of the Reservation). This section describes condition and intent for the various types of land actions, units, and parcels discussed for mitigation planning. Other types of land protection may come available and be included to this the Plan through coordination with MassWildlife and NHESP. However, this current Plan focuses on the following mitigation efforts; each one described in a section below.

- Land Preservation
  - Land Preservation by Transfer of Parcels to MassWildlife
  - Land Preservation with Management (Parcel H – Unit K)
  - Pine Barrens Forest Canopy Reserve Areas (FCRA)
- Management of existing habitat with Mitigation Focal Areas
  - Pine Barrens Mitigation Focal Areas
  - Grasslands Mitigation Focal Areas
- Monitoring and research of rare species
- Avoidance and minimization
- Cost of management

Figure 5-1 provides an overview map of JBCC including the location of land preservation parcels and mitigation focal areas. To date, the MAARNG has already performed actions which contribute to the net benefit of the rare species at Camp Edwards and JBCC including the following:

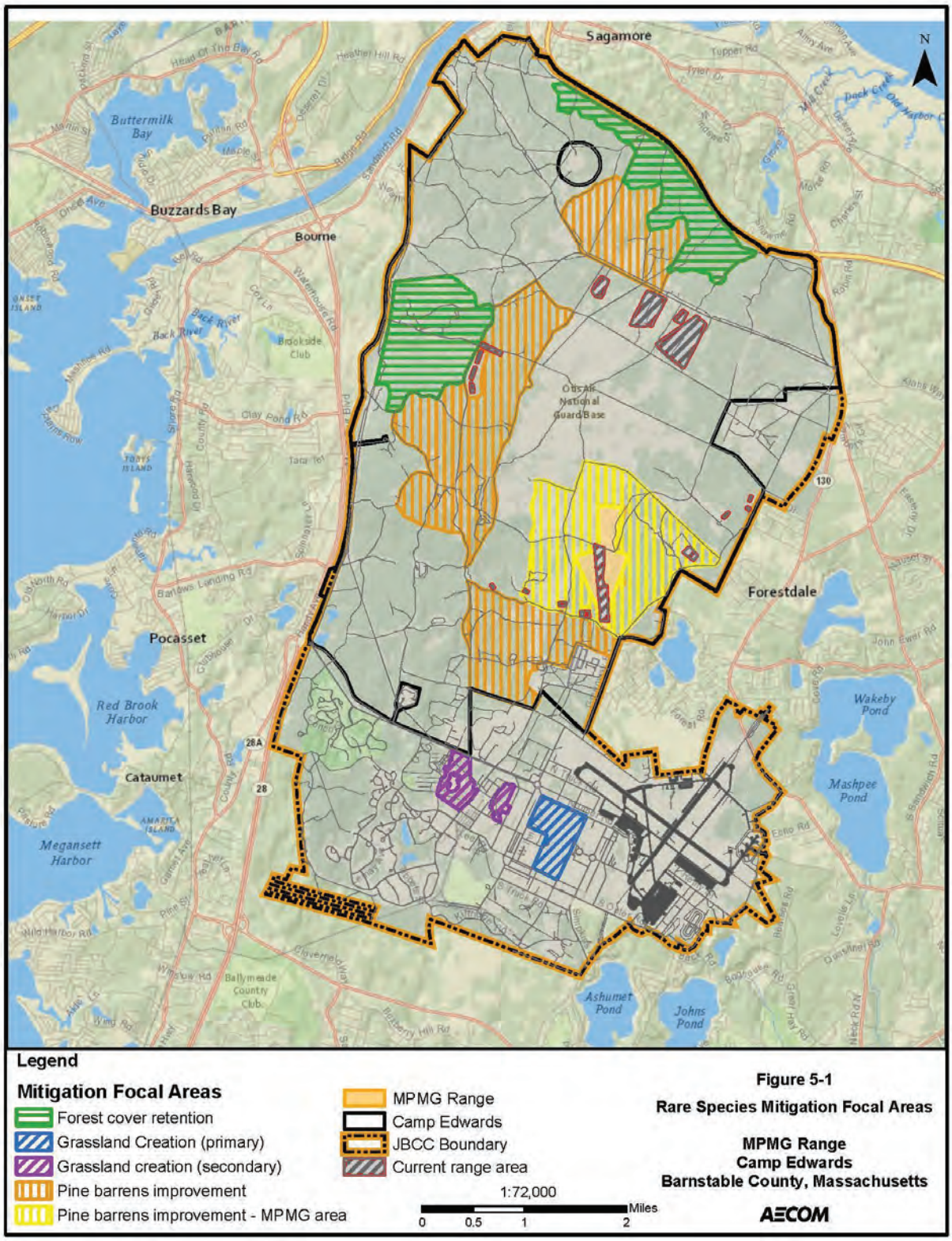
- Land Transfer of Tract 5 (133 acres) 2014, 2017 (PPSO)
- Land Transfer of Tracts 1-4 (128 acres) 2019 (PPOF)
- Land Transfer of Parcel H of unit K (150 acres) (MG)
- Development and implementation of Range Complex Master Plan
- Development and implementation of site-wide INRMP

On-going actions are continuing which contribute to the management of resources at Camp Edwards:

- Collaborative development of mutually beneficial mitigation and monitoring strategies
- Range and infrastructure environmental review and design process
- Mitigation implementation

The conversion, management, and protection of rare species habitat will be assigned to “Mitigation Focal Areas”. Benefits of using focal areas including consolidating mitigation for maximum benefit while providing flexibility of management and ensuring sufficient acreage for new or revised projects The Mitigation Focal Areas include two types of areas where active or passive mitigation through management may occur:

- Pine Barrens Mitigation Focal Areas
- Grassland Mitigation Focal Areas


Sagamore
Buzzards Bay
Bourne
Pocasset
Cataumet
Forestdale
Buttermilk Bay
Red Brook Harbor
Megansett Harbor
Wakeby Pond
Mashpee Pond
Ashumet Pond
Johns Pond
Otis Air National Guard Base
Brookside Club
Ballymeade Country Club
N
Legend
Mitigation Focal Areas
Forest cover retention
Grassland Creation (primary)
Grassland creation (secondary)
Pine barrens improvement
Pine barrens improvement - MPMG area
MPMG Range
Camp Edwards
JBCC Boundary
Current range area
1:72,000
0 0.5 1 2 Miles
Figure 5-1
Rare Species Mitigation Focal Areas
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

Some parcels may have multiple mitigation strategies applied such as land preservation combined with management of grasslands as is proposed at Parcel H – Unit K.

A summary of impacts and mitigation for the MPMG Range and other projects described in Section 4.0 are provided in **Table 5.2**.

5.1 Land Preservation

Land preservation actions include the transfer of parcel to MassWildlife as describe in Section 5.1.1 and the preservation of land through the creation and management of the Forest Canopy Reserve Areas (or Forest Retention Areas) as described in **Section 5.1.2**.

5.1.1 Land Preservation with Transfer of Parcels to MassWildlife

Based on previous and ongoing discussions and coordination efforts with MassWildlife, MassWildlife will provide mitigation credit for parcels already transferred, parcels to be transferred, and possible parcels to be transferred in the future. Projects proposed within the JBCC will be reviewed individually regarding impacts to rare species including an analysis of alternatives and rare species impacts avoidance, minimization, and mitigation. For the purposes of the JBCC, specifically MAARNG activities at JBCC, MassWildlife has agreed that land previously transferred for mitigation by MAANG or SMRC may be used for credit for a different project in the same habitat type if the original project was cancelled. Accordingly, in order to provide a long-term net benefit to State-listed species, MAARNG proposes to utilize land acreage credits for the parcel previously transferred to MassWildlife as part of the Capped Landfill Solar Array project that is no longer occurring. This includes Tract 5 (SMRC) and Parcel H – Unit K

MAARNG and other agencies at the JBCC have worked with NHESP to transfer land at the JBCC to the Commonwealth of Massachusetts, Division of Fisheries and Wildlife (MassWildlife) as a primary mitigation measure for rare species impacts for the previously proposed solar array project at the closed landfill and more recently the overall mitigation bank. Land transfer elements as part of the overall MAARNG mitigation bank includes:

- Transfer of SMRC parcels owned by the Commonwealth of Massachusetts direct to MassWildlife ownership (Track 5, Tracts 1-4)
- Transfer of the Massachusetts Division of Capital Asset Management and Maintenance (DCAMM) parcels under MAARNG license (Parcel H – Unit K)
- Active management on MAARNG-held parcels and MassWildlife-owned parcels

The following section is a description three parcels within four mitigation areas possible as summarized in **Table 5-1** below.

Table 5-1: Mitigation Transfer Parcels and Acreages

Mitigation Transfer Parcels	Habitat	No Management Proposed	Manage Grassland (Standard #4)	Total
Tracts 1-4	PPOF	128.0		128.0
Tract 5A	PPSO	133.0		133.0
Parcel H – Unit K	MG, PP, red cedar, invasives		150.0	150.0
Totals		**261.0**	**150.0**	**411.0**

Table 5-2: Summary of Impacts and Mitigation

Acres of Direct Impact	Pine Barrens Guild	Grasslands Guild	Eastern Box Turtle	TOTAL
MPMG Range	171	36	207	**207**
Gym Expansion	8		8	**8**
Transient Troop Headquarters		18		**18**
Sierra Range Expansion	11		11	**11**
Tango Range Expansion	2		2	**2**
Infantry Squad Battle Course (ISBC)	65		65	**65**
TOTAL	**257**	**54**		**311**
Mitigation Acreage Required based on MESA Ratios [1,2]	**Pine Barrens (2:1)**	**Grassland (2:1)[3]**	**Eastern Box Turtle (1.5:1)**	**TOTAL**
MPMG Range	342	36	310	**378**
Gym Expansion	16		12	**16**
Transient Troop Headquarters		36		**36**
Sierra Range Expansion	22		17	**22**
Tango Range Expansion	4		3	**4**
Infantry Squad Battle Course (ISBC)	130		98	**130**
TOTAL	**514**	**72**		**586**

Land Preservation Proposed	Pine Barrens Guild	Grassland Guild	Eastern Box Turtle	TOTAL
MPMG Range (Tract 5, FCRA)	133		177	**310**
Gym Expansion (Tracts 1-4)	16			**16**
Transient Troop Headquarters (none)				**0**
Sierra Range Expansion (FCRA)			17	**17**
Tango Range Expansion			3	**3**
Infantry Squad Battle Course (ISBC)			98	**98**
TOTAL	**149**	**0**	**294**	**443**
Management Mitigation Proposed by MAARNG [2] (at 8:1)	**Pine Barrens Guild**	**Grassland Guild**	**Eastern Box Turtle**	**TOTAL**
MPMG Range	832	36		**868**
Gym Expansion				**0**
Transient Troop Headquarters		144		**144**
Sierra Range Expansion	88			**88**
Tango Range Expansion	16			**16**
Infantry Squad Battle Course (ISBC)	520			**520**
TOTAL	**1456**	**180**	**0**	**1636**

[1] Impacts may overlap, acreages used for totals are highlighted in grey

[2] Totals not including "continued maintenance/management" (e.g., Standard #3)

[3] 36 acres at the MPMG Range to be mitigated at 1:1 ratio

All numbers have been rounded up to the nearest whole number

5.1.1.1 Tracts 1-4

Tracts 1-4 (see **Figure 5-2)** are comprised of 128.0 acres located within the Town of Falmouth owned by the SMRC and licensed to MassWildlife for recreation and hunting as part of Crane WMA. Several tracts were set aside for the SMRC decades ago with the expressed intent of future mitigation use and their management and use is under the control of the SMRC. The license was expiring in November 2019 prior to transfer. These tracts are dominated by pitch pine-oak woodland dominated by white oak with some pitch pine component and dense understory dominated by low-bush blueberry and huckleberry. The western half of these tracts is moraine dominated (including "Mt. Zig") with more pitch pine and topographic relief while the eastern half is level and has little pine being dominated with white oak. These tracts have been transferred to MassWildlife after being deemed to be surplus similar to Tract 5 below. This allowed this land to be transferred to MassWildlife ownership and be used for future mitigation of projects at JBCC. No management of these tracts by MAARNG is proposed. Transfer required approval of the SMRC and signature by the Governor, which was completed on in September of 2017 (see **Appendix E).** Transfer of these tracts will significantly contribute to ensuring net benefit for the Eastern Box Turtle and Eastern Whip-poor-will through land protection. In addition, with the consolidation of the Crane WMA parcels with Tracts 1-4, a large area can be protected and managed for wildlife habitat. The following table outlines the various tracts and associated descriptions. No costs are associated with this mitigation method other than staff coordination with MAARNG and MassWildlife.

Table 5-3: Mitigation Tracts 1-4

Mitigation Transfer Parcel	Habitat	Total
Tracts 1-4	PPOF	128.0
Total		128.0

5.1.1.2 Tract 5

Tract 5 is comprised of 132 acres located within the Towns of Falmouth, Bourne, and Sandwich along the southern boundary of the JBCC and abuts the Crane WMA as shown on **Figure 5-2**. It is almost all PPSO woodlands with a mature pitch pine canopy except for a small cleared area. It is bounded on all sides by either dirt roadways or railroad lines. Bearberry *(Arctostaphylos uva-ursi)* is common plant along these roadsides which is an evergreen groundcover that thrives on sandy, acidic soils. Tract 5 has already been transferred from SMRC MassWildlife as signed by Governor Charles Baker in 2017 relative to the Capped Landfill Solar Array project. As that project is no longer going forward, this tract is still available to be utilized for rare species mitigation for the MPMG Range project and other projects proposed. This is particularly viable as the PPSO habitat existing provides good quality replacement for the MPMG Range and consolidates with the Crane WMA. The following table provides a description of the resources at this tract.

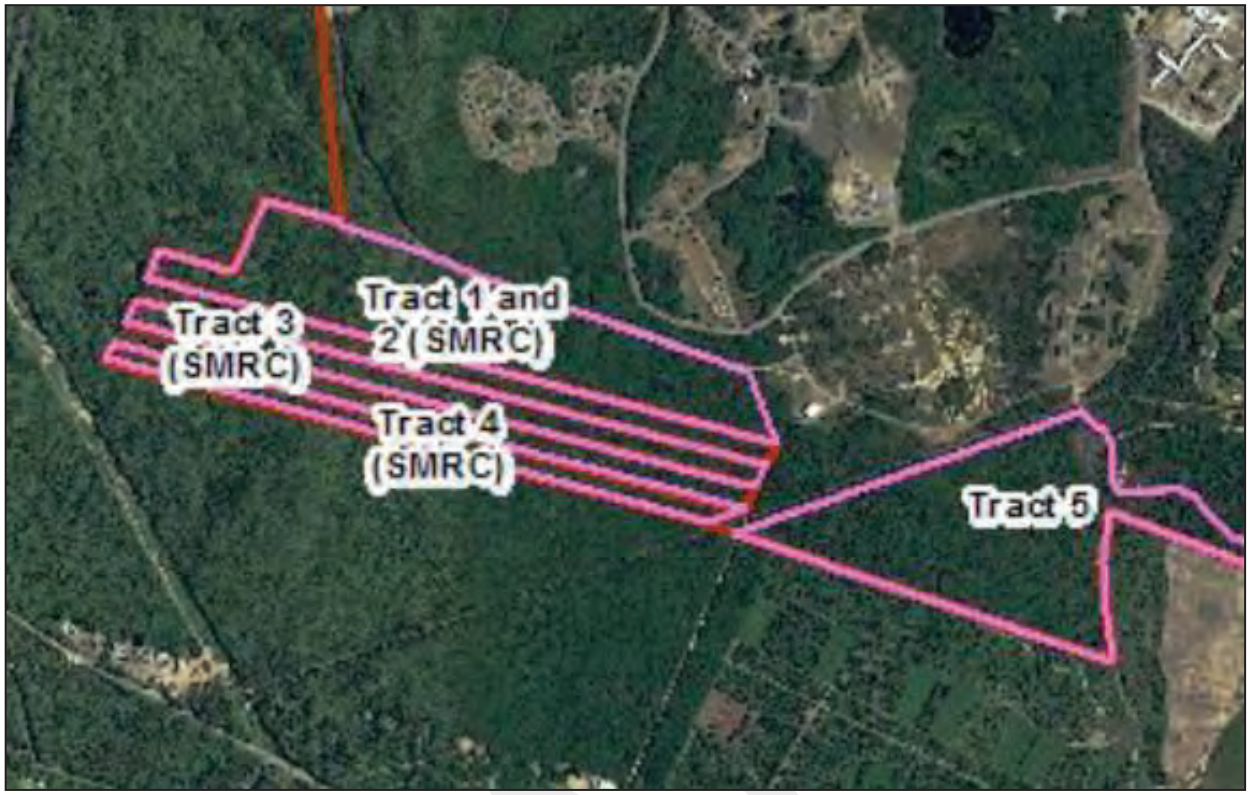


Figure 5.2: Mitigation Tracts 1-4

The eastern portion of the tract (identified as Track 5B) was previously slated for grassland conversion in accordance with the Solar Array Project Grasslands Mitigation Plan. However, based on PPSO condition and Eastern Box Turtle records, current use is as PPSO mitigation. The western portion of this tract (identified as Track 5A above) was slated to be held "in reserve" for future projects needing PPSO mitigation. The western portion may benefit from a prescribed burn but is currently in suitable PPSO condition. This large tract of high quality PPSO natural community adjacent to Crane WMA will significantly contribute to net benefit for a variety of pine barrens lepidopterans, Eastern Whip-poor-will, and Eastern Box Turtles. Mitigation credit for this parcel would be transferred from the Capped Landfill Solar Array project and applied to the MPMG range. No costs are associated with this mitigation method other than staff coordination with MAARNG and MassWildlife.

Table 5-4: Mitigation Tract 5

Mitigation Transfer Parcel	Habitat	Total
Tracts 5	PPSO	133.0
Total		133.0

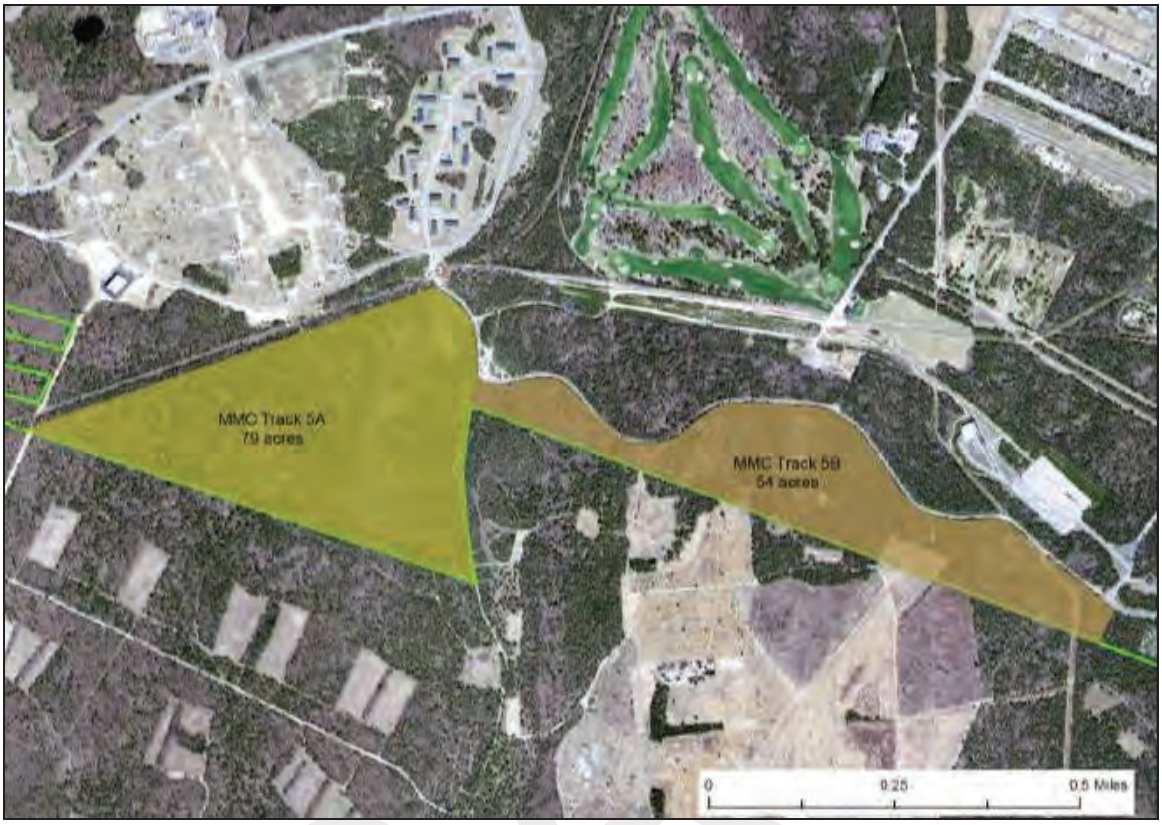


Figure 5.3: Mitigation Tract 5

5.1.2 Land Preservation with Management (Parcel H – Unit K)

Parcel H – Unit K is comprised of 150 acres located within the JBCC (see **Figure 5-4**). The parcel was owned by DCAMM and leased to the MA ANG/USAF who in turn licensed the parcel to the U.S. Department of Transportation (US DOT) for the Volpe Research Center. This parcel was proposed as mitigation for the Capped Landfill Solar Array project that has now been cancelled. Nonetheless, the parcel has been processed for transfer to MassWildlife to be used for future mitigation similar to the tracts described above. It had been proposed that the entire parcel would be maintained and managed as MG by MAARNG throughout the 150 acres over the course of eight years. This parcel will be used for both land preservation and management of grasslands.

Unit K is currently in an intermediate state consisting of cultural grassland, managed grassland, and transitional (treed) grassland. There was remnant impervious surfaces scattered throughout the area (14 acres) that was removed in 2013. The area is dominated by grass species including filiform fescue (*Festuca tenuifolia*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), hairgrass (*Deschampsia flexuosa*), redtop (*Agrostis gigantea*), poverty grass (*Danthonia spiccata*), and Pennsylvania sedge (*Carex pennsylvanica*). The only common tree species are immature pitch pine and red cedar. Sweetfern (*Comptonia peregrina*), bayberry (*Myrica pensylavanica*), blueberry, and dewberry are all through in dense clumps. Some areas are managed to reduce at least the first two species. Many nonnative and invasive species such as honeysuckle (*Lonicera* spp.), Asiatic bittersweet (*Celastrus orbiculata*), autumn olive, and spotted knapweed (*Centaurea maculosa*) occur in this grassland area. However, several Watch List species also occur and indicate the central area lacked soil disturbance. The previous commitments were to:

- Maintain all grassland areas outside the airfield fence in order to provide habitat for State-listed bird species and prevent areas from returning to forested lands.
- Approximately 27 acres will be managed each year either by mechanical means such a mowing or prescribed burns.
- This equates to return management intervals at any one area within this parcel every four years.
- Mowing to be accomplished in accordance with the Grasslands Management Plan 02, including but not limited to, not mowing the area during the period May 1 - July 31 of each year.
- Clear grassland areas that are slowly succeeding to forest. Seed with native grasses.
- Maintain as grasslands in accordance with the Grasslands Management Plan 02, in order to provide habitat for State-listed bird species and prevent areas from returning to forested lands.
- Particularly in Unit K, consider use of controlled burns for grassland management.[3]

Figure 5.4: View of Mitigation Parcel H - Unit K

[3] Otis ANGB Solar Project Grasslands Mitigation Plan. October 2012, included as an appendix to the Environmental Assessment for Power Purchase Agreement Photovoltaic Solar Array Installation

Figure 5.5: View of Mitigation Parcel H - Unit K

Approximately 90 acres is presently dominated by forest or invasive shrubs as is not presently managed. The remaining 60 acres is MG that is managed by MAARNG through prescribed burning. Conversion to MG of the 90 acres is proposed by MAARNG along with continued management of the 60 acres. Mitigation credit would not be applied by MassWildlife for the transfer/protection of 150 acres until the habitat was fully converted to MG. However, the conversion and management over the eight-year period will mitigate the projects in this Plan and capacity for additional. The value of Parcel H – Unit K as grassland mitigation is that it provides "core" MG habitat area, which is critical to grassland species. MAARNG completion of habitat conversion will take the form of completed land clearing (approximately 60 acres remaining), followed by prescribed burns through 2023, one or two mowings (either targeted or complete depending on needs), and potentially approximately 20 acres of chemical treatment to managed the invasive species. Habitat conversion would be consistent with actions at Crane WMA (e.g., vertical extraction of trees, minor grading, seeding with local/regional native seed, and prescribed fire) under guidance of the State forester and others. This conversion and transfer will significantly contribute towards net benefit for multiple grassland obligates, including the Grasshopper Sparrow, Vesper Sparrow, and Upland Sandpiper.

An approximately 27 acre area will be managed each year. This will equate to every area of the parcel being managed on a four year return interval. This will allow for the slow conversion of low value habitat to high value grasslands. One the eight year period has been completed (and all areas within the parcel managed two times), the parcel will be available to use the acreage as part of the "Mitigation Bank". Management is being credited now as described in **Section 5.0**. The land transfer has already occurred but land preservation credits (at a 2:1 ratio = 75.0 acres) will not occur for another eight years.

It is the expressed hope of JBCC that USDOT and MassWildlife will develop a mutually beneficial agreement. The USDOT Volpe Research Center has been very helpful and supportive of grassland management. We believe the continued colocation is consistent with goals and interagency cooperation.

Table 5-5: Parcel H - Unit K

Mitigation Transfer Parcel	Habitat	Total
Parcel H – Unit K	MG, PP, red cedar, invasives	150.0
Total		150.0

MAARNG proposes and has discussed using long-term management of Parcel H – Unit K for MassWildlife as the primary grassland mitigation method. This present mutual benefit while also being most valuable conservation for grassland species. A grassland management plan will be developed for this parcel to guide MAARNG in the managing and treatment of the acreage to be converted to grassland or resulting in enhanced grassland. MAARNG is proposing to develop this plan with input from MassWildlife. Management strategies to review include lighter mechanized conversion to MG in combination with prescribed fire in lieu of heavy conversion of forest to grassland elsewhere. A slower transition back to grassland is proposed for a number of reasons. The highest priority reason is that initial investigation with the State botanist found several species indicating a lack of past soil disturbance. Maintaining this recently discovered diversity and condition is high conservation value while also restoring sandplain grassland condition of currently wooded areas. Additionally, MAARNG has had good results with combining intensive fire with herbicide and mechanical management while minimizing mycorrhizal impacts. While results at Crane WMA are exemplary, this site would benefit from a slower conversion and its history as a sandplain grassland field means the species are already there and waiting for release rather than converting PPSO to MG.

The standard for grassland conversion for projects included herein is to manage an acreage equal to the project take annually for an eight year period. This achieves an 8:1 ratio consistent with other mitigation (i.e., 4:1 ratio, plus same for continued management). For the grasslands, this effort will be apportioned based on the identified priorities and the goal of the entirety of the parcel being suitable and occupied sandplain grassland at the end of the eight years. Some portions require basic maintenance (e.g., targeted spray and fire) while others will require successive treatments and rotation of intensive burning, spraying invasives (including encroaching native species), and targeted mowing). A standard metric will be to treat no more than half of the cantonment (non-airfield) grasslands with any combination within a six month period.

A key consideration is working to maximize species benefit within the parcel and across the cantonment grassland. The parcel combing with the adjacent southwest corner is the prime area which requires small stands of trees, while Upland Sandpipers need wide open space. The current structure of the parcel provide a great opportunity to maintain current rare species use by all species while improving conditions throughout with a mosaic of sandplain grassland reference condition. Secondary sites have been identified if required and are described briefly below. However, maximum benefit can be achieved for all listed species by MAARNG improvement of Park H – Unit K as opposed to clearing PPSO in cantonment.

5.1.3 Pine Barrens Forest Canopy Reserve Areas

The Forest Canopy Reserve Areas (FCRA) are comprised of 1,177 acres in two separate areas within Camp Edwards as shown on **Figure 5-1** and **Figure 5-6** in green. The intent of these FCRAs are to be “set aside” for management planning for the goal of retention of the forest canopy to preserve a closed canopy condition which is valuable for the Eastern Box Turtle. That is, these areas are for the preservation of more forested later successional areas. These areas are primarily vegetated with mature PPOF with closed

canopy. These FCRAs will also allow woods with less of a canopy cover to evolve into a more closed canopy condition. Two distinct FCRAs have been identified:

- **Primary FCRA** (or first FCRA) 545.0 acres in northern unit
- **Secondary FCRA** (reserve, if needed) 632.0 acres in southern unit

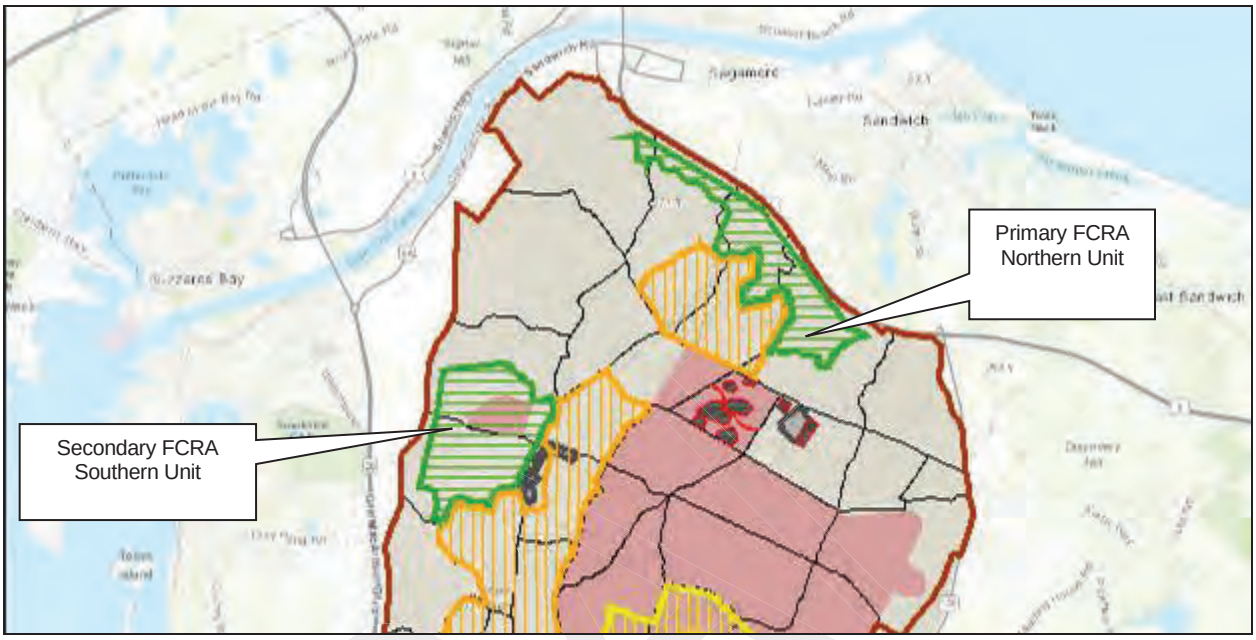


Figure 5.6: Forest Canopy Reserve Areas

FCRAs will be included in the INRMP update and all other Camp Edwards/JBCC planning documents to place priority on maintaining the closed forest canopy condition. Existing roads and firebreaks would be maintained to preserve as much canopy closure as possible, especially as canopy fire hazard is low in these areas. Pine barrens habitat improvement and other forest opening projects will not be planned within FCRAs. Although not proposed at this time, any prescribed burning that may be planned will be designed to limit canopy impacts through ignition, timing, and other methods as well as to limit ground-level intensity.

In order to maintain and improve the level of MAARNG training at Camp Edwards, the FCRAs will not limit MAARNG or other service training activities beyond those limits currently in place due to the EPS (e.g., no off-road travel, no vegetation cutting without Natural Resources Office approval, etc.). FCRA will not impede maintenance of existing utilities and infrastructure (e.g., powerline ROW, bivouac site[s], roads and firebreaks). Training use in designated FCRAs is minimal and will not increase to a level problematic for Eastern Box Turtles or canopy retention.

Table 5-6: Forest Canopy Reserve Areas

FCRA Parcel	Habitat	Total
Primary FCRA – Northern Unit	PPOF, PPSO, oak forest	545.0
Secondary FCRA – Western Unit	PPOF, PPSO, oak forest	632.0
Total		1,177.0

If the designation of one or both of these areas as FCRA becomes precluded due to unforeseen changes in Army training requirements or other true requirements, then designation of replacement areas in currently healthy, closed forest condition will be coordinated with MassWildlife. If groundwater remediation activities require clearing forested areas, coordination will occur to determine if long-term site plans warrant excising the area from the FCRA and/or designating replacement.

The cost of this type of mitigation is limited to developing planning documents and management strategies for each of the areas. That is, there is no physical work in these areas for mitigation purposes proposed at this time including no current plans for further fire breaks or prescribed burns.

5.2 Mitigation Focal Areas

Mitigation Focal Areas have been developed by the Camp Edwards Natural Resources Office in order to describe various types of mitigation possible for potential impacts of projects on rare species. The following two types of Mitigation Focal Areas are described in detail below and in **Table 5-7** along with the seven physical parcels that have been assigned to each types. Over 4,600 acres have been identified for mitigation.

- Pine Barrens Mitigation Focal Areas
- Grassland Mitigation Focal Areas

Table 5-7: Mitigation Focal Areas and Acreages

Area Description	Pine Barrens Mitigation Focal Areas	Grasslands Mitigation Focal Areas	Total
Northern Unit	519		519
Western Unit	1,204		1,204
Southern Unit	619		619
MPMG Zone	1,060		1,060
Training Area BA-2		78	78
1500/1700 Areas		29	29
Totals	**3,402**	**107**	**4,686**

The following table identifies how each of the mitigation areas types associate with the various guilds.

Table 5-8: Mitigation Areas and Associated Guilds

Mitigation Focal Area	Pine Barrens Guild	Grassland Guild	Northern Harrier	Eastern Whip-poor-will	Eastern Box Turtle
Pine Barrens Mitigation Focal Areas	x		x	x	x
Grassland Mitigation Focal Areas		x	x		

5.2.1 Pine Barrens Mitigation Focal Areas

The Pine Barrens Mitigation Focal Areas are comprised of 2,342 acres in three different areas within Camp Edwards as shown in **Figure 5-1** and **Figure 5-7** in orange. The intent is to implement needed management of these focal areas in order to maintain the PPSO and SOS communities. All Pine Barrens Mitigation Focal Areas were chosen based upon long-term management planning for the best areas to improve pine barrens conditions based on combined need for ecosystem management, Army training, and wildland fire hazard. Fires that did occur within the frequently burned areas burned less intensely and more patchily. The three focal areas, plus the MPMG zone, are core areas for PPSO and SOS at Camp Edwards, but are also where these communities are most at risk due to encroachment, lack of fire, vegetative density, and ongoing conversion/mesification. Management of these areas has the most potential benefit to rare fauna and flora as well as the overall pine barrens ecosystem and also serves to most benefit Army training and reduction of fire hazard. Additionally, the proximity to the Impact Area is intended for maximum benefit to species losing habitat due to tree encroachment and lack of management in ordnance hazard zones. Three distinct Pine Barrens Mitigation Focal Areas have been identified, all of which are located outside of the Impact Area:

- **Northern unit:** 519 acres dominated by PPSO and SOS, needing management due to white oak encroachment and severely over-mature scrub oak; high potential for moths, New England Cottontail, Eastern Whip-poor-will
- **Western unit:** 1,204 acres dominated by PPSO, prioritized for prescribed fire and mechanical treatment; high priority PPSO and SOS restoration adjacent to Impact Area. Includes Training Area A-5 restoring pine shrub savanna
- **Southern unit:** 619 acres in active management for PPSO and SOS, critical need of further management as well as having close proximity to MPMG “take”

In addition, as part of the MPMG Range project, there are an additional 1,060 acres of very high priority PPSO and SOS that need to be managed to address severe fuel loading hazard and detrimental pitch pine encroachment impacting habitat quality and potential high hazard condition from MPMG Range development identified as the “MPMG Zone”. The majority of this zone is Impact Area or other ordnance hazard zones of very high habitat value degrading from lack of management. There is extremely high conservation value in reintroducing management. The following table provides a summary of the four Pine Barrens Mitigation Focal Areas along with identified habitat categories under existing conditions and habitat that could be restored through active management.

This “MPMG Zone” is not directly included in the overall mitigation plan calculations as timelines are uncertain when work would be started and the work is directly linked to the proposed MPMG Range project. However, implementation of the necessary management to reduce fuels and fire hazard will be highly beneficial to pine barrens species and critical to community safety. Uncertainty is based on funding or ordnance removal, firebreaks, and development of aerial ignition program.

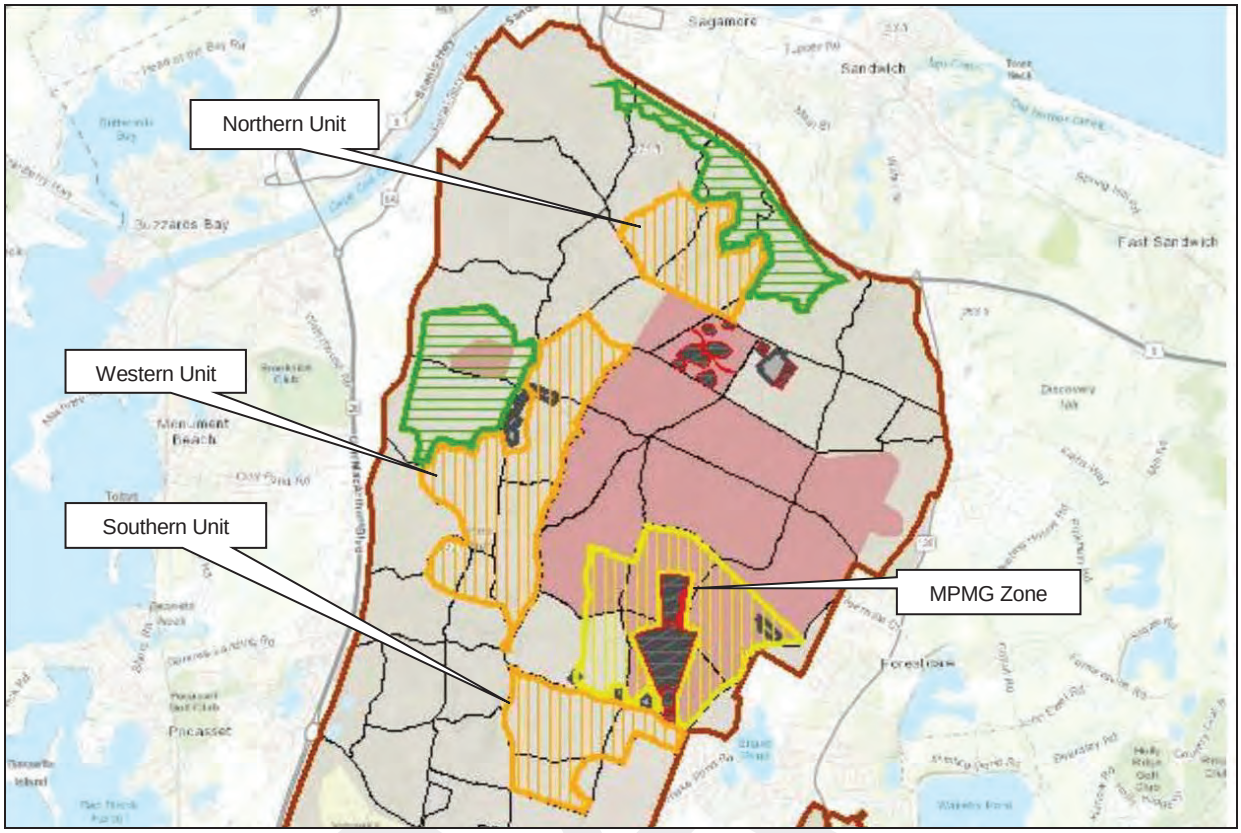


Figure 5.7: Pine Barrens Mitigation Focal Areas

Table 5-9: Pine Barrens Mitigation Focal Areas

Area Description	Habitat	Total
Northern Unit	PPSO, SOS	519
Western Unit	PPSO	1,204
Southern Unit	PPSO, SOS	619
Subtotal		**2,342**
MPMG Zone	SOS, PPSO, PPOF	1,060
Total		**3,402**

Mitigation of restoring healthy PPSO and SOS habitats can be done mechanically or by prescribed fires. The two are often most effective when combine for reduces restoration timelines and reduced fire behavior. Mechanical management is much more expensive, but when targeted to facilitate further actions can maximize conservation benefit. Also, as described in Standard #1, mechanical forestry is critical for providing open canopy woodland/shrub condition. The cost of this mitigation is estimated below.

- **Costs of manual mitigation:** Mechanical pine barrens rehabilitation/improvement costs the same, typically, for mowing (e.g., brontosaurus and other forestry mowers) or whole-tree

harvesting with various benefits to each, but whole-tree harvesting typically reducing restoration timelines and long-term expense at $2,200/acre.

- **Cost of prescribed fire mitigation:** Prescribed fire is budgeted by burn day, which in pine barrens at Camp Edwards typically ranges from 30 acres to 120 acres at $10,000/day but also requiring long-term planning and management/preparation costs to include fire management program, operation planning, firebreaks, and fuel preparation. See **Section 6.0** for more information on fire management.

5.2.2 Grassland Mitigation Focal Areas

The Grassland Mitigation Focal Areas are comprised of 107 acres in two different areas within the JBCC Cantonment Areas as shown in Figure 5-1 and Figure 5-8 (below) in purple. The intent is to hold these areas in reserve for grassland conversion in the even additional area is needed or conditions/agreements change relative to the primary mitigation area (Parcel H – Unit K). Neither area would be as beneficial for State-listed species as intensive improvement/management in this primary location, but if needed they can provide nearby grassland habitat by removing existing woodland.

The primary weakness to mechanical forestry is dependence on market influence and biomass power generation which is in decline in New England. Reduction in biomass power generation poses a significant risk to effective pine barrens restoration in New England. Two distinct areas have been identified:

- **Training Area BA-2:** 78 acres of PPSO community in a rough “doughnut” shape, leaving a scrub oak filled depression interior that could be managed as a habitat component.
- **1500 Area and 1700 Area:** 29 acres of PPOF immediately west of existing managed grasslands, but separated by paved parking with limited use by remediation programs, especially lay-down and storage for well drilling operations.

The following table provides a summary of the two Grassland Mitigation Focal Areas along with identified habitat categories under existing conditions and habitat that could be restored through active management.

Table 5-10: Grassland Mitigation Focal Areas

Area Description	Habitat	Total
1500 and 1700 Area	PPOF	29.0
Training Area BA-2	PPOF, PPSO	78.0 *
Total		**107.0**

* Currently wooded area, surrounding nine acre central scrub oak frost bottom (excised from mitigation). Grassland mitigation benefit from proximity to frost bottom

The intent is to utilize one or both of these parcels if Parcel H – Unit K is untenable. Conversion of these areas to MG would involve mechanically converting forested areas to grasslands by removing trees and brush, harrowing, and seeding with native grass seed. Management of the MG would include mechanical mowing and /or prescribed fire every three years and chemical treatment of invasive species, as needed. The cost of this mitigation is estimated below.

- **Costs of manual conversion:** Conversion of forested areas to grassland at $6,000/acre.
- **Cost of prescribed fire mitigation*:*** Prescribed fire is budgeted by burn day, which in grasslands at Camp Edwards typically ranges from 20 acres to 60 acres at $10,000/day.

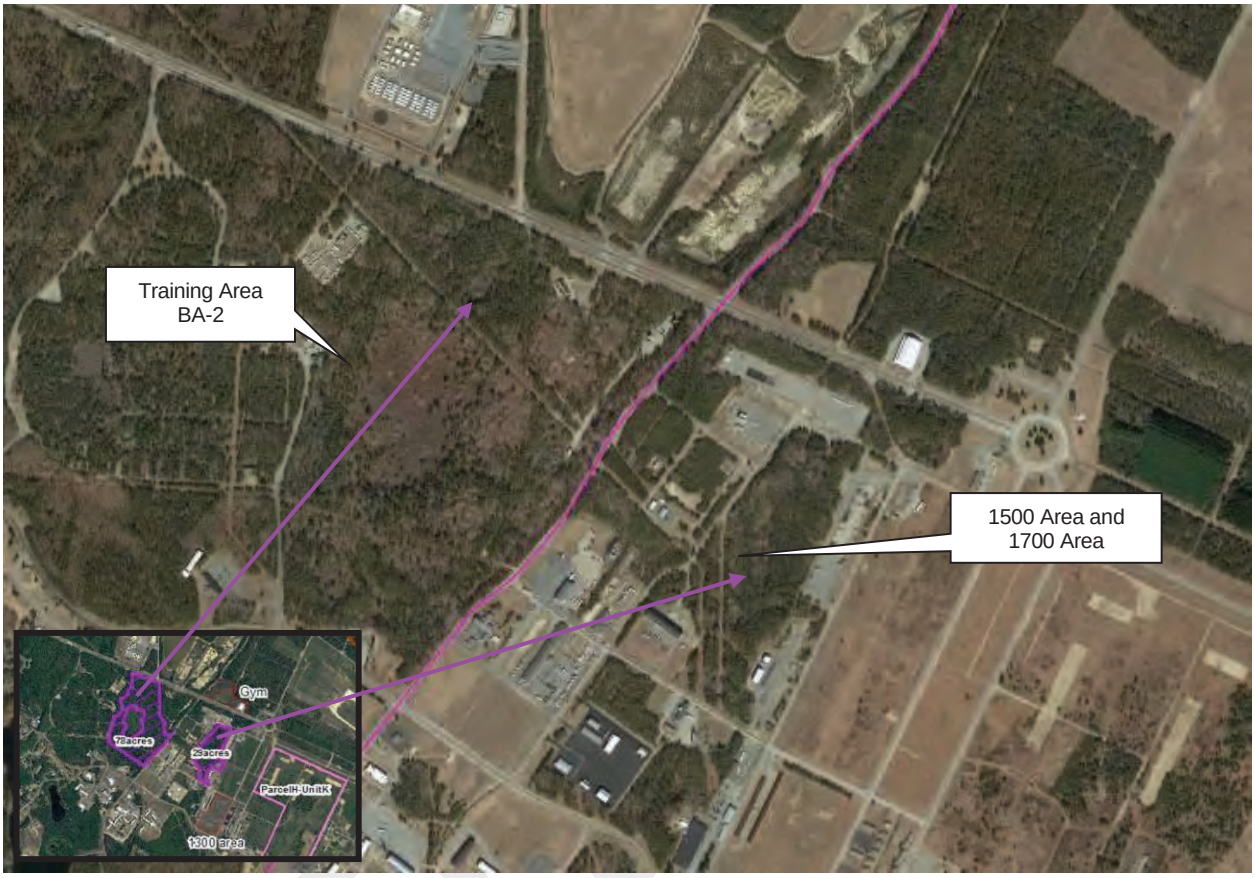


Figure 5.8: Grassland Mitigation Focal Areas

5.3 Monitoring and Research

The following monitoring and research efforts are anticipated to be performed in the upcoming years by MAARNG or with support of MAARNG. Mitigation funding will be required to monitor resources to evaluate effects of proposed actions and effects (long- and short-term) of mitigation actions. This is critical to address some unknowns and to guide adaptive management strategies. Monitoring and research that has already been performed is discussed in **Section 2.13**. Please refer to Table 5-11 for a summary of mitigation costs and year proposed.

- **Moth (Lepidoptera) Survey:** While excellent baseline information exists from Mello (1998, 2017), a targeted survey protocol must be developed and implemented. A plan is scheduled for contracting in 2020 with biennial implementation beginning in 2021.
- **Eastern Whip-poor-will Survey**: Annual implementation of Massachusetts Nightjar Survey Project, including additional route and/or points to cover range and mitigation areas and evaluate population response to impacts and management.
- **Eastern Whip-poor-will Research**: Support of MassWildlife research focused on eastern whip-poor-will. The current focus is a migration study receiving both financial and personnel support from MAARNG.
- **Eastern Box Turtle Monitoring:** Long-term (e.g., four to five year) monitoring of eastern box turtles found and transmittered during construction phase of various project(s) to evaluate impacts of range development and habitat management.

- **Grassland Bird Monitoring:** Annual implementation of grassland bird monitoring throughout MG parcels outside the airfield fence This in continuation of point counts initiated in 2015 and following area census efforts conducted from the 1980s through 2015, providing robust baseline data for trend analysis.
- **Site-wide Bird Monitoring:** While not focused on State-listed fauna site-wide bird monitoring provides for effective site-wide and regionalized impacts analysis.
- **Rare Plant Monitoring:** Populations of State-listed plants will continue to be monitored with particular focus on areas adjacent to project sites or in mitigation parcels.
- **Monitoring of Invasive Species:** The MAARNG has an active invasive plant monitoring mapping and treatment program through the INRMP which is particularly critical in grassland habitat.

5.4 Alternatives Analysis, Avoidance, and Minimization

In consultation with NHESP, the Applicant has developed a plan to avoid and minimize impacts to rare species. A variety of measures will be implemented to avoid and minimize impacts as described below.

- Site selection: An alternatives analysis is performed for each project to determine the best site selection relative to impacts and design.
- Design minimization: All projects have been designed with significant reductions compared to Army standards specifically to minimize habitat impacts (e.g., reduction of two 800 meter lanes on MPMG Range). Intensive project development including environmental review occurs to minimize impacts.
- Restrict lighting used in the proposed development (and during construction) to sodium lights or lights within the yellow/red range. Moths are attracted to lights in the blue range (i.e., mercury vapor lights) which should be avoided.
- Minimize impacts to rare species during the construction phase of the Project. Components of construction phase elements include, but are not limited to, employee and construction phase education.
- Avoid wetlands: During the site design process, impacts to wetlands will be avoided where possible. If work is proposed within the 100-foot buffer zone to wetlands, approval from the local Conservation Commission will be required. Indirect impacts will be minimized through the use of design minimization, stormwater management, and other BMPs, as applicable.

5.5 Cost of Management

MAARNG has developed a budget for the mitigation of MPMG and the other projects. This budget has been proposed to include all management costs, including mechanical, fire, monitoring and research. Also included is a discussion of financial mechanisms to guarantee restoration and management of habitat

Financial resources are budgeted for the proposed actions through Federal (Army, National Guard Bureau) funding. The Project has been designed to meet the long-term net benefit performance standard by providing for financial or in-kind contributions toward the development. Monitoring and research funding will be provided over a period of years as described in **Table 5-11**. Mitigation funding for range MILCON projects is through the environmental budget of ARNG while facilities projects are through a combination of environmental (e.g., staff) and installation funding. Environmental funding is entered through the Status Tool for Environmental Programs (STEP) and we maintain a seven-year budget including these plans and projects which are included in the INRMP project tables. In addition to the monitoring and research funding, the MAARNG will be funding the various habitat management actions proposed as described in this Plan.

Table 5-11: Actions Proposed by Year

Year		Action	Acres	Cost	Year total
1	2019	Land transfer	132		$181,700
		Mechanical harvest (Wheelock)	52	$114,000	
		Prescribed burn	406	$42,500	
		Mechanical prep for burns*	18	$11,200	
		Admin (plans, permits)		$14,000	
2	2020	Prescribed burn	160	$51,000	$458,600
		Mechanical harvest (RAW3)	40	$88,000	
		Mechanical prep for burns	42	$54,000	
		Admin (plans, permits)		$22,500	
		Moth survey plan		$26,500	
		Eastern Box Turtle support		$216,600	
3	2021	Prescribed burn	160	$51,000	$334,500
		Mechanical harvest (BA-7/BA-1)	50	$110,000	
		Mechanical prep for burns	30	$36,000	
		Admin (plans, permits)		$22,500	
		Moth survey year 1		$55,000	
		Eastern Box Turtle support		$60,000	
4	2022	Prescribed burn	160	$51,000	$162,000
		Mechanical prep for burns	30	$36,000	
		Admin (plans, permits)		$15,000	
		Eastern Box Turtle support		$60,000	
5	2023	Prescribed burn	160	$51,000	$205,000
		Mechanical prep for burns	20	$24,000	
		Admin (plans, permits)		$22,500	
		Moth survey year 2		$55,000	
		Eastern Box Turtle support		$60,000	
6	2024	Prescribed burn	160	$51,000	$162,000
		Mechanical prep for burns	30	$36,000	
		Admin (plans, permits)		$15,000	
		Eastern Box Turtle support		$60,000	
7	2025	Prescribed burn	160	$51,000	$205,000
		Mechanical prep for burns	20	$24,000	
		Admin (plans, permits)		$22,500	
		Moth survey year 3		$55,000	
		Eastern Box Turtle support		$60,000	

Due to early planning for mitigation needs, MAARNG accessed $76,600 of funds dedicated to MPMG Range mitigation and leveraged this for an additional $158,791 of funded mitigation projects. Funding is also approved for the coming seven years in the Federal budget, but will benefit from the funding assurance provided by a formal CMP. The direct FY2019 funds and associated acres were obligated for mitigation implantation as follows:

- Wheelock Overlook: $114.461.50 (52 acres)
- Prescribed Burn (Grassland Parcel H - Unit K): $7,487.50 (42 acres, burn days only)
- Prescribed Burn (Pine Barrens Focal Areas): $56,492 (446 acres, 8 burn days)
- Eastern Box Turtle Protection Plan development and initial survey: $36,000
- In-house turtle surveys: estimated $5,270
- Site-wide and grassland bird monitoring: $12,320
- State-listed plants : $3,360
- **Total: $235,391**

Ongoing monitoring includes the following:

- Grassland and site-wide birds: $8,960
- State-listed plants: $3,360

The following actions were performed in FY2020 (October 2019):

- Roads and Grounds crews mowed about 80 acres of Parcel H - Unit K in October 2019 to fight back invasive plants and woody encroachment. While this is more than the intended 30% per year management standard (#4) it is well within that percentage for the overall grassland complex in Cantonment. The mowing was specifically targeted on setting back invasive shrubs which is most effective with a late season mow. The location was predominately the area cleared of trees in 2017 and is at the greatest risk of loss to invasive shrubs. This over investment relative to the mitigation bank is not intended to reduce effort in following years but can help to offset management shortfalls that may occur due to unforeseen circumstances.

5.6 Annual Reviews

The MAARNG will commit to annual reviews by NHESP to determine the success of the mitigation work. The Camp Edwards Environmental & Readiness Center (E&RC) already performs annual reviews publishes as required by Chapter 47, Acts of 2002. An Annual State of the Reservation Report is published for each training year. Copies of the report are provided to the EMC, SAC, and CAC, made available at the town libraries in Bourne, Sandwich, Mashpee, and Falmouth, and a notice of availability published in the Environmental Monitor annually. The MAARNG recommends that the annual review coincide with the drafting of the Annual Report prior to publishing.

6.0 Fire Management

Natural communities within the Camp Edwards, such as pitch pine and scrub oak communities, are fire-dependent systems shaped over thousands of years. With Euro-American influence, the natural fire regime has mostly been suppressed and replaced with infrequent human induced catastrophic fires creating a severe wildland urban interface. Risk of wildfire at the base increases the risk of wildfire entering the adjacent urban/suburban areas outside of the base. It is imperative that the MAARNG and the surrounding communities address and plan for wildland fire. Fuel load is presently extreme particularly in areas with UXO hazards as is the case in the majority of areas around the MPMG Range.

New aspects of range use at Camp Edwards introduce significant wildfire hazard into unmanaged and high risk fuels conditions through the use of tracers and training aids including flares. Tracers are forms of ammunition that include a small pyrotechnic charge which makes the trajectory of the ammunition visible in the day time and night time. All ranges using tracers will need to be surrounded with firebreaks and managed fuel conditions. Other ignition sources are flares (used to illuminate the range temporarily at night) and simulators (used to mimic artillery or grenades from opposing forces).

In addition, the MPMG Range is located partially within the dudded (high explosive) Impact Area at the northern portion of the proposed range. Additionally areas surrounded the range to the west and east are UXO hazard areas due to past range use. Risk reduction measures are proposed prior to range use through reduction of fuels, creation and maintenance of fire breaks, and prescribed burning. The Camp Edwards Integrated Wildland Fire Management Plan (IWFMP) is presently being updated and will include the location of needed firebreaks including appropriate scale to sufficiently reduce the risk of MPMG Range-caused wildfires. Firebreaks will help facility safe suppression operations combined with prescribed burning to reduce wildfire risk.

The initial 2 to 5 years of fire management will be the most challenging as fuel loading is extreme due to vegetative growth and lack of fire after the end of explosive ordnance training and a majority of areas have ordnance concerns. The MAARNG is in the process of planning now for future actions including ordnance removal and fuel treatment efforts. The introduction of fire will only occur once these actions are completed introducing timing uncertainty. following initial entry with fire, there will be some increase in fine and light woody fuels requiring at least one re-entry fire to reduce ignition probability and achieve hazard mitigation through reduction of ladder fuels and other characteristics.

6.1 Firebreaks

The firebreak project involves the construction and maintenance of firebreaks throughout Camp Edwards to reduce the risk of a large wildfire and assist in managing the fighting of fires. Firebreak and fuels management involves the alteration of fuels to reduce the likelihood of a fire starting or to reduce its effects if one does start. These techniques may improve access for fire apparatus, and provide buffer or safety zones for firefighters while focusing on improving habitat conditions overall. Natural communities within the Camp Edwards, such as PPSO and SOS communities, are fire-dependent systems shaped over thousands of years. With Euro-American influence, the natural fire regime has mostly been suppressed and replaced with infrequent human induced catastrophic fires creating a severe wildland urban interface. It is imperative that the MAARNG and the surrounding communities address and plan for wildland fire.[4]

The firebreak planning standard is a 15-foot gravel or hardpacked dirt road with 30-feet of winter mowed grass/forb/low shrub on each side and a 200-foot fuel management buffer (shaded fuel break) beyond that

[4] IWFMP 2006

on each side with mosaic understory mowing (initial) and mechanical tree thinning to 20-40 foot spacing. This project involves 10.0 acres of new road (roughly 4.5 miles of new road) which will be considered a Take and 77.0 acres of mowed firebreak edge which will be considered as overall habitat benefit from mowing for early successional species. This will result in the direct impact, but not loss, of PPSO, ____ acres of SOS, ____ acres PPOF, and ____ acres of MG habitat to range development and firebreak roads.

Most or all species are anticipated to benefit from a combination of direct habitat management (e.g., fuel management buffers, prescribed fire) and the indirect habitat management made possible through range development, fire management support (e.g., new or improved firebreaks), and ordnance remediation. An explicit overarching goal for fire and fuels management is to maintain the existing barrens habitat types. Firebreaks will directly convert 10 acres of habitat into new firebreak roads. The remaining 77 acres will be mowed 30-foot edges from the roads managed for fire control while also enhancing habitat value, but especially intended to allow for managing currently unmanageable and degrading habitat. Shaded fuel breaks will be designed and implemented to maintain community composition, but in more open conditions which will better support all the listed species and provide for community safety and ecosystem resilience.

Strategic firebreaks are proposed to be constructed along the exterior of the MPMG Range and surrounding area. The firebreak immediately surrounding the range will be part of initial construction. Additional firebreaks will be constructed as a separate project with different funding. Well planned, strategically located, and well maintained firebreaks are key to reduce the risk of a large wildfire and assist in managing the fighting of fires. Firebreak and fuels management involves the alteration of fuels to reduce the likelihood of a fire starting or to reduce its effects if one does start. These techniques may improve access for fire apparatus, increase water resources available on-site, adjust target placement, and provide buffer or safety zones. The proposed firebreaks are shown in **Figure 6-1** which include a combination of:

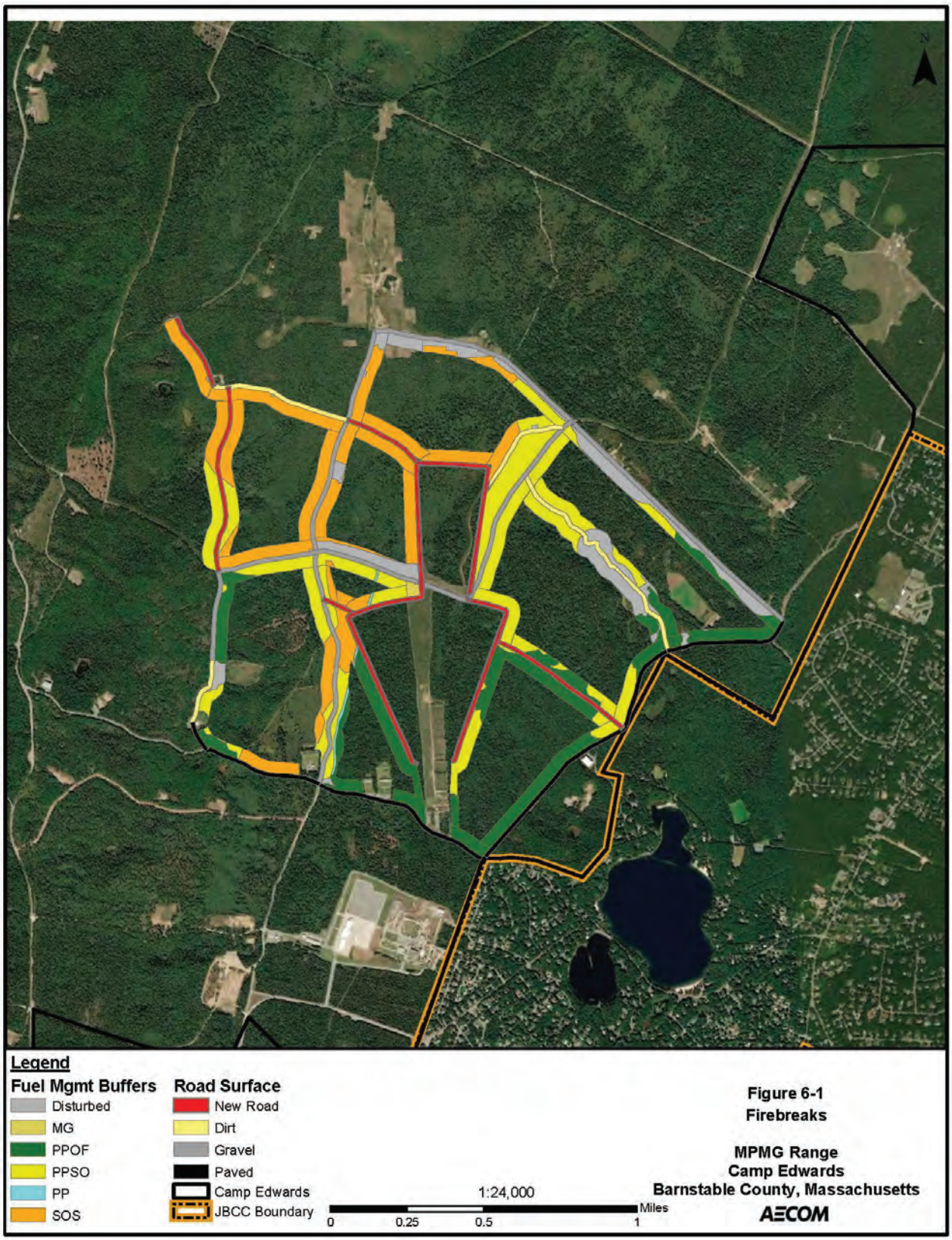
- Maintaining existing roads and mowed edges,
- Improving and widening existing roads and/or mowed edges
- Creating new roads and mowed edges, and
- Creating shaded fuel reduction zones flanking all fire breaks.

Firebreaks will be located along existing roads where they exist. However, based on anticipated fire behavior additional break are necessary to minimize ecological and community risk. The firebreak planning standard is a 15-foot gravel road with 30-feet of winter mowed grass/forb/low shrub on each side and a 200-foot fuel management buffer beyond that on each side with mosaic, targeted understory mowing (initial) and mechanical tree thinning to 20-40 foot tree spacing. Each of these firebreak components are described in more detail below. It is anticipated that most or all pine barrens species will benefit from a combination of direct habitat management (e.g., fuel management buffers, prescribed fire) and the indirect habitat management made possible through range development, fire management support (e.g., new or improved firebreaks), and ordnance remediation. Construction of the MPMG Range and tracer use elsewhere forces fire hazard reduction projects in areas previously and currently unmanageable due to UXO hazard. This inability to manage is the greatest threat to SOS and associated rare species at Camp Edwards, and, by extension, Southeastern Massachusetts.

Overall firebreak elements include:

- **Firebreak roadways:** 15-foot wide gravel or dirt road; maintained sufficiently for infrequent emergency and management vehicles.
- **Mowed edges**: 30-foot wide mowed edges (total width with road and both sides = 75 feet);
- **Shaded fuel breaks**: 200-foot wide thinned forest buffer on either side (20-40 feet average tree spacing).

Please see **Appendix A** the end of this section for photographic examples of these elements.


N
Legend
Fuel Mgmt Buffers
Disturbed
MG
PPOF
PPSO
PP
SOS
Road Surface
New Road
Dirt
Gravel
Paved
Camp Edwards
JBCC Boundary
1:24,000
0
0.25
0.5
1
Miles
Figure 6-1
Firebreaks
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

Firebreak work associated with the MPMG Range is proposed to involve 10 acres of new road (roughly 4.5 miles of new road) and 77 acres of new mowed firebreak edge. The roadway impacts are addressed in **Section 4.6** relative to the MPMG Range project. While the roads are being treated as a Take, the introduction of additional road edge and shaded fuel breaks is considered beneficial pine barrens management, including Eastern Box Turtles, assuming BMPs for maintenance are followed. Monitoring will inform this determination and responsive action/mitigation.

6.1.1 Firebreak Roadways

Firebreak roadways are designed to be 15-feet wide and constructed of either gravel or dirt. Dense-grade bluestone will be used where needed with stretches of roadway stabilized and capped. These roadways are either existing and will be improved to meet the current planning standard width or they will be newly constructed (see **Figure 6-1**). New roadways will look similar to the existing roads surrounding the Impact Area. Firebreak work associated with the MPMG Range is proposed to involve 10.0 acres of new road (roughly 4.5 miles of new road). Range roads along the exterior of the MPMG Range and within the range will be graded and spot repaired as necessary to allow for emergency access (fire response) and will be gated and locked most of the time. The intent is somewhat primitive roads, but sufficient for habitat management assess and emergency response as with the training road/trail network existing at Camp Edwards.

6.1.2 Mowed Edges

Mowed edges will be 30-feet wide to allow for tractor mowing (two bat-wing deck widths). These edges will be mowed once a year late November to mid-December and will be cut down to 6-8 inches. Mowed edges will be located at firebreaks and adjacent to primary access roads for the MPMG Range. The vegetation is kept low enough to minimize fire behavior. It is critical to provide separation to reduce crown fire potential and minimize firefighter exposure at edges. In addition, this low vegetation management allows for emergency equipment to pull off the road.

This work will provide a moderately high diversity of native grasses, forbs, and low shrubs anticipated to be used by pollinators and other rare species to include Eastern Box Turtle nesting habitat. This treatment allows for effective mowing of woody species while avoiding negative impacts on turtles and birds. Current roads managed in this way have exceptional pollinator habitat and use by woodland edge species. Vegetation such as wild indigo (*Baptisia tinctoria)* is abundant as are heath species such as blueberry, huckleberry, and scrub oak, all intermixed with openings of bare soil, native grasses, and variety of flowering plants, ideal for species like the Frosted Elfin and Walsh's Digger Bee. Additionally, research has found that Whip-poor-wills at Camp Edwards prefer these edges for display and nesting. Access to forbs and diverse forage is apparently a primary limiter to species like the New England Cottontail at Camp Edwards and the edges will presumably provide nesting habitat for Eastern Box Turtles and puddles for Agassiz's Clam Shrimp.

The mowing of roadway edges for fire protection is not considered a Take of rare species as it will enhance the habitat as described above and the habitat is still vegetated. This work actually improves habitat for rare species concerned by providing edge habitat (used by Eastern Whip-poor-wills) and rare food/nesting (turtles) habitat including forbs for a variety of species. Maintenance work will be scheduled in late fall/early winter to avoid encounters with rare species and designed to minimize or eliminate any impacts to rare species. Approximately 77 acres of new mowed edges are proposed throughout Camp Edwards as shown on **Figure 6-1**.

6.1.3 Shaded Fuel Breaks

Shaded fuel breaks are strips of land adjacent to the mowed edges of the roadways where fuel is managed and reduced to limit the spread of a fire especially development or spreading of crown fires. These fuel breaks will be roughly 200-feet wide and mechanically thinned. The goal of this management feature is to maintain significant tree canopy with an open heath/scrub understory while reducing severe wildfire conditions that currently exist including closed canopy with sever ladder fuels (connection of shrub layer to canopy). This will maintain a high quality PPSO natural community and barrens heath community. At this time, these fuel breaks are proposed specifically for the MPMG Range but may be used in the future elsewhere if needed. An example of a target condition is found at the western portion of Crane WMA (northern unit).

Trees would be thinned to roughly 20 or 30 foot spacing to minimize potential for running crown fire while maintaining canopy cover for speckled shade and moisture retention. Mechanical treatment of the understory will be done with by mowing with a skid steer or other heavy equipment only as needed to reduce wildlife hazard which will likely occur in the winter. This forestry will occur hopefully in 2021 to 2023.

With the reduced canopy cover, the understory would benefit significantly from increased solar exposure, a critical need of pine barrens moths, but drying conditions would be moderated by remaining canopy to reduce fire hazard. As a benefit, shaded fuel breaks will mimic typical thinning projects for southern pine beetle risk reduction (e.g., 80 square feet per acre basal area) while providing enhancement of pine barrens flora and fauna. Retention of the trees will help to reduce potential noise issues when the range is in use and will minimize tracer ricochet and travel. The overall goal is to maintain and promote a high quality pine barrens habitat while significantly reducing wildfire hazard, which are consistent and achievable goals realized with success through the region and on-site over the past five years.

6.2 Prescribed Burns

Prescribed burning is a form of active management that is labor intensive and requires much planning in advance. Historically the pine barrens were subject to periodic burning by wildfire. These fires resulted in a regeneration and maintenance of the habitat type. Absent other management intervention strategies, fire may be needed for many of the ecological processes which take place in the pine barrens habitat. Without fire or other disturbances, the pitch pine canopy closes and greatly reduces the value of habitat for the rare moth species. White oak also begins to dominate pine and oak stands and convert communities through mesification. Wildfires are typically contained and extinguished before large areas are burned. Prescribed burns are controlled and can closer mimic the wildfires of the past. Reduction of fuel loads could prevent or reduce the intensity of possible wildfires thereby protecting existing and proposed developments such as bordering neighborhoods. In order to implement prescribed burning, MAARNG developed the 2007 IWFMP which has been implemented since that time with successful burning of over 4,000 acres.

The goal of fire management is to support the military mission of the Camp Edwards Training Site, to promote public safety and the protection of the surrounding community from wildland fire, while promoting the sustainable management of native biological systems by encouraging sound fire management planning, policy, and procedure and also to:

- Guide the decision making process so that safety, social, political, and resource values are evaluated and addressed with appropriate management.
- Provide a framework for fuels management through the use of prescribed fire.
- Provide a platform for cooperation in planning and implementing a fire program within and across agency boundaries.

General policy for the JBCC is to control wildfires due to the potential for damage to resources, the protection of property, and to avoid potential liability from property loss and threats to human safety. However, an integral part of wildland fire management at Camp Edwards includes proactive steps at both the local and landscape scale. Fire management strategies specific to Camp Edwards at the JBCC include wildland fire suppression, wildland fire use, prescribed fire, non-fire fuel management, no action policy, and emergency rehabilitation and restoration, if needed. The IFMP outlines potential management strategies and options.[5]

Prescribed burns are, or will be planned throughout the Pine Barrens Focal Areas and MPMG Zone. Burn plans already exist for the northern and western units, with some burns already completed. Fire techniques and management goals vary by unit and operation, but overall are designed to scorch the majority of the ground and shrub level, promoting resprouting and plant vigor and reducing ladder fuels. A primary need of fire management is treatment diversity. Homogenous treatment leads to homogenization of habitat and, typically, significant reduction in biodiversity as it selects for only a subset of species depending on timing, severity, and other conditions. A mix of seasonality, weather conditions, ignition techniques, pre-treatment, and other variables is critical to ecosystem management and meeting conservation goals.

6.2.1 Fuel Treatments

Fuels within pine barrens include fine fuels from the leaf litter of oaks and pitch pines that is fast drying and can ignite rapidly. Moderate fuels in the shrub layer and heavy fuels comprised of larger diameter branches and logs which are slower to burn than the fine fuels. Older stands of scrub oak and ericaceous shrubs have more dead branches which can catch fire Vegetation present at Camp Edwards like huckleberry and scrub oak contain volatile oils that may increase the intensity of a fire. The type of fuels can affect how a fire ignites, how it spreads, the intensity of the fire, and the duration of the fire.

A burn plan will quantify the "fuel load" for any mitigation areas proposed to be burned which is the amount of combustible material within a habitat including live fuels, dead woody material, and leaf litter. When a burn plan is developed, the fuel load is estimated based on field assessment and fuel model assignments, quantifiable reduction goals can be developed at that time. For example, for units with high fuel loads (and therefore, more fire danger), the fuel load goals may be reduction of 60-80 percent. Once these loads are established, mechanical treatments can be performed tailored to each burn unit. If fuel loads should be reduced by 60-80 percent, then it is possible to perform a heavy mechanical treatment reducing the midstory shrub layer by this amount to be followed by a prescribed burn.

Fuel loads can be reduced through mechanical treatments such as mowing, brush-hogging, and logging of trees. This treatment is often used to treat areas prior to prescribed burns to reduce fuel loads. Prescribed burning is critical tool to keeping fuel loading down to avoid catastrophic wildfire. Immediate areas surrounding the range and priority fire breaks will require targeted mechanical mowing of shrub layer (mastication) to safely implement fire. This could create short-term impact on state-listed species (e.g., lepidoptera) and some loss of turtles. Efforts will be made to implement brush mowing during the hibernation period, however, burning masticated fuels could also present a risk to turtles. Mastication will be limited to areas critical to provide for safe prescribed burning or critical wildfire hazards areas. Many areas are currently unburnable or unsafe to burn without prior fuel treatment of overstory (e.g., dense pitch pine canopy) or understory (e.g., dense and tall scrub oak).

[5] https://www.massnationalguard.org/ERC/fire_mgmt.htm

6.2.2 Burn Intervals

Burn intervals necessary to avoid extreme hazard conditions are being studied at this time and it will likely be necessary to have less than a 5-year return interval. Prescribed burns will likely occur every three years depending on conditions and adaptive management as the MPMG Range is used. The MPMG Zone will likely required frequent burning in the initial five years of range operations (annual to biennial) to reduce fuel loads, reduce fire risk from duff/litter and forest structure, and enhance habitat. Maintenance burning will likely occur on a three-year interval within approximately 2,000 acres. This will mimic historic fire intervals of the SOS from the later 1800s through 1980s.

Short return intervals would be beneficial ecologically because that would facilitate patchy burns with low severity. Fuel accumulation is unlikely to support annual intervals unless there is some vegetative community conversion (e.g., significant incursion of grasses and other fine fuels to carry fire) which is counter to overall habitat goals. Longer return intervals will lead to more significant fuel loading and higher severity (less frequent, but more intense/severe burns). After the initial two burns within a unit, the annual leaf drop will be unlikely to carry fire and intervals will be two to five years based on fuel accumulation.

- Immediate areas surrounding MPMG Range will likely require frequent burning in the initial five-years (annual to biennial for first and second entry into a unit) to reduce fuel loads and reduce fire risk from duff/litter and forest structure.
- Anticipated maintenance burning on three-year average (range two to five years) interval throughout approximately 2,000 acre area. Rotation should closely mimic historic fire interval of these scrub oak barrens from the late 1800s through the 1980s.
- Likely short-term impact on scrub oak and heath lepidopterans in immediate area, but based on rotation and rerun intervals through large areas, this should provide significant long-term benefit.

It is anticipated that areas within the MPMG Zone will be subject to ordnance removal and mechanical fuel treatment before any prescribed burns occur. Therefore, it will likely be at least 2023 before fire is reintroduced into the areas surrounding the MPMG Range. Safety standards addressing firefighter proximity to potential ordnance for prescribed burning and wildfire suppression are being investigated and developed. Burning will likely require aerial ignition of interior areas and ordnance removal within a safety buffer around firebreaks.

6.2.3 Fire Training

MAARNG funds and hosts wildland fire training including a spring safety refresher. Typically, MAARNG hosts an annual wildland fire mini-academy for local wildland fire partners through New England. The partners provide program and operation support to MAARNG in return. This ensures all well-trained wildland fire community and maintains partnerships. Additionally, MAARNG has a volunteer in-house fire crew (all serving “other duties”) receiving internal safety refreshers and support, proactive fire support, equipment maintenance, and wildland fire operational support.

6.3 Management Methods

Active management involves mechanical treatments (i.e., mechanical tree removal, brush hogging) and, if practicable, prescribed burning. MAARNG has identified management units suitable for active management. These units will be subjected primarily to mechanical actions in accordance with the proposed management goals. In many circumstances such as locations close to boundaries, highways, or buildings, fire may not be an appropriate means for managing habitat. Mechanical removal of vegetation can mimic many of the benefits of fire where fire is precluded due to complexity or proximity to resources.

Restoration, for the purposes of this Plan, is defined as the reversion of a succeeding habitat condition to a previously existing habitat condition. For example, reduction of non pine barrens species from the tree canopy to promote the pine barrens habitat vegetation can be performed in areas not presently identified as pine barrens. This is an appropriate strategy where the pine barrens habitat once existed but has become dominated by non pine barrens species such as white pine and white oak which are less tolerant to fire. By removing or reducing the canopy coverage using forestry management activities, the habitat value can be "increased" in areas where the pitch pine overstory has become dense or overgrown and has thereby reduced the value of the rare species habitat provided by the scrub oak and ericaceous understory. Methods used for habitat management are described in **Section 5.3**.

6.3.1 Mechanical Tree Removal

Mechanical tree removal is the removal of individual trees from the tree canopy to promote the growth of shrub species in the understory and promote healthier tree and stand condition in the overstory. It serves to maintain or restore more early succession pine barrens habitat and usually involves whole-tree harvesting. This can be achieved through logging with or without chipping of the harvested logs. Stand treatment is determined based on site conditions, habitat goals, and forestry assessment. Logs will be removed from the mitigation area or trees will be chipped at the site As there is no merchantable timber at Camp Edwards, chipping for biomass fuel generation is standard. This depends on market and sufficient generation. If chipping is the method of disposal for the logs, all chips shall be removed from the site in order to reduce build-up of fire fuel and avoid mesification and conversion of pine barrens through increase in soil nutrients. A significant benefit of whole tree removal combined with fires is restoring lower soil nutrient conditions that support the barrens community. Additionally, pine chips encourage bark beetle incursions. Logging, including the dragging of trees to a landing area, can be used to create bare areas in the soil to promote recolonization of heath or grasses species in areas of dense scrub oak cover and to provide more mineral habitat for the recolonization of pine barrens species. While some scarification of the soil is beneficial, the management contractor will be directed to minimize scarification of the soil in order to reduce the colonization of densely grown pitch pine saplings.

Timing of this type of treatment and application as mitigation for projects depends on the timing of the projects. For example, this type of mechanical tree removal includes projects such as the Wheelock Overlook timber harvest which was completed in 2019 to remove live and dead standing trees in order to reduce canopy closure and dead fuel loading on approximately 50 acres where a 2015 prescribed burn occurred. The removal of the dead trees will improve the safety of the area for training purposes, significantly reduce smolder/smoke hazard for fire, and help to restore the PPSO in this area. In addition, the thinning of mature trees will increase understory productivity and enhance wildlife value. This treatment has been prioritized as the first mitigation implementation to offset loss of pine barrens habitat to the development of the MPMG Range as this restoration component is a critical accomplishment associated with the MPMG Range project (See Standard #1). The cost of mechanical tree removal is typically around $2,200/acre but is dependent on market value for biomass generation (a declining industry, regionally).

6.3.2 Mastication

Mastication involves the mechanical removal of the understory by mowing and chipping. Buildup of wood chips can increase the fuel load of the habitat and create a smolder concern in additional to increasing soil nutrients (counter to barrens management). Therefore, chips would need to be removed from the treated area or kept at a minimum. Scrub oak can be cut to approximately one foot above the ground by brush hogging and will regenerate with sprouts. This type of cutting is recommended for early successional scrub oak habitat where the scrub oak is greater than three feet in height. Based on scrub oak growth rates, some areas will be treated by mastication once every 10 years if not maintained by fire. Timing of additional treatments will be decided based on future monitoring efforts. The cost of mastication averages $2,000/acre. Mastication is critical to making some areas burnable or managing fuels in areas otherwise unburnable. Fire

is typically the best method for removing masticated debris (chips) and the collapse of hazardous fuels to ground level makes unburnable fuels management with high intensity ground level fire and exceptional scrub oak response.

6.4 Adaptive Management

All fire management at Camp Edwards is performed with a focus on minimizing ecological impact and maximizing community safety. Monitoring of various resources will guide adaptive management for the use of fire. Information obtained from monitoring will allow the MAARNG to react accordingly, if reasonable. Necessary adjustments will be made relative to return intervals of fire or other management actions. Adaptive management will also allow the MAARNG to mitigate unanticipated negative effects, if any, specifically on State-listed species such as Eastern whip-poor-wills, State-listed moths, Eastern Box Turtles, etc. Impacts on State-listed species and vegetation guilds will be assessed. All monitoring will be reported to the State annual including actions taken, action proposed, monitoring of resources, and assessment of management and treatment regimes.

Adaptive management will model expected fire behavior, inform fuel reduction projects, and drive long-term management decisions on type and frequency of management. Options include reducing management (e.g., longer return burn interval) or increasing management (e.g., adding mowing, shorter return burn interval) depending on results from both wildfire and natural resources monitoring (e.g., moths). If treatments intended for habitat improvement are found to have unanticipated negative impacts, sufficient areas are identified for mitigation to provide additional mitigation and/or adjust techniques appropriately.

6.5 Fire Management Performance Standards

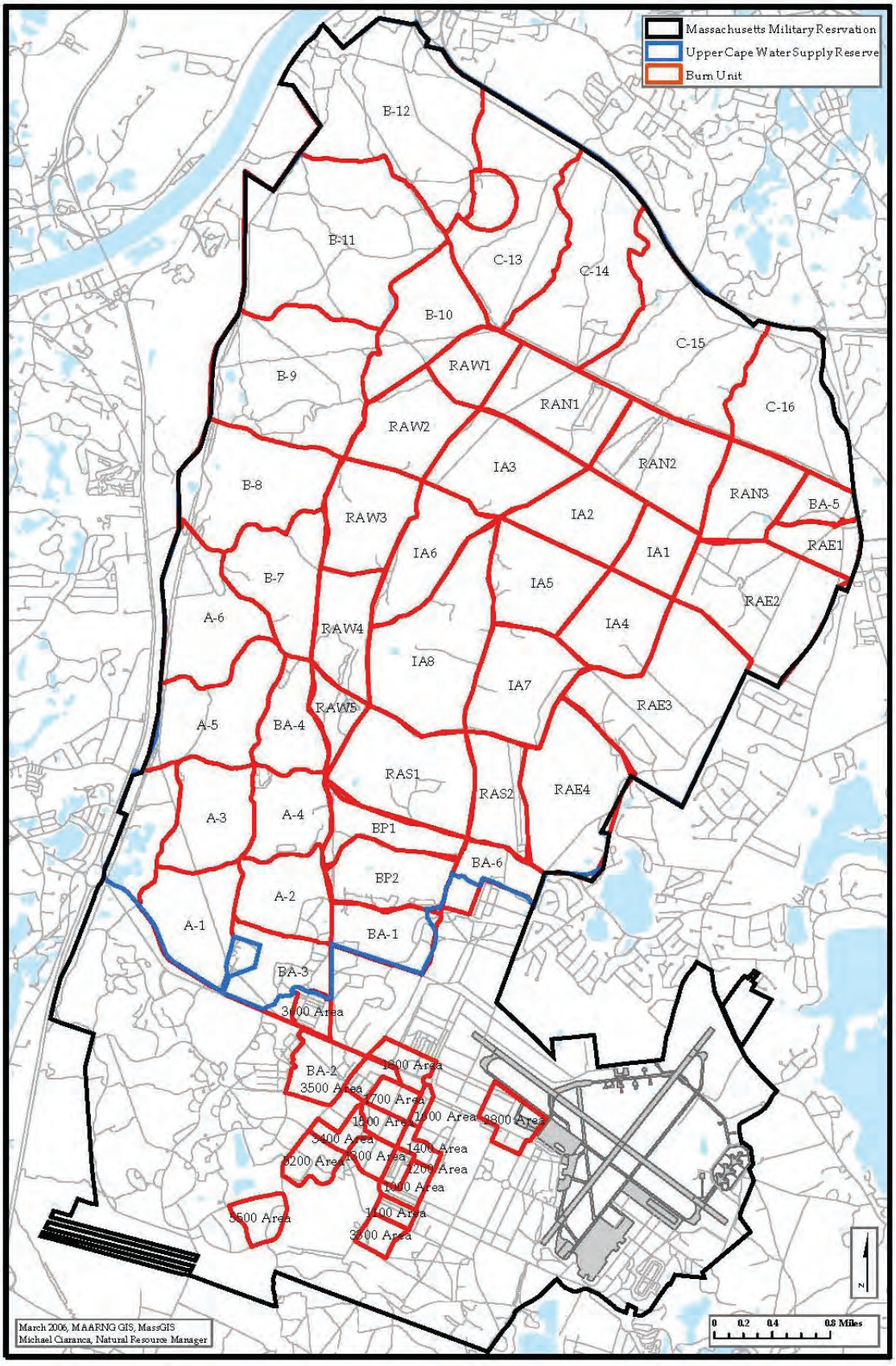
All activity at Camp Edwards must meet the EPS Fire Management Performance Standards which include the following:

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

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

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

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


Massachusetts Military Reservation
Upper Cape Water Supply Reserve
Burn Unit
B-12
B-11
C-13
C-14
B-10
C-15
B-9
RAW1
RAN1
C-16
RAW2
IA3
RAN2
B-8
RAN3
BA-5
RAW3
IA2
IA6
IA1
RAE1
B-7
IA5
RAE2
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March 2006, MAARNG GIS, MassGIS
Michael Ciaranca, Natural Resource Manager
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Appendix A: Fire Management Element Photographs

Appendix A: Fire Management Element Photographs

Photo 1: Mowed Firebreaks Image show current conditions (September 2019) of mowed firebreak with a 20-foot mow to the right of the road and an 8-foot mow to the left. Note the plant diversity in the mowed areas which is consistent throughout and responds well to an annual later fall mow.	
Photo 2: Mowed Firebreaks Image show current conditions (September 2019) of mowed firebreak with a 30-foot mow to the right of the road and an 10-foot mow to the left. These edges provide quality habitat for many species.	

Photo 3: Shaded Fuel Breaks Image shows management results to maintain high quality pine barrens by reducing overall basal area, ladder fuels, and canopy connectivity to significantly moderate fire behavior and facilitate fire suppression response.	
Photo 4: Shaded Fuel Breaks Aerial example of shaded fuel breaks in the western portion of the Crane Wildlife Management Area.	

Photo 5: Managed Fuel Breaks	
Photo 6: Managed Fuel Breaks	

Photo 7: Range Floor (Managed Grasslands)