Camp Grayling Maneuver Training Center
Integrated Natural Resources Management Plan
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EXECUTIVE SUMMARY

This Integrated Natural Resources Management Plan (INRMP) was developed to provide a single, comprehensive document that can be used to guide the management and conservation of natural resources at Camp Grayling Maneuver Training Center (CGMTC). Development of this INRMP was consistent with the Sikes Act, and Army Regulation 200-1, *Environmental Protection and Enhancement*. In accordance with the Sikes Act, this INRMP will be reviewed annually as well as reviewed at least every five years for operation and effect.

Implementation of this INRMP will be coordinated with various state-wide plans developed by the Michigan Department of Natural Resources (MDNR) and the Michigan Department of Military and Veterans Affairs (MDMVA), and eleven programs and initiatives specific to CGMTC. Implementation of this INRMP will support the military mission; provide cooperative natural resources management with no net loss in the capability of military lands that support the military mission; ensure compliance with federal, state, local, and Army environmental regulations; and, apply adaptive management in cooperation with the Michigan Department of Natural Resources (MDNR) and U.S. Fish & Wildlife Services (USFWS) to:

- Enhance native ecosystems and habitats
- Maintain native flora and fauna
- Maintain viable populations of listed species with minimal impacts to military training
- Protect, maintain, and improve wetlands and water resources
- Provide for outdoor recreational opportunities consistent with the military mission and resource protection.

CGMTC is a state-owned National Guard training installation located in the northern lower peninsula of Michigan. Training facilities accommodate heavy artillery, anti-tank weapons, bridge deployment, air-to-ground bombing, convoy live fire, non-standard small arms, modified multi-purpose machine gun training, maneuver training resources, amphibious assault training, and other applications. Training and support resources include but are not limited to over 100 firing points, an Improvised Explosive Device Defeat facility, a Combined Arms Collective Training Facility, an 870-acre airfield, a 62-acre Mobilization and Training Equipment Site, and a 1,243-acre Cantonment.

CGMTC is comprised of 147,000 non-contiguous acres that transect three counties and three watersheds. Approximately 60 lakes and ponds, and 312 miles of streams and rivers are situated on or adjacent to CGMTC. The Cantonment is adjacent to the 1,922-acre Lake Margrethe. Of the 9.5 miles of the Lake Margrethe shoreline, 4.2 miles are owned by the MDMVA and the remaining 5.3 miles are owned by private residents.

Land ownership and lease arrangements at CGMTC are complex. Of the 147,000 acres, the MDMVA owns 46,700 acres, 26 acres of which are leased to the MDNR for use as a state campground, and 200 acres of which are leased to the Grayling Recreation Authority (GRA) for use as an outdoor recreation complex. The MDNR owns 97,200 acres, all of which are leased to the DMVA under two different types of lease agreements that specify different types of military

use. The federal government owns 1,050 acres, 870 acres of which are the MIARNG Grayling Army airfield, 170 acres of which are used for training, and 12 acres of which are leased to Crawford County for use as a civilian airfield. Various entities other than the federal government, the MDNR, and the DMVA own 2,050 acres, all of which are used by the DMVA pursuant to various land use agreements.

Natural resource management responsibilities are shared between the MDMVA and the MDNR to accommodate the complex distribution of land ownership and leases.

- With the exception of 1,050 acres owned by the federal government, the MDNR manages all forestry, game and fish resources at CGMTC, in accordance with language in the 1913 Hanson Land Grant and the subsequent 1949 agreement between the military and Department of Conservation (now MDNR).
- Wildland fire response and prescribed burn activities are jointly managed by MDNR and CGMTC.
- The MDNR is responsible for water resources, soils, vegetation, invasive species, listed species, and wildlife habitat at the 26-acre state campground located northwest of the Cantonment.
- The MDNR and MIARNG work collaboratively to manage the water resources, soils, vegetation, invasive species, listed species, and wildlife habitat on the 54,000 acres owned by the MDNR and leased in perpetuity by the MIARNG, as well as the 2,050 acres used by the MIARNG pursuant to various land use agreements.
- The MDNR is responsible for all management on the 43,200 acres owned by the MDNR and leased under 20-year agreement by the MIARNG. MIARNG ensures the lease restrictions are upheld.
- MIARNG is responsible for the water resources, soils, vegetation, invasive species, listed species, and wildlife habitat on 46,674 acres owned by the MIARNG.
- MIARNG is responsible for forestry and game management, as well as water resources, soils, vegetation, invasive species, listed species, and wildlife habitat on the 1,040 acres owned by the federal government.

The collaborative nature of natural resources management between MIARNG and the MDNR at CGMTC may carry some implications regarding the manner in which various aspects of this INRMP will be implemented. Those implications are not expected to hinder the advancement of natural resources protection and conservation because the MDNR and MIARNG have common goals regarding natural resources protection and conservation. Whenever possible, collaboration occurs when it is mutually beneficial to achieve aligned goals through landscape level or habitat level management.

The CGMTC Natural Resources Management Program addresses nine natural resources elements: soil, water resources, vegetation, wildland fire, invasive species, fish and wildlife, species of special concern, recreation management, and climate resilience. Goals, objectives, and recommendations for managing each of the nine elements that integrates the remaining eight elements have been developed into more than fifty projects and initiatives.

CGMTC maintains several cooperative agreements with conservation partners, such as Huron Pines, the MDNR, the Michigan Natural Features Inventory, and the Upper Manistee River Association. As partnering opportunities arise, the CGMTC Environmental Department staff, with the support of the MDMVA Environmental Program staff, intends on initiating several more cooperative agreements with additional conservation partners.

Request for funding for each of these projects and initiatives is submitted annually to the Army National Guard, Installations & Environment Directorate (ARNG I&E). The primary funding source is the U.S. Army.

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1 INRMP OVERVIEW

1.1 PURPOSE AND SCOPE OF INRMP

The purpose of this Integrated Natural Resources Management Plan (INRMP)[1] is to provide a single, comprehensive document that can be used to guide the management and conservation of natural resources at Camp Grayling Maneuver Training Center (CGMTC). Implementation of this INRMP will:

- Support the military mission
- Provide cooperative natural resources management while ensuring that there is no net loss in the capability of military lands to support the military training mission
- Ensure compliance with federal, state, local, and Army environmental regulations
- Apply adaptive management in cooperation with the Michigan Department of Natural Resources (MDNR) to:
    - Enhance native ecosystems and habitats
    - Maintain native flora and fauna
    - Maintain viable populations of listed species with minimal impacts to military training
    - Protect, maintain, and improve wetlands and water resources
    - Provide for outdoor recreational opportunities consistent with the military mission and resource protection.

The goals and objectives described herein have been integrated with applicable plans, programs, and initiatives that support the military mission and conservation at CGMTC. The goals and objectives described in this updated INRMP are a consolidation and continuation of the goals and objectives in the 2002 and 2007 INRMPs. In some cases, previous goals and objectives have been combined to avoid repetition and some previous projects are now designated as ongoing activities.

This INRMP is a living document that is based on short-, medium-, and long-term planning horizons. Short-term tasks include activities and projects that are planned to occur in less than 5 years, while medium-term tasks include activities and projects in a 6- to 10-year period. Long-term tasks can be scheduled beyond 10 years.

1.2 DEVELOPMENT OF INRMP

Development of this INRMP was consistent with: 1) the Sikes Act Improvement Act (SAIA) of 1997, 16 US Code (USC) §670a et seq., as amended; 2) Department of Defense Instruction (DoDI) 4715.03, Natural Resources Conservation Program; 3) Army Regulation (AR) 200-1, Environmental Protection and Enhancement; and, 4) the 2019 ARNG I&E INRMP Policy .

[1] The list of acronyms is provided in Appendix A.

This INRMP was developed for use by the Michigan Department of Military and Veterans Affairs (MDMVA) based on the original 2002 CGMTC INRMP, for which an Environmental Assessment (EA) was conducted, in accordance with the National Environmental Policy Act (NEPA) to evaluate the potential impacts of proposed actions described in the plan. As a continued implementation of previous CGMTC INRMPs, this 2020 INRMP is not expected to result in biophysical consequences materially different from those that are described in the 2002 or subsequent CGMTC INRMPs. Continued implementation of previous INRMPs do not require another EA or an opportunity for public comment. Thus, an Environmental Checklist and a Record of Environmental Consideration (REC) were completed that "tier off" the original INRMP. The Environmental Checklist describes the Proposed Action (update and continued implementation of the previous INRMP), confirms that the activities in this updated INRMP are addressed in the EA, identifies potential impacts to various environmental media, and concludes that a REC is the appropriate level of NEPA documentation. A copy of the REC is provided in Appendix B.

1.3 AUTHORITY AND REGULATORY COMPLIANCE

A comprehensive list of relevant laws, regulations, executive orders, and policies is provided in Appendix C**.** The laws and policies that serve as the foundation and primary drivers of conservation and natural resources management at CGMTC are summarized below.

- The **Sikes Act** (Public Law 86-797) requires the Department of Defense (DoD) develop and implement INRMPs for many military installations within the U.S. The intent of the Sikes Act is to ensure that ecosystems and natural resources on military installations are protected and enhanced while allowing the military lands to continue to meet the needs of military operations. Thus, the Sikes Act is the foundation for conservation programs on military installations. The Sikes Act: 1) specifies the review timeline and process; 2) requires that trained professionals manage the installation's natural resources.
- **Army Regulation (AR) 200-1,** *Environmental Protection and Enhancement* addresses the environmental responsibilities of all Army organizations and agencies and provides a framework for the Army Environmental Management System (EMS). This regulation provides guidance on the development, maintenance, and implementation of the INRMP, as well as how to integrate the INRMP with other programs and plans.
- The **National Environmental Policy Act** of 1969 (NEPA; 42 USC §4321 *et seq*.) requires that federal agencies consider potential environmental consequences of proposed actions. NEPA states that new INRMPs and major revisions of INRMPs require an EA, but continued implementations of previous INRMPs do not require a new EA or an opportunity for public comment.
- **Michigan's Natural Resources and Environmental Protection Act (NREPA)**, 1994, Public Act (PA) 451, as amended (Act 451) codifies and consolidates state laws promulgated to protect the environment and natural resources of the state, to regulate the discharge of certain substances into the environment, to regulate the use of lands, waters, and other natural resource of the state, to protect the people's right to hunt and fish, and to prescribe the powers and duties of certain state and local agencies and officials. Act 451 incorporates the key federal cornerstone environmental acts, such as

but not limited to the Clean Water Act, Clean Air Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

- **Michigan's Crawford County Land Act, PA 172 of 1913** authorizes the Michigan State Military Board to accept property granted to it by the state. It is the Act that allowed the development of the Hanson Land Grant, which is the mechanism by which lumber baron Rasmus Hanson gifted 13,807 acres of land to the Military Board (now the MDMVA). The Hanson Land Grant specifies that the military can train on the acreage, that the public can use the acreage when the military is not using it, that the military shall not be charged a land tax, and that the wildlife within the acreage shall not be hunted, harassed, harmed, or killed.
- **CGMTC AR 200-1** is patterned after Army Reg. 200-1 and specifies requirements and guidance to CGMTC staff and transient troops to ensure compliance with applicable federal, state, local, and Army environmental regulations, and to ensure the protection of land and water resources at CGMTC for the purpose of preserving training areas for use by future transient units. The CGMTC AR 200-1 signed in January 2018 is currently being updated and will be finalized in January 2020, after which the CGMTC AR 200-1 will be reviewed annually by the CGMTC Environmental Manager who will make recommended modifications to the Deputy Garrison Commander. The CGMTC AR 200-1 will be signed by the Deputy Garrison Commander and the CGMTC Environmental Manager. The CGMTC AR 200-1 is summarized in the Soldier Field Card (SFC) which is distributed to transient troops. The purpose of the SFC is to provide a ready reference to transient troops regarding their training requirements and limitations to ensure compliance with applicable federal, state, local, and Army environmental regulations and CGMTC policies. The SFC is available on the Army-EU App in 2020.

1.4 AGENCY AND PERSONNEL ROLES AND RESPONSIBILITIES

Natural resource management responsibilities are shared between the MDMVA and the MDNR to accommodate the complex distribution of land ownership and leases. CGMTC consists of 147,000 non-contiguous acres that transect Crawford, Kalkaska, and Otsego Counties and three watersheds.

1.4.1 National Guard Bureau (NGB) - Installations and Environment (I&E)

NGB is the higher headquarters for the MIARNG. The Natural Resources Manager at ARNG-I&E is responsible for reviewing the INRMP and advising the Environmental Office before formally submitting the Plan to the USFWS and the MDNR. ARNG-I&E ensures operational readiness by sustaining environmental quality and promoting the environmental ethic and is also responsible for tracking projects, providing technical assistance, quality assurance and execution of funds. ARNG-I&E provides policy guidance and resources to create, sustain, and operate facilities that support the Army National Guard.

1.4.2 MDMVA

- The Adjutant General (TAG) of the Michigan Army National Guard (MIARNG) and Michigan Air National Guard (MIANG) is also the Director of the MDMVA, and is responsible for providing support to the natural resources programs at military installations throughout the State of Michigan, and reports to the Governor of Michigan.
- The Assistant to the Adjutant General (ATAG) for the Michigan Army National Guard provides overall review and direction on all environmental programs at MIARNG installations in Michigan.
- The Director of the Construction and Facilities Management Office (CFMO) reports directly to the ATAG. The Director of the CFMO provides a full range of engineering, financial, and environmental functions for all facilities under the jurisdiction of the MDMVA. Specific responsibilities include: (1) procurement and contracting; (2) warehousing of materials; (3) facility master planning; and, (4) program management requiring construction, base operations, and environmental funding and guidance.
- The Environmental Program Manager (EPM) reports to the Director of the CFMO and ensures that MIARNG activities comply with environmental laws and land stewardship responsibilities. The EPM also oversees the Integrated Training Area Management (ITAM) program and associated funding for MIARNG.
- The CGMTC Garrison Commander serves as trustee for the natural and cultural resources managed by CGMTC and is responsible for protecting the quality of the air, land, and water entrusted to CGMTC, and for ensuring that all relevant environmental laws are communicated and ultimately followed by users of CGMTC.
- The CGMTC Deputy Garrison Commander reports to the CGMTC Garrison Commander and is responsible for the daily management of CGMTC and for ensuring that all relevant environmental laws are communicated and ultimately followed by users of CGMTC.
- The CGMTC Environmental Manager reports to the EPM. The primary responsibilities of the CGMTC Environmental Manager are to ensure MIARNG personnel, facility operations and transient troops maintain compliance with environmental laws and regulations, and to provide stewardship of lands on which troops train by ensuring the INRMP is effectively implemented. The responsibilities are fulfilled by the coordination of environmental policies and procedures with military protocols, and by the collaboration between Environmental Department staff and other CGMTC directorates in a manner that facilitates fulfillment of the military training mission while ensuring compliance with applicable federal, state, local, and Army environmental regulations and CGMTC environmental policies. The CGMTC Environmental Department:
    - Oversees management programs and conservation initiatives for the purpose of preserving and enhancing natural resources at CGMTC, inclusive of the development, review, and implementation of the INRMP
    - Assists Range Control with the site clearance program
    - Facilitates the implementation of the Integrated Training Area Management (ITAM) program at CGMTC
    - Coordinates and consults with the MDNR regarding military use and restrictions of MDNR lands, public access restrictions to various parts of CGMTC lands

- Facilitates approved MDNR timber harvests
- Reviews and approves/disapproves Soil Erosion and Sedimentation Control (SESC) plans submitted by the Facilities Engineering (FE) Department and its contractors and issues SESC permits and Authorizations to Proceed to FE and its contractors; coordinate and communicate with public entities (e.g., Lake Margrethe Property Owners Association [LMPOA] board.)
- Develops procedures, policies, and protocols relating to natural resource management; and, oversees and/or manage spill responses and confirms remediation is complete.

- The Director of FE is responsible for the development and maintenance of CGMTC facilities and Cantonment grounds. The Director of FE coordinates with the CGMTC Environmental Department, which ensures that environmental criteria are incorporated into new and existing construction projects. The Director of FE coordinates with the CGMTC Environmental Department regarding various initiatives (e.g., identifying proposed locations of new gravel pits, maintenance of the waste water treatment plant lagoons) inclusive of execution of ITAM projects.
- The Director of Department of Plans, Operations, Training, and Security (DPOTS), known also as Range Control, is mainly responsible for overseeing the scheduling of military training and the safety of all personnel during training exercises at CGMTC. The Director of DPOTS coordinates with CGMTC Environmental Department personnel regarding site clearance, spill response, and restrictions on natural resources field events based on military training activities.

1.4.3 MDNR

The MDNR is the designated state wildlife, fisheries, and forestry management agency in Michigan and is a cooperating partner in the development and review of this INRMP. The MDNR's natural resource management responsibilities vary depending on the land ownership and property agreements.

The MDNR Fisheries Division is responsible for making decisions regarding the management of Michigan fisheries, rearing and stocking fish, fishing regulations, and managing invasive species. The Fisheries Division is divided into management units that correspond with major state watersheds. The western portion of CGMTC is primarily situated within the Manistee River watershed that discharges to Lake Michigan. The Manistee River watershed fisheries are managed by the MDNR Central Lake Michigan Management Unit. The eastern portion of CGMTC is situated within the Au Sable River watershed, which discharges to Lake Huron. The fisheries in the Au Sable River watershed are managed by the MDNR Northern Lake Huron Management Unit.

The MDNR Wildlife Division is responsible for the enhancement, restoration, and conservation of the state's wildlife resources, natural communities, and ecosystems for the benefit of future generations, as well as managing state wildlife and habitat in support of hunting, fishing, camping, trail use, and other outdoor recreation activities. The Wildlife Division implements management based on the Wildlife Division Strategic Plan 2016-2020, the State Game and Wildlife Area Master Plans, and the Michigan Wildlife Action Plan (WAP).

The MDNR Forest Resources Division (FRD) is responsible for implementing the Northern Lower Peninsula Regional State Forest Management Plan and the Michigan State Forestry Management Plan, fire management activities, maintaining the forest inventory, preparing bid packages for strategic timber harvests and contracting with timber harvesters. The FRD communicates and collaborates with the Fisheries and Wildlife Divisions and with CGMTC Environmental staff to obtain approval of proposed timber harvests. Prior to granting approval of a timber harvest, the CGMTC Environmental staff communicate with DPOTS to confirm the proposed timber harvest will not adversely impact the military training mission. Additionally, the FRD is currently responsible for all prescribed burns at CGMTC, until CGMTC can provide a qualified Burn Boss. The FRD is the first responder to wildfires located outside the fenced impact areas, while CGMTC staff is the first responder to wildfires located inside the fenced impact areas.

The MDNR reviews military actions proposed by the MDMVA that may potentially impact conservation efforts on property owned by the MDNR, such as the development and maintenance of helicopter landing zones, the construction of new training areas, the construction of firing points, etc. Similarly, the MDMVA reviews conservation and timber harvest actions proposed by the MDNR that may potentially impact the military mission on land owned by the military.

CGMTC Environmental Department staff work closely with the local MDNR representatives, and communication between the two agencies is often as much as several times per week on multiple topics, such as the use of maneuver trails as snowmobile trails, maintenance and seeding of firing points, coordination of prescribed burns, wildlife sightings, encounters between transient troops and the public, etc. During peak training season (June, July, August) it is not unusual for local MDNR representatives and CGMTC Environmental Department staff to communicate with each other multiple times per day. Additionally, the MDNR is provided daily end-of-day summaries of transient unit site clearance reports.

1.4.4 USFWS

The U.S. Fish and Wildlife Service (USFWS) is a cooperating partner in the development and review of the INRMP, as well as fulfilling regulatory duties related to Endangered Species Act Section 7. USFWS personnel consult with the CGMTC Environmental Department staff, particularly on issues relating to specific protected or threatened and endangered (T&E) species populations, wildlife and wildlife habitat management, such as the degree of impact that construction and training activities may have on T&E species, migratory birds, and bald eagles.

USFWS also has regulatory authority for migratory birds through the Migratory Bird Treaty Act and bald eagles through the Bald and Golden Eagle Protection Act. CGMTC staff work with USFWS to ensure regulatory compliance and implementation of conservation measures under these acts.

1.4.5 Michigan Department of Environment, Great Lakes, and Energy

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) is the regulatory agency with which CGMTC Environmental Department personnel coordinate compliance issues, many of which are integrated with environmental concerns and conservation. EGLE:

- Reviews, issues, and enforces:
    - Groundwater Discharge Permits
    - Certificates of Coverage and the Wastewater Discharge General Permits
    - Storm Water Pollution Prevention Plans (SWPPPs).

- Provides consultation to CGMTC Environmental Department personnel regarding compliance with applicable and relevant environmental laws and regulations regarding specific aspects of military training operations that potentially impact conservation efforts, such as discharge of grey water to the ground surface by transient troops, removal of water from lakes for purification and use by transient troops, proposed impacts to wetlands, lakes, streams, and floodplains, evaluation and remediation of uncontrolled releases, etc.

1.4.6 District Health Department

The District Health Department #10 is tasked by the Governor to promote and enhance the health of communities and environment in ten counties through protection, prevention, and intervention. The District Health Department #10 conducts regularly scheduled health inspections of CGMTC drinking water wells and sanitary conveyances, and advises CGMTC personnel regarding the quality of recreational surface waters at CGMTC that are available for public use. Integrated activities that involve environmental issues are primarily concerned with water quality of Lake Margrethe.

1.5 REVIEW AND REVISION PROCESS

In accordance with the Sikes Act, DoDI 4715.03, and AR 200-1, there are two components to the INRMP review process: the annual review, and the review for operation and effect. The annual review is focused primarily on project implementation and specific performance goals. The review for operation and effect is focused primarily on the overall effectiveness and approach of the INRMP. The goals, objectives, and associated tasks can be revised over time to reflect evolving environmental conditions, adaptive management, and the completion of projects or tasks.

1.5.1 Annual Review

An annual review process is the mechanism by which the USFWS, MDNR, MDMVA personnel, and other conservation partners receive an update on what has been accomplished in the last year and what is planned for the coming year. The annual meeting provides the MDMVA an opportunity to:

- Invite comments from the USFWS, MDNR, and other conservation partners regarding the effectiveness of the INRMP

- Inform the USFWS, MDNR, and other conservation partners of project development and implementation
- Discuss conservation compliance needs
- Discuss the integration of projects described in the INRMP with:
    - Mission critical initiatives
    - Operational requirements
    - Land use by transient troops
    - Site restoration and maintenance
    - Other programs and initiatives at CGMTC

- Discuss specific accomplishments and upcoming activities
- Schedule the review for operation and effect, as needed

The CGMTC Environmental Manager shall:

- Develop and distribute the agenda, which will include discussion items that address whether goals have been achieved, the status of project implementations, and project budgets and funding.
- Meet annually with USFWS, MDNR, and other conservation partners.
- Develop and distribute a Memorandum of Record for the Annual Review that summarizes the meeting or conference call. The Memorandum of Record is appended in Appendix B, making this INRMP a document and program that can be continually developed.

1.5.2 Review for Operation and Effect

The review for operation and effect must occur at least every five years, and may be conducted as part of every annual review or as a separate review process. The review is the mechanism by which the USFWS, MDNR, and EPM (or designee) comprehensively examine the INRMP for the purpose of determining its effectiveness, implementability, and whether the document needs to be revised. The review shall consider substantial changes regarding military scope and mission, and natural resource programs.
The result of the review is a collective determination by the three entities that the CGMTC Environmental Department shall either continue implementation of the existing INRMP with minor updates, or proceed with a major revision of the INRMP.

- Minor updates will be completed by the CGMTC Environmental Manager and CGMTC Environmental Department staff with support, as needed, by the EPM
- A major revision will be completed by the CGMTC Environmental Department with the support of state-approved vendors and the EPM. The major revision shall include the development and review of associated NEPA documentation
- CGMTC Environmental Manger shall ensure that the updates or revisions are completed within a timely manner to ensure the INRMP remains compliant

- The existing INRMP shall remain *Operational* until the updates or revision is complete, and all concurrences are received. To meet the Army's definition of *Operational*, MDNR and USFWS must agree in writing that the current INRMP will remain in place until the updated/revised INRMP is signed.

The CGMTC Environmental Manager shall:

- Develop and distribute the agenda, which will include discussion items that critically analyze the effectiveness and implementability of the INRMP
- Communicate with USFWS, MDNR, and internal stakeholders either by meeting or conference call.
- Develop and distribute a Memorandum of Record for the Operation and Effect Review that summarizes the meeting or conference call. The Memorandum of Record will be appended in Appendix B, making this INRMP a document and program that can be continually developed.

1.6 INTEGRATION WITH OTHER PLANS, PROGRAMS AND INITIATIVES

This INRMP was developed in coordination with other plans that provide information critical to identifying and prioritizing projects, have processes and protocols integrated with those of the natural resources program, or are otherwise influenced or impacted by the natural resources program, conservation initiatives, and/or environmental regulations. The adaptive management and documentation associated with annual reviews and reviews for operation and effect contribute to the EMS already in place at CGMTC.

1.6.1 MDMVA Statewide Plans

- The **MDMVA Integrated Pest Management Plan (IPMP, updated 2014)** describes the MDMVA's statewide integrated pest management approach, inclusive of the management of invasive species. The IPMP suggests Standard Operating Procedures (SOPs) and protocols that are required for effective pest management on military installations throughout the state.
- The **MDMVA Integrated Cultural Resources Management Plan (ICRMP, updated 2020)** describes cultural resources present on military installations throughout the state, inclusive of the 18 that have been identified on CGMTC. The ICRMP suggests SOPs and best management practices (BMPs) that can be implemented to protect and manage cultural resources.
- The **MDMVA Soil Erosion and Sedimentation Control Guidebook (Revised 2018)** is the plan and guidance document used by the MDMVA for managing soil erosion and sedimentation pursuant to Act 451, Part 31, Water Resources Protection Act and Part 91, Comprehensive Soil Erosion and Sedimentation Control. The MDMVA is an approved Authorized Public Agency (APA), which allows certified individuals within the CGMTC Environmental Department to review SESC plans, write SESC permits, inspect SESC sites, and provide Authorization to Proceed documentation to permitted sites.

- The **Adaptation Planning for Climate Resilience (2016)** is an assessment that documents current conditions at three military installations, including CGMTC. Evaluation of the associated vulnerability assessment of CGMTC and surrounding communities resulted in installation leaders, the steering committee, and the Michigan Climate Coalition recommending specific resiliency goals and actions for CGMTC.
- The **Statewide Operation Noise Management Plan (2005)** was developed by the US Army and provides a strategy for noise management at four Michigan military installations, including CGMTC. The follow-up **Installation Compatible Use Zone** (ICUZ) **Study (2015)** was developed as part of the Army's nationwide ICUZ Program, the goal of which is to promote land use that is compatible with the military noise environment while minimizing adverse impact upon the quality of nearby civilian environments.

1.6.2 Other Statewide Plans

- The **Michigan Wildlife Division Strategic Plan 2016-2020** was developed by the MDNR and describes the Division's guiding principles, as well as the strategies implemented to obtain the Division's seven goals. The plan is available at https://www.michigan.gov/documents/dnr/Wildlife_GPS_Strategic_Plan_434049_7.pdf.
- The **Michigan Wildlife Action Plan** (WAP) was developed in partnership with other agencies, and serves as a framework for management of wildlife and wildlife habitat, especially for those species that are in decline. The MDMVA was an active participant in updating the Michigan WAP and contributing to the goals and conservation actions identified during that process. CGMTC has incorporated the Michigan WAP into its natural resources management program. During the INRMP update process, the MIARNG consulted the Michigan WAP to ensure INRMP goals, objectives and strategies are consistent with Michigan's overall statewide and site-specific plans. The Michigan WAP is available at https://www.michigan.gov/dnr/0,4570,7-350-79136_79608_83053---,00.html.
- The **Michigan State Forest Management Plan (2008, amended 2014)** was developed by the MDNR to restore the forest resource that was devastated from over-exploitation in the late 19th century within a framework of long-term sustainability and continuing use. The document is available at https://www.michigan.gov/dnr/SFMPDraftJan2008_222799-7.
- The **Northern Lower Peninsula Regional State Forest Management Plan (2013)** was developed by the MDNR to provide guidance in the economic, recreational, and environmental management of state forest lands using an ecosystem-based approach that meets current forest needs while not compromising the needs of future generations. The document is available at https://www.michigan.gov/dnr/0,4570,7-350-79136_79237_80916_85456-284917--,00.html

1.6.3 ITAM Program

The Sustainable Range Program (SRP) is the Army's overall approach for managing and improving the Army's ranges and training lands for long-term sustainability. One of the core

components of the SRP is the ITAM program, which provides for the management and maintenance of training and testing lands by integrating mission requirements with environmental requirements and environmental and natural resources management practices. The ITAM program has been in place at CGMTC since 1992. Additional details and the current work plan are provided in Appendix N. The objectives of the ITAM program are to:

- Achieve optimal sustained use of lands for realistic training and testing by providing a sustainable core capability that balances usage, condition, and level of maintenance
- Implement a management process that integrates Army training and other mission requirements for land use with sound natural resources management
- Advocate proactive conservation and land management practices by aligning Army land management priorities with the Army training and readiness priorities.

The ITAM program supports sustainable use of training and testing lands by:

- Supporting land management through inventorying and monitoring land conditions;
- Integrating training and testing requirements with training land carrying capacity;
- Educating land users to minimize adverse impacts; and
- Providing training land rehabilitation and maintenance.

The ITAM program is divided into three components, Range Training Land Assessment (RTLA), Land Rehabilitation and Management (LRAM), and Sustainable Range Awareness (SRA). Each of the components provide a difference service to CGMTC and all programs involve natural resources management and Geographic Information Systems (GIS) management.

Range Training Land Assessment (RTLA)

The RTLA program provides an assessment of the training areas. This is focused on monitoring training assets of CGMTC to ensure that they are maintained for long term use. RTLA assesses the impacts of units on the training sites, monitoring for erosion, vegetation damage, woody encroachment inhibiting site use, and monitoring the trail network.

Land Rehabilitation and Management (LRAM)

The LRAM program implements ITAM projects within the training areas. The LRAM component focuses on maintaining, repairing, or reconfiguring the training areas or training assets which include: on and off trail maneuver, live-fire maneuver, movement, tactical training helicopter operations, artillery and mortar firing training, observation points, warrior tasks, battle drills, signal training, tactical assembly and bivouacking, patrol exercises, and land navigation. The maintenance, repair, or reconfiguration of these sites can vary from heavy earth moving to vegetation management and mowing sites. The ITAM coordinator works with CGMTC Environmental staff for associated permitting and management techniques of implementation of ITAM projects.

Sustainable Range Awareness (SRA)

The SRA program is implemented to provide transient troops with important information and awareness to environmental regulations, BMPs, and relevant installation point of contact (POC)

information. This information transfer is accomplished by distribution of the SFC, the Military Installation Maps, and the Army-EU App.

1.6.4 CGMTC Plans, Programs and Initiatives

- The **Range Complex Master Plan** is updated annually, and is a comprehensive plan for current and future range development. It provides a list of available assets, identifies users, and establishes training requirements based on Army training doctrine and resource guidance. It establishes current requirements and utilization levels for available training assets, providing a near and long-term project plan for training, public works, and environmental planners. The projects identified in the plan consider the impacts on the MIARNG's mission, economic resources, and environmental stewardship. The CGMTC Environmental Manager or designee participates in this process to ensure any potential environmental impacts are identified.
- The **Facility Master Plan** is in the process of being updated. The purpose of the Master Plan is to guide the upgrading and expansion of CGMTC's facilities to accommodate future mission sets. The CGMTC Environmental Manager or designee participates in this process to ensure any potential environmental impacts are identified.
- The **Cantonment Forestry Management Plan** (CFMP) is a new 2019 initiative that is being developed by the Environmental Department to integrate the Northern Lower Peninsula Regional State Forest Management Plan (2013), as it applies to the Cantonment with the Facility Master Plan, based on a set of criteria that can be used to decide under what conditions timber harvesting, tree plantings, or other management can occur on the Cantonment. The CFMP compliments the Integrated Wildland Fire Management Plan (IWFMP), specifically with regard for invasive species management and prescribed ecological burns.
- The **Joint Land Use Study (2019)** (JLUS) is intended to evaluate ways in which civilian life and military training activities intersect and provide information that can contribute to the decision-making process that will ensure optimal experiences for both groups of stakeholders. The JLUS serves as a foundation for the CGMTC Environmental Department's 2020 Noise Management and Community Outreach Program, as well as assessing and development of the Readiness and Environmental Protection Integration (REPI) and Army Compatible Use Buffer (ACUB) initiatives.
- The **Noise Management and Community Outreach Program** is based on findings and recommendations described in the 2015 ICUZ Study. The CGMTC program is in the initial stages of development and is intended to inform local residents and organizations regarding information on expected maximum noise levels, particularly during peak training months of June, July and August. The primary communication mechanisms will be via a dedicated website, print, and a series of charrettes to which the public will be invited.
- **Transient Troop Monitoring Initiative**. The Environmental Department monitors training activities of transient troops and communicates environmental policies and regulations to transient troops using four primary methods: during one-on-one meetings when the transient troops visit/call/email the Environmental Department office, during the Environmental Briefings, wide distribution of the Soldier Field Card, and public access to the US Army-Europe (USAREUR) online app. Each of these four methods of

communication imparts to the transient troops information vital to the conservation and sustainability of natural resources and existing training lands. Topics covered include, but are not limited to actions that need to be taken to eliminate or minimize erosion due to discharge of gray water, vehicle movement, fueling operations, spill response, tree cutting, digging and earth moving, encounters with wildlife and threatened and endangered species, wetlands and surface water protection. In addition to monitoring before and during the transient unit's training exercises, DPOTS and the Environmental Department initiated a Site Clearance Program in 2019 which ensures each training site is either enhanced or restored to its original condition, based on the expectation that transient units should leave no trace, a concept consistent with strategic battle field actions.

- The **CGMTC Spill Prevention and Response Plan** was developed in 2018, and describes expected transient troop spill prevention preparedness, and SOPs the Environmental Department and DPW staff can implement in the event of a petroleum/oil/lubricant (POL) spill or a non-POL spill.
- The **Integrated Wildland Fire Management Plan (IWFMP) (2020)** was developed in collaboration of the MDNR. The IWFMP describes policies, actions, training requirements, and chain-of-command communication protocols regarding wildfire prevention and suppression at CGMTC.
- The **Lake Margrethe Watershed Management Plan (2018)** was developed by the DMVA and CGMTC in cooperation with the LMPOA, Huron Pines, Inc., EGLE, and the MDNR. The purpose of the plan is to assess the condition of Lake Margrethe, and to provide guidance for continuing restoration and protection of Lake Margrethe and its watershed. The plan presents recommendations for management actions and future projects, particularly with regard for shoreline erosion and sedimentation control, invasive species management, and storm water runoff management. The plan was approved by the U.S. Environmental Protection Agency (USEPA) in November 2018.
- The **Portage Creek Watershed Plan (2017)** was developed by the Upper Manistee River Association (UMRA) with the support of the DMVA and CGMTC. The plan identifies and inventories various biological, chemical and habitat components of Portage Creek, to which Lake Margrethe discharges. The plan describes macro invertebrate communities, water chemistry attributes, instream habitat concerns, beaver dam locations, sand trap and fish spawning locations, and stream bank erosion locations.
- The Range Best Management Practices Implementation Plan (2014) and the Operational Range Assessment Report (2013) contribute guidance to the overall **Range Sustainability Program** at CGMTC. The purpose of the Range Sustainability Program is to assess and develop actions that can be implemented to conserve and promote range sustainability by protecting natural resources and ecosystems. The program in the process of being updated, and it is expected an action plan will be available in late 2020.
- The National Guard Bureau is leading investigations at CGMTC pursuant to CERCLA to determine the nature and extent of PFAS contamination. More information is available at https://www.michigan.gov/pfasresponse/0,9038,7-365-86511_95645-493751--,00.html.

2 INSTALLATION OVERVIEW

2.1 GENERAL DESCRIPTION

CGMTC is located in the north central portion of the lower peninsula of Michigan, as indicated on Figure 1 (Appendix D). The installation is located approximately 200 miles northwest of Detroit and approximately 30 miles south east of Traverse City. Grayling, Michigan is the nearest urban center, located between North Camp and South Camp with a 2016 census population of 1,837 people.

CGMTC consists of 147,000 non-contiguous acres that transect Crawford, Kalkaska, and Otsego Counties and three watersheds, making CGMTC the largest National Guard installation in the nation. The majority of the 147,000 acres are in Crawford County (approximately 99,000 acres). Smaller acreages lie within southern Otsego (approximately 5,500 acres) and eastern Kalkaska Counties (approximately 42,500 acres). Approximately 60 lakes and ponds, and 312 miles of streams and rivers are situated on or adjacent to CGMTC.

As indicated on Figure 1 (Appendix D) the installation is bisected by Interstate Highway 75 into North Camp (67,000 acres) and South Camp (80,100 acres), each of which provide facilities and training areas to achieve different types of training opportunities. North Camp training areas accommodate heavy artillery, anti-tank weapons, bridge deployment, air-to-ground bombing, convoy live fire, non-standard small arms, modified multi-purpose machine gun training, and various other heavy weapons use and maneuver training resources, including a Combined Arms Collective Training Facility (CACTF) and more than 100 firing points. South Camp training areas accommodate light demolition, multipurpose machine gun training, grenade training, small arms and pistol training, bridge deployment, amphibious assault training, and various other resources, including a simulation facility and an Improvised Explosive Device (IED) Defeat facility.

Primary CGMTC support facilities include the 870-acre Grayling Army Airfield (GAAF), the 1,243-acre Cantonment, and the 62-acre Mobilization and Training Equipment Site (MATES).

- The GAAF is located in the northeast corner of South Camp, as indicated on Figure 2 (Appendix D). Private residences are located immediately west, east, south, and northeast of the GAAF. The DMVA collaborates with GAAF management and 40 Complex management to coordinate wildlife management and Bird and Wildlife Aircraft Strike Hazard (BASH) plan activities to protect humans and wildlife from potential harm resulting from collisions between wildlife and aircraft. Wildlife species that warrant particular consideration include deer, geese, and raptors.
- The Cantonment is adjacent to the south shoreline of Lake Margrethe, as indicated on Figure 2 (Appendix D). Lake Margrethe is 1,922 acres with approximately 9.5 miles of shoreline, 4.2 miles of which are owned by the DMVA, and 5.3 miles of which are owned by residents. The DMVA collaborates with the LMPOA to share responsibilities of invasive species management and shoreline erosion and sedimentation control and management.
- The MATES is located in the southwest corner of North Camp, as indicated on Figure 2 (Appendix D). Private residences are located immediately west of the MATES.

Public recreational facilities located within the CGMTC boundary include a 13-acre civilian airfield, a 26-acre state campground adjacent to Lake Margarethe, the 200-acre Hanson Hills Recreation Area, and numerous campgrounds and hunting grounds, as well as lakes, rivers, and streams that are used for fishing, boating, and kayaking. Many roads and trails on training grounds are used by the public as snow mobile trails and for off-road driving. Areas with restricted public access are indicated on Figure 3 (Appendix D).

A detailed description of the physical environment including climate information, topography, geology, soils, surface water, and wetlands is provided in Appendix E.
A detailed description of the biological environment including ecoregion, historic and current vegetation, invasive species, and fish and wildlife is provided in Appendix F.

2.2 LAND OWNERSHIP, OCCUPANCY AND NATURAL RESOURCES MANAGEMENT AUTHORITY

As indicated on Figure 2 (Appendix D), of the 147,000 acres that comprise CGMTC:

- The DMVA owns 46,700 acres (32%), 26 acres of which are leased to the MDNR for use as a state campground, and 200 acres of which are leased to the Grayling Recreation Authority (GRA) for use as an outdoor recreation complex.
- The MDNR owns 97,200 acres (66%), all of which are leased to the DMVA under two different types of lease agreements. Approximately 54,000 acres are leased under a perpetuity lease, which allows the military to train in accordance with certain restrictions. Approximately 43,200 acres are leased under a renewable 20-year lease, which further restricts certain military training activities (e.g., no digging).
- The federal government owns 1,050 acres (<1%), 870 acres of which are the GAAF, 170 acres of which are used for training in South Camp, and 12 acres of which are leased to Crawford County for use as a civilian airfield.
- Various entities other than the federal government, the MDNR, and the DMVA own 2,050 acres (>1%), all of which are used by the DMVA pursuant to various land use agreements.

As indicated in Table 2.1, natural resource management responsibilities shown on Figure 4 (Appendix D) are shared between the MDMVA and the MDNR to accommodate the complex distribution of land ownership and to optimally promote natural resources management programs and initiatives.

- With the exception of the 1,050 acres owned by the federal government, the MDNR manages all forestry, game and fish resources at CGMTC, in accordance with language in the 1913 Hanson Land Grant and the subsequent 1949 agreement between the military and Department of Conservation (now MDNR). The Hanson Land Grant and the 1949 agreement states that CGMTC personnel will be consulted to obtain the appropriate approval of the CGMTC before action will be taken which may adversely affect military training capabilities. In effect, the MDNR consults CGMTC prior to proposing contracted timber harvests.

- Wildland fire response and prescribed burn activities are jointly managed by MDNR and CGMTC, pursuant to the IWFMP.
- The MDNR is responsible for water resources, soils, vegetation, invasive species, listed species, and wildlife habitat at the 26-acre state campground located on the northwest shoreline of Lake Margarethe.
- Crawford County is responsible for forestry and game management, as well as water resources, soils, vegetation, invasive species, listed species, and wildlife habitat at the 12-acre civilian airfield adjacent to the GAAF.
- MIARNG is responsible for the water resources, soils, vegetation, invasive species, listed species, and wildlife habitat at the 200-acre Hanson Hills Recreation Area.
- The MDNR and MIARNG work collaboratively to manage the water resources, soils, vegetation, invasive species, listed species, and wildlife habitat on the 54,000 acres owned by the MDNR and leased in perpetuity by the MIARNG, as well as the 2,050 acres used by the MIARNG pursuant to various land use agreements.
- The MDNR is responsible for all management on the 43,200 acres owned by the MDNR and leased under 20-year agreement by the MIARNG. MIARNG ensures the lease restrictions are upheld.
- MIARNG is responsible for the water resources, soils, vegetation, invasive species, listed species, and wildlife habitat on the 46,674 acres owned by the MIARNG (i.e., the 46,700 acres owned by the MIARNG minus the 26 acres managed by Crawford County).
- MIARNG is responsible for forestry and game management, as well as water resources, soils, vegetation, invasive species, listed species, and wildlife habitat on the 1,040 acres owned by the federal government (i.e., the 1,052 acres owned by the federal government minus the 12 acres that is leased to Crawford Country for use as a civilian airfield).

The collaborative nature of natural resources management between MIARNG and the MDNR at CGMTC may carry some implications regarding the manner in which various aspects of this INRMP will be implemented. Those implications are not expected to hinder the advancement of natural resources protection and conservation because the MDNR and MIARNG have common goals regarding natural resources protection and conservation. Additionally, the MIARNG is obligated under the Sikes Act to ensure that ecosystems and natural resources are protected and enhanced on all military training lands. Whenever possible, collaboration occurs when it is mutually beneficial to achieve aligned goals through landscape level or habitat level management.

Table 2.1
Summary of Land Use

Land Tract / Location	Owner / Occupant / Occupancy Mechanism	Acres	Limitations to Military Training Use	Public Access	Primary Natural Resource Managing Entity					
					Water Resources	Soils, Vegetation and Invasive Species	Listed Species and Wildlife Habitat	Wildland Fire Response	Prescribed Fire	Forestry, Game and Fish
Hanson Land Grant / South Camp	MIARNG / MIARNG / Granted to the Military Board in 1913 (shown in Figure 4 in red)	13,574 incl. fenced Canton-ment	No training activities within 400 ft of surface water or wetland. Weapons training is restricted in the Cantonment	Cantonment is restricted	MIARNG			DNR		DNR with MIARNG approval
Hanson Land Grant / South Camp	MIARNG / DNR / MIARNG leases to DNR for use as state campground (shown in Figure 4 in red)	26	No military use	Unrestricted public access	DNR					
Hanson Land Grant / South Camp	MIARNG / GRA / MIARNG leases to GRA for use as an outdoor recreation complex (shown in Figure 4 in red)	200	Available for military use	Unrestricted public access	MIARNG			DNR		

Table 2.1
Summary of Land Use

Land Tract / Location	Owner / Occupant / Occupancy Mechanism	Acres	Limitations to Military Training Use	Public Access	Primary Natural Resource Managing Entity					
					Water Resources	Soils, Vegetation and Invasive Species	Listed Species and Wildlife Habitat	Wildland Fire Response	Prescribed Fire	Forestry, Game and Fish
Land purchased by ARNG / South Camp and North Camp	MIARNG / MIARNG / Purchases of various parcels and land tracts (shown in Figure 4 in red)	15,000 incl. fenced impact areas	No training activities within 400 ft of surface water or wetland. Some restricted areas based on habitat conservation. Some restricted use based on safety and security considerations	Impact areas are restricted	MIARNG			DNR outside impact areas / MI ARNG within impact areas	DNR	MDNR with MI ARNG approval
GAAF / South Camp	US Army / MIARNG / Land Purchase (shown in Figure 4 in orange)	800 fenced	No restrictions	Restricted	MIARNG			Not Applicable (no wildlands)		MI ARNG
GAAF/ South Camp	US Army / MIARNG / Land Purchase Shown in Figure 4 in orange)	70	Restrictions based on areas of habitat protection	Not restricted	MIARNG			Not Applicable (no wildlands)		MI ARNG
Crawford County Airfield / South Camp	US Army / Crawford County / County leases from DoD via DMVA (shown in Figure 4 in orange)	12	Not available for military training activities	Not restricted	County			Not Applicable		County

Table 2.1
Summary of Land Use

Land Tract / Location	Owner / Occupant / Occupancy Mechanism	Acres	Limitations to Military Training Use	Public Access	Primary Natural Resource Managing Entity					
					Water Resources	Soils, Vegetation and Invasive Species	Listed Species and Wildlife Habitat	Wildland Fire Response	Prescribed Fire	Forestry, Game and Fish
Federal Tract / South Camp	US Army / MIARNG / Land purchase (shown in Figure 4 in orange)	170	No training activities within 400 ft of surface water or wetlands.	Not restricted	MIARNG			MDNR		MI ARNG
Various tracts / Primarily North Camp	Various owners / MIARNG / Various land use agreements (shown in Figure 4 in green)	2,050	No training activities within 400 ft of surface water or wetland. Some restricted use based on safety and security considerations	Generally not restricted	MDNR and MIARNG collaborative management			MDNR		MDNR with MI ARNG approval
DNR Tracts / North Camp	DNR / MIARNG / Leased in perpetuity (shown in Figure 4 in green)	54,000	No training activities within 400 ft of surface water or wetland. Some restricted areas based on habitat protection	Impact areas are restricted	MDNR and MIARNG collaborative management			MDNR outside impact areas / MI ARNG within impact areas	DNR	MDNR with MI ARNG approval
MDNR Tracts / Primarily South Camp	MDNR / MIARNG / Lease renewal every 20 years (shown in Figure 4 in blue)	43,200	No training activities within 400 ft of surface water or wetland. No earth moving.	Not restricted	MDNR; MIARNG ensures lease restrictions are upheld			MDNR		MDNR with MI ARNG notification
	Total Acreage	**147,002**								

2.3 HISTORY OF CGMTC

The training area now named CGMTC was established in 1913 pursuant to Michigan PA 172, when Rasmus Hanson, a Grayling lumber baron gifted 13,754 acres of land at the south end of Portage Lake (now Lake Margrethe) to the Military Board to function as a training site of the state militia, a game preserve, and a forest reserve. The training area has grown over the past 106 years from less than 14,000 acres to 147,000 acres.

National Guard troops first trained at CGMTC in 1914 but the first major building effort took place in 1917. Land for the first artillery range was obtained between 1918 and 1921, bringing the camp's total acreage to approximately 48,000 acres. The Grayling airport was constructed for use by the National Guard Air Squadron of Detroit in 1929, with expansions and additional buildings in following years.

Following World War II, more than 53,000 acres of land were acquired for the Michigan National Guard on a long-term (in perpetuity) lease from MDNR. In 1984, the MDMVA and the MDNR agreed to a 20-year management agreement (which is renewed as needed) encompassing approximately 47,000 acres in Kalkaska and Crawford Counties.

A complete facility modernization program commenced at the camp in the early 1960s, with most of the facility replaced by the early 1980s. Several additional facilities were added starting in the 1980s, largely within the cantonment area or associated with ranges.

Training activities and equipment have undergone a similar history of replacement and upgrade at the camp. Since the horses left in 1936, tanks, armored personnel carriers, helicopters, and jet aircraft have moved in. Tanks came in 1948 and began firing on the range complex that same year. Range upgrades have been performed over the last 40 years to update and automate ranges as needed to support the military mission.

2.4 MILITARY MISSION

The MIARNG mission is to provide relevant and ready operational military forces, consistent with values in support of our state and nation; and to provide support to military personnel, civilian employees, families, retirees, and veterans.

The mission for CGMTC is to provide customer-focused training support and facilities to enable military commanders and civilian leaders to meet their unit training requirements. CGMTC is envisioned to be a full-spectrum, four-season, training complex capable of supporting the needs of military and civilian leaders. CGMTC's firing ranges and other training facilities offer unique opportunities for individual to battalion-sized elements for a variety of weapon systems and scenarios.

2.5 CURRENT LAND USE

The primary land use at CGMTC is military training, but non-military uses also occur throughout most of CGMTC. Non-military uses consist of forestry, hunting, fishing, and other recreation, as well as training for local fire and law enforcement. For safety reasons, the live fire ranges are

mostly fenced and closed to the public by MDNR Director's closure order, supplemented with road closures when necessary.

2.5.1 North Camp

North Camp contains the fenced Range 30 Complex and Range 40 Complex, which include an air-to-ground range and ranges for artillery, tanks, and larger crew-served weapons and can accommodate up to battalion-sized units. Also in North Camp is the Dismounted Complex with the CACTF. The CACTF allows for urban simulation training with multiple buildings, city streets, and other features to simulate the urban environment.

Range 30 Complex (5,232 acres): This complex includes a fenced area of 5,232 acres that contains the Multi-Purpose Range Complex. The MATES is located at the southwest end of Range 30.

Range 40 Complex (7,278 acres): This complex includes facilities for Joint Training and Live Fire Exercises, including maneuver areas; live fire ranges; dudded impact area; an air-to-ground range complex with restricted airspace up to 23,000 feet; and a variety of other live fire ranges.

The terrain in this area, like all of CGMTC, is generally flat to gently rolling. Community types include swamps, Pine Barrens, and various age oak, aspen and jack pine stands. The southern half of North Camp contains a considerable amount of open Pine Barrens and grasslands that are used for off-road maneuver training. Dry, open forest stands, as well as established sites are used for command posts and associated activities.

2.5.2 South Camp

South Camp includes the cantonment area, which can house over 10,000 soldiers at a time. South Camp also has an extensive array of small arms ranges as well as a fenced mortar range (Range 13), explosive demolition ranges, a counter-IED range, and a hand grenade range. South Camp includes the, Home State Training Lane, and Simulation Center. The federally owned GAAF is located in the northeast section of South Camp.

South Camp consists of primarily closed-canopy forests and has historically been used for infantry training. As these units have become more mechanized, this area has seen an increase in wheeled and tracked vehicles. Under the management agreement with the MDNR, approximately 43,500 acres are closed to tracked vehicles due to concerns related to oil wells, sensitive habitats and species, and potential conflicts with recreational users.

2.5.3 Operations and Activities

CGMTC is a year-round training facility. There are approximately 150,000 to 200,000 man-days of use annually by military entities. This includes Active and Reserve components of the Army, Navy, Marine and Air Force and Guard units of the Army and Air Force, and allied forces.

CGMTC has seen a substantial reduction in heavy vehicles, especially tracked vehicles, over the last 15 years, with more emphasis on urban and roadside training. However, tracked vehicles are still used at CGMTC and will continue to be part of training there for the foreseeable future. There are some range upgrades planned that will occur within existing footprints.

In addition to the military uses discussed above, non-military activities include similar recreational opportunities as are available on other state lands nearby. Most recreation is managed by MDNR and includes hunting, fishing, camping, hiking, skiing, snowmobiling, etc. Most public users do not check in with CGMTC staff and as such there are no data on public use within the CGMTC boundary. Disturbance to sensitive areas and species from recreational activities is monitored through routine assessment and management conducted by CGMTC staff. Unauthorized recreational activities that are observed are reported to MDNR Law Enforcement Division and/ or field personnel to coordinate resolution as appropriate.

Other than recreational users, other non-military users include research and development by private industry and academic institutions, local and state law enforcement, shooting clubs, and scout troops.

2.6 Regional Land Use and Regional Planning

The predominant land use outside the CGMTC boundary is primarily public forest lands managed by MDNR and US Forest Service. Private lands and residences are scattered within and around the edges of CGMTC. These privately-owned areas create safety considerations for the military mission, result in noise and land use conflicts, and also impact implementation of natural resources management across the landscape. Light industrial and heavy industrial zoning is found only in the City of Grayling and Grayling Township.

There are a number of state-owned public lands (in addition to those included as part of CGMTC) surrounding CGMTC. These include the Hartwick Pines State Park, Grayling State Forest, and Traverse City State Forest. The Huron National Forest is located south of North Camp and extends to the east. The Kirtland's National Wildlife Refuge is to the east of North Camp.

The 2019 JLUS describes ways in which civilian life and military training activities intersect and provide information that can contribute to the decision-making process that will ensure optimal experiences for both groups of stakeholders. The JLUS serves as the foundation for the CGMTC Environmental Department's 2020 Noise Management and Community Outreach Program, as well as assessing the development of the REPI and ACUB initiatives.

2.7 Constraints & Opportunities

Natural resources at CGMTC that could constrain training and development include wetlands, streams, lakes, floodplains, steep terrain, highly erodible soils, cultural resources sites, and the presence of sensitive species or habitats.

Every year the CG 200-1 regulation is reviewed and updated as necessary. Continuous directives reflected in CG 200-1 that are based on AR 200-1 and Michigan Act 451 include, but are not limited to:

- No mechanical earth moving or hand digging is allowed within 500 feet of any lake, pond, river, saturated wetland or unsaturated wetland.
- No military activities within 400 feet of any stream or river other than on existing roads.

- No building roads or berms without prior authorization from DPOTS and the Environmental Department
- No clearing or grubbing without prior approval from the Environmental Department.
- Do not feed, harm, kill, or harass any wildlife.
- Use of concertina wire is limited and strictly controlled by DPOTS.
- No digging or earth moving on the 20-year lease tracts.
- No refueling with 400 feet of a lake, pond, river, saturated wetland or unsaturated wetland.
- Refueling in the field can only occur on secondary containment, with proper spill prevention equipment on-hand, and more than 400 feet from a lake, pond, river, saturated wetland or unsaturated wetland.
- Leave no trace; the transient unit is directed to restore or enhance its site to the condition in which it was found in preparation for Site Clearance, which occurs prior to the unit's demobilization from CGMTC.

In addition to these continuous directives, an annual "Training Areas Limitations" memorandum (Appendix H) has been developed that summarizes the limitations to military activity based on species and habitat protection and conservation that may change over time. Some of the limitations for 2020 include limited access to wildlife research areas and high quality habitats. Although sensitive habitats and known locations of threatened and endangered species' habitats are not mapped in order to continuously protect the species from potential poaching or other activities harmful to the survival of the species, areas of restricted military activity are shown on Figure 5 (Appendix D).

3 NATURAL RESOURCES MANAGEMENT

The purpose of this INRMP, as described in Section 1.1, will be accomplished by identifying goals, objectives, and an implementation plan for each natural resource element that aligns with other CGMTC programs, initiatives, and policies. The natural resource elements[2] described herein are:

- Natural Resources Program Management
- Soil Conservation
- Water Resources
- Vegetation Management
- Wildland Fire Management
- Invasive Species and Integrated Pest Management
- Fish and Wildlife Management
- Species of Conservation Concern
- Recreation Management
- Climate Resilience and Regional Growth

A description of each element is provided in following subsections. Objectives for each of the element's program are described in Appendix G, and best management practices for managing the element are described in Appendix M. Overall goals of each natural resource element will be met by prioritizing CGMTC objectives, assessing the implementation of the associated recommendations, and developing an overall project description, schedule, and budget. Many of the objectives and recommendations are applicable to more than one natural resource element; therefore, many of the projects can accomplish multiple objectives. The project list is presented in the Implementation Table (Appendix I).

3.1 NATURAL RESOURCES PROGRAM MANAGEMENT

Successfully implementing this INRMP and achieving the goals and objectives requires a complex set of programmatic tools. Some of these are state-wide and apply at all MIARNG installations and some are specific to CGMTC. Undertaking annual coordination with USFWS and MDNR, evaluating whether the objectives are being met, and determining if any modifications in the objectives, projects or activities are needed is a core function of the natural resources program at CGMTC.

Since CGMTC encompasses a large expanse and variety of natural communities, it affords excellent opportunities for research and study. Purdue University has conducted on-going research on reptiles (eastern massasauga, wood turtle, and Blanding's turtle) for a number of

[2] A description of a coastal/marine management program is not included in this INRMP because that ecosystem is not a natural resource element at CGJMTC.

years. Studies of pine barrens ecosystems, which are rare natural communities in Michigan, have been completed by Michigan Natural Features Inventory (MNFI). Projects on various species of flora and fauna have been conducted, and the theses and dissertations produced from the research are shared with CGMTC. The CGMTC ENV Dept. will continue to look for opportunities to work with researchers to gain more information on the rare natural resources present at CGMTC

3.1.1 Environmental Education and Public Outreach

Environmental awareness and public outreach are important actions for sharing information, ensuring compliance with laws and policies, minimizing adverse effects, and gaining cooperation to achieve the goals and objectives of this INRMP. At CGMTC, there are two primary programs with different audiences: environmental awareness for military users (units, leaders, commanders, and training center staff) and public outreach for non-military community members (area residents, hunters, and community groups). These programs are intended to inform military users about CGMTC's natural and cultural resources and the restrictions and measures that are in place to protect and manage them. The MDMVA uses the tools and venues listed below to implement environmental awareness and public outreach.

3.1.1.1 Information Transfer between Internal Departments

- The Environmental Department staff continuously coordinate and collaborate with the Garrison Commander, CFMO, Deputy Garrison Commander, DPOTS, FE, MDNR, USFWS, and EGLE regarding construction, MILCON project development, NEPA, compliance with environmental regulations, and recommendations for implementation of BMPs throughout the installation.
- Weekly CGMTC Directorate meetings conducted by the Deputy Garrison Commander facilitates regularly scheduled information transfer. Break-out meetings with specific Directorates and CGMTC staff ensures agility within and between the Environmental Department, DPOTS and FE, and ensures required Do-Outs can be identified, developed and assigned on an as-needed basis.

3.1.1.2 Information Transfer with Transient Troops

- Environmental information pertinent to transient units is conveyed to a unit's specific POCs during face-to-face meetings, phone conversations, and email exchanges.
- Environmental information is transferred to transient units in a classroom environment during safety briefings. The briefings occur at the beginning of a unit's training period
- Daily synchronization meetings are held with transient unit POCs during peak training season to address specific issues that arise in the field during training.
- The CGMTC *Soldier Field Card* (SFC) developed in 2019 provides environmental information and is provided to transient troops as a water-resistant hardcopy and can be folded into a pocket size reference. The SFC will be available on the USAR-EUR online app. The SFC contains:

- Restrictions and procedures regarding refueling, spill prevention and response, fire prevention, convoy movement, transportation of ammunition, use of wash racks
- Restrictions and protocols for handling gray water, kitchen grease, food waste, recyclables, trash, earth moving, tree cutting
- Restrictions regarding land use, water resources, and protected areas
- Site clearance expectations to leave no trace
- Safety protocols and actions to be taken if a person becomes injured, or if wildlife or unexploded ordinance is encountered

- Environmental information, logistics, DPOTS, FE and a summary of CGMTC 200-1 is provided in the CGMTC Pamphlet 5-3, which is distributed to transient troops.
- The Environmental Compliance Officer trains and informs troops within his/her command of SOPs and BMPs regarding hazardous waste handling, pollution prevention, TRI, and other elements of the overall hazardous materials handling program and the associated protection of human health and the environment.

3.1.1.3 Information Transfer with the Public Sector

- The Deputy Garrison Commander meets monthly with the Grayling Community Council to present and discuss CGMTC actions that may impact the public sector.
- The Deputy Garrison Commander or the CGMTC Community Affairs Representative broadcasts information weekly on a local radio station.
- The CGMTC Community Affairs Representative distributes emails to various public groups (e.g., Grayling Township Council, LMPOA) with updates on training schedules, general noise and activity expectations.

3.1.2 GIS Data Management

The MIARNG and MDMVA maintain a state-wide GIS database that includes data for all aspects of MIARNG and MDMVA facilities in Michigan. All GIS data must meet the federal Spatial Data Standard for Facilities, Infrastructure and Environment (SDSFIE). Completed GIS data relating to natural resources is incorporated into this master dataset. Comprehensive data maintenance is the main focus of the GIS program for natural resources, ensuring that other users of CGMTC have access to the most accurate data.

The GIS program benefits multiple users of CGMTC, particularly by providing overlays to get a snapshot of a specific portion of the base. Trainers use this data to plan maneuvers using terrain, topography, vegetation and sensitive habitats. CFMO, DPOTS, and the Environmental Department use this data to evaluate proposed construction, proposed MILCON projects, and develop NEPA and real estate assessments.

3.1.3 Natural Resources Law Enforcement

MDNR Conservation Officers are the primary enforcement personnel for natural resource laws. Additional law enforcement resources include the U.S. Forest Service, local police and sheriff,

and the Michigan State Police. Many aspects of natural resources management require effective enforcement if they are to be successful. Such management tools as hunting/fishing harvest controls, riparian zone use, wetland protection, rare species protection, and similar restrictions are dependent on consistent law enforcement.

3.1.4 Natural Resources Management Staff and Training

Adequate training of natural resources personnel is important to the success of military sustainability and land management. The continuing professional development of natural resources management staff will greatly enhance the effectiveness of this INRMP. This requires maintaining staff knowledge through training and participation in conferences and workshops. When the MIARNG does not have the equipment, in-house staff, or expertise to perform certain tasks or projects, the MIDMVA contracts with state-approved environmental consultants and contractors, issues interagency agreements with the MDNR, or issues agreement with other conservation partners (e.g., Huron Pines, Michigan Natural Features Inventory [MNFI]).

3.1.5 Agency Responsibilities

- CGMTC is responsible for ensuring that potential adverse impacts to natural resources resulting from military training and construction activities are avoided to the greatest extent by strict adherence to requirements specified in permits and SESC plans, and by ensuring that transient troops comply with applicable federal, state, local, Army, and CGMTC rules and regulations.
- CGMTC, the MDNR, the USFWS, and other conservation partners work collaboratively to manage natural resources throughout the installation.

3.1.6 CGMTC Policies

Specific policies associated with the Natural Resources Program include:

- CGR 200-1: CGMTC will (a) manage installation and natural resources to provide the optimum environment which sustains the military mission; (b) develop, initiate, and maintain progressive programs for land management and utilization; and (c) maintain, protect and improve environmental quality, aesthetic values and ecological relationships.
- CGR 385-1 and CGR 210-1.

3.2 SOIL CONSERVATION

CGMTC's soil conservation program is closely aligned with its vegetation management program, the CFMP, and the water resources management program because many of the BMPs are similar or the same. The intention of the soil conservation program at CGMTC is to protect soil resources, identify areas prone to soil erosion, and prevent soil erosion on construction sites for the purpose of minimizing or eliminating adverse impacts to land resources, vegetation, wildlife habitat, and training areas. Soil conservation and the prevention of soil erosion are the first step to control sedimentation (the process by which soil enters a

surface water body or wetland) and the protection of water resources, including surface waters, wetlands, and groundwater.

CGMTC utilizes physical and procedural controls to manage soil and eliminate sedimentation.

- Physical controls regarding standard soil conservation, soil erosion control, and sedimentation prevention practices at CGMTC include critical area seeding using native species whenever possible, storm water retention, culvert systems, and catch basins.
- Procedural controls regarding soil management are spill prevention/response and strict adherence to the state's SESC procedures.
    - Spill prevention and response protocols protect surfaces and subsoils from contamination, which in turn protects against contaminants leaching from surface soil and subsoils into the underlying groundwater.
    - SESC plan reviews by state-certified Environmental Department staff and the issuance of SESC permits protect against soil erosion throughout the 147,000 acres. SESC BMPs also prevent soil from leaving a construction or maneuver site and entering a water body through the process of sedimentation.

The main soil associations at CGMTC are Graycalm, Grayling, and Rubicon Sands (approximately 70 percent of the installation). A detailed description of CGMTC soils is provided in Appendix E and soil associations are shown on Figure 6 (Appendix D).

3.2.1 Agency Responsibilities

- CGMTC is responsible for soil management at all sites at which military training activities occur and for ensuring that transient troops comply with applicable federal, state, local, Army, and CGMTC rules and regulations.
- As an APA, the CGMTC Environmental Department is responsible for reviewing SESC plans, issuing SESC permits, and inspecting sites that are within 500 feet of a water body or are equal to or greater than one acre.
- The MDNR and its contractors are responsible for soil management on sites at which timber is being harvested.
- The MDNR and CGMTC work collaboratively to manage soil on tracts of land under various land use agreements and used by the CGMTC.
- Crawford County is responsible for soil management at the Crawford County civilian airfield.
- See Table 2.1.

3.2.2 CGMTC Policies

Specific policies associated with the Soil Conservation Program include:

- Continue the SESC inspection and permitting program, in accordance with CGMTC's APA status pursuant to the Soil Erosion and Sedimentation Control Act (1994 P.A. 451 Part 91).

- Develop or use existing soil and water quality BMPs recommended by the DMVA, and EGLE to prevent and control soil erosion and sedimentation, and to protect sensitive resources and habitats (EGLE 2018).
- Restore exposed soil resulting from wildland fire suppression activities to address potential erosion, habitat fragmentation, invasive species, and unauthorized off-road vehicle (ORV) access.

3.3 WATER RESOURCES MANAGEMENT AND WETLAND PROTECTION

Water on CGMTC is abundant and is essential to ecosystem services, biodiversity, and native species, which are essential to the long-term sustainability of the military mission at CGMTC. For the purposes of this INRMP, the term water resources refers to waters of the US, water of the state of Michigan, and water bodies that do not meet these criteria but that provide important habitat (lakes, ponds, rivers, streams, saturated wetlands, unsaturated wetlands, floodplains and groundwater).

CGMTC's water resources management program is closely aligned with its fish and wildlife management program, its Operational Range Sustainability Program, the Range Training Land Assessment (RTLA), and its species of conservation concern program. The water quality management program at CGMTC is based on protecting aquatic habitats, protecting the groundwater-surface water interface, pollution prevention, and monitoring water quality in surface water and groundwater.

As shown on Figure 7 (Appendix D), CGMTC is transected by three major watersheds: the Manistee River watershed, the Au Sable River watershed, and the Muskegon River watershed. Most streams in this ecoregion are perennial and are formed from glacial lakes or wetlands. Stream density is approximately one mile per square mile. The Manistee and Au Sable Rivers and their tributaries are designated under the Natural Rivers Act under Michigan state law (Part 305 of Act 451. The intent of the Natural Rivers designation is to preserve and enhance the rivers values for water conservation, its free-flowing condition and its fish, wildlife, boating, aesthetic, flood plain, ecologic, historic and recreation values and uses (DNR 1987). Therefore, all military use of lands within the Natural River District other than on existing trails or roads is prohibited.

More than 60 lakes and ponds are located on CGMTC. Lake Margrethe is the largest lake associated with CGMTC. Approximately half of the lake's shore is privately owned, with the remainder owned by MDMVA. Lake Margrethe has a court ordered summer and winter lake level which is controlled by the water control structure at the northwest side of the lake. Lake Margarethe has a significant influence on the health of the Manistee River, as it forms the mouth of Portage Creek, which feeds into the Manistee River. The majority of Portage Creek is situated on CGMTC lands, and it extends from the outlet at Lake Margarethe to the confluence with the Manistee River.

Many of the wetland communities identified at CGMTC are associated with the river drainages of the Au Sable and Manistee rivers. These wetlands are dominated by mixed conifer forests, though smaller areas of scrub/ shrub and more open emergent wetland communities are also found. Isolated wetland depressions can be found scattered across the region in outwash deposits. National Wetland Inventory (NWI) map layers are available for CGMTC and

surrounding areas. NWI data provides only potential and approximate locations of wetlands and wetland conditions, and should not be used to make jurisdictional determinations. Onsite inspections are typically needed to confirm wetland conditions, determine exact wetland boundaries, and make jurisdictional determinations. Surface waters are described in detail in Appendix E.

Michigan assesses functions and values of streams and rivers through the Surface Water Assessment Section (SWAS) program. This program oversees the protection of the quality of surface waters throughout the State of Michigan through water quality standards and monitoring to ensure they are being met (www.mi.gov/waterquality). Michigan was the first state (and is one of only two states) to have received authorization from the federal government to administer the federal wetland, lake, and stream program under Section 404 of the Clean Water Act (CWA). Because of this approval, wetlands, lakes, and streams permits issued by EGLE under state law also provide federal approval (www.mi.gov/wetlands). For an area to be classified as wetland, prior to determining jurisdictional status, three conditions must be present: (1) wetland hydrology; (2) hydric soil; and (3) a predominance of hydrophytic vegetation. Areas that may be periodically wet, but that do not meet all three criteria, are not classified as wetlands.

The Michigan Rapid Assessment Method for Wetlands (MiRAM) is a tool to determine the functions and values of a particular wetland and to assign a rating level to that wetland compared to other wetlands. MiRAM offers a rapid assessment of wetland functions and values, but it is not intended to modify the existing regulatory process in Michigan or replace more detailed quantitative measures of ecosystem function, such as Indices of Biological Integrity (IBI), Floristic Quality Assessment or other detailed ecological studies.

As a partner with other groups and the MDNR, CGMTC has helped to improve water quality and fisheries habitat through the following activities.

- Constructed three bridges over the East Branch Au Sable River and one over Portage Creek to replace culvert crossings, restoring the natural stream channel and hydrology, and preventing sedimentation.
- Provide funds to stabilize streambank erosion sites on Portage Creek.
- Provide funds to maintain two sand traps on the East Branch Au Sable River.
- Constructed and maintained two sand traps on Portage Creek.
- Assisted with fish surveys on Lake Margrethe.
- Developed plans for and directed the work on rehabilitation of erosion sites on Frog and Duck Lakes
- Partnered with UMRA, Au Sable River Watershed Restoration Committee and the Grayling Storm water Committee.

Water quality standards are the foundation of the water quality-based pollution control program mandated by the CWA and Michigan's Water Quality Standards outlined in Act 451. Water Quality Standards define the goals for a waterbody by designating its uses, setting criteria to protect those uses, and establishing provisions such as anti-degradation policies to protect waterbodies from pollutants. All designated uses for water bodies must be protected under law, and those include: agriculture, navigation, industrial water supply, public water supply at the

point of water intake, warmwater or coldwater fish, other indigenous aquatic life and wildlife, fish consumption, partial body contact recreation, and total body contact recreation from May 1 to October 31.

In accordance with the CWA and Michigan Act 451, CGMTC has been issued four permits and has developed five management plans to protect the quality of receiving waters at the MATES, the Cantonment, and the GAAF, as listed below.

- MATES
    - National Pollutant Discharge Elimination System (NPDES) General Permit and Certificate of Coverage (COC)
    - Groundwater Discharge Permit
    - Storm Water Pollution Prevention Plan (SWPPP)
    - Spill Prevention Control and Countermeasures (SPCC) Plan

- Cantonment
    - NPDES General Permit and COC for the Cantonment
    - Groundwater Discharge Permit for the Waste Water Treatment Plant
    - SWPPP for the Cantonment
    - SPCC Plan for the Cantonment

- GAAF
    - SPCC Plan

The permits describe allowable specifications of volume, discharge rates, and water quality, and the plans describe the physical and administrative mechanisms and strategies that are applied or implemented to ensure the permit requirements are maintained, such as, but not limited to, systems of retention ponds, culverts, catch basins, and oil/water separators.

CGMTC requires transient troops to comply with the CWA, Michigan Act 451, and CGMTC protocols and SOPs to eliminate sedimentation and to protect the quality of surface water and groundwater throughout the training areas.

3.3.1 Agency Responsibilities

- CGMTC is responsible for water resource management at all sites at which military training activities occur and for ensuring that transient troops comply with applicable federal, state, local, Army, and CGMTC rules and regulations.
- As an APA, the CGMTC Environmental Department is responsible for preventing sedimentation into receiving waters by reviewing SESC plans, issuing SESC permits, and inspecting sites that are within 500 feet of a water body or are equal to or greater than one acre.
- The MDNR and CGMTC work collaboratively to manage water resources on tracts of land under various land use agreements and used by the CGMTC.
- Crawford County is responsible for water resource management at the Crawford County civilian airfield.
- See Table 2.1.

3.3.2 CGMTC Policies

Specific policies associated with the Water Resources Management Program include:

- State Law: Water Resources Protection (Part 31, NREPA, 1994, PA 451, as amended)
- State Law: Soil Erosion and Sedimentation (Part 91, NREPA, 1994, PA 451, as amended)
- State Law: Inland Lakes and Streams (Part 301, NREPA, 1994, PA 451, as amended)
- State Law: Wetlands Protection Act (Part 303, NREPA, 1994, PA 451, as amended) State Law: Natural Rivers Act (Part 315, NREPA, 1994, PA 451, as amended)
- CG 200-1 sets forth multiple specific policies relative to the management of surface waters.
- An annual 'Training Area Limitations' memo describes specific TA limitations that protect water resources.
- Avoid, minimize and mitigate for losses of wetlands and other water resources as required by EO 11990 (Protection of Wetlands).

3.4 VEGETATION MANAGEMENT

CGMTC's vegetation management program is closely aligned with its soil management, wildland fire management, invasive species management, and threatened and endangered species management programs.

Vegetation and forest lands at CGMTC are managed to maximize the ecological health of the installation while minimizing adverse impacts to the military training mission. The vegetative communities at CGMTC are important military training assets and they are highly valued for their commercial benefits through timber harvesting. In addition to military training and commercial benefits, vegetative communities are managed to enhance other natural resource elements. The vegetation management program should:

- Maximize beneficial habitat for rare and sensitive species
- Minimize potential negative impacts from wildfire, forest pests and invasive species

Of the 882 plant species identified by recent surveys (Appendix J), 14 are state-listed and one is federally listed. The MDNR's regional forestry plan identifies seven major forest cover types: oak, aspen, jack pine, red pine, upland open/semi-open lands, lowland open/semi-open lands, and other forest types (MDNR 2018), as shown on Figure 8 (Appendix D). For the purposes of this INRMP, the "other" forest type category has been divided into "upland other" and "lowland other" on Figure 8 to reflect the differences in management approach, ecological functions and values, and applicable regulatory requirements between upland and lowland cover types.

CGMTC has seventeen high quality natural areas (HQNA) which were most recently assessed in 2018. The HQNA's, shown on Figure 9 (Appendix D) are:

- Beaver Creek
- Cannon Creek Meadow
- Cantonment wetland
- Watson Swamp
- Portage Creek and Howes Lake Complex
- Lake Margrethe North
- The Doughnut
- Lewiston Grade Complex
    - Lewiston Grade
    - Lewiston Grade Swamp
    - Lewiston Grade Fen

- C-Shaped Depression
- Frog Lake Complex
- Pine Barrens
- Barker Creek Fen
- Crawford Red Pines
- Best Bog
- Lovells Fen
- Lovells Bog
- Chub Creek Swamp

Most of the high-quality natural areas on the installation are wetlands. Two of the natural communities in the high-quality natural areas – the Pine Barrens and the Portage Creek-Howes Lake Complex – are unique in the state and provide high quality habitat for at least 10 listed plant and animal species. The ownership of these high-quality natural areas is shared between the MDMVA and MDNR. A list of flora inventory surveys that have been conducted at CGMTC since 2000 is provided in Appendix K.

As indicated on Figure 10 (Appendix D), the historic vegetative cover on the CGMTC footprint was approximately 50% pine/oak forests, approximately 25% savanna/grassland, and the remaining 25% covered by northern hardwood-conifer forest and conifer swamp. Prior to the modern era, fire was a significant natural disturbance that shaped the vegetative communities across the landscape.

3.4.1 Agency Responsibilities

- The MDNR is responsible for timber management throughout the installation, with special consideration provided to the Cantonment pursuant to the CGMTC Cantonment Forestry Management Plan
- CGMTC is largely responsible for the management of non-timber vegetation management at HQNAs and listed species habitat

- CGMTC limitations require that transient troops do not cut trees with a diameter of greater than one inch without approval from Environmental
- Crawford County is responsible for vegetation management at the Crawford County civilian airfield.
- See Table 2.1.

3.4.2 CGMTC Policies

Specific policies associated with the Vegetation Management Program include:

- CG 200-1 sets forth multiple specific policies relative to vegetation management.
- Timber harvests are typically restricted May 1st through October 31st due to military training activities.
- Cantonment Forestry Management Plan
- Native plant species and communities shall be maintained, enhanced, and restored to conserve their biodiversity and health.
- Grounds will be maintained at the levels and intensities necessary to meet the designated use criteria, protect, and enhance natural resources, and ensure a pleasing appearance with the natural landscape.
- Vegetation management includes maintaining the natural disturbance processes, while maintaining intact functional landscapes, ecosystems, and communities.
- Re-establish native vegetation following site disturbance using appropriate seeding specification.
- Upon completion of harvesting, temporary spur and seasonal roads will be closed and stabilized.
- Characteristics of stands that may be given preference in designations as old-growth stands are as follows:
    - Adjacent to or within recreational areas, water or travel influence zones, wetlands**,** or natural areas.
    - Poorly accessible stands.
    - Stands that are known to contain specific, unique, or unusual ecological conditions, or threatened or endangered species.

3.5 WILDLAND FIRE MANAGEMENT

Historically, wildland fire was a significant disturbance that shaped the ecosystems in the northern lower peninsula of Michigan prior to European settlement. Historic fire return intervals for the region are thought to range between 10 to 80 years (Kost et al. 2007). “Research indicates jack pine ecosystems in the region had comparable historical stand replacing fire rotations of 50-60 years, and much shorter rotations within the open land component of this landscape ecosystem.” (Cleland et al. 2004). Fire frequencies were important in determining species and structural composition, with jack pine and northern pin oak being far more common because of this disturbance regime (MDNR 2018). Fire suppression in the region has resulted in shifts in ecosystems and vegetative communities. Oak, aspen, red pine, and northern

hardwoods are more common today (MDNR 2018). Fire has played an important role in the initial propagation and maintenance of oak and natural oak/pine types and small inclusions of aspen or grass/upland brush types. Oak is currently the dominant forest type on CGMTC. In general, the CGMTC and surrounds is considered to be a high risk for wildfire due to the vegetative cover, soil types, and sources of ignition (MDNR 2018). Recent fire history on CGMTC is shown in Figure 11 (Appendix D).

Wildland fire management currently has several functions on CGMTC including wildfire response; prescribed fires for mission, ecological purposes; and fuel load management. Fire is a key ecological disturbance necessary for restoring or maintaining some of the communities present on CGMTC. At the same time, wildfires are a significant hazard on CGMTC in terms of lost training time, public safety, and property damage. Ranges are a special consideration when discussing wildfire on CGMTC, as accidental starts due to ammunition discharges are common. An average of over 100 wildfires per year occur on the installation, including from accidental starts from military training on ranges (MIARNG & LIAA 2016). Under environmental conditions of high fire danger, CGMTC Range control staff has limited the use of pyrotechnics under high, very high, and extreme fire danger ratings. Waivers to utilize pyrotechnics at these different fire danger ratings are required, high fire danger rating requires a waiver from the Range Manager, very high requires the DPOTS director, and extreme requires a waiver from the Camp Commander.

Planning ecological disturbances and managing for vegetation composition through the application of prescribed fire is preferred, but the flammability of the jack pine and grassland communities and their presence near ranges mean that wildfires are a regular occurrence on CGMTC. Wildfires near ranges are generally suppressed and not allowed to burn, although there are circumstances when a wildfire can be managed for a beneficial ecological effect and not immediately suppressed.

3.5.1.1 Wildfire Response

Initial wildfire response within CGMTC ranges are undertaken by CGMTC fire staff, with CGMTC fire staff relying on MDNR when range fires cannot be contained with in-house resources. Otherwise, MDMVA and MDNR work cooperatively in fighting wildfires with MDNR being responsible for wildfires which occur off of Ranges. Ideally, all wildland fire activities are coordinated and managed according to a mutual aid agreement between the two agencies, as described in the IWFMP. MDNR's Forest Resources Division Fire Management Section is responsible for statewide wildland fire program oversight and providing support as needed in local areas.

3.5.1.2 Prescribed Fires for Mission and Ecological Purposes

MDNR has a prescribed fire program and conducts prescribed burns to achieve various management objectives, including silviculture, habitat management, and habitat restoration. Each year, all burns prescribed on state forests, parks, and wildlife game lands are evaluated and ranked, with funding allocated to the highest priority burns (MDNR 2018). With the completion of the IWFMP, a robust prescribed burn program will be implemented at CGMTC that supports both mission and ecological requirements. The planning process and specific procedures for prescribed fire are described in the IWFMP

Given the fire-dependent vegetation types present on CGMTC, many areas are reliant upon prescribed fire for ecosystem health and maintenance of biodiversity and community structure. In addition, prescribed fire is an important tool for reducing fuel loads in areas prone to wildfires, particularly in and near ranges.

The main objectives of prescribed fire on CGMTC have been to reduce fuel loads, maintain firebreaks, and achieve ecological management objectives. Typically, only a portion of a management area is burned each year, on a rotational basis. For example, prescribed burns in the 5,000-acre Pine Barrens Management Area typically do not exceed 200 acres in any given year, which example equates to approximately 4% of the management area burned with 96% as refugia. Areas near ranges – particularly those characterized by grasses with short fire return intervals - are burned most frequently due to the higher risk posed by unintentional range wildfires resulting from live artillery exercises.

Using fire as a habitat management mechanism provides refugia for many organisms including migratory birds, pollinators/ insects, bats, and sensitive vegetation. This approach results in improved habitat conditions by maintaining fire in fire-adapted communities and allows species from adjacent unburned areas to recolonize recently burned areas.

Many species of plants and animals in these areas are fire-adapted and thrive from the use of fire for habitat management. Any adverse impacts are typically temporary, with a net benefit to most species.

The presence of species of concern in a proposed burn unit will be considered and measures will be taken to avoid and minimize adverse impacts to the resident population.

3.5.1.3 Fuel Load and Fire Break Management

It is common at CGMTC for prescribed burns to be conducted in order to reduce the fuel load for warm season fires. In addition, as discussed above, timber harvesting and thinning occur on the installation and can also reduce fuel loads. Timber harvests contracted by the MDNR on CGMTC training lands must meet a specified chipping requirement; this requirement can be waived by CGMTC, if appropriate.

Fire breaks are an essential tool when conducting prescribed burns and suppressing wildfires. Normally, this is done through vegetation clearing and through soil plowing or disking. In certain locations permanent fire breaks are maintained to manage wildfires. There are other methods with less soil disturbance, such as back burning, that can also be used to create fire breaks. Erosion control is a concern when exposing bare soil during fire control activities.

3.5.2 Agency Responsibilities

Wildland fire management on most of CGMTC is the responsibility of MDNR, regardless of land ownership. MDNR responds to fires within the training areas, outside of the fence, while CGMTC responds to fires on ranges, or within the fenced areas. MDNR will respond to fires within the fences if requested by CGMTC fire staff. MDNR attempts to suppress most wildfires to 10 acres or less in size (MDNR 2008). As with other resource areas, MDMVA always ensures its activities comply with any laws, regulations, and permits, regardless of land ownership or primary responsibility.

Approximately 10% of the base is behind a fence and declared a range. In these areas CGMTC fire staff is the primary responder, however, MDNR is still the regional lead so MDMVA still works closely with them for wildland fire management. In addition, these MDMVA parcels are often surrounded by parcels under MDNR responsibility and authority, so any wildfire response or prescribed fire has to be fully coordinated at the burn unit, not at the parcel level.

For parcels owned by MDMVA but where the fire is managed by MDNR (generally parcels subject to Public Act 172), the MDMVA can direct specific management actions and has final approval of any management, but MDNR is responsible to planning for and executing any fire related management.

For long-term and management agreements lands, MDMVA can only request changes to planned wildland fire management that conflict with military training; MDNR has responsibility for all wildland fire management on these parcels, unless it is first response to a range fire which would still be an MDMVA responsibility.

- The MDNR is responsible for wildland fire response on CGMTC outside the impact areas.
- The MDNR is currently responsible for prescribed fire planning and execution on all CGMTC outside the impact areas, and works collaboratively with CGMTC personnel to ensure prescribed burns will have no conflicts with military training. Upon completed personnel training, equipment procurement, and staffing specified in the CGMTC IWFMP, CG personnel may take a greater role in prescribed burn planning and management process outside the impact areas.
- Grayling Township is responsible for structural fire suppression at the GAAF, the Cantonment, and the MATES.
- See the IWFMP for further details.
- See Table 2.1.

3.5.3 CGMTC Policies

Specific policies associated with the wildland fire management program include:

- All policies identified in the IWFMP, including training, incident command, approvals, and prescription requirements.
    - Fire suppression will be the first response to wildfires on CGMTC except in those cases when it is possible to allow wildfires to burn out on their own in areas where that will be beneficial to native species.
    - MDMVA/CGMTC provides first response for fires that start on ranges. MDNR provides first response for all other wildfires and supports managing range fires if needed.
    - Provide wildland fire training to MDMVA and MDNR personnel as appropriate. Follow training requirements in the IWFMP.
    - CGMTC and MDNR will continue to cooperate on prescribed burns or fuels reduction, as personnel and equipment are available. MDNR will notify CGMTC and coordinate planning and implementation of all fuels reduction projects that may impact military training.

- CG 200-1: Maintain, protect and improve environmental quality, aesthetic values and ecological relationships. Protect CGMTC real estate from depreciation. Prevent damage and destruction of valuable natural resources from fire, insects and disease. Protect plants and animals and the habitat they depend on, especially endangered and/or threatened species. Support military missions, especially training and field exercises, in a manner which will best accomplish the mission while protecting the environment. Protect environmentally sensitive areas such as floodplains, wetlands, steep slopes, riparian zones and natural areas.
- Relevant MDNR regulations and procedures (Appendix C).
- The responsibility for fire-fighting costs and damages are identified in the IWFMP.
- Maintain mutual aid agreements and implement all procedures and recommendations in the IWFMP.
- MDNR will notify the installation of fire restrictions, which will be no more restrictive to the military than for civilian users of the forest.
- Use prescribed fire to maintain healthy conditions in fire-adapted ecosystems and landscapes and to maintain fuel breaks.
- Continue education efforts of CGMTC personnel and neighbors of the presence and ecological role of fire and how to help prevent damaging wildfires.
- Reduce the risk of large crown fires in conifer cover types.
- Limit and monitor the use of incendiary devices, ordinance, explosives, live ammunition, pyrotechnics and campfires during periods of fire restriction.
- Continue collaborating with other agencies to encourage land owners and residents within the wildland-urban interface to reduce excessive fuel loads and to establish “defensible space” around structures.
- No campfires are allowed without a permit or during fire restrictions.

3.6 INVASIVE SPECIES AND INTEGRATED PEST MANAGEMENT

CGMTC’s invasive species management program is closely aligned with the water resources management, the vegetation management, the wildland fire management, the fish and wildlife management, and the rare species management programs.

Invasive species management and pest management at CGMTC apply the lowest-impact measures necessary for control. Invasive species have been actively managed on CGMTC since 2000, with projects completed annually for high priority species in high quality natural areas. Categories of management in this section include terrestrial plants, aquatic plants and animals, forest pests, pest-borne diseases, and other pests.

CGMTC implement the MIARNG’s IPMP to prevent pests and disease vectors from adversely impacting military operations and missions while using environmentally sound techniques for safe and effective control (MDMVA 2014). Integrated pest management involves four primary control strategies: mechanical and physical control (physical removal or exclusion of pests), cultural control (altering the environment to make it less suitable or attractive to the pest),

biological control (use of other organisms that control the pest), and chemical control (use of pesticides and herbicides). This INRMP focuses on those invasive species and pests that can potentially adversely impact CGMTC's natural resources. A complete list of priority invasive plant species, tree diseases and invasive insects, and invasive animals is provided in Appendix F. CGMTC is located in a forested and rural setting and does not exhibit the urban characteristics that might attract feral cats and dogs; therefore, feral cats and dogs have not been recorded at CGMTC.

No invasive species or pest management operations are conducted that are likely to have a negative impact on endangered or protected species or their habitats without prior approval from the MIARNG Environmental Program Manager and the NGB Pest Management Consultant (MDMVA 2014).

Coordination with both state and federal authorities, as well as local groups and agencies is key to success for regional control of invasive species and forest pests. The Integrated Pest Management Coordinator (IPMC) oversees the MIARNG IPMP. As CGMTC spans three counties, coordination with multiple regional entities and non-profit organizations helps ensure that priority species for management on CGMTC are aligned with regional priorities and that efforts on CGMTC are conducted in conjunction with larger regional efforts. There are various organizations that have resources such as mobile boat washing, identification of new invasive and priority species, and pooled resources for invasive species control and removal.

3.6.1 Agency Responsibilities

- CGMTC is responsible for terrestrial invasive species management at the GAAF, the MATES, and the Cantonment.
- LMPOA has assumed management responsibility for aquatic invasive species in Lake Margrethe, with the support of CGMTC and MIARNG.
- The MDNR and CGMTC work collaboratively to control invasive species on tracts of land under various land use agreements and used by the CGMTC.
- The MDNR is responsible for invasive species management at the Lake Margrethe State Campground.
- Crawford County is responsible for invasive species management at the Crawford County civilian airfield.
- See Table 2.1.

3.6.2 CGMTC Policies

Specific policies associated with the Invasive Species Management Program include:

- Compliance with federal and state laws, such as Noxious Weed Control Act, Federal Insecticide, Fungicide and Rodenticide Act, and other laws and regulations listed in Appendix C.
- CG 200-1: Maintain, protect and improve environmental quality, aesthetic values and ecological relationships. Prevent damage and destruction of valuable natural resources from fire, insects and disease. Protect plants and animals and the habitat they depend on, especially endangered and/or threatened species. Support military missions,

especially training and field exercises, in a manner which will best accomplish the mission while protecting the environment. Protect environmentally sensitive areas such as floodplains, wetlands, steep slopes, riparian zones and natural areas.

- Implementation of IPMP:
    - All pesticide use and storage will be compliant with the IPMP, permits, labels, and relevant laws and regulations.
    - Maximize integrated strategies and minimize pesticide use when possible.

- Continuance of early control and rapid response to invasive species and pests.
- Firewood removal on cantonment requires a Letter of Permission from the Environmental Office, and is limited to the salvage wood pile on Beaver Creek Road.
- Firewood removal outside of cantonment requires a Personal Use Fuelwood Permit by MDNR.
- Any symptoms of forest pest disease will be noted and CGMTC will notify and work with MDNR to manage these pests.
- Work cooperatively with state agencies and individual counties to prevent the introduction and establishment of noxious weed infestations, control existing infestations, and share resources and expertise.
- During planning for any management, conduct a noxious weed risk assessment and incorporate mitigation and control as needed into any action. During any management actions, ensure that all equipment is weed-free.
- Priority areas for annual monitoring and treatment are Lake Margrethe, Portage Creek riparian zone, high quality natural areas, and rare plant communities.
- Establishment of policies and procedures to keep military vehicles clean of invasive plant species propagules.

3.7 FISH AND WILDLIFE

CGMTC's fish and wildlife management program is closely aligned with its water resources management program, its vegetation management program, and its species of conservation concern program that focused on threatened and endangered species, Partners in Flight species of concern, and bald eagle.

Management of fish and wildlife populations and their habitats on CGMTC is consistent with accepted scientific principles, in compliance with federal and state laws and other land use agreements and as required by the SAIA and other DoD regulations and policies. Military and land management practices influence wildlife numbers and species composition, particularly vegetation management and prescribed burning.

Survey efforts for reptiles and amphibians at CGMTC have been limited. Some call surveys have been conducted per the Michigan Frog and Toad survey protocols. Most of the species observed have been incidental observations during other natural resources field work. Of the 14 frog and toad species in Michigan, 9 have been documented at CGMTC. Only 5 of the 12 species of salamanders have been documented. Reptiles documented include one lizard, 10

snake, and 4 turtle species. This includes the state Special Concern wood turtle and Blanding's turtle, as well as the federally listed eastern massasauga rattlesnake (EMR). In cooperation with Purdue University, research is being conducted on the two state listed turtle species at CGMTC. The research is focused on determining movement patterns, habitat use, and spatial ecology.

A total of 36 mammal species have been documented at CGMTC. These species were documented through direct sightings, scat, tracks, and trail cameras. Bat acoustic surveys have been conducted in 2016, which confirmed the presence of the federally listed northern long-eared bat (NLEB). Species that have not been observed but are very likely present on CGMTC include bobcat, river otter, gray fox, and opossum.

Fish surveys have documented 81 species on CGMTC. These have primarily been documented through MDNR fish surveys, angler catches, and fish stocking efforts. Fish survey efforts have been limited to Lake Margrethe, Portage Creek, Howes Lake, the Upper Au Sable River, and the Manistee River. Additional small lakes and tributary streams found throughout CGMTC have not been surveyed. The Au Sable River flows to Lake Huron and the Manistee River flows to Lake Michigan, however multiple dams on both river systems prevent fish passage from the Great Lakes.

Invertebrate surveys have primarily focused on just a few species that are associated with high quality natural communities. Species confirmed through these efforts include the secretive locust, dusted skipper, and Hungerford's crawling water beetle (HCWB). Additional discussion on HCWB is included in Section 3.8. There is a need for additional survey efforts to develop a more comprehensive inventory and inform conservation efforts; particular emphasis will be on the secretive locust (also known as the Michigan bog grasshopper), monarch butterfly, and pollinators.

Due to the size of CGMTC, comprehensive planning level surveys for wildlife species occur on a rotating basis. For birds and insects, in particular, a number of specialized surveys may be conducted separately from comprehensive surveys (e.g., pollinator surveys, nocturnal surveys, etc.). A list of fish and wildlife surveys completed on CGMTC is provided in Appendix K. A list of fish and wildlife species known to be present on CGMTC is provided in Appendix J.

Fishing is allowed throughout the installation on lakes and rivers that are outside the impact areas. Of the 147,000 acres at CGMTC, hunting is permissible on 119,758 acres. Hunting is prohibited on 27,242 acres of non-contiguous land that is comprised of:

- The 13,800-acre Hanson Land Grant tract (inclusive of the 1,243-acre Cantonment and approximately 1,700 acres of the 5,000-acre SARSA that overlaps the Hanson Land Grant)
- The 13,442 acres that comprise the 30 and 40 Complexes (12,513 acres), GAAF (870 acres), and the MATES (62 acres)

3.7.1.1 Migratory Birds

As required by the Migratory Bird Treaty Act, Executive Orders, policies and regulations, migratory bird species and their habitats are protected and managed on CGMTC. Multiple bird surveys have been conducted since the early 1990's as a means to inventory the species present at CGMTC. Currently there have been a total of 136 bird species documented, with

another 110 likely to occur. The survey results represent, breeding, non-breeding migratory species as well as resident species for the region. “Northern forests in the Great Lakes region contain the highest overall species richness of breeding birds in the U.S. and Canada” (Robbins et al. 1986, Price et al. 1995). Michigan is one of the northern most states in the U.S. in the Mississippi Flyway, which also extends into Canada. While CGMTC provides important breeding habitat for birds of regional and national significance, its geographic location also contributes to a network of sites that link breeding grounds to the north with wintering grounds to the south for many other migrating species.

Pursuant to Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (66 FR 3853 [January 17, 2001]), an MOU was established between the U.S. Department of Defense and the U.S. Fish and Wildlife Service to promote the conservation of migratory birds while sustaining the use of military managed lands and airspace for testing, training, and operations. Consistent with the EO and associated MOU, CGMTC will implement reasonable efforts to avoid or minimize impacts on migratory birds for non-readiness activities. CGMTC will implement cooperative projects and programs to benefit the health and well-being of birds and their habitats, when consistent with the military mission, military readiness, and the safety of personnel.

Under rule 50 CFR 21, military Services take of migratory birds is authorized during military readiness activities (MRAs). For activities that may result in significant impacts of a migratory bird species, the Armed Forces must confer and cooperate with the USFWS to develop and implement appropriate conservation measures to minimize or mitigate such significant adverse effects.

There are a number of multi-partner, migratory bird planning resources that are relevant to the region. These include the Bird Conservation Plan for Bird Conservation Region 12 (2009), the U.S. Shorebird Conservation Plan (2001), the Upper Mississippi Valley/ Great Lakes Regional Shorebird Conservation Plan (2016), the North American Waterfowl Management Plan (2012), and the Waterbird Habitat Conservation Strategy (2018). Current natural resource management is consistent with portions of these plans to the benefit of migratory birds. Additional portions of these plans will be incorporated into natural resource management activities as appropriate.

3.7.1.2 MDNR Featured Species

The MDNR has selected eight Featured Species in the CGMTC Management Area, which are listed below. These are animals that are highly valued, are limited by habitat availability, and have been selected to focus habitat management efforts. Habitat management through restoration of young forest and large open grasslands, retaining large trees and snags, and expanding mesic conifers are the recommendations for these eight species (MDNR 2018). Utilizing management tools such as prescribed fire and timber harvest will aid in working toward an age class and vegetation composition that will benefit these species. While these management tools are already employed at CGMTC, the purposeful use of them to these ends in planning along with monitoring and collaboration with other agencies will help to improve the outcome.

- American woodcock
- Eastern massasauga

- Pileated woodpecker
- Red-headed woodpecker
- Ruffed grouse
- Snowshoe hare
- Wild turkey
- White-tailed deer

3.7.1.3 Game Species

Game managed by the State of Michigan (MDNR 2019c) includes bear, white-tailed deer, elk, wild turkey, and waterfowl. Small game includes coyote, crow, ruffed grouse, pheasant, quail, rabbit and hare, squirrel, woodcock, and other game species (see https://www.michigan.gov/dnr/0,4570,7-350-79119_79147_80218---,00.html.) MDNR 2019d). Waterfowl includes American coot, Canada goose, common moorhen, ducks and mergansers, geese, rails, and Wilson's snipe. Furbearing species commonly trapped include badger, beaver, bobcat, coyote, fisher, fox, marten, mink, muskrat, otter, and raccoon. Multiple game species are included in the MDNR Featured Species list. The species contribute to overall biological diversity while provide recreational value through hunting and viewing opportunities.

While the deer population was very low when CGMTC was established, the deer population is now quite high, particularly in and around the Hanson Grant game refuge where hunting is not permitted. The intense browse in this portion of South Camp is having a negative impact on forest regeneration and ecological health. Impacts to forest regeneration and vegetative composition in the understory are obvious in areas in and around the refuge. Intense browse has been shown to significantly influence wildlife habitat by altering forest conditions. Elevated deer population densities can also adversely impact the health of the deer herd by increasing competition for food, a lack of available high-quality forage, and increasing the likelihood of disease transmission and parasites.

3.7.1.4 Non-Game Species

Many additional non-game species, such as reptiles, amphibians, birds, mammals, fish, mussels, etc., occur across CGMTC. This includes animals that aren't harvested but aren't necessarily listed as special concern/ threatened or endangered. The majority of fish and wildlife species found at CGMTC fall into this category. These species contribute to overall biodiversity, food web connectivity, and biological function of native systems. Many non-game species have been documented in the multiple fauna inventories conducted at CGMTC. It remains important to monitor status and ensure conservation of these species so they remain common. To do otherwise could lead to species declines resulting in additional State and Federal listings, triggering regulatory requirements and restrictions that would impact the overall mission.

3.7.1.5 Wildlife Management regarding BASH Programs

A wildlife hazard assessment was recently completed which identified high risk wildlife and provided suggestions for reducing BASH risk (USDA 2018) at the GAAF. Hazardous wildlife are generally birds, but some large mammals (i.e., deer and coyote) can also pose a BASH risk.

- Continue to follow Federal Aviation Administration (FAA) and DoD guidelines
- Continue to maintain the BASH program and review the BASH Plan annually in collaboration with the CGMTC Environmental Department
- Obtain appropriate wildlife permits and/or establish an agreement with either MDNR or USDA to assist with controlling wildlife around the airfield.
- Maintain a wildlife log, including any hazardous wildlife activity.
- Maintain a wildlife strike database (or use an existing database) to track any wildlife-bird strikes with aircraft associated with either the airfield or ranges.
- Institute a zero-tolerance policy towards high risk, hazardous wildlife as determined by BASH experts and airfield management.

The air-to-ground impact zone (40 Complex) is jointly managed by the MIANG and CGMTC MIARNG. The BASH activities at the 40 Complex are included in a joint BASH plan for the Combat Readiness Training Center in Alpena. The plan is implemented by MIANG

3.7.1.6 Fish

CGMTC is situated at the headwaters of two of the most renowned blue-ribbon trout streams in Michigan, the Au Sable and the Manistee Rivers. MDNR Fisheries Division is responsible for management of fisheries on CGMTC. There are two Fisheries Management Units that transect CGMTC, including the Central Lake Michigan Management Unit (Kalkaska County) and Northern Lake Huron Management Unit (Crawford and Otsego Counties) (MDNR 2019a). These units include 11 high priority trout streams, mostly in the Au Sable and Manistee River watersheds (MDNR 2013b).

MDNR conducts fish surveys in Lake Margarethe, and the Au Sable and Manistee River systems, and provides reports with management recommendations (Tonello 2007, 2009). The

focus species potentially present on CGMTC and targeted for fisheries management by MDNR include (MDNR 2019b):

- Muskellunge (Esox masquinongy)
- Northern pike (Esox lucius)
- Salmon
    - Lake herring (Coregonus artedi)
    - Lake whitefish (Coregonus clupeaformis)
    - Round whitefish (Prosopium cylindraceum)
- Trout
    - Brown trout (non-native; Salmo trutta)
    - Brook trout (Salvelinus fontinalis)
    - Lake trout (Salvelinus namaycush)
    - Rainbow trout (non-native; Oncorhynchus mykiss)
- Walleye (Stizostedion vitreum)

The Au Sable River, the Manistee River, and some of the larger lakes on the installation have watershed restoration committees that have created management plans and continue implementing restoration and habitat improvement associated with these water resources. As a partner with these groups and the MDNR, MDMVA continues to collaborate on these projects.

3.7.2 Agency Responsibilities

- CGMTC is responsible for ensuring that transient troops comply with applicable federal, state, local, Army, and CGMTC rules and regulations, including restrictions on the Hanson Land Grant, which is a wildlife refuge.
- The MDNR and CGMTC work collaboratively to manage fish and wildlife resources and habitats throughout the installation, with the exception of the GAAF, and the Crawford County civilian airfield.
- CGMTC and GAAF are responsible for fish and wildlife management at the GAAF.
- Crawford County is responsible for wildlife management at the Crawford County civilian airfield.
- See Table 2.1.

3.7.3 CGMTC Policies

Specific policies associated with the fish and wildlife management program include:

- CG 200-1:

    - Protect and conserve water resources, including wetlands, watersheds, and groundwater.
    - Protect plants and animals and the habitat they depend on, especially endangered and/or threatened species.
    - Fish and wildlife of any type will not be taken by any military personnel or civilian employee of CGMTC except while legally engaged in hunting or fishing activities as licensed and governed by the MDNR.

- Allow for creative solutions to deer population control, especially in areas with fencing or other restrictions on movement.
- DNR Policy and Procedure 39.21-20 Beaver Management and IC 4011 will be used to discourage beaver activity near high priority trout streams.
- Cooperate with MDNR in order to protect and preserve fish and wildlife that use CGMTC for all or part of their range.
- Ensure stream crossings (including culverts) do not create barriers to upstream or downstream passage for aquatic-dependent species.

3.8 SPECIES OF CONSERVATION CONCERN

CGMTC's species of conservation concern program is closely aligned with its water resources, vegetation, and fish and wildlife management programs.

Threatened and Endangered Species

As required by the Endangered Species Act (ESA), Michigan Endangered Species Act (MESA), and DoD and MDMVA policies and regulations, federally and state listed T&E species and their habitats are protected and managed on CGMTC. The CGMTC staff work collaboratively with the USFWS and the MDNR on management of T&E species.

A list of surveys is provided in **Appendix K**. All known special status species, their federal and state status, and a species summary for each is in **Appendix L**. A list of key legislation related to T&E species is provided in **Appendix C**.

Federally protected species known to occur on CGMTC:

- Hungerford's crawling water beetle (endangered)
- Eastern massasauga rattlesnake (threatened)
- Northern long-eared bat (threatened)
- Bald eagle (federally protected under BGEPA)
- Voss's goldenrod (threatened)

State protected species known to occur on CGMTC:

- Kirtland's warbler (endangered)
- Red-shouldered hawk (threatened)

- Common loon (threatened)
- Trumpeter swan (threatened)
- Caspian tern (threatened)
- Evening bat (threatened)
- Rough fescue (threatened)
- Vasey's rush (threatened)
- Fleshy stitchwort (endangered)
- New England violet (threatened)
- Canada rice grass (threatened)
- Whorled pogonia (threatened)

The USFWS has been petitioned to list four additional species (wood turtle, Blanding's turtle, monarch butterfly, and tricolored bat). Additionally, 18 state species of special concern known to occur on CGMTC. While not afforded legal protection under MESA, special concern species have declining or relict populations in the state. If these species continue to decline, they could be recommended for listing. In many cases, natural resources management benefiting federal and state listed species will also benefit these species.

A population of goldenrod that was previously thought to be the federally threatened Houghton's goldenrod (*Solidago houghtonii*) was determined through phylogenetics to be a new species, Voss's goldenrod (*Solidago vossii*) (Laureto P. et. al 2010). The new species is only known from a northern wet prairie/pine barrens complex within a 2.25 square mile area on CGMTC. Voss's goldenrod is still afforded federal protection under the ESA, as it was considered part of the listed entity when originally described as Houghton's goldenrod. Voss's goldenrod is currently not afforded any legal protection under state endangered species laws. However, state listing is anticipated during the next review and amendment process. Conservation and protection measures have been in place for this species and will continue to be employed. Any new state or federal species listings will be incorporated during the INRMP review process as needed.

Michigan Wildlife Action Plan (WAP)

The Michigan Wildlife Action Plan (WAP) contains a framework for conserving wildlife and their habitats through cooperative partnerships throughout the state (Derosier et al. 2015). The Michigan WAP for 2015-2025 has identified 15 priority habitats/key issues, listed in Table 3.1. As indicated in the table, six of the habitats/key issues overlap with CGMTC habitat, and multiple focal species identified in the MI WAP occur on CGMTC.

Table 3.1. Michigan Wildlife Action Plan Priorities	
Key Habitat or Issue Habitats or issues in **bold** have been identified at CGMTC	**Focal Species** Species in **bold** have been identified at CGMTC
Dry Northern Forests & Pine Barrens	**Kirtland's Warbler**, Dusted Skipper, **Secretive Locust, Eastern Massasauga Rattlesnake**
Young Forests	**Golden-winged Warbler**
Prairies & Savannas	Karner Blue, Frosted Elfin, Eastern Box Turtle, Rusty-patched Bumble Bee, Blazing Star Borer, **Eastern Massasauga Rattlesnake, Monarch Butterfly**
Great Lakes Marsh & Inland Emergent Wetlands	**Black Tern, Black-crowned Night-heron**, Eastern Fox Snake, King Rail
Fens	**Eastern Massasauga Rattlesnake**, Mitchell's Satyr, Tamarack Tree Cricket, Yellow Rail, Poweshiek Skipperling, Hine's Emerald Dragonfly
Emerging Diseases	**Eastern Massasauga Rattlesnake, Northern Long-eared Bat**, Indiana Bat, Tri-colored Bat, **Little Brown Bat**
Warmwater Streams & their Headwaters	Orangethroat Darter, Redside Dace, Silver Shiner, Southern Redbelly Dace, Northern Clubshell, Rayed Bean, Riverine Clubtail Dragonfly
Littoral Zones	Pugnose Shiner, Starhead Topminnow, Blanchard's Cricket Frog
Big Rivers	Lake Sturgeon, River Redhorse, Snuffbox
St. Clair – Detroit River System	Lake Sturgeon, Mooneye Northern Madtom, Pugnose Minnow, Mudpuppy
Inland Cisco Lakes	Cisco, Ives Lake Cisco, Siskiwit Lake Cisco
Great Lakes Ciscoes	Cisco, Kiyi, Shortjaw Cisco
Open Dunes & Sand-Cobble Shores	Piping Plover, Common Tern
Floodplain Forests	Cerulean Warbler, Indiana Bat, Copperbelly Water Snake
Large Grasslands	Henslow's Sparrow, Dickcissel, Grasshopper Sparrow, Monarch Butterfly
Source: Derosier et al. 2015.	

Dry Northern Forests & Pine Barrens are fire-dependent communities spanning approximately 104,000 acres on CGMTC. Young Forests are forests under 20 years old and dominated by fast growing tree species. Young forest habitats are maintained through active forest management at CGMTC. Currently, there is approximately 3,000 acres of young forest on CGMTC. Prairies & Savannas habitat type include fire-dependent communities present on CGMTC. There are a number of prairie patches throughout CGMTC (approximately 2,700 acres of prairie, with virtually no savannah), mostly associated with ranges. These prairies are not large enough nor have the right species composition to be considered 'Large Grasslands' as presented in the Michigan WAP. There are lowland forests (total of 5,800 acres in 15 different forest types) with significant ecological value on CGMTC, however they are not the size nor have the species composition as described in 'Floodplain Forests' in the Michigan WAP.

Inland Emergent Wetlands are wetland communities often associated with rivers or lakes, inland from the Great Lakes coastal areas. There are approximately 500 acres of emergent wetlands on CGMTC, including some high-quality natural areas. Fens are a type of wetland with particular soil characteristics and groundwater driven hydrology. There are approximately 50 acres of fens on CGMTC, including some high-quality natural areas.

CGMTC actively manages its natural resources to protect and conserve state and federally listed species. Other species in these key habitats include focal species as identified in the Michigan WAP.

Partners in Flight (PIF) species of concern

Partners in Flight (PIF) is a multi-partner initiative with a mission of keeping common birds common. Planning efforts have provided tools and recommendations to address threats, reduce long-term population declines, and prevent land birds from becoming at risk. The species of concern list and Bird Conservation Plan for Bird Conservation Region 12 (BCR) (M. Sumner et. al., 2009) identifies priority land bird species and associated habitat types. Of the 39 species in the region identified by PIF as regionally or continentally important, 31 have been documented at CGMTC, as indicated on Table 3.2, and the remaining five species listed on the table are likely to occur.

The conservation of these species will be considered as natural resource management activities are planned and implemented. Preventing further decline of species of concern will work to avoid the potential for additional species to be state or federally listed requiring further regulatory oversite. This is consistent with natural resource management goals as well as with the military mission.

Table 3.2. BCR 12 Priority Landbirds at CGMTC			
Species Species in **bold** have been identified at CGMTC	**Habitat Guild**	**Continental Concern**	**Regional Concern**
Red-headed woodpecker	Barrens	X	X
Olive-sided flycatcher	Coniferous forest	X	X
Willow flycatcher	Shrub wetland	X	
Wood thrush	Deciduous wetland	X	X
Golden-winged warbler	Regenerating forest	X	X
Kirtland's warbler	Regenerating forest	X	X
Bay-breasted warbler	Coniferous forest	X	X
Canada warbler	Coniferous forest	X	X
Whip-poor-will	Deciduous forest		X
Chimney swift	Urban		X
Northern flicker	Deciduous forest		X
N. rough-winged swallow	Shoreline		X
Bank swallow	Shoreline		X
Barn swallow	Urban		X
Veery	Deciduous forest		X
Brown thrasher	Shrub-grassland		X
Connecticut warbler	Coniferous forest		X
Field sparrow	Shrub-grassland		X
Bobolink	Open grassland		X
Purple finch	Coniferous forest		X
Ruffed grouse	Regenerating forest		
Broad-winged hawk	Deciduous forest		
Black-billed cuckoo	Regenerating forest		
Belted kingfisher	Shoreline		
Yellow-bellied sapsucker	Deciduous forest		
Least flycatcher	Deciduous forest		
Nashville warbler	Regenerating forest		
Black-throated blue warbler	Deciduous forest		
Black-throated green warbler	Coniferous forest		
Blackburnian warbler	Coniferous forest		
Mourning warbler	Regenerating forest		
Common yellowthroat	Shrub wetland		
Swamp sparrow	Open marsh		
White-throated sparrow	Regenerating forest		
Rose-breasted grosbeak	Deciduous forest		
Source: Matteson et al. 2009.			

3.8.1 Agency Responsibilities

- CGMTC is responsible for ensuring that transient troops comply with applicable federal, state, local, Army, and CGMTC rules and regulations regarding the protection of species of concern, and the conservation of associated habitats.
- CGMTC is responsible for ensuring that military training and operations conducted on CGMTC do not impact federally listed species, and to conduct Section 7 consultations, regardless of land ownership or underlying management responsibilities. In some cases, the Section 7 consultation results in significant management effort by CGMTC personnel for a federally listed species as a result of MDMVA actions. This means any potential impacts resulting from MDMVA activities are minimized and permitted as needed for the activity and any mitigation or management is undertaken by MDMVA.
- CGMTC is responsible for the management of federal and state listed species throughout CGMTC, with support from the MDNR.
- CGMTC is responsible for proactive management of T&E species, including habitat improvements, surveys, and studies.
- The MDNR and CGMTC work collaboratively to manage species of special concern throughout CGMTC.
- Crawford County is responsible for managing species of concern at the Crawford County civilian airfield.
- See Table 2.1.

3.8.2 CGMTC Policies

Specific policies associated with the Species of Conservation Concern Management Program include:

- CG 200-1:
    - CGMTC is committed to be a leader in the conserving of species of plants and animals that have been listed by federal and state agencies as threatened, endangered or being of special concern (listed species). CGMTC personnel at all levels must ensure they carry out mission requirements in harmony with the requirements of the ESA and the MESA. All CGMTC lands are subject to the requirements of the ESA and MESA. Mission requirements DO NOT justify actions violating the ESA or MESA. The key to successfully balancing mission requirements and the conservation of listed species is long-term planning and effective management to prevent conflicts.
    - In fulfilling its conservation responsibilities under the ESA and MESA, CGMTC will work closely and cooperatively with the enforcers of the acts: the USFWS and the MDNR.
    - It is a CGMTC goal to systematically conserve biological diversity on CGMTC lands within the context of its mission. Natural ecosystems can best be maintained by protecting the biological diversity of naturally occurring organisms and the ecological process that they perform. CGMTC also recognizes the

importance of habitat management, the key to effective conservation of biological diversity in the protection of listed species and proposed species. Conserving and restoring biological diversity minimizes the number of species that must be protected.

- CGMTC personnel who violate the provisions of the ESA or MESA or implementing regulations of the USFWS or MDNR are subject to both criminal and civil penalties. Criminal violations are punishable by a fine and/or imprisonment for each violation. The law imposes civil and criminal penalties for the knowing failure to take required action and for the commission of prohibited acts. Military and civilian personnel of CGMTC are not immune from prosecution. Actions in violation of the ESA or MESA or the implementing regulations of the USFWS or MDNR are not within the scope of the official duties of CGMTC personnel.
- Failure to comply with the ESA or MESA can result in delaying or halting ongoing or proposed projects or activities. Proponents of actions will coordinate with the EM early in the planning stage of projects and activities to identify potential conflicts with the conservation of listed and proposed species.
- No taking of listed fish or wildlife species or to remove or destroy listed plant species will occur on CGMTC.
- Smoke hexacholoroethane will not be used within 1 kilometer of any known listed animal species or listed animal species nesting site.

- CGMTC has established a mandatory, ongoing T&E awareness training program for personnel who may have contact with listed species or their habitat, per CG200-1. The training covers the following topics:
  - Identification of listed species and markings that identify restricted areas.
  - Actions necessary to avoid injury to listed species and their habitat.
  - The pertinent requirements of the ESA and MESA and applicable regulations.
  - The importance of protecting listed species and biological diversity.
  - CGMTC policy that mission accomplishment must be consistent with the conservation of listed species and critical habitats.

- Appropriate permits are required by anyone handling or surveying listed species from USFWS, MDNR, or other agencies as necessary.
- Evaluate protective measures based on new data and modify the measures to best protect the species, while minimizing impacts to military training.
- Only foot traffic is allowed off-road in STA 9 and in the Red Pine Natural Area in NTA 9. No military activity of any kind is allowed May 1 through August 15 in NTA 9 and 10, and only on-road activities allowed the remainder of the year.
- Implement a 1,500 feet vertical and lateral buffer around active bald eagle nests.
- Camp Graying immediately contacts USFWS if eagle nesting occurs near aerial or ground operations.

- Aircraft will maintain a minimum elevation of 500 feet over all occupied Kirtland's warbler habitat. All restrictions on posted Kirtland's warbler habitat will be followed.
- All areas occupied by Kirtland's warblers, as located by spring census, are identified on the annual training area map restrictions overlay and are either not assigned or are scheduled with restrictions. Restrictions will be covered as part of environmental briefings given to visiting units.

3.9 RECREATION

Recreation in Michigan state forests is very robust and occurs year-round, including CGMTC land to which the public has access. Recreational activities include hiking, mountain biking, horse riding, camping, hunting, fishing, hiking, mushroom hunting, snowmobiling, ORV trail use, and boating. The economic benefits that come along with recreation in state forests in and around CGMTC is important to the nearby communities of Gaylord, Grayling and Kalkaska.

The MDNR operates two State Forest Campgrounds adjacent to CGMTC lands, and issues daily use permits for camping and other recreational uses. Forest resources are important to the regional economy for the setting and resources they provide to support recreational activities. Recreational facilities that are situated on CGMTC or transect CGMTC are listed below.

Campgrounds:

- Jones Lake State Forest Campground
- CCC Bridge State Forest Campground
- Manistee River Bridge State Forest Campground
- Lake Margrethe State Forest Campground
- Shupac Lake State Forest Campground

Boating Access Sites (BAS):

- Jones Lake BAS
- Shupac Lake BAS
- Guthrie Lake BAS
- Section One Lake BAS
- KP Lake BAS
- CCC Bridge BAS
- Lake Margrethe BAS
- Cantonment BAS (open to LMPOA members when military amphibious vehicles are not in the vicinity)

ORV Trails:

- Frederic Route
- Kalkaska Route

Snowmobile Trails:

- Various

Non-Motorized Trails:

- Hanson Hills Recreation Area Cross Country Ski and Mountain Bike trails.

The MDNR has some recreational areas that are on military lands, including the Lake Margarethe and Jones Lake State Forest campgrounds; other recreational areas managed by MDNR in the Grayling Management Unit are outside of military areas (MDNR 2018). The Lake Margarethe campground is leased by MDNR from the military and Jones Lake is on and surrounded by military lands (MDNR 2018).

Much of CGMTC is open for public access which is managed by MDNR. All rules, permits, and licenses required for activities on other state land also apply at CGMTC Public access areas are shown on Figure 3 (Appendix D). The Hanson Grant lands are designated as a game refuge at which hunting is not allowed. The Hanson Grant lands include the 277-acre Hanson Hills Recreational Area, which is open year-round. The Hanson Hills Recreational Area is managed by the GRA and is used extensively for cross-country ski and mountain bike trails, as well as downhill skiing and other recreational trail programs. Access to Lake Margrethe is available to the public on the west side of the lake at the lake Margrethe State Campground.

MDMVA and CGMTC manage recreation areas within the Cantonment. Canoes and kayaks are available for military personnel to use on Lake Margrethe through the CGMTC special services warehouse located on the beach. No designated swimming area signs or lifeguards are provided by CGMTC. Athletic areas in the Cantonment include softball fields, tennis courts, basketball courts, and volleyball courts. Equipment for these and other activities, including footballs, badminton, horseshoes, table tennis, Frisbees, and darts, are also available for use through the special services warehouse. A campground, privately owned and operated by the Officer's Club, is located near main entrance to the Cantonment. All of these recreational facilities can only be accessed by visitors with a military identification.

There is a significant network of snowmobile trails throughout CGMTC that are managed by the MDNR under an agreement with the MDMVA. Development of new ORV trails has been discouraged due to potential conflicts with training.

3.9.1 Agency Responsibilities

- The CGMTC is responsible for the management of land and facilities at the campgrounds within the Cantonment.
- The MDNR is responsible for the management of land and facilities at the Lake Margrethe State Campground.
- Management of recreational programs is the responsibility of CGMTC and MDNR on each agency's respective ownership. Given the ownership patterns, CGMTC and MDNR work collaboratively where appropriate.
- The GRA is responsible for the management of the Hanson Hills Recreation Area.
- See Table 2.1 for a list of areas with restricted or unrestricted public access.

3.9.2 CGMTC Policies

As indicated on Figure 3 (Appendix D), public access to CGMTC impact areas, the GAAF, and the MATES is prohibited. Public access to the Cantonment is restricted. Table 2.1 lists the areas to which the public has unrestricted access when lands are not being used for military training exercises.

Outside the Cantonment, the primary recreational land uses include hunting, fishing and ice fishing, snowmobiling, snowshoeing, cross-country skiing, downhill skiing, hiking, boating, kayaking, driving all-terrain vehicles, camping, and horse-riding. Recreational areas and amenities outside the Cantonment such as campgrounds, lake shore beaches, public trails, boat ramps, etc., are managed by the MDNR.

The primary recreational land uses within the Cantonment include ice fishing, boating, and camping. The recreational areas within the Cantonment are managed by the DTMB and are available to members of the public with valid military identification and military veterans. The CG recreation management policy is described in AR 200-1 (Section 4-3 Land Resources) and provides for controlled recreation of uniformed personnel, and for access to the Cantonment by military personnel, their families, and military veterans.

3.10 CLIMATE RESILIENCE AND REGIONAL GROWTH

Climate resilience is aligned with all the CGMTC's overall Natural Resource Program Management approach and the remaining eight natural resource elements described herein. CGMTC's climate resilience and regional growth program is in the early stages of development and is founded on published science. The continued initial development of the program will be closely integrated with the water resources management program and the species of concern program, with particular attention paid to ERM and an observed shift in the hibernaculum that may be in response to perceived rising water table elevations in Portage Creek.

Michigan's climate has been warming, and current projections are that the state are expected to continue to warm 10 times as quickly in the next 30 years than it has in the last 100 years (Hoving et al. 2013). This trend will impact ecosystems by shifting species ranges, impacting the seasonality and intensity of weather events, and other potential impacts. The Michigan WAP identifies climate change as one of the primary stressors affecting wildlife, and ranks wildlife vulnerability according to the adaptive capacity of their habitat. For instance, a low vulnerability ranking indicates that the habitat has a high adaptive capacity and the potential impacts of climate change could be positive, and a high vulnerability ranking indicates that the habitat has a low adaptive capacity and the potential impacts of climate change could be negative (Derosier et al. 2015).

In 2016, MIARNG/MDMVA completed *Adaptation Planning for Climate Resilience*, which assesses current conditions, documents planning efforts, and makes recommendations to improve climate resilience (MIARNG & LIAA 2016). Several partner agencies were involved in the drafting of the plan, including Michigan Office of the Great Lakes, Michigan Climate Coalition, Michigan Environmental Council, MDNR, EGLE, Michigan State University, the University of Michigan, Michigan State Police-Emergency Management Division, the Great

Lakes Integrated Sciences and Assessment Program, and the Natural Resources Conservation Service.

3.10.1 CGMTC Policies

Specific policies associated with the Climate Resiliency Program include:

- Collaboration with established partners to improve models, assess vulnerabilities, and develop graphical depictions of the potential impacts from climate change on CGMTC.
- Cultivation and expansion of partnerships for collaboratively addressing regional climate change issues, as needed and feasible.

Provide for the management of threatened, endangered, and other special status species such that changes in distribution and abundance may be understood in the context of climate change.

4 PLAN IMPLEMENTATION

As specified in AR 200-1, implementation of this INRMP will be accomplished if the following actions occur:

- Actively request, receive, and use funds for priority projects and activities.
- Ensure sufficient numbers of professionally trained natural resources management staff are available to perform the tasks required by the INRMP.
- Coordinate annually with cooperating agencies and completes a review for operation and effect at least every five years.
- Document specific INRMP activities and projects undertaken each year.
- Evaluate the effectiveness of past and current management activities and adapts appropriately to implement future actions.

4.1 PROJECT IMPLEMENTATION AND PRIORITIZATION

Projects for each natural resource element have been developed and prioritized based on an evaluation of CGMTC objectives and management recommendations. As indicated in the Implementation Table (Appendix I), many objectives are applicable to more than one natural resource element, therefore, many of the projects will accomplish multiple objectives. A list of primary recurring natural resource management activities is provided in Table H-2 (Appendix **I),** and performance criteria for each objective are provided in Table H-3 (Appendix I).

Project funding requests will be submitted in accordance with current Army National Guard Environmental Programs Division's procedures for conservation projects. The Office of Management and Budget considers funding for the preparation and implementation of this INRMP, as required by the SAIA, to be a high priority. The prioritization of the projects is based on need, legal drivers, and ability to further implement the INRMP. Therefore, some projects identified in the Implementation Table are not likely receive immediate funding. Projects need to be funded consistent with timely execution to meet future deadlines. Projects are generally prioritized with respect to compliance. Highest priority projects are projects related to recurring or current compliance, and these are generally scheduled earliest.

As such, these projects have been placed into three priority-based categories: (1) high priority projects which are essential for maintaining compliance or for successful natural resources management, (2) medium priority projects with no immediate compliance requirement or less impact on the natural resources, and (3) low priority projects with a natural resources benefit but no legal driver.

Recurring requirements include projects and activities needed to cover the recurring costs that are necessary to meet applicable compliance requirements (federal and state laws, regulations, Presidential EOs, and DoD policies) or which are in direct support of the military mission. Recurring costs include manpower, training, supplies, permits, fees, sampling, reporting, record keeping, and maintenance of equipment.

4.2 INSTALLATION PLANNING AND PROJECT REVIEW PROCESS

For maintenance or construction projects and new or large training events, CGMTC Environmental office completes an ARNG Environmental Checklist and Record of Environmental Consideration (REC). Routine training activities are covered under the EIS, 1994.

In both cases, if any permits or further NEPA analysis is needed to conduct the proposed activity then the relevant process is undertaken.

4.3 COLLABORATION WITH THE MDNR

CGMTC Environmental Department staff work closely with the local MDNR representatives, and communication between the two agencies is often as much as several times per week on multiple topics, including but not limited to maneuver damage extent and restoration, timber harvests, maintenance and seeding of firing points, coordination of prescribed burns, wildlife, encounters between transient troops and the public, transient troop locations and flow-through, site clearance inspections, and planning and review of proposed construction.

The MDNR reviews military actions proposed by the MDMVA that may potentially impact conservation efforts on property owned by the MDNR, such as the development and maintenance of helicopter landing zones, the construction of new training areas, the construction of firing points, etc. Similarly, the MDMVA reviews conservation and timber harvest actions proposed by the MDNR that may potentially impact the military mission on land owned by the military.

On the entire 147,000-acre installation, CGMTC is responsible for ensuring that transient troops comply with all applicable federal, state, local, Army regulations and CGMTC and policies. Proactive attempts are made to enforce this responsibility in the form of communication, distribution of the SFC, pre-mobilization briefings, daily meetings with the unit leaders, site clearance inspections, etc. (see Sections 1.3, 1.6.4, and 3.11 for further details). Maneuver damage is continually assessed during peak training season (May, June, July, and August). In the event that an infringement occurs by transient troops (e.g., unpermitted earth-moving), the Environmental Departmental staff work with the transient unit, FE, and the MDNR to mitigate the infringement as quickly as possible to the satisfaction of all parties.

4.4 COOPERATIVE AGREEMENTS AND CONSERVATION PARTNERSHIPS

Intra- and inter-agency cooperation, coordination, and communication at the federal, state, and local levels (e.g. USFWS and MDNR) are requisite to the success of the INRMP. USFWS and MDNR review the INRMP and its implementation. As discussed in Section 2.2, cooperation with MDNR is essential for successful INRMP implementation on CGMTC.

Additional technical assistance, however, is sometimes needed and can be sought from federal and state agencies, universities, and non-governmental groups. More than half of this additional help is expected to be satisfied through contractual arrangements – either with private consultants or with governmental or non-governmental conservation organizations. Regional governmental and non-governmental organizations with which CGMTC has a history of

contracting with the MDNR, EGLE, MNFI, Huron Pines, Upper Manistee River Association, Au Sable River Watershed Restoration Committee, Kirtland's warbler Conservation Team, Kalamazoo Nature Center, US Forest Service, US Army Corps of Engineers, and Natural Resources Conservation Service.

Additional technical assistance is also available through the following two DoD initiatives.

- DoD Partners in Amphibian and Reptile Conservation (PARC) - initiative to support management of reptiles and amphibians on military installations. More information at http://www.dodnaturalresources.net/DoD-PARC.html.
- DoD Partners in Flight (PIF) – initiative to support management of birds on military installations. It is part of the international PIF partnership and facilitates connections between DoD entities and other PIF partners. More information at http://www.dodpif.org/.

The DoD and subcommand entities have Memorandums of Understanding (MOUs), Memorandums of Agreement (MOAs), and other cooperative agreements with other federal agencies, conservation and special interest groups, and various state agencies in order to provide assistance with natural resources management at installations across the US. Generally, these agreements allow installations and agencies or conservation and special interest groups to obtain mutual conservation objectives and are updated or modified as needed.

CGMTC embraces the surrounding communities and has established MOUs and MOAs for law enforcement, firefighting, and emergency services.

- Mutual Aid Agreement MDNR and MDMVA for fire suppression (March 2011)
- Interdepartmental Agreement between MDNR and MDMVA for MDNR assistance in developing the IWFMP for CGMTC (2017-2019)
- Interdepartmental Agreement between MDNR and MDMVA for MDNR assistance to conduct prescribed fires in the Pine Barrens (2018-2023)

4.5 FUNDING

Implementation of this INRMP is subject to the availability of funding. The installation requests project validation and funding through the Army National Guard, Installations & Environment Directorate. Funding sources for specific projects can be grouped into three main categories by source: ARNG funds, other federal funds, and non-federal funds. This is not an all-inclusive list of funding sources and available sources and criteria can change from year to year. When activities or projects cannot be completed due to lack of funding or other reasons, the MIARNG will review the INRMP to determine whether adjustments are necessary.

4.5.1 Army National Guard, Installations & Environment Directorate

Environmental funds from ARNG I&E are be used for core natural resources activities and projects. Further guidance is provided in funding documents issued yearly.

In addition to Environmental funds, Installation and ITAM funds can also be used to implement INRMP activities and projects. Installation funds support facilities operation and maintenance,

including facility planning, maintenance of roads and trails, vegetation management, pest management, construction, and master planning. Installation funds can also be used for pest and noxious weed control, invasive species control, facilities vegetation control and controlled burns to manage vegetation and fuels on training areas and ranges. ITAM funds can be used for monitoring, habitat restoration, land management and water quality improvements related directly to military training.

The following natural resources management areas can be addressed with multiple funding sources: erosion control, invasive species management, wildlife management, and wildland fire. However, the type of funding used for these management areas depends on purpose. Current guidance should be referred to annually to determine the most appropriate source of funding for a specific activity or project.

4.5.2 Other Federal Funds

Cooperative agreements may be made with state or local governments, non-governmental organizations, and individuals for the improvement of natural resources or to foster research on military facilities. The USFWS is a cooperator in the development and implementation of the INRMP. In this capacity, the USFWS may facilitate access to matching funds and services. In addition, the following federal partnerships are also beneficial to natural resources management and protection at CGMTC.

- The Natural Resources Conservation Service can assist CGMTC with management of erosion and soil resources, and produce engineering designs, construction/material specifications and estimated costs for high priority erosion sites.
- The Wildlife Services Division of U.S. Department of Agriculture's Animal Protection and Health Inspection Services provides federal leadership in managing problems caused by wildlife and can provide technical assistance to resource owners on a variety of methods that can be used to resolve problems. At CGMTC, these services would be most relevant on the airfield.

4.5.3 Non-Federal Funds

Opportunities exist to use state or local funds or private grants to support INRMP projects, particularly those relating to rare species, invasive species, public access or natural resources education. For example, Public Lands Day grants are relatively easy to obtain and can be used for signs, native plant landscaping, trail construction and other similar activities using the assistance of volunteers. Non-federal partnerships are beneficial to natural resources management and protection at CGMTC and currently include:

- The **MDNR** is a critical partner that provides personnel to accomplish natural resources management at CGMTC.
- The **Purdue University** provides graduate research relevant to natural resources on CGMTC. These relationships and agreements will continue, which provides valuable data and expertise to improve natural resources management on CGMTC.
- **Huron Pines,** a non-profit conservation organization provides expertise and cost-effective support for the implementation of several initiatives at CGMTC specifically

regarding invasive species management, water resources management, and habitat management through ecological burns and other means.

- **Upper Manistee River Association**
- **National Wild Turkey Federation.** This non-profit cooperates with MDNR and MDMVA to implement habitat improvements on CGMTC.

4.6 MONITORING INRMP IMPLEMENTATION

The ultimate successful implementation of this INRMP is realized supporting the military mission, while at the same time providing effective natural resources management. Initiation of projects is one measure that is used to monitor INRMP implementation, but it does not give the total picture of the effectiveness of the natural resources management program. Natural resources management is not simply the sum total of projects, interagency coordination, or program funding and staffing. A significant portion of INRMP implementation is done through internal coordination in regard to training site operations and land use decision making. This type of implementation cannot be measured by project implementation or funding levels. It is evidenced by such things as the ability to continually train, sustainable land use, ongoing regulatory compliance, retention of species diversity, protection of surface water quality, and the acknowledgement of sustainable natural resources management by partnering conservation agencies and other interested organizations and individuals.

With this INRMP update, success criteria are explicitly stated for each goal and/or objective. This creates a transparent process for assessing INRMP implementation for all parties. The effectiveness of the INRMP as a mission enabling conservation tool will be decided by mutual agreement of USFWS, MDNR, and MDMVA during annual reviews and/or reviews for operation and effect. For INRMP implementation, the reporting requirements are defined in DoDI 4715.03.

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APPENDIX A
ACRONYMS

ACUB	Army Compatible Use Buffer
APA	Authorized Public Agency
APHIS	Animal Protection and Health Inspection Services
AR	Army Regulations
ATAG	Assistant to The Adjutant General
BASH	Bird and Wildlife Aircraft Strike Hazard
BCR	Bird Conservation Region
BMP	best management practice
CACTF	Combined Arms Collective Training Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CGMTC	Camp Grayling Maneuver Training Center
CFMO	Construction and Facilities Management Officer
CFMP	Cantonment Forestry Management Plan
COC	Certificate of Coverage
CWA	Clean Water Act
DoD	Department of Defense
DoDI	Department of Defense Instruction
DPOTS	Department of Plans, Operations, Training and Security
EA	Environmental Assessment
EAB	emerald ash borer
EGLE	(Michigan Department of) Environment, Great Lakes, and Energy
EMR	eastern massasauga rattlesnake
EMS	Environmental Management System
EPM	Environmental Program Manager
FAA	Federal Aviation Administration
FE	(Department of) Facilities Engineering
FNSI	Finding of No Significant Impact
FRD	Forest Resources Division
GAAF	Grayling Army Airfield
GIS	Geographical Information System

GRA	Grayling Recreation Authority
HCWB	Hungerford's crawling water beetle
HQNA	High Quality Natural Areas
ICRMP	Integrated Cultural Resources Management Plan
ICUZ	Installation Compatible Use Zone
IED	improvised explosive device
INRMP	Integrated Natural Resources Management Plan
IPMP	Integrated Pest Management Plan
ITAM	Integrated Training Area Management
IWFMP	Integrated Wildland Fire Management Plan
JLUS	Joint Land Use Study
LMPOA	Lake Margrethe Property Owners Association
LRAM	Land Rehabilitation and Management
MATES	Mobilization and Training Equipment Site
MDEQ	Michigan Department of Environmental Quality
MDMVA	Michigan Department of Military and Veterans Affairs
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
MESA	Michigan Endangered Species Act
MIARNG	Michigan Army National Guard
MIM	military installation map
MNFI	Michigan Natural Features Inventory
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act of 1969
NGB	National Guard Bureau
NRCS	Natural Resources Conservation Service
NREPA	Natural Resources and Environmental Protection Act (Michigan P.A. 451)
ORV	off road vehicle
PIF	Partners in Flight
POC	point of contact
POL	petroleum/oil/lubricant
REC	Record of Environmental Consideration
REPI	Readiness and Environmental Protection Integration

RTLA	Range and Training Land Assessment
SAIA	Sikes Act Improvement Act of 1997
SESC	Soil Erosion and Sedimentation Control
SFC	Soldier Field Card
SOP	Standard Operating Procedures
SPCC	Spill Prevention Control and Countermeasure
SRP	Sustainable Range Program
SWPPP	Storm Water Pollution Prevention Plan
T&E	threatened and endangered
TA	training area
TAG	The Adjutant General
UMRA	Upper Manistee River Association
USAREUR	US Army-Europe
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WAP	Wildlife Action Plan
WWTP	waste water treatment plant

APPENDIX B
MEMORANDUM OF RECORD

Review for Operation and Effect (June 2018)

Agency Correspondence on Revised INRMP

NEPA Documentation for Revised INRMP

Annual Reviews

Section	Page	Paragraph	Line	Sentence	Comment (CAMP GRAYLING INRMP)	Reviewer	Office of Reviewer	Name of Responder	Action Taken to Address the Comment:
					Use of CGMTC is used Throughout the document and not listed in Appendix A, I believe you want to use CGJMTC.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	CGJMTC changed to CGMTC throughout plan and appendices.
2.2	17				Bullet Point 4 - GRA only has a recreational lease, Camp Grayling is responsible for the Resource management of this area. I believe this bullet point is misleading. I don't believe GRA is doing any type of treatments for vegetation or invasives.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	Changed GRA to MIARNG
	18-20				Table 2.1, This table conflicts with Figure 4. MIARNG is responsible for all resource management on lands that DMVA owns. MDNR is responsible for all resource management they own. The entities who lease the lands are not responsible for the resource management unless that is specified in the lease agreement, i.e. GRA. There are also lands owned by DMVA that were purchased after the 1948 agreement, which the MDNR conducts no managmement for Forestry, Game and Fish. These lands show up as private in our inventory system.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	In addition to lease language, additional resource management responsibilities by MIARNG are required under the SIKES Act. Changed GRA to MIARNG in 3rd line of table. Figure 4 and Table 2.1 edited to address inconsistencies.
3.2.1	29				Bullet Points 4 & 5, I believe are redundent and could be combined this is repeated throughout the document.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	deleted bullet 4
3.2.2	30				1st Bullet Point, This point talks about restoration to exposed soil following different disturbances, is this ongoing or a new policy. I would caution don't if this is not happening then don't include in plan. Mainly the unauthorized vechicle access. This is	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	This is a new effort starting in 2020.
3.3.1	32				See Comment # 4	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	deleted bullet 4
3.4	34	1			Might be splitting hairs, ownership and management of High Quality Natural Area is conducted by the respective landowner. This was more clear in the Appendix.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	HQNA's are located on lands owned by both DMVA and DNR
3.4.1	34				Bullet Point 3, This is not an acheivable objective. I would recommend either removing or increasing the size of the tree to make the objective acheivable.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	clarified this bullet point to say that CGMTC limitations apply to trees >1" diameter.
3.6.1	40				See Comment # 4	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	deleted bullet 4
3.9	53	1	1	1	This was the first time CGJMTC was used in the document, consistency.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	changed CGJMTC to CGMTC
3.9	53	8	1 & 3		First time the Grayling Management Unit is mentioned all other times you reference MDNR, I would remove the Grayling Management Unit and stay consistent with MDNR. The Grayling Management Unit does not manage the Campgrounds mentioned those are managed by the Parks & Recreation Division.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	changed Grayling MU to MDNR.
3.9	54	1	2-4	2	This sentence is confusing regarding MDNR attempts to solve access limitations to state recreational areas due to military activity. Is this implying areas like BAS or Campgrounds, I not aware any efforts to do this. Again I'm not sure what you are trying to convey here.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	agree the sentence is confusing. Deleted.
3.9.1	54				Bullet Point 3 CGMTC has recreational authority for all land owned or deeded and MDNR works with CGMTC on these lands. The inverse is true on MDNR ownership. This point implies MDNR has recreational control over all lands.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	reworded bullet point per comment.

Section	Page	Paragraph	Line	Sentence	Comment (CAMP GRAYLING INRMP)	Reviewer	Office of Reviewer	Name of Responder	Action Taken to Address the Comment:
4.3	58	2	5		Typo - "Actins" should be "Actions"	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	fixed typo
					If CGMTC is going to be use then list in Appendix A	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	CGMTC added to Append A
					General Comment, I will research the Other Land Agreements to see where they should fall within the Camp Grayling ownership pattern, I'm not aware of any other agreements other than our leases.	Tom Barnes	MDNR - FRD, Grayling	M. Kleitch	
	67				Matt,You should cite this Lake Margrethe report instead of the earlier one:Caution-https://www.michigan.gov/documents/dnr/SFR2017-235_575579_7.pdf < Caution-https://www.michigan.gov/documents/dnr/SFR2017-235_575579_7.pdf >	Mark Tonello	MDNR-Fisheries Div., Cadillac	M. Kleitch	replaced existing link with updated link
	44	2		2	The only question or comment that I have is regarding the rusty-patched bumblebee (RPB). I read somewhere in the text of the plan that it was documented on Camp Grayling, I apologize but I lost track of where in the document I read it, but I didn't see it listed in the table in Appendix L, page L-4. I am suspecting that I have just gotten confused and the RPB is listed elsewhere in the appendix?	Steve Griffith	MDNR Wildlife Div., Traverse City	M. Kleitch	A review of insect surveys revealed that rusty-patched bumblebee has not bee documented on CGMTC as of the writing of this plan. Deleted the species from text. Additional insect surveys are planned for 2021 pending funding.
3.3	33	3			In Section 3.3 (p. 31), you list activities that the Guard has partnered with MNDR and other groups on for water quality and fisheries habitat. I believe you have funded the excavation of two sand traps (Tank Trail and Smock) on the East Branch Au Sable a number of times. I did not see that in your list.	Neal Godby	MDNR-Fisheries Div., Gaylord	M. Kleitch	Added text per comment
	E-9	1		3	In Appendix E, you list the mean daily discharge for the Au Sable as 76 cfs. That seems pretty low, you may want to double check. The mean discharge at the Au Sable Red Oak gage is 782 cfs for June 25 based on 30 years of data.	Neal Godby	MDNR-Fisheries Div., Gaylord	M. Kleitch	The 76cfs discharge was taken from the DNR-Au Sable River Assessment report (Zorn et al. 2001). A reference review did not reveal any additional calculations for discharge of the Au Sable near Grayling. If an updated calculation can be provided it will be incorporated into the document.
	E-9	1		5	Also in Appendix E, you state there are no stream gaging stations on the East Branch or North Branch of the Au Sable River. Mason Griffith TU funded the installation of a gage on the North Branch at Kellogg Bridge last fall. Those data can be accessed at: Caution-https://waterdata.usgs.gov/mi/nwis/uv/?site_no=04135800&PARAmeter_cd=00065,00060,62615,63160 < Caution-https://waterdata.usgs.gov/mi/nwis/uv/?site_no=04135800&PARAmeter_cd=00065,00060,62615,63160 > .	Neal Godby	MDNR-Fisheries Div., Gaylord	M. Kleitch	Details on new stream gauge added to text.

Section	Page	Paragraph	Line	Sentence	Comment (CAMP GRAYLING INRMP)	Reviewer	Office of Reviewer	Name of Responder	Action Taken to Address the Comment:
E.3.1	E-9	6		4	In Appendix 3, Section E.3.1 Rivers, you mention that the North Branch Au Sable River "is relatively shallow making fishing and canoeing difficult." I would say that its shallow nature makes wading and fishing easier.	Neal Godby	MDNR-Fisheries Div., Gaylord	M. Kleitch	Text modified based on comment.
					For the Implementation Table, Project WA2.5 is to "inventory stream crossings and wetland crossing/equalization structures…." I recommend that the Great Lakes Stream Crossing Inventory Protocol be used, and that the data be entered using the Great Lakes Stream Crossing Inventory electronic application. For more information on the protocol and/or app, please contact Patrick Ertel (cc'd on this message).	Neal Godby	MDNR-Fisheries Div., Gaylord	M. Kleitch	Comment will be considered during implementation of this project.
					As mentioned in your document, there is not currently a stream flow gage on the East Branch Au Sable River. A number of issues have come up over the last few years where having gage data on this river would have been help. If possible, I would recommend adding an item to the Implementation Table to fund the installation and maintenance of a streamflow gage (preferably USGS) on the East Branch Au Sable River. Among other benefits, this would help partners develop a sediment rating curve, as well as assist in designing habitat improvement projects in the watershed.	Neal Godby	MDNR-Fisheries Div., Gaylord	M. Kleitch	Comment will be considered during implementation of stream projects.
					I understand that some of the local angling/conservation groups may be planning to do instream fisheries habitat work and fishing access improvements on the East Branch Au Sable in the next few years. I would recommend adding an item to the Implementation Table for these projects if it would help with funding for these groups to accomplish this work.	Neal Godby	MDNR-Fisheries Div., Gaylord	M. Kleitch	MIARNG will consider this suggestion as part of water resources projects where possible.
					Phone call discussion between B. Piccolo and M. Kleitch, 6 July 2020. No additional comments on review of INRMP.	B. Piccolo	MDNR-Wildlife Div., Roscommon	M. Kleitch	NA
F.3.3	F-15	2			Mentions of Houghton's goldenrod - should be replaced with Voss's Goldenrod	C. Mensing	USFWS	M. Kleitch	Voss's added to list in page 47.
L.1.2	L-6	6			No mention of delisting Kirtland's warbler; the species was delisted November 8, 2019	C. Mensing	USFWS	M. Kleitch	KW delisting is included in Appendix M, pg M-22
L.1.2	L-7	1			Updated KW census info available (last listed in INRMP is 2006). We can assist you in getting the updated information.	C. Mensing	USFWS	M. Kleitch	CGMTC will follow up with USFWS to obtain KW updated census info. CGMTC staff currently conduct annual presence/ absence surveys and will conduct full KW census on the same schedule as DNR.
L.1.2	L-8	5			Updated BAEA nesting data is available ("Data not readily available"). We can assist you in getting the updated information.	C. Mensing	USFWS	M. Kleitch	A GIS shapefile of BAEA nest locations was provided by USFWS (C. Mensing) in 2019. CGMTC staff will follow up with USFWS to obtain any recent updates to the data.
L.2	L-12				Voss's Goldenrod should be included in the table of listed plants as it would receive ESA protection.	C. Mensing	USFWS	M. Kleitch	Added to table on pg L-12; Description summary added to L-13&L-14
M.1	M-2,3				Encourage use of Wildlife Friendly Erosion Control (WiFEC) throughout Camp Grayling.	C. Mensing	USFWS	M. Kleitch	included on pg M-3

Section	Page	Paragraph	Line	Sentence	Comment (CAMP GRAYLING INRMP)	Reviewer	Office of Reviewer	Name of Responder	Action Taken to Address the Comment:
M.2	M-5				Buffers should be placed around water resources to avoid or minimize adverse impacts from management (e.g. timber harvest)	C. Mensing	USFWS	M. Kleitch	Timber harvests are conducted by DNR. MDMVA provides review and input on proposed harvests to ensure management is consistent with Camp Grayling training activities. BMP's are followed per standard DNR protocols.
M.7	M-19	3			Provide dates to avoid management - "Consider timing activities to avoid adverse impacts to species of concern. For example conducting activities outside of nesting season for migratory birds (April 15 - Aug 15), and outside of pupping season for bats (June 1 - July 31)." Could also look to provide consideration of timing duirng the bat's active season April 1 - Sept 30)	C. Mensing	USFWS	M. Kleitch	Dates added to Pg M-20
M.7	M-21	2			Recommend following USFWS BMP document in EMR areas (provided) as appropriate and feasible.	C. Mensing	USFWS	M. Kleitch	Added sentence on pg M-22. Added BMP document to references in Section O.
M.7	M-22	1			Recommend including specific protective measures for northern long-eared bat.	C. Mensing	USFWS	M. Kleitch	Added specific measures to pg M-23. Additional bat surveys were scheduled for 2020 field season, but are delayed due to Covid-19 related issues. Surveys will provide additional detail on NLEB presence and distribution. Additional BMP's will be developed and implemented based on the results of surveys.
M.7	M-23	3			Recommend providing information on current Kirtland's warbler breeding habitat at STA9 (population numbers and origin of habitat.)	C. Mensing	USFWS	M. Kleitch	Added a sentence on pg M-24 on current distribution of KW on CGMTC. Full KW census will be conducted in synch with DNR in 2021.
1.4.4	6	5			USFWS also has regulatory authority for migratory birds through the Migratory Bird Treaty Act and bald eagles through the Bald and Golden Eagle Protection Act; Consider pulling out discussion on bald eagle under separate section on Bald and Golden Eagle Protection Act as well as seperate discussion on USFWS regulatory authority for migratory birds through the Migratory Bird Treaty Act.	C. Mensing	USFWS	M. Kleitch	Added language in Section 1.4.4. Additional details are included in Appendices.
3.4	33	4			No plant species identified are federally listed However, the newly desovered Voss's Goldenrod population would still reveive ESA protection as it was considered part of the listed entity when described as Houghton's goldenrod.	C. Mensing	USFWS	M. Kleitch	Modified language to include 1 Federally listed species.
3.8	47	3			Wood turtle, Blanding's turtle, Monarch, and tricolored bat are not "Proposed" The USFWS has been petitioned to list those species, and a listing determination will be made, but they are not formally proposed at this time.	C. Mensing	USFWS	M. Kleitch	Deleted "proposed", change to "USFWS has been petitioned…"
3.8	47	4			Voss's Goldenrod would still reveive ESA status, as it was considered part of the listed entity when described as Houghton's goldenrod.	C. Mensing	USFWS	M. Kleitch	changes made on pg 47 to address comments
3.8.2	52	5			Does STA9 and the Red Pine Natural Area contain all known locations of EMR on Camp Grayling? These protections measures should apply to all known locations, if compatible with military mission.	C. Mensing	USFWS	M. Kleitch	population of EMR on CGMTC. Additional eDNA surveys will be done in the near future to determine presence in potentially suitable habitat in other parts of CGMTC.
PM2.4					Clarify what is meant by maintain permits for T&E species ? 10a1a permits for recovery actions, or section 7 authorization / section 10a1b permits for incidental take?	C. Mensing	USFWS	M. Kleitch	clarification added to implementation table

Section	Page	Paragraph	Line	Sentence	Comment (CAMP GRAYLING INRMP)	Reviewer	Office of Reviewer	Name of Responder	Action Taken to Address the Comment:
					Priority actions should be established to detect Per- and polyfluoroalkyl substances (PFAS) and their impact to wildlife and human environment, and remediation of contaminated sites, as appropriate	C. Mensing	USFWS	J. Edglery	Priority actions to evaluate the impacts of PFAS to CGMTC wildlife and CGMTC natural resources components have been initiated by the National Guard Bureau (NGB) in accordance with the CERCLA process. National Guard Bureau in conjunction with Michigan Department of Military and Veterans Affairs closely coordinates with the community and local and state partners as they continue to move throughout the stepwise investigative process; including but not limited to EGLE, MDHHS, Local Health Department #10, DNR, Installation Restoration Advisory Board, and MPART.
					Prioritize restoration/enhancement activities in the pine barrens / portlage creek - howes lake complex / STA9 area. (fire management, invasive species management, research, etc)	C. Mensing	USFWS	M. Kleitch	Specific management activities and priorities are identified in HQNA an Pine Barrens Management Area management plans
					Provide specific protection around the Voss's goldenrood site (Portage Creek Howes Lake Complex), and the Hungerford's crawling water beetle site (if 400ft riparian protection buffer is not adequate)	C. Mensing	USFWS	M. Kleitch	These areas have protections under wetland and stream related restrictions and are included in the Limitations Memo, Appendix H and Figure 5
					We suggest adding specific actions to promote/enhance sites for pollinators.	C. Mensing	USFWS	M. Kleitch	FW2.6 and FW2.7 are focused on surveys and BMP's for pollinators. This project is scheduled to begin in 2021 pending funding.
					Regarding Section 7, ESA review, "we request that you re-evaluate your determination of effects and consult with our office as appropriate".	J. Dingledine	USFWS	M. Kleitch	In repsonse to the comment, a memo request for informal consultation was sent with the INRMP cover letter. The memo requests USFWS concurrence with our determination "May affect, not likely to adversely affect" for the species listed.

APPENDIX C

LIST OF RELEVANT LAWS, REGULATIONS, EXECUTIVE ORDERS AND POLICIES

Federal Laws

American Indian Religious Freedom Act of 1978 (Public Law 95-341; 42 United States Code [USC] §1196) – requires the US, where appropriate, to protect and preserve religious rights of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

Animal Damage Control Act of 1931 (7 USC §426 *et seq.*) – provides broad authority for investigation, demonstrations and control of mammalian predators, rodents and birds.

Anti-Deficiency Act of 1982 (31 USC §1341 *et seq.*) - provides that no federal official or employee may obligate the government for the expenditure of funds before funds have been authorized and appropriated by Congress for that purpose.

American Antiquities Act of 1906 (Public Law 59-209; 16 USC §431-433) – authorizes the President to designate historic and natural resources of national significance, located on federal lands, as National Monuments for the purpose of protecting items of archeological significance.

Archeological and Historical Preservation Act of 1974 (Public Law 95-96; 16 USC §469 *et seq.*) – provides for the preservation of historical and archeological data, including relics and specimens, threatened by federally funded or assisted construction projects.

Archeological Resources Protection Act of 1979 (16 USC §470 *et seq.*) – prohibits the excavation or removal from federal or Indian lands any archeological resources without a permit.

Bald Eagle Protection Act of 1940 (Public Law 87-884; 16 USC §668a-d) – prohibits the taking or harming (i.e. harassment, sale, or transportation) of bald eagles or golden eagles, including their eggs, nests, or young, without appropriate permit.

Clean Air Act of 1970 (42 USC §7401 *et seq.*) – regulates air emissions from stationary, area, and mobile sources. This law authorizes the US Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment.

Clean Water Act of 1972 (Public Law 92-500; 33 USC §1251 *et seq.*) – aims to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Under Section 401, states have authority to review federal permits that may result in a discharge to wetlands or water bodies under state jurisdiction. Under section 404, a program is established to regulate the discharge of dredged or fill material into the Nation's waters, including wetlands.

Coastal Zone Management Act of 1972 (Public Law 92-583; 16 USC §1451 *et seq.*) – provides incentives for coastal states to develop coastal zone management programs. Federal actions that impact the coastal zone must be consistent to the maximum extent practicable with the state program.

Conservation and Rehabilitation Program on Military and Public Lands (Public Law 93-452; 16 USC §670 *et seq.*) – provides for fish and wildlife habitat improvements, range rehabilitation, and control of off-road vehicles on federal lands.

Conservation Programs on Military Reservations (Public Law 90-465; 16 USC §670 *et seq.*) – Requires each military department to manage natural resources and to ensure that services are provided which are necessary for management of fish and wildlife resources on each installation; to provide their personnel with professional training in fish and wildlife management; and to give priority to contracting work with federal and state agencies that have responsibility for conservation or management of fish and wildlife. In addition, it authorizes cooperative agreements (with states, local governments, non-governmental organizations, and individuals) which call for each party to provide matching funds or services to carry out natural resources projects or initiatives.

Defense Appropriations Act of 1991 (Legacy Program) – establishes the "Legacy Resource Management Program" for natural and cultural resources with emphasis is on inventory and stewardship responsibilities.

Emergency Wetlands Resources Act of 1986 (16 USC §3901-3932) – requires reporting of wetland loss by the Secretary to Congress; authorizes the purchase of wetlands; requires the Secretary to establish a National Wetlands Priority Conservation Plan; and requires states to include wetlands in their Comprehensive Outdoor Recreation Plans, among others.

Endangered Species Act of 1973, as amended (16 USC §1531 *et seq.*) – provides for the identification and protection of threatened and endangered plants and animals, including their critical habitats. Requires federal agencies to conserve threatened and endangered species and cooperate with state and local authorities to resolve water resources issues in concert with the conservation of threatened and endangered species. This law establishes a consultation process involving federal agencies to facilitate avoidance of agency action that would adversely affect species or habitat. Further, it prohibits all persons subject to US jurisdiction from taking, including any harm or harassment, endangered species.

Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (Public Law 92-516; 7 USC §136 *et seq.*) – governs the use and application of pesticides in natural resource management programs. This law provides the principal means for preventing environmental pollution from pesticides through product registration and applicator certification.

Federal Land Policy and Management Act of 1976 (43 USC §1701) – establishes public land policy and guidelines for its administration and provides for the management, protection, development, and enhancement of the public lands.

Fish and Wildlife Conservation Act of 1980 (Public Law 96-366; 16 USC §2901 *et seq.*) – encourages management of non-game species and provides for conservation, protection, restoration, and propagation of certain species, including migratory birds threatened with extinction.

Fish and Wildlife Coordination Act of 1934 (16 USC §661 *et seq.*) – provides a mechanism for wildlife conservation to receive equal consideration and coordinate with water-resource development programs.

Military Reservations and Facilities: Hunting, Fishing and Trapping (an update to the Military Construction Authorization Act; 10 USC §2671) – dictates that the Secretary of Defense require that all hunting, fishing, and trapping on military installations be in accordance with the fish and game laws of the State in which it is located, that license be obtained (except with respect to members of the armed forces), and that safety protocols be enacted.

Land and Water Conservation Act of 1965 (16 USC §4601 *et seq.*) – assists in preserving, developing, and assuring accessibility to outdoor recreation resources.

Migratory Bird Conservation Act of 1929 (16 USC §715 *et seq.*) – establishes a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds.

Migratory Bird Treaty Act of 1918 (Public Law 65-186; 16 USC §703 *et seq.*) – provides for regulations to control taking of migratory birds, their nests, eggs, parts, or products without the appropriate permit and provides enforcement authority and penalties for violations.

National Environmental Policy Act of 1969 (Public Law 91-190; 42 USC §4321 *et seq.*) – mandates federal agencies to consider and document environmental impacts of proposed actions and legislation. In addition, it mandates preparation of comprehensive environmental impact statements where proposed action is "major" and significantly affects the quality of the human environment.

National Historic Preservation Act of 1966, as amended (PL 89-665; 16 USC §470 et seq.) – directs federal agencies to take into account the effect of any undertaking (a federally funded or assisted project) on historic properties.

Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601; 25 USC §3001-3013) – addresses the recovery, treatment, and repatriation of Native American and Native Hawaiian cultural items by federal agencies and museums. It includes provisions for data gathering, reporting, consultation, and issuance of permits.

Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990 – created the Aquatic Nuisance Species Task Force which is committed to preventing and controlling aquatic nuisance species and implementing the act.

Noxious Plant Control Act (PL 90-583) – provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.

Plant Protection Act of 2000[1] **(7 USC §7701 et seq.) (replaces Federal Noxious Weed Act of 1973 [PL 93-629] –** authorizes the USDA to prohibit or restrict the importation or interstate movement of any plant, plant product, biological control organism, noxious weed, article, or

[1] Replaces Federal Noxious Weed Act of 1974 (Public Law 93-629; 7 USC §2801).

means of conveyance if the Secretary of Agriculture determines it is necessary to prevent introduction or spread of plant pests or noxious weeds.

Plant Quarantine Act (7 USC §151-167) – regulates the importation and interstate movement of nursery stock and other plants that may carry pests and diseases that are harmful to agriculture.

Readiness and Environmental Protection Initiative (within Section 2811, FY 2003 National Defense Authorization Act) (10 USC §2684a) – outlines agreements to limit encroachments and other constraints on military training, testing, and operations.

Resource Conservation and Recovery Act of 1976 (42 USC §6901 *et seq.*) – establishes a comprehensive program which manages solid and hazardous waste. Subtitle C, Hazardous Waste Management, sets up a framework for managing hazardous waste from its initial generation to its final disposal. Waste pesticides and equipment/containers contaminated by pesticides are included under hazardous waste management requirements.

Sikes Act Improvement Act of 1997 (Public Law 105-85; 16 USC §670a *et seq.*) – amends the Sikes Act of 1960 to mandate the development of an integrated natural resources management plan through cooperation with the Department of the Interior (through the US Fish and Wildlife Service [USFWS]), Department of Defense, and each state fish and wildlife agency for each military installation supporting natural resources.

Soil Conservation Act of 1935 (16 USC §590a *et seq*.) – provides for soil conservation practices on federal lands.

Watershed Protection and Flood Prevention Act (PL 84-566; 16 USC §1001-1009) – the Soil Conservation Service at the Department of Agriculture provides planning assistance and construction funding for projects constructed by local sponsors, often in the form of flood control districts.

Federal Regulations

15 Code of Federal Regulations [CFR] 930 – Federal Consistency with Approved Coastal Management Programs

32 CFR 190 – Natural Resources Management Program

40 CFR 6 – USEPA Regulations on Implementation of NEPA Procedures

40 CFR 162 – USEPA Regulations on Insecticide, Fungicide, and Rodenticide Use

40 CFR 1500-1508 – Council on Environmental Quality (CEQ) Regulations on Implementing National Environmental Policy Act (NEPA) Procedures

50 CFR 17 – USFWS list of Endangered and Threatened Wildlife

50 CFR 10.13 – List of Migratory Birds

32 CFR 651 – Environmental Effects of Army Actions

Federal Executive Orders (EOs)

Environmental Safeguard for Activities for Animal Damage Control on Federal Lands (EO 11870) - restricts the use of chemical toxicants for mammal and bird control.

Exotic Organisms (EO 11987) – restricts federal agencies in the use of exotic plant species in any landscape and erosion control measures.

Floodplain Management (EO 11988) – specifies that agencies shall encourage and provide appropriate guidance to applicant to evaluate the effects of their proposals in floodplains prior to submitting applications. This includes wetlands that are within the 100-year floodplain and especially discourages filling.

Off-Road Vehicles on Public Lands (EO 11989[2]) – establishes criteria for designating public lands as open, limited or closed to the use of off-road vehicles (ORVs) and establishes rules for use and operation of ORVs in order to protect the resources of the public lands, to promote safety, and to minimize conflicts among various users.

Protection of Wetlands: Amends Executive Order 11990 (EO 12608) – directs all federal agencies to take action to minimize the destruction loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. This applies to the acquisition, management, and disposal of federal lands and facilities; to construction or improvements undertaken, financed, or assisted by the federal government; and to the conduct of federal activities and programs which affect land use.

Protection and Enhancement of Environmental Quality: Amends Executive Order 11514 (EO 11991) – provides for environmental protection of federal lands and enforces requirements of NEPA.

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 12898) – requires environmental protection for all communities by focusing federal attention on the environmental and human health effects of federal actions on minority and low-income populations.

Energy Efficiencies and Water Conservation at Federal Facilities (EO 12902) – federal agency use of energy and water resources is directed towards the goals of increased conservation and efficiency.

Indian Sacred Sites (EO 13007) – provides for the protection of and access to Indian sacred sites.

Protection of Children from Environmental Health Risks and Safety Risks (EO 13045) – requires that the USEPA evaluate the effects of a planned regulation on children and explain why the regulation is preferable to potentially effective and reasonably feasible alternatives.

[2] Amends Executive Order 11644.

Invasive Species (EO 13112) – directs federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Greening the Government through Leadership in Environmental Management (EO 13148) – requires the head of each federal agency to be responsible for ensuring that all necessary actions are taken to integrate environmental accountability into agency day-to-day decision making and long-term planning processes across all agency missions, activities, and functions.

Consultation and Coordination with Indian Tribal Governments (EO 13175) – ensures that all federal departments and agencies consult with Indian tribes and respect tribal sovereignty as they develop policy on issues that impact Indian communities.

Responsibilities of Federal Entities to Protect Migratory Birds (EO 13186) – directs all federal agencies taking actions that have a potential to negatively affect migratory bird populations to develop and implement a Memorandum of Understanding with the USFWS by January 2003 that shall promote the conservation of migratory bird populations.

Strengthening Federal Environmental, Energy, and Transportation Management (EO 13423) – requires federal agencies to lead by example in advancing the nation's energy security and environmental performance by establishing new and updated goals, practices, and reporting requirements for environmental, energy, and transportation performance and accountability.

Facilitation of Hunting Heritage and Wildlife Conservation (EO 13443) – directs the Department of the Interior and its component agencies, bureaus and offices facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

Executive Order 13148: Greening the Government Through Leadership in Environmental Management (2000). – requires federal laboratories, testing facilities, maintenance facilities, hospitals, and others with operations that interact with the environment across all federal departments and agencies to implement an Environmental Management System (EMS) by December 31, 2005.

Presidential Memorandum, Government-to-Government Relations with Native American Tribal Governments (1994)– outlines principles that federal executive departments and agencies must follow in their interactions with Native American tribal governments such that the federal government operates within a government-to-government relationship with federally-recognized Native American Tribes.

Department of Defense Directive (DODD), Department of Defense Instruction (DoDI), Army Regulation (AR), & Army National Guard Regulation (ARNG)

DoDD 4150.7, DoD Pest Management Program

DoDD 4700.4, Natural Resources Management Program[3]

DoDD 4710.1, Archaeological and Historic Resources Management

DoDD 4715.1E, Environment, Safety, and Occupational Health

DoDD 6050.1, Environmental Effects in the US of DoD Actions

DoDD 6050.2, Use of Off-Road Vehicles on DID Lands

DoDI 4150.07, Pest Management Program

DoDI 4165.57, Air Installations Compatible Use Zones

DoDI 4715.03, Natural Resources Conservation Program

DoDI 4715.1, Environmental Security

DoDI 4715.9, Environmental Planning and Analysis

DoDI 6055.06, Fire and Emergency Services Program

Department of Defense, American Indian and Alaska Native Policy

AR 200-1 Environmental Protection and Enhancement dated 13 December 2007

AR 210-9 – Use of Off-Road Vehicles on Army Lands

AR 215-1 – Morale, Welfare, and Recreation Activities and Non-Appropriated Fund Instrumentalities

AR 315-19 – The Army Sustainable Range Program

AR 405-80 – Management of Title and Granting Use of Real Estate

AR 420-40 – Historic Preservation

AR 420-90 – Fire and Emergency Services

ARNG Guidance for the Creation, Implementation, Review, and Revision and Update of INRMPs dated 9 April 2012

[3] Cancels DoD Directive 4700.1. Replaced by 32 CFR 190 – Natural Resources Management Program.

Department of Defense Memoranda

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 20 Sept 11, Subject: *Interim Policy on Management of White Nose Syndrome in Bats*.

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 3 Apr 07, Subject: *Guidance to Implement the Memorandum of Understanding to Promote the Conservation of Migratory Birds*.

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 14 Aug 06, Subject: *Integrated Natural Resource Management Plan (INRMP) Template*

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 17 May 05, Subject: *Implementation of Sikes Act Improvement Amendments: Supplemental Guidance concerning Leased Lands*

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 1 Nov 04, Subject: *Implementation of Sikes Act Improvement Amendments: Supplemental Guidance concerning INRMP Reviews*

Memorandum, Deputy Under Secretary of Defense (Installations and Environment), 10 Oct 02, Subject: *Implementation of Sikes Act Improvement Act: Updated Guidance*

Memorandum, Assistant Deputy Under Secretary of Defense (Environment), 5 Aug 02, Subject: *Access to Outdoor Recreation Programs on Military Installations for Persons with Disabilities*.

Memorandum, Assistant Secretary of Army (Environment, Safety and Occupational Health), Deputy Assistant Secretary of the Navy (Environment), Deputy Assistant Secretary of the Air Force (Environment, Safety and Occupational Health), 20 Sep 11, *Subject: Interim Policy on Management of White Nose Syndrome in Bats*.

Memorandum, DAIM-ED Guidance for Implementation of the Sikes Act Improvement Act (SAIA) (Updated),25 May 2006. Subject: *USFWS and State involvement in developing INRMPs; defining "mutual agreement" with the USFWS and the appropriate State agency; and coordinating INRMPs with other planning statutes.*

Memorandum, DAIM-ZA (200-3) Army Wildland Fire Policy Guidance, 04 September 2002

Memorandum, United States Army policy entitled Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys (PLS) and INRMP ("Army INRMP Policy"); 21 March 1997

Memorandum, Army National Guard Directorate, Environmental Programs Division (ARNG-ILE) Guidance for the Creation, Implementation, Review, and Revision and Update of INRMPs; 9 April 2012

US Fish and Wildlife Service (USFWS) Guidance

USFWS Guidelines for Coordination on Integrated Natural Resource Management Plans (June 2015). Provides updated guidance to USFWS personnel for implementing the requirements of the Sikes Act. It replaces the following memorandum: *Guidance for Coordination of Department of Defense Sikes Act Integrated Natural Resource Management Plans (June 8, 2001).*

Michigan State Laws

Public Act 172 Crawford County Land dated 13 May 1913: Authorizes the military board to accept certain lands for state, authorizes fishing in Lake Margarethe, authorizes lease of facilities for training, and allows examination of documents to Grayling Recreation Authority.

Public Act 321 Recreational Authorities Act dated 1 December 2000: Provides for the establishment of recreational authorities; powers and duties of an authority; authorizes the assessment of a fee, the levy of a property tax, and the issuance of bonds and notes by an authority; and provides for the powers and duties of certain government officials.

Act 451 Natural Resources and Environmental Protection Act (NREPA), 1994 as amended: Michigan's environmental laws have been consolidated into the Natural Resources and Environmental Protection Act of 1994 (as amended).

The Natural Resource and Environmental Protection Act serves to protect the environment and natural resources of the state; to codify, revise, consolidate, and classify laws relating to the environment and natural resources of the state; to regulate the discharge of certain substances into the environment; to regulate the use of certain lands, waters, and other natural resources of the state; to prescribe the powers and duties of certain state and local agencies and officials; to provide for certain charges, fees, assessments, and donations; to provide certain appropriations; to prescribe penalties and provide remedies; and to repeal acts and parts of acts.

The Natural Resources and Environmental Protection Act is organized into Parts, which include Habitat Protection, Management of Renewable Resources, Management of Nonrenewable Resources, and Recreation. Details regarding the provisions within each Part can be found at: http://legislature.mi.gov/doc.aspx?mcl-act-451-of-1994. Other parts of NREPA may be applicable occasionally at Camp Grayling, but those listed below are the most applicable to the INRMP and its implementation.

Article II Pollution Control

Part 31 – Water Resources Protection: new or upgraded stream crossing or stream bank stabilization activities and any other alterations of water courses. Requires MDEQ/USACE Joint Permit Application (JPA). Other sections of Part 31 apply to wastewater and other water quality discharges and rules.

Part 91 – Soil Erosion and Sedimentation Control: specifies requirements related to soil erosion and sediment control, changes in land use, and enforcement by county and municipal entities.

Article III Natural Resources Management

Part 301 - Inland Lakes and Stream: most activities that occur within or along the shoreline of inland lakes and streams (e.g. dredging, installation of rip rap, interfering with the natural flow of water, etc.) require a permit (MDEQ/USACE JPA).

Part 303 - Wetlands Protection: most activities that alter a wetland require a permit (MDEQ/USACE JPA).

Part 305 - Natural Rivers: legal authority for managing river systems and regulating all land management or construction activities occurring on these river systems; Rules for Utilities and Publicly Provided Facilities (include standards related to road/stream crossings, erosion control, management of vegetation in utility corridors and others)

Part 309 - Inland Lake Improvements: provides for lake boards and establishes rules related to improvements and regulations on inland lakes.

Part 311 - Local River Management: provides for watershed councils, river management districts, and minimum stream flows, along with specifies duties and rules associated with them.

Part 355 - Biological Diversity Conservation: directs state agencies to recommend strategies for conserving biological diversity; has no regulatory requirements.

Part 365 - Endangered Species: protects and prohibits take of federally and state listed species and allows for certain exceptions.

Part 401 - Wildlife Conservation: generally relates to regulation of game species.

Part 411 - Protection and Preservation of Fish, Game, and Birds: generally relates to regulation of game species.

Part 831 – State Forest Recreation: defines recreation with state forests and establishes rules associated with recreation on state forest lands.

MDNR Wildland Fire Policy

- DNR Policy and Procedure 33.42-08, Prescribed Burning, revised September 20, 2013.
- DNR Policy and Procedure 33.42-09, Wildfires in State Natural Areas, issued July 11, 2005.

Forest, Mineral and Fire Management and Wildlife Division (FMFMD) Policy and Procedures

- DNR FMFMD Policy and Procedure 141, Wildfire Training for Fire Departments, dated October 22, 1999
- DNR FMFMD Policy and Procedure 161, Physical Fitness Standards, dated February 17, 2000
- DNR FMFMD Policy and Procedure 511, Five-Year Unit Management Planning, undated

- DNR FMFMD Policy and Procedure 512, Annual Fire Plan, dated December 13, 1999
- DNR FMFMD Policy and Procedure 514, Incident Command System
- DNR FMFMD Policy and Procedure 521, Forest Fire Law, dated June 16, 1981
- DNR FMFMD Policy and Procedure 522, Control of Open Burning, dated June 16, 1981
- DNR FMFMD Policy and Procedure 542, Fire Operations Involving Structures, dated March 24, 1988
- DNR FMFMD Policy and Procedure 572, Wildfires in State Natural Areas, dated March 15, 2001
- DNR FMFMD Policy and Procedure 581, Prescribed Burning, undated.

MDNR Director's Order No. FO-224.13 - It shall be unlawful to kill, take, trap, possess, buy, sell, offer to buy or sell, barter, or attempt to take, trap, possess or barter any reptile or amphibian from the wild, or the eggs of any reptile or amphibian from the wild, except as provided within this Order. Available at: https://www.michigan.gov/documents/dnr/FO-224-02_182417_7.pdf

Michigan Department of Agriculture

Regulation No. 637, Pesticide Use, amended 2008, section 8325 of 1994, PA 451, MCL 324.8325 - The statute that regulates pesticide products including their use, the people that apply them, licensing requirements, and penalties.

Regulation No. 636, Pesticide Applicators, amended 1991, section 8325 of 1994, PA 451, MCL 324.8325 - Rules that regulate pesticide applicators including categories of certification and registration, and licensing of firms that apply pesticides and record keeping.

APPENDIX D
FIGURES

E.1 CLIMATE

E.1.1 CLIMATE SUMMARY

Camp Grayling is located approximately halfway between Lake Michigan and Lake Huron (see Figure 1 in Appendix D). Winters are cold, with an annual extreme minimum temperature of -20° F. The prevailing winds are westerly during the summer as the Bermuda high-pressure center pushes into the southeastern United States. Climatic effects of Lakes Michigan and Huron are discernible in their influence on snowfall and cloud cover during the late fall and early winter months. Afternoon showers and thundershowers are the major sources of summer precipitation.

Table E-1 provides an overview of climate in Grayling, MI (located in the center of Camp Grayling) from 1891 to 2016.

Table E-1. Climate Summary for Grayling, Michigan, 1891-2016

Month	Temperature (°F) - Average Daily			Average Total (Inches)	
	Maximum	Minimum	Mean	Precipitation	Snowfall
January	25.8	8.9	17.4	1.69	11
February	27.5	7.1	17.3	1.38	14
March	37.7	15.8	26.8	1.70	9
April	52.9	29.0	46.4	2.61	1
May	66.7	39.9	58.2	3.23	0
June	76.7	49.7	65.4	3.45	0
July	80.9	54.1	66.4	3.50	0
August	78.3	51.8	61.7	3.26	0
September	70.0	45.1	52.8	3.52	0
October	57.8	35.6	42.1	3.06	1.5
November	42.2	26.3	28.8	2.67	10.7
December	30.2	15.3	30.9	1.78	20.3
Annual	*53.9*	*31.5*	*42.7*	*31.85*	*90.8*

Source: (WRCC 2018)

Based on a comparison of historical data from Grayling, MI for the periods 1961-1990 and 1981-2010, there has been no change in average minimum or maximum temperature, average temperature overall increased by 0.5°F and average precipitation increased 1 inch between those two time periods (WRCC 2018). Extreme temperature data for the area include record high temperatures of 101°F in July of 1901, 1916, and 1921 and a record low of -37°F in February 1979 (NWS 2018).

For comparison, a more comprehensive summary of historical climate data from the 1950s to present is available for Gaylord, MI (immediately north of Camp Grayling) at http://glisa.umich.edu/media/climatologies/GaylordMI_Climatology.pdf. For the most recent climatological period (1981-2010), the mean annual temperature was 44°F, with an average of only 3 days per year over 90°F and 164 days per year below 32°F. The mean annual precipitation was 35 inches, with a range from 28 to 44 inches and an average of only 4 days

per year with more than 1 inch of precipitation. The average annual snowfall in the area is 141.4 inches, more than double that at Houghton Lake which is only 25 miles south (NWS 2018). This circumstance arises because Gaylord is on the backside of the "Lake Snow Belt" - an area centered in the western section of the lower peninsula's tableland region approximately 30 miles north of Grayling.

Over a broader regional scale, an analysis of changes over the last century was analyzed for the northeastern lower peninsula including Otsego and Crawford counties (http://glisa.umich.edu/division/mi04), from 1950 to 2017. This analysis indicates that mean annual precipitation has increased by 2.4 inches while the mean annual temperature has increased by 2.7°F.

E.1.2 REGIONAL PROJECTIONS

It is expected that Michigan's lower peninsula will experience an overall warming trend assuming emissions of greenhouse gases continue to rise (projections are based on RCP8.5). Regional projections for the northeastern lower peninsula have been developed by GLISA and are summarized below in Table E-2, using the Gaylord, MI summary as a benchmark. Note that Gaylord, MI receives more precipitation and snowfall than Grayling, MI just a short distance to the south. Camp Grayling itself may receive different amounts of precipitation and snowfall, depending on the part of Camp Grayling.

Table E-2. Climate Projections for Northeastern Lower Peninsula, Michigan

	Annual (Range)
Mean Temperature (°F)	
1981-2010 Average for Gaylord, MI	43.8
Regional Mid-Century Expected Change	+4 (+2 to 5)
Regional End of Century Expected Change	+8 (+5 to 10)
Days over 90°F (days/year)	
1981-2010 Average for Gaylord, MI	3
Regional Mid-Century Expected Change	+17 (+8 to 27)
Regional End of Century Expected Change	+39 (+23 to 57)
Mean Precipitation (inches)	
1981-2010 Average for Gaylord, MI	35.3
Regional Mid-Century Expected Change	+0.7 (-2 to +2)
Regional End of Century Expected Change	+2.5 (-1 to +6)
Annual Snowfall (inches)	
1891-2016 Average for Gaylord, MI	91
Regional Mid-Century Expected Change	-17 (-11 to -24)
Regional End of Century Expected Change	-33 (-28 to -40)
Heavy Precipitation (> 1 inch) (days/year)	
1981-2010 Average for Gaylord, MI	4
Regional Mid-Century Expected Change	+1 (+0.3 to 2)
Regional End of Century Expected Change	+2 (+1 to 3)

Sources: (Notaro et al. 2013, 2014, 2016; WRCC 2018; GLISA 2019)

Base Period for calculating change is 1980-1999 based on regional data, Mid-Century is 2040-2059, End of Century is 2080-2099.

Farming, timber, and tourism industries employ the most people in the area around Camp Grayling, and are expected to be negatively impacted when compared to historic climate changes (GLISA 2013). In terms of natural resources, the increase in number of days over 90°F and the reduction in snowfall are likely to change critical conditions for some species and potentially shift species ranges, along with the overall increase in average temperature. As vulnerability assessments are completed and updated, individual species and vegetative communities should be identified for monitoring and in some cases mitigating actions may be identified.

E.2 LANDFORMS, GEOLOGY AND SOILS

The University of Michigan delineated the state's 91 physiographic regions (Schaetzl et al. 2013). Camp Grayling covers five physiographic regions, all located within the major physiographic region called the High Plains, a large area in the north-central portion of the lower peninsula that is high in elevation with thick, sandy drift formed by direct glacial deposition, as well as deposition by meltwater and lakes. The Grayling Outwash Plain ranges in elevation from 900 to 1,580 feet (Albert 1995).

The Physiographic Map of Michigan (Schaetzl et al. 2013) shows the following five regions which make up Camp Grayling. The majority of the northern part of the installation is in the Grayling Fingers physiographic region, with flat-floored valleys separating five "Finger" plateaus, which is the highest part of the high plains. Below the Grayling Fingers region is the Outer Port Huron Plains, named for the outwash plain created by the Outer Port Huron glacial advance, which slopes toward the Manistee and Au Sable Rivers to the west and east, respectively (Schaetzl et al. 2013). South of the Outer Port Huron Plains is the third physiographic region, the Manistee – Au Sable Escarpment, which is a bisected, generally north-facing escarpment along the southern edge of Manistee and Au Sable River valleys. Fourth is the Houghton Lake Basin, the lowest and wettest area in the central region. The Houghton Lake Basin is a bowl-shaped, low-moderate relief plain, interspersed with isolated, high, dry, sandy ridges. A very small part of the southern part of the installation falls within the Cadillac Morainic Uplands, an area of high relief with many kettles and short, steep slopes.

Most of the outwash plains occur between 1,050 and 1,300 ft. above sea level, and Camp Grayling lands encompass this range. The sandy outwash deposits are highly variable in depth, from 1 to approximately 100 m (3 to 300 ft) thick. Where outwash deposits are thick, soils are excessively drained and very dry. Lake Margrethe is a large kettle lake formed by an ice block buried in sandy outwash over clay lacustrine deposits.

Michigan's Northern Lower Peninsula was completely glaciated during the Late Wisconsinan period. Common glacial landforms in this region include lake plain, outwash plain, end moraine and ground moraine (MDNR 2012b). The geology underlying Camp Grayling is the result of the latest episode of continental glaciation, with no exposed bedrock – the glacial till is 250 to 800 feet thick in the Grayling Outwash Plain (Albert 1995). Thus, glacial till and outwash are the major parent materials for the soils of the camp. The region is primarily of Paleozoic age with interbedded layers of shale, sandstone, and limestone ranging in total thickness from 500 to 600 feet were formed 325-350 million years ago from the deposition of marine sediments from ancient seas (Albert 1995). As these sedimentary layers were deposited, the earth's crust

subsided beneath Michigan forming what is today called the Michigan Basin. The glaciers in this region created two separate moraines underlying Camp Grayling. A southern moraine, which is several hundred feet thick, was deposited south of Lake Margrethe. A northern moraine of similar thickness was deposited north of Lake Margrethe (Schaetzl et al. 2013).

The soils at Camp Grayling are largely a result of soil-forming factors operating on the glaciofluvial parent materials (USDA 1989, 2018).The soils are predominantly sandy soils that are somewhat excessively to excessively drained. These soils exhibit relatively low fertility and vegetation production potentials but a high tolerance to the compaction and erosion impacts of vehicle use. The rest of the soils present on the camp range from very poorly drained to well-drained soils. These can be found on the outwashes, wetlands, and other low areas (USDA 2018).

There are three primary soil series and four soil groups within the camp. The three distinct soil series which comprise approximately 70% of the camp are the Graycalm, Grayling, and Rubicon soil series (Figure 4 in Appendix D).

(a) Graycalm Series: The most common soil is the Graycalm soil series. By itself the soil comprises about 14% of the soil on the camp and approximately 28% considering its inclusion in soil complexes. Graycalm soils are excessively drained and have rapid permeability. Water erosion potential is low except on slopes greater than 18% and the soil is extremely erodible by wind in wide open exposed sites.

(b) Grayling Series: The second most common soil is the Grayling soil series. This soil covers approximately 23% of the camp and an additional 15% in soil complexes. Grayling soils consist of excessively drained sandy soils found on outwash plains and outwash terraces. The Grayling soils have rapid permeability, are an erosion hazard on slopes greater than 18%, and are highly susceptible to wind erosion in large open exposed areas.

(c) Rubicon Series: The third distinct soil series, comprising 5% of the camp and another 5% in complexes with other soil series is the Rubicon series. It consists of excessively drained soils found on outwash plains and terraces. These soils are extremely susceptible to wind erosion when exposed and are subject to water erosion on slopes greater than 18%.

Wind erosion is dependent on characteristics of climate, soil and vegetation. The wind velocity, direction, duration, and turbulence are important determinants of erosion. As wind velocity and duration of turbulence increases, the quantity of soil loss increases. The wind erosion potential is particularly dependent on the length of unprotected area relative to wind direction and on the amount of protective vegetation on the surface.

Soils are assigned to wind erodibility groups (WEG) of 1 to 8 based on the texture of the surface layer. A WEG value of 1 refers to soils consisting of very fine, fine, and medium sand, which erode easily. A WEG value of 8 refers to soils consisting of very wet or stony soils, which are not subject to erosion.

The water erosion potential is dependent on the percent and length of slope, the rainfall intensity, the vegetative cover, and specific soil characteristics like texture. Water erosion increases as slope and rainfall increase and as the vegetative cover and soil particle size decrease.

A complete list of the soils found at Camp Grayling is shown in Table E-3, including the corresponding water and wind erodibility classifications. Soils are assigned to wind erodibility groups (WEG) of 1 to 8 based on the texture of the surface layer. Soils with a "high" water erosion potential or a wind erodibility index of "2" or less are very susceptible to erosion once they are disturbed. For the most part, the soils at Camp Grayling have a high wind erosion potential and a low water erosion potential. Table E-3 does not include soils that occur on less than 500 acres within Camp Grayling.

Table E-3. Water and Wind Erosion Potential for the Soils of Camp Grayling

Soil Series, Percent Slope	Acres	Water Erosion Potential	Wind Erodibility Index Group
Au Gres sand, 0 to 3 % slope	2,158	slight	1
Ausable-Bowstring mucks, frequently flooded	643	slight	2, 8
Blue Lake sand, 0 to 18 % slope	1,250	slight	1
Croswell sand, 0 to 3 % slope	7,943	slight	1
Dawson-Loxley peat, 0 to 2 % slope	710	slight	7
Graycalm sand, 0 to 18 % slope	39,611	slight	1
Graycalm sand, 18 to 45 % slope	3,007	moderate	1
Graycalm-Klacking complex, 6 to 18 % slopes	11,944	slight	1, 2
Grayling sand, 0 to 18 % slope	27,831	slight	1
Grayling sand, 18 to 45 % slope	2,943	moderate	
Kalkaska sand, 0 to 18 % slope	4,013	slight	1
Kalkaska sand, 18 to 45 % slope	843	moderate	1
Kinross muck, 0 to 2 % slope	1,692	slight	2
Kinross-Au Gres complex, 0 to 3 % slopes	1,484	slight	1, 2
Klacking loamy sand, 0 to 6 % slopes	2,359	slight	2
Leafriver muck, 0 to 1 % slope (with or without Tawas)	3,579	slight	2
Montcalm loamy sand, 0 to 6 % slope	1,213	slight	2
Rubicon sand, 0 to 18 % slope	9,835	slight	1
Rubicon sand, 18 to 45 % slope	926	moderate	1
Rubicon-Graycalm sands, 0 to 18 % slopes	4,538	slight	1
Rubicon-Graycalm sands, 18 to 45 % slopes	1,409	moderate	1
Tawas-Lupton muck, 0 to 2 % slope	3,579	slight	2
Udipsamments (multiple forms)	10,203	n/a	n/a

*Source: (USDA 1989; NRCS 2018)

E.3 SURFACE WATER

Camp Grayling is located in the Northern Lakes and Forests Ecoregion in the northern portion of Michigan's Lower Peninsula, on the Mio Plateau (Omernik & Gallant 2010). Most streams in this ecoregion are perennial and are formed from glacial lakes or wetlands. Stream density is approximately one mile per square mile. Typically, surface waters in the Northern Lakes and Forests Ecoregion carry few sediments, although they often have high levels of dissolved organic matter. Historic logging activity and extensive fires have altered stream quality by adding woody debris, changing flow dynamics, and affecting water temperatures over time.

Camp Grayling is situated within three major watersheds: the Manistee, the Au Sable, and the Muskegon (see Figure 5 in Appendix D) through a 185-mile stream network. The two major rivers draining Camp Grayling slope in opposite directions and are the Manistee River and the Au Sable River. The Manistee River drains the southern portion of the installation and flows west into Lake Michigan. The Au Sable River drains the northern portion of the installation, flows southeast, and drains into Lake Huron. A third drainage from Camp Grayling is not associated with a river on base, but the Muskegon River drains the small southeast corner of Kalkaska county that lies within CGMTC. Due to the layout of Camp Grayling, little of the actual river beds for any major rivers are within its boundaries, although they are close to the boundaries (see Figure 5 in Appendix D).

The majority of the installation falls within the Au Sable Watershed (HUC 04070007), which covers most of Crawford County and the southern portion of Otsego County (USGS 2018) in the northern part of CGMTC. Elevation in the Au Sable Watershed ranges widely from approximately 575 ft to 1540 ft (Montana State University 2013). The Manistee Watershed (HUC 04060103) reaches into all three counties associated with Camp Grayling – Kalkaska county, the western and central borders of Crawford county (including Lake Margrethe), and the southwest corner of Otsego County (USGS 2018), and drains the southern portion of the base. Elevation in the Manistee Watershed ranges from approximately 575 ft to 1700 ft (Montana State University 2013). A small area adjacent to the Manistee Watershed, the Muskegon Watershed (HUC 04060102) drains a small area in the extreme south of CGMTC in both Kalkaska and Crawford counties, but there are no identified streams in this area. Pertinent data relative to surface waters at Camp Grayling are given in Table E-4.

Table E-4. Surface Waters on Camp Grayling

Watershed	Drainage Area (acres)	Stream Length (miles)	Lake/Pond Surface Area (acres)
Au Sable	90,079	25	311
Manistee	54,303	30	37*
Muskegon	2,979	0	0.1
Total	*147,361*	*185*	*348*

* Only includes 3 acres of the surface area of Lake Margrethe.
Source: National Hydrology Dataset, USGS 2018

E.3.1 RIVERS

Manistee River

The Manistee River (HUC 04060103) is a major tributary to Lake Michigan, draining approximately 1,950 square miles (1,247,879 acres) in the northwest portion of Michigan's Lower Peninsula (Blumer et al. 2006). The Upper Manistee River was designated as a state Natural River in 2003 by MDNR Fisheries Division. It was also designated from the MDNR boat ramp below Tippy Dam to the Michigan State Highway 55 Bridge as a National Recreational River by Congress in 1992 (26 miles of river) (National Wild and Scenic River System 2018).

Seventy percent of the watershed is forested (USFS 1983). The major tributaries include the North Branch of the Manistee, Bear Creek, and the Pine River. Mean discharge at Manistee

River for data covering the last 97 years is 1,560 cubic feet per second (cfs), with a maximum of 2,880 cfs and a minimum of 841 cfs (USGS 2017).

Approximately 54,303 acres of Camp Grayling lands (37%) occur in the Manistee watershed, all in South Camp.

(a) Manistee River at Camp Grayling: Camp Grayling is in close proximity to the Manistee River and several tributaries, including the North Branch of the Manistee River, Portage Creek, Black Creek, Goose Creek, Clear Creek, Big Devil Creek, Little Cannon Creek, and Big Cannon Creek. The main stem of the Manistee River parallels the western boundary of a portion of the South Camp. This reach of the Manistee main stem, approximately 27 miles in length, is a third order stream, extending from near the Michigan Highway 72 bridge to the Civilian Conservation Corps bridge on Sunset Trail (County Road 608) upstream from Sharon Road. The Black Creek Training Area is adjacent to approximately 11 miles of the North Branch of the Manistee River.

(b) Headwaters Main Stem Corridor: The headwaters of the Manistee River contain lowland conifer swamps, alder swamps, and scattered upland birch-aspen communities. This segment of the Manistee River is narrow and only 2 – 3 feet in width but widens considerably (up to 40 feet) upon reaching County Road 612 bridge, west of Frederic. The river flows through conifer swamps and occasionally into open marshes (one-half to one mile wide), and in the area above the confluence of Goose Creek multiple channels occur. Banks are often low (1 – 2 feet) providing an open view of adjacent uplands.

(c) South Camp Main Stem Corridor: From County Road 612 bridge, downstream to County Road 608 (Sunset Trail) bridge, the Manistee River becomes more readily defined into a single channel with tall banks. This section has many riffles with relatively little woody debris and obstructions. Swampy areas occur less frequently in this segment which is highly scenic. Stands of spruce, fir, and tamarack are visible along this section but eventually yield to red and white pine intermixed with upland northern hardwoods. This section of the Manistee parallels the western boundary of a large portion of the South Camp.

(d) North Branch Manistee River Corridor: The North Branch of the Manistee flows in a southwest direction along the western edge of South Camp, eventually meeting the Manistee main stem at Sharon. This section of the North Branch is predominantly open marsh and alder lowlands. Stream width is approximately 15 feet, water depth is about 18 inches, and beaver dams and woody debris clog the main channel (USFS 1983). Visibility is restricted by dense vegetation and access is limited.

(e) Portage Creek: This major tributary to the Manistee, located entirely within South Camp, flows approximately six miles from the northwest end of Lake Margrethe to the Manistee River. It is the primary outlet for Lake Margrethe. Five streambank erosion sites have been stabilized, two sand traps placed, and several stream crossing improvements have been completed. Portage Creek was evaluated for erosion potential in 2016, and it was found to have stabilized from former severe erosion years and adjusted to the flow regime regulated by the dam that serves to maintain a constant water level at Lake Margrethe (Williams 2016).

(f) Other Tributaries: The other six creeks in the Manistee River watershed are less than ten miles in length and flow through small portions of the camp. These creeks are Black Creek, Goose Creek, Clear Creek, Big Devil Creek, Little Cannon Creek, and Big Cannon Creek.

Au Sable River

The Au Sable River (HUC 04070007) is a major tributary to Lake Huron, draining an area of 2,049 square miles (1,311,053 acres) in northcentral lower Michigan. More than 70% of the watershed is forested (USFS 1983). Major tributaries include the East Branch, North Branch, and South Branch. Mean annual flows for the main stem of the Au Sable at Grayling is 76 cfs (Zorn et al. 2001). There are no stream gaging stations on the East Branch Au Sable River. A gage was recently installed on theNorth Branch of the Au Sable River at Kellog Bridge.

Camp Grayling comprises a significant portion of the Au Sable River watershed. Approximately 90,079 acres of Camp Grayling lands (61 %) occur in the Au Sable watershed, most being in the North Camp. Most of the North Camp drains into the East Branch of the Au Sable River, a second order stream originating from Barnes Lake, and the North Branch of the Au Sable River, a third order stream originating near Otsego Lake.

The Au Sable River, and most of its tributaries, has been designated a State Natural River by MDNR Fisheries Division and is now further regulated in accordance with the adopted Au Sable River Natural River Plan under State Act 231, The Natural River Act. In 1984, the Au Sable River received Federal Wild and Scenic River status for a 23-mile section downstream of the City of Mio due to its outstanding scenic values and its nationally recognized trout fishery (National Wild and Scenic Rivers System 2017). These designations and associated regulations have no impact on the military use of Camp Grayling. CG Regulation 200-1 prohibits all military activity within 400 feet of all streams and water bodies except on established roads and trails or with prior authorization. This rule meets the requirements set in the Au Sable River Natural River Plan (MDNR 2002).

(a) Au Sable River at Camp Grayling: Camp Grayling includes a small portion of the Au Sable main stem (less than 400 feet over 2 parcels.

(b) East Branch Au Sable Corridor: The East Branch of the Au Sable River emanates from Barnes Lake, flows south through River Lake and eventually meets the main stem of the Au Sable at Grayling. The East Branch is typical of a headwaters stream in this region coursing through lowland conifer swamps and alder marsh. The East Branch originates in the impact area of Range 40 on the North Camp.

(c) North Branch Au Sable Corridor: The North Branch of the Au Sable River arises from marsh and groundwater seepage near Otsego Lake. It is rather small and meandering in the headwater section but widens considerably below Lower Chub Lake and Turtle Creek as it approaches Lovells. Corridor vegetation consists primarily of alder marsh, white cedar , and scattered aspen, white spruce, and black spruce. Above Lovells, the North Branch contains much woody debris and is relatively shallow making for easier fishing and wading. . Chub Creek and the North Branch of the Au Sable lie adjacent to the North Camp boundary extending in an arc from Farrar Landing to Twin Bridges Road above Lovells for a total of about 21 miles.

Muskegon River

Approximately 3,000 acres (2%) of Camp Grayling lands occur in the Muskegon watershed, but there are no streams and only one small pond in this area.

E.3.2 LAKES

Camp Grayling contains more than 60 lakes and ponds within its borders that comprise approximately 350 acres of surface area in the Manistee and Au Sable watersheds. Although Lake Margrethe is the largest lake associated with the camp, very little of if it is within camp boundaries and approximately half of the lake's shore is privately owned (Figure 5). Table E-4 shows the total surface acreage of lakes and ponds in the Au Sable and Manistee watersheds.

Manistee River Basin

Lake Margrethe is the largest lake within the boundaries of Camp Grayling and is located in the Manistee River Basin. Lake Margrethe is located in South Camp and is bordered by both military and private lands. The lake has a surface area of 1,924 acres, 10 miles of shoreline, maximum depth of 65 feet, mean depth of 15.4 feet, and contains approximately 30,000 acre-feet of water. The lake has 20 inlet creeks and drains a watershed of approximately 7,730 acres. Portage Creek is the outlet of Lake Margrethe. The other lakes on Camp Grayling in the Manistee watershed are smaller and less significant, with 17 lakes/ponds less than 3 acres surface area. Howes Lake is the only larger water body and is 15 acres.

Au Sable River Basin

Lakes and ponds are scattered through Camp Grayling in the Au Sable watershed. These lakes total approximately 311 acres. There are 10 lakes with more than 10 acres of water surface within Camp Grayling, and approximately 40 ponds (or portions of lakes) with less than 10 acres within Camp Grayling. Most of those are less than 5 acres. The named lakes include Marsh Lake, Timber Lake, Lonesome Lake, Sand Lake, River Lake, Bear Lake, Jones Lake, KP Lake, Little KP Lake, Duck Lake, Frog Lakes (2), Kyle Lake, Barnes Lake, and several unnamed lakes. Section One Lake and Guthrie Lake are bisected by the North Camp boundary. The eastern shoreline of Lower Chub Lake comprises a short section of the Camp Grayling boundary. The majority of these lakes have no surface water connection to the Au Sable.

E.4 WETLANDS

MNFI identified thirteen different wetland communities on the installation in 1994 (MNFI 1994). The wetland communities include bog, northern fen, poor fen, shrub thicket, intermittent wetland, poor conifer swamp, rich conifer swamp, hardwood conifer swamp, emergent marsh, northern wet meadow, submergent marsh, mesic sand prairie and the relict conifer swamp. MNFI also assessed the accuracy of draft National Wetlands Inventory (NWI), maps, and found them to be fairly accurate with a few corrections made and incorporated into the final NWI maps. Current NWI data indicates five types of emergent wetlands (PEM), five types of forested wetlands (PFO), and six types of scrub-shrub wetlands (PSS). The largest contiguous wetland on camp is a lowland/tamarack swamp, just west of Lake Margrethe (Figure 5 in Appendix D). Most of the wetlands are associated with the river drainages of the Au Sable and Manistee rivers. Table E-5 summarizes the wetlands documented on Camp Grayling.

Table E-5. Wetlands on Camp Grayling			
Wetland Type	**Cowardin Categories**	**Area (acres)**	**No. of Features**
Emergent (PEM)	PEMA, PEMB, PEMC, PEMF, PEM/FO2B, PEM/FO4B	89	18
Forested (PFO)	PFO1B, PFO1C, PFO2B, PFO4B, PFO1/4B, PFO4/1B, PFO4/2B	711	25
Scrub-shrub (PSS)	PSS1C, PSS3B, PSS1/EMB, PSS3/1B, PSS3/FO2B, PSS3/FO4B	512	35
Total		*1,312*	*78*

*Cowardin categories are from Cowardin et al. 1979.

Source:(Cowardin et al. 1979; USFWS 2018)

As part of a comprehensive vegetation study by MNFI in 1994, pre-European settlement vegetation (circa 1800s) maps were developed. These historic vegetation maps provide an historical perspective on land use changes at Camp Grayling and were also used to compare to 1994 land conditions following the survey (MNFI 1994). The result of the comparison was that much of the landscape in Camp Grayling was shown to be severely impacted by land uses dating from the logging era. Historic vegetation information was used to create management and restoration recommendations for two unique ecosystems identified during the study which provided habitat for at least 12 listed species at the time: 1) a pine barrens complex in North Camp and 2) a mesic sand prairie complex in South Camp (MNFI 1994). See Appendix **F** for more information on the vegetation on Camp Grayling.

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APPENDIX F
BIOLOGICAL ENVIRONMENT

F.1 ECOREGION

Following the USEPA ecoregion hierarchy, Camp Grayling is located in the Northern Lakes and Forests Ecological Region (Level III), which occupies northern lower Michigan (Omerlink & Bryce 2010). The Level III Northern Lakes and Forest Region has numerous lakes dotting the landscape and is considered less productive than the ecoregion to the south. Camp Grayling is in the Mio Plateau ecoregion (Level IV), which has the shortest growing season in the lower peninsula and more snow than other areas on the lower peninsula. Glacial drift is very deep, with lakes in areas with clay lenses. The ecoregion's climate supports jack pine forests more than deciduous forests (Albert 1995). The northern boundary is delineated at the edge of the high plateau where it drops off toward the northern Lake Michigan and Lake Huron shorelines. The western boundary marks a similar drop in elevation to the Manistee-Leelanau Shore. The southwestern boundary is drawn where the flat outwash plain meets the Cadillac Hummocky Moraines. Finally, the transition to the finer- textured soils of the Tawas Lake Plain forms the eastern boundary. Frequent fires created a mosaic of forest successional stages and species, with open savannahs being common. Fire suppression, logging and land use change have altered the ecosystem significantly since the area was settled heavily in the 1800s.

F.2 HISTORIC VEGETATION

Frequent wildfires shaped the natural communities on the dry outwash plains that comprise most of Camp Grayling. Pre-European settlement (early 1800s) vegetation on these deposits was a shifting mosaic of dry sand prairie, open pine barrens, and closed-canopy, dry northern forest (MNFI 1994). The pine barrens included jack pine (*Pinus banksiana*), red pine (*Pinus resinosa*), northern pin oak (*Quercus ellipsoidalis*), aspen (*Populus* spp.), and prairie grasses. In areas less exposed to frequent wildfires, there were dry-mesic northern forests that commonly included white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), white oak (*Quercus alba*), and red oak (*Quercus rubra*) (Whitney 1986).

The historic vegetation in poorly drained portions of the outwash plains included more white pine and hemlock. In contrast, current vegetation in these areas consists of species found in northern shrub swamps, rich conifer swamps, poor conifer swamps, tamarack swamps, hardwood-conifer swamps, northern wet meadows, and mesic sand prairies.

Mesic northern forests, dominated by American beech (*Fagus grandifolia*), sugar maple *(Acer saccharum)*, hemlock, red oak, yellow birch *(Betula alleghaniensis)*, and white pine, were common on well drained, sandy loam soils in the 1850s. Dry-mesic northern forests of red pine, white pine, white oak and quaking aspen *(Populus tremuloides)* were historically common on more sandy and cobbly soils. Dry northern forests, with northern pin oak and jack pine are common on excessively drained portions of these ridges, primarily on slopes with a south or west aspect.

Because portions of these moraine ridges were re-worked by later glacial activity, irregular "ice-contact" surface features are common throughout. Small kettle lakes are found throughout these moraines. Some similar depressions support bogs, poor fens, and occasionally, intermittent wetlands.

With the arrival of Europeans in North America, fire effects and frequency were greatly altered, both intentionally and accidentally, particularly in grasslands (Wright & Bailey 1982) and

coniferous forests (Van Lear & Waldrop 1989; Baker 1992). Over the last century, fire suppression has adversely affected many of these fire-dependent ecosystems. When wildfires do occur after a long period of fire suppression, they may escape to burn a larger area and at a greater intensity than they would otherwise, transforming a normal ecological event into a catastrophe.

In the late 1800s, the landscape of northern Lower Michigan began to undergo dramatic change. The logging era had a tremendous impact on the extent and composition of forests throughout the region, with severe declines in the relative abundance of white pine, red pine, and eastern hemlock. Intense slash fires associated with logging and sawmill operations burned many areas that had experienced relatively infrequent wildfires in the past. In many cases, the organic-rich topsoil was burned off completely, leaving exposed, sterile sands. Many of these areas today are characterized as “stump fields”, where white pine stumps remain in open fields of scattered shrubs on a lichen-encrusted soil surface.

Subsequent land management activities have caused further changes from the pre-European settlement (early 1800s) condition. Forests dominated by northern hardwoods, such as beech, sugar maple, basswood *(Tilia americana)*, white pine, and hemlock were most common on sandy loam soils where historical wildfires were uncommon. These lands, along with sufficiently cleared and drained wetlands**,** were found to be the most suitable lands for agriculture in the region. The forested areas that remain today typically do not include white pine or hemlock that was historically characteristic.

The forests historically dominated by red pine, white pine, white oak, red oak, and aspen were likewise impacted by the logging-era removal of pines. Today, these forests are found in steeply-sloping areas. These historical pine-oak forests have often been converted and maintained as nearly pure aspen stands for timber/pulp production and wildlife management.

Fire suppression policies instituted in the 1920s allowed for the process of natural succession in many plant communities where natural wildfires had previously maintained a mosaic of pine barrens and grassland openings. During the 1930s, the establishment of pine plantations was begun across this region. As a result, many of the open pine barrens were replaced by closed-canopy jack pine forest and/or pine plantations. Today, most of the acreage currently represented as “open/barrens” in current land cover maps falls within areas mentioned above as “stump fields” rather than relatively intact examples of the historic jack pine barrens.

As with many areas in the southern Lower Peninsula of Michigan where wetland*s* were drained for conversion to agricultural production, wetland acreages within the northern Lower Peninsula have also declined since the 1850s. The relative composition of many swamp forests has changed, caused by the logging-era removals of white pine, northern white cedar *(Thuja occidentalis)*, and hemlock.

Figure 6 in Appendix D depicts the historic land cover on Camp Grayling. Tables F-1 through F-4 help to illustrate the vegetative changes that have taken place on Camp Grayling lands since the 1850s. The tables represent calculations from the historic land cover maps (1811-1856) based on Comer et al. (1995) and from current land cover information provided by the Michigan Resource Information System (MIRIS) (MNFI 2018).

The data for North Camp Grayling indicate changing land cover trends similar to the region as a whole. Areas historically characterized as pine barrens and oak-pine barrens were either

converted to military ranges (now shown often as grassland and shrub savanna) or have converted to closed-canopy jack pine forest. Acreage of jack pine forests has remained relatively stable through natural succession of barrens into closed-canopy forest and through plantation establishment. Natural stands of red pine, white pine, and/or hemlock have all been virtually eliminated from the landscape. Red pine is mostly represented on today's landscape in the form of monoculture plantations.

Portions of North Camp were historically dominated by red pine, white pine, and/or hemlock. With the removal of the former species, white oak, red oak, and quaking aspen were able to become dominant. Timber and wildlife management has favored these species, resulting in the dramatic acreage changes noted in the table, where these types now occupy approximately 50% of the surface area of North Camp. Northern hardwoods in North Camp have been impacted by past logging activities, which removed white pine and eastern hemlock, and by conversion to aspen management. Tables F-1 and F-2 summarizes historic and current land cover in North Camp, for uplands and wetlands respectively.

Table F-1. Historic and Current Upland Cover for Camp Grayling - North Camp

COVER TYPE	HISTORIC (acres)	CURRENT (acres)
Urban (camp facilities)	0	184
Upland grassland	1,028	6,833
Shrub savanna	0	4,422
Pine barren	18,054	0
Oak-pine barren	301	0
Jack pine	7,863	8,134
Jack pine-red pine	4,267	*
Red pine-white pine	16,731	3,277
"Pine"	0	5,819
White pine-hemlock	4,220	*
Hemlock-beech	229	*
Northern hardwoods	6,580	2,234
Oak-aspen ("central hardwoods")	0	14,180
Aspen-birch	299	20,139

Source: Historic land cover (1811-1856) from Comer et al. (1995), current land cover from MNFI 2018.
* = not differentiated

Although wetlands historically accounted for only 12% of the North Camp landscape, there have been significant declines since 1850 (Table F-2). Both cedar-dominated swamps (historically the dominant wetland type on North Camp) and emergent wetlands had significant declines. Shrub swamps and hardwood-dominated swamps appear to have increased over time. This fits a trend common throughout the region, where commercially-valuable conifers, such as cedar, were removed from these swamps, and if they were not drained entirely, swamps were converted to shrub or hardwood-dominated swamps.

Table F-2. Historic and Current Wetland Cover for Camp Grayling - North Camp		
COVER TYPE	**HISTORIC (acres)**	**CURRENT (acres)**
Mixed lowland hardwoods (aspen/maple)	6	538
Hardwood-conifer swamp	249	*
Lowland conifer	-	1,288
Cedar swamp	6,376	149
Spruce swamp	59	68
Tamarack swamp	848	61
Shrub swamp	-	900
Bog	90	*
Alder/willow/bog birch	83	*
Emergent wetlands	-	230
Emergent marsh	206	*
Intermittent wetland	242	*
Wetlands (Total)	*8,159*	*3,234*
Source: Historic land cover (1811-1856) from Comer et al. (1995), current land cover from MNFI 2018. * = not differentiated		

The data for South Camp indicate some trends that are similar to those found in North Camp, and in the region as a whole. Historically, South Camp included less pine barrens than North Camp and nearly all of these were converted to red pine and jack pine plantations. Acreage of closed-canopy jack pine forest, unlike on North Camp, shows a slight decline on South Camp. This may just reflect errors in photo interpretation or the relative abundance of red pine versus jack pine plantations that have been established since the 1930s. Another difference between North Camp and South Camp is an apparent increase in northern hardwoods. This is probably because of a relatively high component of red maple in the historical red pine-oak forests. With the removal of the red pine, red maple has become dominant in many cases, and subsequently classified as northern hardwoods from aerial photos. Tables F-3 and F-4 summarizes historic and current land cover in South Camp, for uplands and wetlands respectively.

Table F-3. Historic and Current Upland Cover for Camp Grayling - South Camp		
COVER TYPE	**HISTORIC (acres)**	**CURRENT (acres)**
Urban (camp facilities)	0	2,723
Upland grassland	327	1,371
Shrub savanna	0	3,129
Pine barren	5,027	0
Oak-pine barren	13,990	10,743
Jack pine	4,435	*
Jack pine-red pine	4,934	1,794
Red pine-white pine	*	8,461
“Pine”	27,270	*
White pine-hemlock	4,770	*
Hemlock-beech	90	*
Northern hardwoods	7,971	18,155
Oak-aspen (“central hardwoods”)	0	12,117
Aspen-birch	0	14,919
Source: Historic land cover (1811-1856) from Comer et al. (1995), current land cover from MNFI 2018. * = not differentiated		

Wetland acreage on South Camp has also declined over time, though not to the degree of the declines seen on North Camp. Tamarack dominated swamps were the dominant wetland type historically on South Camp. Again, conifer-dominated swamps have been converted to hardwood and shrub-dominated swamps through past logging activity.

Table F-4. Historic and Current Wetland Cover for Camp Grayling - South Camp

COVER TYPE	HISTORIC (acres)	CURRENT (acres)
Mixed lowland hardwoods (aspen/maple)	0	2,416
Hardwood-conifer swamp	14	*
Lowland conifer	1,931	3,242
Cedar swamp	850	135
Spruce swamp	180	303
Tamarack swamp	7,823	322
Jack pine swamp	245	0
Shrub swamp	-	1,000
Bog	32	*
Alder/willow/bog birch	201	*
Emergent wetlands	41	90
Emergent marsh	53	*
Wet meadow	87	*
Intermittent wetland	242	*
Mud flat	0	57
Wetlands (Total)	*11,699*	*7,565*

Source: Historic land cover (1811-1856) from Comer et al. (1995), current land cover from MNFI 2018.
* = not differentiated

F.3 CURRENT VEGETATION

As discussed in Section 2.2 of the INRMP, MDNR plays a significant role in the natural resources management on Camp Grayling, with forestry and fire being MDNR's responsibility on the majority of Camp Grayling. The Grayling Forest Management Unit encompasses 100,619 acres of state-owned land within Crawford and Kalkaska counties (MDNR 2018). Most of Camp Grayling is in this FMU.

From 2000 – 2018, a total of fourteen surveys focusing on vegetation on Camp Grayling have been conducted, covering a range of topics from overall vegetation to invasive plants (see Appendix K for a complete list of surveys). One comprehensive vegetation survey was completed in 2003 and another targeted threatened/endangered flora in 2018. In addition, five multi-taxa surveys including vegetation have occurred on Camp Grayling since 1994.

- Comprehensive and Invasive: Data on erosion trends, areas of bare ground, land use and invasive species from 1992 to 1993 (Tanis & Stegink 2003). A review of previous surveys and additional field surveys was completed in 2018 (DLZ 2018).
- Rare Plants and High-Quality Natural Areas: A survey of rare plants and high-quality natural communities was completed in the 1990s (MNFI 1994). Re-survey of rare plants and high-quality natural areas (HQNAs) was completed in 2005 (Higman et al. 2005a; Kost & Cohen 2005). Additional rare plant surveys were performed in 2017 and 2018 (DLZ 2018).

- Pine Barrens: A management plan developed in 2000 for the North Camp Grayling Pine Barrens Management Area involved conducting inventories for rare plant and animal species, characterizing the avian community, and performing an assessment of management actions (Kost et al. 2000). A digital map of plant alliances was created for the pine barrens in 2005 (Cohen et al. 2005).
- Invasive Plant Species: In addition to the 2003 report above, invasive plant surveys and digital mapping were completed in 2005 (Higman et al. 2005b). For at least eight years, annual invasive species surveys and management has been completed. The most recent years included reports summarizing current invasive plants provided after each season of management activities (Koziatek & Wilson 2016, 2018).
- Vegetation Change: A vegetative cover baseline inventory was completed for the Multi-Purpose Range Complex and Northern Training Area at Camp Grayling using a combination of field surveys and remote sensing (Tweddale et al. 2001).

In addition, MDNR regularly assess the forest structure in forest management units. MDNR maintains some data on the harvesting of forests that is included in Section F.3.1, where appropriate (MDNR 2018). As shown in Figure 7 in Appendix D and summarized in Table F-5, the current vegetation on Camp Grayling is primarily forest (more than 85%) but includes grasslands. There are high quality communities throughout Camp Grayling as well (see Section F.3.3).

F.3.1 FORESTS

Camp Grayling is located in a belt of oak and pine that occupies a two-county tier along Lake Michigan, north of Grand Rapids, and extends along a band through Crawford County to Iosco County. This band cuts through the southern portion of a major maple-birch forest north of Kalkaska County and a major aspen-birch forest extending from Cheboygan County south to Isabella County. The land within Camp Grayling contains these major forest types, as well as other minor forest types, as summarized based on forest cover GIS data provided by MDNR in 2015 (See Table F-5).

Table F-5. MDNR Land Cover and Forest Types on Camp Grayling

Forest Type	Acres
Deciduous	***64,459***
Alder-Willow	430
Aspen	21,062
Aspen-Deciduous	1,321
Aspen-Oak	6,829
Black Oak-Northern Pin Oak	4,982
Black Oak-Northern Pin Oak-White Oak)	4,872
Deciduous Forest (multiple dominant species)	1,050
Maple-Beech-Cherry	763
Northern Hardwood	1,943
Oak (multiple species, with non-oaks)	7,275
Red Oak	5,837
Red Oak-White Oak	5,980
Sugar Maple	2,115

Table F-5. MDNR Land Cover and Forest Types on Camp Grayling	
Forest Type	**Acres**
Conifer Forest/Plantations	***40,000***
Black Spruce	1,040
Cedar	922
Hemlock	5
Jack Pine (multiple types)	18,037
Mixed Pine (multiple types)	3,182
Red Pine	3,213
White Pine (multiple types)	1,098
Tamarack	594
Upland Cedar	39
Upland Spruce/Fir	72
Conifer Plantations	11,798
Mixed	***20,241***
Aspen-Mixed Conifers (multiple types)	2,580
Hemlock-Mixed Deciduous (multiple types)	41
Mixed Deciduous Forest (multiple types)	12,086
Mixed Northern Hardwoods (multiple types)	1,915
Mixed Oak (multiple types)	3,613
Maple-Conifer	6
Riparian Forests	***5,807***
Lowland Ash	139
Lowland Aspen	484
Lowland Balsam Poplar	8
Lowland Cedar	374
Lowland Mixed Conifer	891
Lowland Mixed Conifer-Deciduous (multiple types)	1,587
Lowland Mixed Deciduous	65
Lowland Fir	79
Lowland Hardwood	202
Lowland Jack Pine (multiple types)	221
Lowland Maple	336
Lowland Pine	424
Lowland Spruce-Fir	275
Mixed Swamp Conifer	722
Shrub Communities	***8,185***
Upland Shrub	6,170
Lowland Shrub	2,015
Wetlands	***1,671***
Bog	588
Cattail	2
Emergent Wetland	341
Fen	52
Shrub Swamp	13
Marsh	153
Non-Forested Wetland	245
Treed Bog	259

Table F-5. MDNR Land Cover and Forest Types on Camp Grayling	
Forest Type	**Acres**
Wet Meadow	18
Herbaceous	***6,488***
Grasslands	2,757
Mixed Herbaceous	3,308
Rubus-Fern	423
Non-Vegetated Cover	***3,613***
Water	434
Bare-Sand-Soil	1,096
Park-Golf Course	3
Urban	2,080
Total Acreage	**150,464***

*Not exactly same acreage as the acreage in Section 2 in the INRMP or Section G.2 above, due to the changing boundaries of Camp Grayling and discrepancies between GIS datasets.

Source: GIS data provided by MDNR for forest management units, 2015

There are eight major forest types at Camp Grayling that cover approximately 90% of the camp (Figure 7 in Appendix D). The remaining land is a mix of shrub communities, herbaceous communities, and non-vegetated areas – most of which are impacted by human activities regularly. These include the three impact areas, cantonment area, airfield, oil well pads, parking lots and any other areas that generally are either impervious or mowed lawn.

In their general order of predominance, the forest cover types are: deciduous (mostly oak), conifer forests/plantations, mixed forests, riparian forests. Upland shrub communities are also present, but generally indicate high disturbance levels. Within these broader forest types, there are several small, individual stands of northern white cedar, white pine, black spruce, lowland poplar (Balm-of-Gilead), spruce fir, tamarack, paper birch, and hemlock scattered throughout the camp and are usually less than 300 acres in size.

Deciduous Forests

Oak Forests

Oak forests on Camp Grayling contain northern red oak (*Quercus rubra*), northern pin oak (*Quercus ellipsoidalis*), white oak (*Quercus alba*), black oak (*Quercus velutina*), and hybrids of black oak and scrub northern red oak. Red oaks are predominant on wetter, more fertile sites while northern pin oaks and scrub northern red oaks are common on drier, sandy sites. White oaks and black oaks are very seldom predominant. Communities where oaks dominate comprise at least 42,000 acres on Camp Grayling.

Oak forests occur almost exclusively on moraines and therefore on the excessively drained Rubicon sands. The largest concentration of oak occurs in a two-mile wide belt in the South Camp on a moraine composed of Rubicon sands. The belt extends from the border of the South Camp area east of Lake Margrethe to the western border of the camp south of Sharon. Oak forests also occur in patches one-mile wide and two to three miles long in the south, north, and central parts of the moraine in North Camp. The only part of the installation which does not contain an appreciable amount of oak is the area west of the Manistee River which are covered with other types of northern hardwoods and aspen.

Currently, most of the oak and other hardwood forests are showing signs of decline and increasing mortality due to their age. Without significant disturbance/treatment to promote oak regeneration, these forests will convert to other community types with more conifer components.

Aspen Forests

Aspen (*Populus* spp.) forests comprise at least 25,000 acres across Camp Grayling in various combinations with other species. Aspen is found throughout the camp in individual stands or mixed in oak forests. Aspen grows on moraines, the slopes of moraines, and in lowlands along the rivers, and is not associated with a specific soil type. The largest concentrations of aspen occur on the east side and the north west corner of the North Camp area and in the lands west of the Manistee River. The aspen on the east side of the camp have pockets of grassland, oak, and red pine, but otherwise is continuous for six to seven miles. The aspen stands west of the Manistee River are about 300 to 600 acres in size and occur on the slopes of the moraine and on the streambed of Black Creek. Most of the scattered pockets of aspen are less than 60 acres in size. Aspen trees are generally absent only in the oak-jack pine forest running in a belt from Lake Margrethe down to the southwest border of the South Camp area.

Hardwood Forests

Hardwood forests (both upland and lowland) comprises approximately 4,500 acres. Most of those occur in upland areas, with a small amount in riparian zones. Northern hardwood forests are composed of sugar maple (*Acer saccharum*), beech (*Fags grandifolia*), basswood (*Tilia* spp.) and small amounts of red maple (*Acer rubrum*). Some paper birch may be scattered throughout the stands.

Northern hardwood cover types occur primarily in two areas: a patch three miles long and one and one-half miles wide in the lands west of the Manistee River and two patches two miles long and one mile wide in the northwest corner of the North Camp area west of Range 40. These northern hardwood occurrences are on moraines composed of excessively to well-drained Group 2 (Kalkaska, Montcalm series) and Group 5 (Kalkaska-Rubicon complex) soils. Other smaller patches occur in the area south and southeast of Lake Margrethe and south of Cannon Creek, in the southwest corner of camp.

Conifer Forests

Jack Pine Forests

Jack pine (*Pinus banksiana*) forests comprise approximately 20,000 acres on Camp Grayling. Jack pine occurs on the slopes of moraines which are composed of excessively drained Graycalm sands and on lowlands (glacial outwash plains) that are composed of excessively drained Grayling sands. The three major occurrences of jack pine include a one-mile wide belt along the southern side of the entire stretch of the Manistee River, a three by three-mile wide patch in the lands by Highway 27, and a four-mile long patch in the south-central portion of the North Camp. There is a limited amount of saw timber size trees. Jack pine forests have been shrinking on Camp Grayling due to efforts to increase other forest types over the last 20 years.

Red Pine Forests

Red pine (*Pinus resinosa*) forests comprise approximately 3,000 acres on Camp Grayling. Red pine is fairly common throughout the camp, occurring primarily on the slopes of moraines, in

excessively to well-drained soils. They also occur in the river valleys but on well-drained soils. The largest contiguous stand of red pine occurs along the east side of the North Camp one to one-half mile west of the North Branch of the AuSable River. The stand is two miles long and three-quarters of a mile wide. The other patches of red pine are usually one-half mile in length and width.

Shrub Communities

Upland Shrub

Upland shrub communities comprise about 6,000 acres. Upland brush occurs throughout the camp but predominantly in lower elevations along the rivers in well-drained sands. The two largest occurrences of upland shrub communities are 700-acre patches in the lands west of the Manistee River and in the northwest part of the North Camp by Range 40. Most of the smaller patches are from 150 to 600 acres in size and are adjacent to grasslands.

Lowland Shrub

Lowland shrub communities comprise about 2,000 acres. Lowland shrub communities are found along rivers, streams, and in wetland areas usually on poorly drained, organic soils from Group 1 (Tawas, Lupton, Loxley). Lowland brush primarily consists of tag alder (*Alnus* spp.) and dogwood (*Cornus* spp.).

Riparian Forests

Riparian forests of all types comprise approximately 5,800 acres throughout Camp Grayling. Mixed deciduous/conifer lowland forests and the mixed swamp conifer forests are the two most common types within the various riparian forest types on Camp Grayling. The swamp conifer forests consist of northern white cedar, balsam fir, black and white spruce, and minor amounts of tamarack. They are found throughout the camp along rivers, swamps, and lowlands, and occur in wet organic soils primarily from Group 1 (Tawas, Lupton, Loxley series). The largest concentration of swamp conifers occurs in Bear Swamp, west of Lake Margrethe. Besides occurring as a group in lowlands and swamps, each of these trees exists individually in small stands throughout the camp.

F.3.2 GRASSLANDS

Grassland areas cover approximately 2,700 acres and mixed grassland-forb areas cover approximately 3,300 acres throughout Camp Grayling. There are a few large parcels of land (640 acres or more) on moraines covered with grasses. Many of these grasslands coincide with training facilities. Some of these grassland areas are a result of forest management practices M(for example, clear cuts) and/or military training activities, but others were h grasslands. Range 40 (air-to-ground training range) is the largest grassland on camp, covering approximately 1,300 acres. Range 13 (mortar range) and Range 30 (tank range) are also predominantly grassland.

F.3.3 HIGH QUALITY NATURAL AREAS

There were fourteen HQNAs previously identified on Camp Grayling (MNFI 1994; Kost & Cohen 2005). The HQNAs were reevaluated in 2017, with the goal of collating all previous information into one location and comparing current conditions with previous conditions (DLZ 2018). One

HQNA occurring in a wetland within the Cantonment Area was added to the original 14 areas in the 2017 assessment, for a current total of fifteen HQNA areas on Camp Grayling. Dominant plant species, presence/change in protected plant species, depth to water table, invasive species presence, and noted wildlife were included in the 2017 reassessment (DLZ 2018).

The Pine Barrens have been added here as a HQNA although it is managed under the Pine Barrens Management Plan (Kost et al. 2000). Four HQNAs near each other (referred to as Lewiston Grade) and straddling the Camp Grayling boundary have also been added here for completeness. The current HQNAs are depicted on Figure 8 in Appendix D. Table F-6 includes a summary of each of the HQNAs and the most current information available on their main characteristics. Additional information on management of these areas is provided in Section 3.4.

The majority of these areas are wetlands and do not require additional protections since CG 200-1 already prohibits activities within 400 feet of any water resources, except for established roads and designated areas. Since most of the HQNAs occur on MDNR land, they have the primary responsibility for managing them. A few occur on MDMVA-owned lands where MDMVA has the primary responsibility for management.

Within these HQNAs, there are two highly significant landscapes that are important for the protection of multiple federal and state-listed species. These areas are the Pine Barrens and the Portage Creek-Howes Lake Complex, which are co-managed with MDNR. Protection and management of these two areas encompasses important habitat for at least 10 listed plant and animal species.

Table F-6. High Quality Natural Areas on Camp Grayling

Name	Community Type	Acres	Rank	Notes	Location*	Priority
Barker Creek Fen	Northern fen	31	G3S3	Fen with sedges and trees and peat mounds. Drains west to Au Sable River.	TA-N09, MDNR	Low
Beaver Creek	Poor conifer swamp (formerly Northern shrub thicket)	41	G4S4	Alder, tamarack, spruce and sphagnum moss wetland drained by Beaver Creek. Partially off site. Numerous oil and gas wells.	TA-S24, MDNR	Medium
Best Bog	Bog	25	G3S3	Bog with established floating bog and open water. Drains southwest into Barker Creek. .	TA-N09, MDNR	Low
Cannon Creek Meadow	Northern wet meadow	149	G4S4	Headwaters of Little Cannon Creek; part of a larger wetland complex. Impacted by invasive plants. Partially off site.	TA-S22, MDNR	Medium
Cantonment Area[b]	Rich conifer swamp and Emergent/scrub-shrub	25	G4S3	Directly connected to Lake Margarethe; lies between the lake and the parade grounds; performs important stormwater functions. Three wetland pockets.	Cantonment Area, MDMVA	Medium
Chub Creek Swamp	Northern shrub thicket, wet meadow/fen, and poor and rich conifer swamp (perimeter)	123	G4S4	On outwash plain at the confluence of Chub Creek and the North Branch of the Au Sable River. Shrubby wet meadow to northern shrub thicket to rich conifer swamp. Partially off site.	TA-N30, MDNR	Low
Crawford Red Pines	Dry northern forest	14	G3S3	Old growth red pines, near other wetlands. Threatened by lack of disturbance/fire.	TA-N09, MDNR	Medium
C-shaped depression	Northern ~~Poor~~ fen	8	G3S3	Rare plants present and responds well to fires (fires common from military activity).	Range 30 Complex, MDNR	Low
Frog Lake Complex	Intermittent wetland	17	G3S2	Series of wetlands[a] with several small lakes. Connected to adjacent pine barrens. Uplands impacted by invasive plants.	TA-N13, MDMVA	High
Lake Margrethe North	Intermittent wetland	237	G3S2	Wetland impacted by water table in Lake Margareth. Impacts from succession of woody plant species/shading, fire suppression, and roads.	TA-S06, MDMVA	Medium
Lovells Bog	Bog	42	G3S3	Sedge meadow with spruce and tamarack.	TA-N25, MDNR	Low
Lovells Fen	Poor fen	1427	G3S3	Sedge meadow and shrub bog with open water. Threatened by reed canary grass.	TA-N15, MDNR	Medium
Pine Barrens	Pine barrens	4,959	G3S2	Remnant fire-dependent, pine barrens and includes several isolated wetlands. One of	TA-N13/ N14, MDNR	High

Table F-6. High Quality Natural Areas on Camp Grayling

Name	Community Type	Acres	Rank	Notes	Location*	Priority
				the best locations in the lower peninsula for restoring this community. Parts of Frog Lake Complex overlap with this area.		
Portage Creek-Howes Lake Complex	Mesic sand prairie	77	G1S1	Occurs in a 2-mile strip on the west side of Howes Lake to the southwest, parallel to Portage Creek. Small pockets of mesic sand prairie within a mosaic of forested swamp and pine-dominated uplands (over 18 fragments) with many rare plants.	TA-S04/ S05/S09, MDMVA	High
The Doughnut	Intermittent wetland	9	G3S2	Shallow depression on an outwash channel which includes the Manistee River. Outer ring of sedge with a center of trees.	TA-S04, MDMVA	Low
Watson Swamp	Rich conifer swamp	305	G4S4	On outwash plan of Manistee River, with many slow-moving streams diverse tree species.	TA-S08, MDNR	Low

*Location indicates Training Area (N=North, S=South) and which agency owns the land where the area occurs.
[a] Frog Lake Complex was originally identified in the 1990s as containing 9 wetlands. In 2017, this increased to include 11 wetlands.
[b]The Cantonment Area was not evaluated before 2017 and is a new addition to the HQNA list.

RANK
G1 = critically imperiled globally due to extreme rarity or factor(s) making it vulnerable to extinction. G2 = imperiled globally due to rarity or factor(s) making it vulnerable to extinction throughout its range. G3 = either very rare and local throughout its range or found locally in a restricted range or other factor(s) making it vulnerable to extinction throughout its range. G4 = apparently secure globally, may be rare in parts of its range.
S1 = critically imperiled in the state due to extreme rarity or factor(s) making it vulnerable to extirpation in the state. S2 = imperiled in state due to rarity or factor(s) making it vulnerable to extirpation from the state. S3 = rare or uncommon in state. S4 = apparently secure in state, with many occurrences.

Sources: (MNFI 1994; Kost & Cohen 2005; DLZ 2018)

Pine Barrens Management Area

The Pine Barrens are located in North Camp and is dominated by remnant pine barrens and includes several isolated wetlands. This area was identified as one of the best opportunities in northern Lower Michigan for restoring a landscape of pine barrens, dry sand prairie, and intermittent wetlands. A management plan was first developed in 1998 for this area (MNFI 2000). Management recommendations included the use of logging, tree planting and prescribed burning in a rotational pattern. MDMVA has an active MOU with MDNR to conduct prescribed burning of this habitat as-needed. Rehabilitation and enhancement of this ecosystem should benefit a number of rare plants and animals and be compatible with military training in the area. Management implementation will be done by or in cooperation with MDNR. In 2005, MDMVA contracted with MNFI to map of the plant alliances in the Pine Barrens (Cohen et al. 2005). The Michigan WAP also identifies this habitat type as extremely valuable to the fish and wildlife of the state and notes that dry northern forests, including pine barrens, are some of the rarest forest types in the Great Lakes Region (Derosier et al. 2015).

Portage Creek-Howes Lake Complex

The Portage Creek-Howes Lake Complex is a mesic sand prairie located in South Camp in a three-mile-long band extending from the west side of Howes Lake to the southwest, parallel to Portage Creek. The southern portion of this site was first located in 1992 due to the presence of the rare Houghton's goldenrod (Kost & Cohen 2005). Through analysis, it was discovered that these small goldenrod populations in depressions were oriented in a linear fashion in what was a prairie-like habitat located in historical shoreline deposits from pro-glacial Lake Margrethe. By following these narrow depressions to the southwest, the full extent of this rare plant community was discovered.The prairie is divided into eighteen fragments. This is a shrub/grass-dominated wetland that experiences significant water table fluctuation during the year. The prairie is broken into eighteen fragments totaling approximately 77 acres. This complex includes the federally threatened Houghton's goldenrod *(Solidago houghtonii)* and other rare plant species including prairie dropseed *(Sporobolis heterolepis,* state threatened), Clinton's bulrush *(Scirpus clintonii,* state threatened), Vasey's rush *(Juncus vaseyi,* state threatened), and long-leaved aster *(Aster longifolius,* state special concern). It also contains the federally threatened eastern massasauga (*Sistrurus catenatus*) and serves as important habitat for this species.

Most of this complex occurs in areas that do not experience off-road vehicle use. In areas that are adjacent to high military use, Camp Grayling has installed signs and, in some cases, barrier posts, to protect this community. In 1995, Camp Grayling rehabilitated a wetland adjacent to Howe's Lake, which also rehabilitated natural water movement between the lake and an adjacent fragment of this complex. The *Training Area Limitations for Calendar Year 2018 Memorandum* (MIARNG 2018) designates training area STA9 (area southeast of Portage Creek) as a Wildlife Research Area. In order to protect research objectives, this area is closed to vehicles and other activities with only foot traffic allowed.

F.4 INVASIVE SPECIES

Given the size of Camp Grayling and diversity of habitats, a variety of invasive species have been documented and a number of others have the potential to occur. Invasive plant surveys and control have been occurring on a semi-regular basis for more than 20 years on Camp Grayling, with annual control occurring since 2010. While invasive species are present, they do

not dominate the communities on Camp Grayling and are not causing major ecological problems at this time. This is partially a result of prioritizing early detection and treatment of invasive species for many decades. An integrated pest management approach is always used to manage invasive species, along with the early detection and treatment.

An updated master list was developed in 2017 (Koziatek & Wilson 2018) to guide surveys of HQNAs and report any high priority invasive species using the Midwest Invasive Species Information Network (MISIN) application (available at https://www.misin.msu.edu/).

F.4.1 INVASIVE PLANTS

Camp Grayling has documented more than 150 species of non-native plants, although not all of these are considered invasive or noxious weeds. Table F-7 summarizes the known and potential priority invasive plant species, along with their state ranking. Every species has a summary on the MISIN website, and the hyperlink is provided as part of the scientific name in the table. Table F-8 identifies those invasive plants that have not yet been documented in Michigan, but if they were to occur, they would be considered a priority for management at Camp Grayling.

Table F-7. Priority Invasive Plant Species for Camp Grayling

Scientific Name	Common Name	State Rank[1]	Camp Grayling[2]
Terrestrial Plants			
Acer platanoides	Norway maple	-	-
Ailanthus altissima	Tree of heaven	-	-
Alliaria petiolata	Garlic mustard	-	Documented
Alnus glutinosa	Black alder	-	-
Berberis thunbergii	Japanese barberry	-	-
Butomus umbellatus	Flowering rush	Restricted	Top Priority
Calstrus orbiculata	Oriental bittersweet	-	-
Centaurea stoebe	Spotted knapweed	Prohibited, Noxious Weed	Documented
Cirsium palustre	Swamp thistle	-	Documented
Dioscorea oppositifolia	Chinese yam	Watch List	-
Elaeagnus angustifolia	Russian olive	-	Documented
Elaeagnus umbellata	Autumn olive	Prohibited	Documented
Euphorbia esula	Leafy spurge	Prohibited, Noxious Weed	Documented
Glyceria maxima	Reed mannagrass	-	-
Gypsophila paniculata	Baby's breath	-	Top Priority
Heracleum mantegazzianum	Giant hogweed	Prohibited	-
Hesperis matronalis	Dame's rocket	-	-
Hypericum perforatum	St. John's wort	-	Documented
Impatiens glandulifera	Himalayan balsam	Watch List	-
Lonicera maackii	Amur honeysuckle	-	-
Lonicera morrowii	Morrow honeysuckle	-	-
Lonicera tatarica	Smooth Tartarian honeysuckle	-	-
Lonicera x bella	Hybrid honeysuckle	-	Documented
Melilotus alba	White sweet clover	-	-
Melilotus officinalis	Wild parsnip	-	-
Microstegeium vimineum	Japanese stiltgrass	Watch List	-

Table F-7. Priority Invasive Plant Species for Camp Grayling			
Scientific Name	**Common Name**	**State Rank[1]**	**Camp Grayling[2]**
Nitellopsis obtusa	Starry stonewort	Prohibited	-
Phalaris arundinacea	Reed canary grass	-	Documented
Phragmites australis	Invasive phragmites, giant reed	Restricted	Top Priority, Documented
Poa compressa	Canada bluegrass	-	Documented
Polygonum cuspidatum	Japanese knotweed	Prohibited	Top Priority
Polygonum sachalinense	Giant knotweed	-	Top Priority
Pueraria montana var. lobata	Kudzu	Watch List	-
Rhamnus cathartica	Common buckthorn	-	-
Rhamnus frangula	Glossy buckthorn	-	-
Rosa multiflora	Multiflora rose	-	Documented
Vinca minor	Common periwinkle	-	Documented
Vincetoxicum nigrum	Black swallow-wort	-	Top Priority
Vincetoxicum rossicum	Pale swallow-wort	-	Top Priority
Aquatic Plants			
Hydrocharis morsus-ranae	European frog-bit	Watch List, Prohibited, Noxious Weed	Top Priority
Lythrum salicaria	Purple loosestrife	Restricted	Documented
Marsilea quadrifolia	European water clover	Watch List	-
Myriophyllum aquaticum	Parrot feather	Watch List, Prohibited	-
Myriophyllum spicatum	Eurasian watermilfoil	Restricted	Documented
Nymphoides peltata	Yellow floating heart	Watch List, Prohibited	-
Pistia stratiotes	Water lettuce	Watch List	-
Potamogeton crispus	Curly pondweed	Restricted	-

[1] State Rankings are provided by Michigan Department of Agriculture under the Natural Resources and Environmental Protection Act (451 of 1994, as amended); Part 413, Section 324.41301 defines prohibited and restricted species in Michigan and limits the possession, import or sale of such species; Part 33, Section 33 defines permitted actions and procedures for the treatment of aquatic nuisance species; Noxious Weeds under Michigan Law: Michigan Seed Law (Act 329 of 1965) and Regulations 715 (Under Act 329) Seed Law Implementation.

[2] Documented indicates species known to occur on Camp Grayling and appears in draft compiled plant species list (Draft list, DLZ 2018). Priority species identified in Koziatek & Wilson 2017.

Noxious Weeds: https://www.michigan.gov/mdard/0,4610,7-125-1569_16993-11250--,00.html
Watch List: https://www.michigan.gov/invasives/0,5664,7-324-68002_74188---,00.html
Laws: https://www.michigan.gov/invasives/0,5664,7-324-68071---,00.html
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Source: (MDARD 2017; Koziatek & Wilson 2018; Michigan's Invasive Species Program 2018; MISIN 2018)

Table F-8. Priority Invasive Plant Species Not Yet Found in Michigan			
Scientific Name	**Common Name**	**State Rank[1]**	**Notes**
Terrestrial Plants			
Myriophyllum aquaticum	Asiatic sand sedge	Watch List	
Persicaria perfoliatum	Mile-a-minute weed	Watch List	
Aquatic Plants			
Egeria densa	Brazilian elodea	Watch List, Prohibited	
Eichhornia crassipes	Water hyacinth	Watch List	
Hydrilla verticillata	Hydrilla	Watch List, Prohibited	
Stratiotes aloides	Water soldier	Watch List, Prohibited	
Trapa natans	Water chestnut	Watch List, Prohibited	

[1] State Rankings are provided by Michigan Department of Agriculture under the Natural Resources and Environmental Protection Act (451 of 1994, as amended); Part 413, Section 324.41301 defines prohibited and restricted species in Michigan and limits the possession, import or sale of such species; Part 33, Section 33 defines permitted actions and procedures for the treatment of aquatic nuisance species; Noxious Weeds under Michigan Law: Michigan Seed Law (Act 329 of 1965) and Regulations 715 (Under Act 329) Seed Law Implementation.

Noxious Weeds: https://www.michigan.gov/mdard/0,4610,7-125-1569_16993-11250--,00.html
Watch List: https://www.michigan.gov/invasives/0,5664,7-324-68002_74188---,00.html
Laws: https://www.michigan.gov/invasives/0,5664,7-324-68071---,00.html
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Source: (MDARD 2017; Koziatek & Wilson 2018; Michigan's Invasive Species Program 2018; MISIN 2018)

In 2005, an invasive plant survey in the HQNAs noted that spotted knapweed, St. John's-wort, and Canada bluegrass (*Poa compressa*) were the most common overall (Kost & Cohen 2005). Autumn olive, multiflora rose, periwinkle (*Vinca minor*), and hybrid honeysuckles (*Lonicera x bella*) were localized and were not observed in high-quality communities. The invasive plants considered to be the highest priority at the time were found in wetlands where they were becoming more widespread. These high priority invasive species included leafy spurge, purple loosestrife, giant reed, and reed canary grass (Higman et al. 2005b). Invasive plants considered to pose the highest threat to biodiversity were giant reed, reed canary grass, spotted knapweed, St. John's wort, and Canada bluegrass (Kost & Cohen 2005).

Camp Grayling has contracted with Great Lakes Environmental Management since 2008 to do approximately 2 weeks of intensive invasive plant control every year. This work has been concentrated on HQNAs. Species treated include spotted knapweed, leafy spurge, reed canary grass, St. John's wort, and garlic mustard.

In 2016, 2017, and 2018 an invasive plant removal crew treated areas focusing on high priority invasive species with emphasis placed on five species at Cannon Creek, Frog Lakes Complex, Portage Creek, and Lovell's Fen Sites (Koziatek & Wilson 2016, 2018). In all years, the targeted species were leafy spurge, St. John's wort, spotted knapweed, garlic mustard, and reed canary grass.

In the 2017, early detection surveys and rapid response treatments took also place. Species targeted included invasive phragmites, black swallow-wort, pale swallow-wort, Japanese and giant knotweed, baby's breath, flowering rush, and European frog-bit in coordination with statewide efforts. Surveys and treatments took place along pathways into and through the high quality areas mentioned above and towards high traffic pathways where potential source populations are likely to occur (Koziatek & Wilson 2018).

In 2002, members of the Lake Margrethe Property Owners Association identified, and MDNR confirmed, the presence of Eurasian milfoil in Lake Margrethe.

F.4.2 TREE DISEASES AND PESTS

Due to the widespread forest throughout this part of Michigan, tree diseases and insect tree pests are a major concern for Camp Grayling. These are largely monitored and managed by MDNR as part of their forestry activities (both as a responsible party on Camp Grayling but also as the agency that provides forestry services in the region), but MDMVA also plays a role in monitoring and managing them. Some of these species are already present or are likely to occur in the near future on Camp Grayling.

Over the years, other forest pests have emerged with *Heterobasidion* root disease (HRD), Asian longhorned beetle (ALB), redheaded pine sawfly (RHPS), white pine decline (pine bast scales), diplodia shoot blight, and mountain pine beetle (*Dendroctonus ponderosae*) as potential threats to forests on or near Camp Grayling.

HRD is a destructive fungus and is most commonly found in managed forests through freshly cut stumps that provide an ideal entry path. Red pine, white pine and jack pine are especially susceptible. Diplodia shoot blight, caused by the fungus *Diplodia pinea*, is prevalent in many areas of Michigan (Kost et al. 2007). Mountain pine beetle is native to western North America, from British Columbia to northern Mexico, but with a warming climate has become an invasive forest pest where it did not previously occur (Minnesota Department of Agriculture 2017).

The RHPS continued to damage young plantation red and jack pine in areas of the Northern Lower Peninsula in 2016; the sawfly is easily controlled by spraying, but if left unchecked, can deform and kill trees. White pine decline is caused by pine bast scales, which are sucking insects. White pine decline was first reported by DNR foresters in the Grayling Forest Management Unit in 2008, and it continues to occur widely on understory white pine near the Au Sable and Manistee Rivers (seemingly associated with lichen).

Another threat to forests, oak wilt, was first discovered in Michigan in 2016 and has been known to spread to state forests through contaminated firewood brought to campgrounds. Emerald ash borer has already impacted most of the ash trees present on Camp Grayling.

ALB was not noted in Michigan for the 6th year in a row in 2016, the result of successful management. It is crucial in management for forest pests that careful monitoring is ongoing and rapid response is readily available. This beetle is damaging forests, mostly commercial pine species, as it moves north and east.

Other species are not yet documented in Michigan but are projected to arrive at some point. These species have the potential to radically change the forest composition in the region and on Camp Grayling and result in a large quantity of dead trees and increased fire fuel load. Table F-9 summarizes the priority tree diseases and insect tree pests identified in Koziatek & Wilson (2017), Michigan invasive rankings, and whether the species has been documented on Camp Grayling.

Table F-9. Priority Tree Diseases and Invasive Insects for Camp Grayling

Scientific Name	Common Name	Trees Affected	State Rank[1]	Camp Grayling[2]
Tree Diseases				
Bretziella fagacearum	Oak wilt	Red oaks	-	Documented
Cryptococcus fagisuga + Neonectria spp.	Beech Bark Disease (BBD)	Beech trees	-	-
Geosmithia morbida*	Thousand Cankers Disease	Black walnuts	Watch List	-
Insect Tree Pests				
Adelges piceae*	Balsam woolly adelgid	True fir trees	Watch List	-
Adelges tsugae	Hemlock woolly adelgid	Hemlocks	Watch List	Top Priority
Agrilus planipennis	Emerald ash borer	Ash trees	Prohibited	Documented
Anoplophora glabripennis*	Asian long-horned beetle	Many tree species, prefers maples	Watch List, Prohibited	Top Priority
Halyomorpha halys	Brown marmorated stink bug		-	-
Lycorma delicatula*	Spotted lanternfly	Commercial fruit trees; oak, willow, maple, sycamore	Watch List	-
Lymantria dispar	Gypsy moth	Many tree species, prefers oak and aspen	-	Documented
Popilla japonica	Japanese beetle	Anthropogenic landscapes, crops	-	-

*Indicates species is not yet detected in Michigan

[1]State Rankings are provided by Michigan Department of Agriculture under the Natural Resources and Environmental Protection Act (451 of 1994, as amended); Part 413, Section 324.41301 defines prohibited and restricted species in Michigan and limits the possession, import or sale of such species; Part 33, Section 33 defines permitted actions and procedures for the treatment of aquatic nuisance species; Noxious Weeds under Michigan Law: Michigan Seed Law (Act 329 of 1965) and Regulations 715 (Under Act 329) Seed Law Implementation.

[2] Documented indicates species known to occur on Camp Grayling.

Diseases: https://www.michigan.gov/invasives/0,5664,7-324-68002_71242---,00.html
Watch List: https://www.michigan.gov/invasives/0,5664,7-324-68002_74188---,00.html
Laws: https://www.michigan.gov/invasives/0,5664,7-324-68071---,00.html
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Source: (Michigan's Invasive Species Program 2018)

Gypsy moth is a non-native insect that has the potential to have a significant impact on natural resources at Camp Grayling. Oak leaves are a favorite food of this pest and Camp Grayling's oak-dominated forests are particularly vulnerable to defoliation. Camp Grayling and MDNR have monitored gypsy moth in the past using fall egg mass surveys and summer canopy defoliation assessments, but they are not prevalent at this time. The moth is known to be present on the camp and outbreaks requiring control have occurred near and across the installation. When egg mass counts make it necessary to treat this pest with control agents, Camp Grayling and/or MDNR coordinates with the USFS and the Michigan Department of Agriculture. The control agent used in the past was an aerial spraying of the microbial insecticide, *Bacillus thuringiensis var. kurstaki*. This biological control agent is available by a variety of manufacturers and has been used extensively in suppression of gypsy moths in Michigan. Other biological control

methods available include the pathogenic fungus, *Entomophaga maimaiga*, and the nucleopolyhedrosis virus. However, the extent of control offered by these two pathogens has not been solidly established. The use of a chemical insecticide such as diflubenzuron is also available as a treatment option.

Emerald ash borer (EAB) is an exotic insect from Asia. The EAB is a wood-boring beetle that was first discovered in Michigan the summer of 2002 near Detroit. The adult EAB is dark metallic green in color, one half-inch in length and one-sixteen-inch wide and is 100% fatal to ash trees. There is currently no effective control of the EAB other than quarantine to prevent its spread. Under the quarantine it is illegal to transport ash wood products or any hardwood firewood out of the quarantined areas. The entire Lower Peninsula of Michigan is under quarantine, and so all of Camp Grayling is included (MDARD 2016). At this point, EAB has killed most of the ash trees that were present on Camp Grayling.

F.4.3 INVASIVE ANIMALS

Michigan has a list of prohibited terrestrial and aquatic animals that have been confirmed in the state of Michigan. Some of these species may be present or are likely to occur in the near future on Camp Grayling. These species also have the potential to cause ecological degradation through competition with other species for resources or by disturbing soils, making areas vulnerable to invasive plant species and erosion (e.g., feral hogs and wallows/rooting behavior). Table F-10 summarizes the priority animals identified in Koziatek & Wilson (2017), Michigan invasive rankings, and whether the species has been documented on Camp Grayling. Additional surveys are warranted to confirm whether any of these species actually occur on Camp Grayling.

Table F-10. Priority Invasive Animal Species for Camp Grayling

Scientific Name	Common Name	State Rank	Camp Grayling
Mammals			
Myocastor coypus*	Nutria	Watch List	-
Sus scrofa	Feral swine	Prohibited	-
Mollusks			
Candidula intersecta*	Wrinkled dune snail	Prohibited	-
Cantareus aspersa	Brown garden snail	Prohibited	-
Corbicula fluminea	Asian clam		-
Dreissena polymorpha	Zebra mussel	Restricted	Documented
Dreissena rostriformis bugensis	Quagga mussel	Restricted	-
Limnoperna fortune*	Golden mussel	Prohibited	-
Lissachatina fulica	Giant African snail	Prohibited	-
Hygromia cinctella*	Girdled snail	Prohibited	-
Monacha cartusiana	Carthusian snail	Prohibited	-
Potamopyrgus antipodaru	New Zealand mud snail	Watch List, Prohibited	-
Xerolenta obvia	Heath snail	Prohibited	-
Fish			
Channa argus	Northern snakehead	Watch List, Prohibited	-
Ctenopharyngodon idella	Grass carp	Watch List, Prohibited	-
Hypophthalmichthys molitrix	Silver carp	Watch List, Prohibited	-
Hypophthalmichthys noblis	Bighead carp	Watch List, Prohibited	-
Mylopharyngodon piceus	Black carp	Watch List, Prohibited	-

Table F-10. Priority Invasive Animal Species for Camp Grayling			
Scientific Name	**Common Name**	**State Rank**	**Camp Grayling**

*Indicates species is not yet detected in Michigan

[1]State Rankings are provided by Michigan Department of Agriculture under the Natural Resources and Environmental Protection Act (451 of 1994, as amended) Part 413, Transgenic and Nonnative Organisms. Annually, species may be added, deleted or re-classified by the legislature based on recommendations from the Natural Resources Commission or the Commission of Agriculture and Rural Development in consultation with the departments of Natural Resources and Agriculture and Rural Development. This list acts as a first line of prevention and awareness, with other supporting activities strengthening this effort.

[2] Documented indicates species known to occur on Camp Grayling.

Source: (MDARD et al. 2018; Michigan's Invasive Species Program 2018)

Additional invasive animals are identified at https://www.michigan.gov/invasives/0,5664,7-324-68002---,00.html. At this time, the species included in Table F-10 are considered a priority, with a focus on those that have been found on Camp Grayling and which are being actively managed and/or monitored. The aquatic invasive animals likely to occur on Camp Grayling are most likely on Lake Margarethe, which is the largest lake on Camp Grayling. A portion of the lake occurs on private property.

Zebra mussels are native to the Caspian Sea region of Asia are now established in all the Great Lakes, the Mississippi River, and are showing up in inland lakes. They have severely reduced and eliminated some native mussel species and disrupted natural aquatic food chains. They are spread by the adults attaching to watercraft or by the microscopic larvae carried in livewells or bilge water.

In 2002, zebra mussels were confirmed in Lake Margrethe, similar to Eurasian milfoil described above. Signs on the Lake Margrethe boat launches explain the precautions that boaters must take to prevent the mussel's spread to inland lakes. Camp Grayling participates in the annual zebra mussel monitoring program in cooperation with the Lake Margrethe Property Owners Association. Units that perform water borne military activities on camp do visual inspections of their equipment and drain their bilges on completion of training events. The bilges remain dry for a long enough period between exercises to kill any larvae they may contain.

F.4.4 PEST-BORNE DISEASES

Pest-borne diseases are those diseases that are carried by pests and insects and affect humans. Sometimes these are called vector-borne diseases. The most common pest-borne diseases around CGMTC, the host species, and a link for further information are below.

Documented in Michigan:

- Lyme disease/blacklegged tick - www.michigan.gov/lyme
- West Nile virus/mosquitoes - www.mighigan.gov/westnile
- Rocky Mountain Spotted Fever (RMSF) (rare)/ ticks, most commonly the American dog tick - www.mighigan.gov/rmsf
- Anaplasmosis/blacklegged tick and the western blacklegged tick - https://www.michigan.gov/emergingdiseases/0,4579,7-186-76711_77938---,00.html

Possible in Michigan:

- Hantaviruses - https://www.uofmhealth.org/health-library/hw191131
- Human Ehrlichiosis - https://www.michigan.gov/emergingdiseases/0,4579,7-186-76711_78018---,00.html

With climate change, it is expected the pest-borne diseases will shift distribution.

Lyme Disease is caused by the bacterium *Borrelia burgdorferi* and is transmitted to humans through the bite of infected blacklegged (deer) ticks (*Ixodes scapularis*). Typical symptoms include fever, headache, fatigue, and a characteristic "bullseye" skin rash. Untreated, Lyme disease can infect joints, the heart, and the nervous system.

In 1992, the U.S. Army Environmental Hygiene Agency (AEHA), conducted a Lyme disease risk assessment of the Camp Grayling area. This assessment reported that there was no evidence of Lyme disease on Camp Grayling. Another assessment for Lyme disease and Anaplasmosis was conducted in 2006 (USACHPPM-North 2007). During the 2006 assessment, blood from 44 white tailed deer and 1 black-legged tick did not show evidence of Lyme disease or Anaplasmosis. The number of confirmed cases of Lyme disease in Michigan over a period of ten years has more than doubled, jumping from 55 confirmed cases in 2006 to 159 in 2016 (CDC 2017). Thus, although past studies indicate that the risk for Lyme disease on Camp Grayling is low, this disease is growing in the number of diagnosed cases per year in Michigan. According to the Michigan Department of Health and Human Services (MDHHS), Kalkaska and Otsego Counties have a potential to contain infected blacklegged ticks. However, as of 2017, Crawford County still had not been confirmed with blacklegged ticks. Consult the MDHHS website for the most current information at www.michigan.gov/lyme.

West Nile virus (WNV) is most commonly transmitted to humans by mosquitoes. WNV sometimes causes a fever and rarely causes neurological disorders, with the risk being higher in those individuals over age 60. In Michigan, outbreaks of WNV have been occurring every summer since 2002. Urban areas in Southeastern Lower Michigan and Western Lower Michigan have historically seen the most West Nile virus activity. The risk of infection is highest for people who work outside or participate in outdoor activities because of greater exposure to mosquitoes.

A WNV Surveillance Program was undertaken at Camp Grayling from 2003 through 2006 (USACHPPM-North 2007). Mosquitoes collected 3 times a week from traps located around the cantonment area were sent to USACHPPM for testing. None tested positive during this sampling period. For the most current information on WNV in Michigan, see the MDHHS website at www.mighigan.gov/westnile.

Rocky Mountain Spotted Fever (RMSF) is a bacterial disease caused by the bacterium, *Rickettsia rickettsia* transmitted by ticks, most commonly the American dog tick (*Dermacentor variabilis*). The American dog tick is very common in Michigan, but RMSF is rarely reported in the state. It is not currently known whether the American dog tick or RMSF occurs on Camp Grayling. For the most current information on RMSF in Michigan, see the MDHHS website at https://www.michigan.gov/emergingdiseases/0,4579,7-186-76711_78010---,00.html.

Anaplasmosis is caused by the bacterium *Anaplasma phagocytophilum* and is also transmitted by the bite of an infected tick, particularly the blacklegged tick and the western blacklegged tick

(*Ixodes pacificus*). This disease is characterized by fever, chills, and muscle aches. See discussion under Lyme disease for previous assessments of this disease on Camp Grayling. For the most current information on anaplasmosis in Michigan, see the MDHHS website at https://www.michigan.gov/emergingdiseases/0,4579,7-186-76711_77938---,00.html.

Other Pest-Borne Diseases

There is a risk for other diseases carried by pests in Michigan, including hantaviruses and human ehrlichiosis. Hantaviruses are pathogens carried by, and transmitted to humans, from rodents. Humans can contract hantavirus infection when they come into contact with infected rodents or their urine and droppings. Ehrlichiosis is a term is broadly applied to multiple different infections; *Ehrlichia chaffeensis* and *Ehrlichia ewingii* are transmitted by the lone star tick (*Amblyomma americanum*) in the southeastern and southcentral U.S and the tick that transmits *Ehrlichia muris-like* (EML) has yet to be determined.

In 1997, USACHPPM performed an "Arthropod and Rodent-Borne Disease Profile" for Camp Grayling. The purpose of this study was to assess the disease threat to personnel at camp for exposure to hantavirus pulmonary syndrome (HPS), Rocky Mountain Spotted Fever (RMSF), Lyme disease, and human ehrlichiosis. Blood and tissue samples were taken from 50 rodents that were live-trapped on Camp Grayling. These rodents were also examined for ticks but none were found. No evidence of RMSF or human ehrlichiosis was found (see above for summary of Lyme disease results). One of 50 rodent blood samples did test positive for antibodies to the causative agent of HPS.

F.5 FISH AND WILDLIFE

Fish and wildlife management are tied in closely with vegetation management. Early successional forests (brushlands and timber types resulting from clearcutting or fire) provide valuable plant communities for many key wildlife game species, as well as many non-game wildlife species. More mature forests and later successional stages of the forest provide habitat for numerous other types of game and non-game wildlife species. It is, therefore, important to realize that the management of various cover types or featured wildlife game species also benefit a host of other game and non-game species. Because of this close association between wildlife and various cover types, wildlife species and populations are good indicators of habitat and ecosystem quality.

F.5.1 SURVEY HISTORY

A variety of fauna surveys have been completed over the years, as can be seen in Appendix K. Six multi-taxa surveys have been completed from 1994-2006. Several new records and significant discoveries occurred during these surveys, as is noted in the Threatened and Endangered Species summary in Appendix L. Full species lists are included in Appendix J.

Amphibians and Reptiles

- Manning et al. 2006. Herpetofaunal Sampling at Camp Grayling. Center for Reptile and Amphibian Conservation and Management, Indiana-Purdue University, Fort Wayne, IN.
- *This report summarizes herpetofaunal biodiversity and health and identifies potential conflicts in management and military training.*

- Ravesi et al. 2016. Detection of Snake Fungal Disease from a *Lampropeltis triangulum* (Eastern Milksnake) in Northern Michigan. Notes of Northeastern Naturalist. 23 (3): N18-N21.

- Eastern massasauga: Thirteen publications for the eastern massasauga have been completed on Camp Grayling, with most of them being a collection of projects associated with university researchers. Some projects are also related to management and population status (see Appendix L).

Mammals

- CEC. 2016. Findings Report for a Survey of Bat Species Composition. Civil & Environmental Consultants, Inc. Crawford, Kalkaska, and Otsego Counties, Michigan: Camp Grayling Joint Maneuver Training Center.

- *This report used acoustic surveys to determine bat species composition on Camp Grayling.*

- Schreiber and Anderson. 1997. Camp Grayling LCTA Wildlife Analyses. Army Environmental Center, San Antonio, TX.

- *Bird and small mammal data from Land Condition Trend Analysis (LCTA) wildlife plots from 1992 – 1994 were analyzed in this document and 1994 wildlife data was added to the LCTA database.*

Birds

- USDA. 2018. Wildlife Hazard Site Evaluation, Grayling Army Airfield. Grayling, MI. October 2016- September 2017, US Department of Agriculture, Animal and Plant Health Inspection Service, Gaylord, MI. Available from www.aphis.usda.gov/wildlife_damage.

- *This report summarizes airfield wildlife hazard data collected over the course of one year.*
- Williams, Dane. 2017. Grayling Army Airfield: Status Report on Seasonal ARNG BASH Surveys. Gaylord, MI: USDA APHIS Wildlife Services.

- *This report summarizes airfield bird strike data.*

- Schreiber and Anderson. 1997. Camp Grayling LCTA Wildlife Analyses. Army Environmental Center, San Antonio, TX.

- *Bird and small mammal data from Land Condition Trend Analysis (LCTA) wildlife plots from 1992 – 1994 were analyzed in this document and 1994 wildlife data was added to the LCTA database.*

- Perez and Huntington. 1986. Cooperative Agreement Between Michigan Department of Natural Resources and Department of Military Affairs: Implementation of a Management Plan for the Range 30 Complex (Tank Range). Michigan Department of Natural Resources and Michigan Department of Military Affairs.

- *This document outlines the management of Range 30, which experiences more land use conflicts, in a cooperative agreement that precedes the larger Kirtland's Warbler recovery plan, which is a cooperative agreement between the USDI, USFS, and MDNR.*

Fish

- Upper Manistee River Association. 2016. Portage Creek Fish Sampling Summary *This summary describes a one-pass census of fish in Portage Creek to determine community composition.*

Invertebrates

- Higman P, Cuthrell D, Montfils M. 2005. Re-assessment of Known Occurrences and Additional Surveys for Rare Species at Camp Grayling Maneuver Training Center (Report No. 2005-07). 2005–07. Michigan Natural Features Inventory, Lansing, MI.
- Raffel, et al. 2017. Progress Report: Michigan Swimmer's Itch Survey 2016. Michigan: Oakland University. (progress report, not final)
- *This report summarized findings of an investigation in Michigan lakes into avian schistosome parasites which cause swimmer's itch and their possible environmental drivers.*
- MIARNG. 2007. Vector-Borne Disease Surveillance Report. US Army Center for Health Promotion and Preventative Medicine. Camp Grayling National Guard Military Reservation, Grayling, MI.
- *This report investigated ticks and blood samples from white-tailed deer for evidence of vector-borne diseases on Camp Grayling.*

F.5.2 WILDLIFE

Much of Camp Grayling is open to the public for hunting and trapping, as well as wildlife watching, hiking, and photography. Any legal game species can be hunted or trapped on Camp Grayling following MDNR and USFWS regulations. Priority game species include deer, beaver, black bear, ruffed grouse, and turkey.

Amphibians and reptiles are abundant at Camp Grayling and the species diversity reflects that expected for this part of Michigan.

Migratory birds are common on Camp Grayling during breeding season. There are some fall and spring migratory birds moving between summer breeding areas in Canada and wintering grounds to the south.

There are a number of rare or unusual insects (at least 11 species) that have been documented on Camp Grayling (MNFI 1994).

There are a nuber of rare wildlife species documented on Camp Grayling. They are summarized in Appendix L.

F.5.3 FISH

The Manistee River is relatively shallow channel that contains woody debris, making fishing and canoeing difficult while creating good nursery habitat for fishes. The reach of the Manistee River between Michigan Highway 72 and Sharon Road provides fair to good fishing for brook and brown trout. A section from M-72 to the CCC Bridge is a state-designated quality fishing area. The Upper Manistee River Watershed has been shown by MDNR to have either a good or

excellent fishery, and the fishery survey MDEQ conducted in 1999 and 2004 indicated similar results (MDEQ 2007).

Portage Creek is an important connector between Lake Margrethe, an important fishery in the region, and the Upper Manistee River. Portage Creek is roughly 7 miles long and is considered a brook trout and brown trout wild fishery stream, with naturally reproducing populations of both. The small dam at the beginning of the creek near Lake Margrethe can decrease flow, especially during summer months, and this can impact water temperature and therefore the species composition of fish in the creek (Williams 2016). A 2016 survey indicated that upstream reaches of Portage Creek are excellent nursery habitat for brook trout (MDNR 2016).

The Au Sable River is also considered a trout fishery, although different reaches have different quality habitat. The East Branch AuSable River contains naturally reproducing populations of brook trout and brown trout.

Some of the small inland lakes including Frog Lake, Duck Lake, and Howe's Lake support populations of warm water fishes, primarily bass and bluegills, that are naturally sustained. Lake Margrethe has been managed for several fish species, including large and smallmouth bass, walleye, northern pike, perch and bluegill. Occasionally, fish stocking occurs in Lake Margrethe. A MDNR fisheries survey showed that Lake Margrethe has generally healthy gamefish populations, with smallmouth bass being the most numerous (MDNR 2007).

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APPENDIX G

NATURAL RESOURCES PROGRAM OBJECTIVES

Natural Resources Management

- OBJECTIVE PM1: Implement INRMP to enhance the land and military mission.
- OBJECTIVE PM2: Maintain appropriate state and federal permits related to natural resources management, including water and wildlife management issues.
- OBJECTIVE PM3: Continue internal environmental awareness program to minimize adverse environmental impacts.
- OBJECTIVE PM4: Continue public outreach in collaboration with other regional entities as available and appropriate.
- OBJECTIVE PM5: Continue to collaborate with other agencies and local landowners on regional land and natural resources management efforts.
- OBJECTIVE PM6: Maintain and improve GIS data and accessibility to inform CGMTC Environmental staff and other stakeholder entities, such as DOTS, MDNR, USFWS, etc.

Soil Conservation

- OBJECTIVE SO1: Manage construction sites, roads, trails, and slopes to comply with regulations and permits, maintain alignment with the Operational Range Sustainability Program, and provide direction to the Range Training Land Assessment (RTLA) program.
- OBJECTIVE SO2: Manage soil erosion and promote awareness of erosion and sedimentation controls to ensure the long-term use of military training areas.
- OBJECTIVE SO3: Continue spill prevention and pollution prevention programs to prevent contamination of soils and water resources.

Vegetation Management

- OBJECTIVE VE1: Maintain HQNAs to promote and maximize habitat for rare and sensitive species and natural communities
- OBJECTIVE VE2: Promote natural resource sustainability and conservation, and support the military mission by collaborating with the MDNR regarding forest management
- OBJECTIVE VE3: Maintain open landscapes to support the military mission and promote habitat diversity, with special attention to the Pine Barrens management area and ranges
- OBJECTIVE VE4: Ensure grounds maintenance, new construction, and landscaping activities do not promote pests (e.g., oak wilt fungus) or invasive species (e.g., spotted knapweed)

Wildland Fire

- OBJECTIVE FI1: Implement the IWFMP and continue to coordinate wildland fire activities efforts with MDNR, and other partners
- OBJECTIVE FI2: Use prescribed fire to support military training, ecological health, biodiversity, and rare species

Invasive Species

- OBJECTIVE IN1: Continue early detection and rapid response to reduce and eliminate new invasive species in both aquatic and terrestrial areas.
- OBJECTIVE IN2: Minimize impacts of invasive species and forest pests to the military mission, native species, and sensitive natural resources.

Fish and Wildlife

- OBJECTIVE FW1: Monitor populations of priority game species as part of regional management plans, in coordination with MDNR.
- OBJECTIVE FW2: Monitor populations of fish and wildlife species, with targeted monitoring for priority species.
- OBJECTIVE FW3: Manage fish and wildlife habitats and promote landscape scale connectivity.
- OBJECTIVE FW4: Provide support services to GAAF and the 40 Complex personnel in their implementation of the respective BASH plans.

Species of Conservation Concern

- OBJECTIVE TE1: Monitor populations of federally listed species as part of regional management plans, in coordination with the USFWS.
- OBJECTIVE TE2: Manage habitat of federally listed species.
- OBJECTIVE TE3: Monitor populations of state-listed species as part of regional management plans, in coordination with MDNR.
- OBJECTIVE TE4: Manage habitat of state-listed species.
- OBJECTIVE TE5: Monitor populations of other species of conservation concern and manage the habitats to avoid further population declines

Recreation

- OBJECTIVE RE1: Coordinate with the MDNR to ensure safe recreational land use by the public does not conflict with military training opportunities or natural resource management, and to resolve any known potential conflicts between authorized recreational land use and military land use.

Climate Resiliency

- OBJECTIVE CC1: Protect natural resources sensitive to climate change and increase ecological resiliency on CGMTC.
- OBJECTIVE CC2: Continue participating in regional efforts to increase resiliency in all arenas to support the military mission.

APPENDIX H
LIMITATIONS MEMORANDUM

MICHIGAN ARMY NATIONAL GUARD
CAMP GRAYLING JOINT MANEUVER TRAINING CENTER
HEADQUARTERS, BUILDING FOUR
CAMP GRAYLING, MICHIGAN 49739-0001

NGMI-JHQ-CG Feb 2020

MEMORANDUM FOR: Units Requesting Utilization of Camp Grayling JMTC

SUBJECT: Training Area Limitations for Calendar Year 2020

1. Camp Grayling Regulation 200-1, Environmental Protection and Enhancement (25 January 2018) sets forth training area limitations. In addition, the following training areas will have limitations to military training activities during calendar year 2020:

Training Area	Type Limitation	Reason
All areas	Limit tracked vehicle movement to existing roads/trails.	Species Management
STA 01, 02, 03, 08, 17, 18, 19, 20, 21, 22, 23, 24 NTA 26 West of gridline 865	No tracked vehicles off of Tank Trail Limit all off road vehicle movement	Lease Agreement
STA 1 North of grid line 545 East of grid line 70 (refer to map)	No military activity of any kind 1 May thru 15 Aug.	Sensitive Species
STA 5 North of grid line 49 and west of grid line 72 to Arrowhead Rd (refer to map)	No military activity of any kind 1 May thru 15 Aug.	Sensitive Species
STA 8 (IVO 643 457)	Small unmarked site. Use limited to roads and trails 100 m from listed point. Rest of STA 8 open to normal training	Protected Area
STA 9 Area south of Portage Creek	Foot traffic only! No bivouac, no vehicles. **Water purification units OK with prior written approval.**	Sensitive Species
STA 12 South of grid line 405 to Military Rd East of grid line 595 to Sunset Trl	No military activity of any kind 1 May thru 15 Aug.	Sensitive Species
STA 13 (IVO FQ 627 391)	Small unmarked site. Restricted area encompasses 100 m from listed point. Use limited to roads and trails. Rest of STA 13 is open to normal training.	Protected Area
STA 14 (IVO FQ 682 415)	Small unmarked site. Restricted area encompasses 100 m from	Protected Area

STA 14 (IVO FQ 682 415) cont.	listed point. Rest of STA 14 is open to normal training.	Protected Area
STA 18 (IVO FQ 672 375)	~ 30 acre fenced area, no access.	Protected Area
STA 22 (IVO FQ 582 320)	Small marked site with signs. Use limited to roads & trails. Rest of STA 22 is open to normal training.	Protected Area
STA 22 (IVO FQ 600 310)	Small marked site with signs. Use limited to roads & trails. Rest of STA 22 is open to normal training.	Protected Area
STA 22 (IVO FQ 654 493)	Small unmarked site. Use limited to roads and trails 100 m from listed point. Rest of STA 22 is open to normal training	Protected Area
STA 23 (IVO FQ 579 327)	Small unmarked site. Use limited to roads and trails 100 m from listed point. Rest of STA 23 is open to normal training	Protected Area
STA 23 (IVO FQ 571 330)	Small unmarked site. Use limited to roads and trails 100 m from listed point. Rest of STA 23 is open to normal training	Protected Area
NTA 4 (IVO FQ 924 519)	Small marked site with signs. Use limited to roads & trails. Rest of NTA 4 is open to normal training.	Protected Area
NTA 9 (Red Pine Natural Area)	Foot traffic only, no bivouac, no vehicles	DNR Natural Area
NTA 9: N. of Gridline 525 NTA 10: S. of Bucks East and West Truck Trail	No military activity of any kind 1 May thru 15 Aug. During the remainder of the year this area may be used with written authorization from Range Operations for foot traffic and wheeled vehicles on existing roads only.	Sensitive Species
NTA 16 (IVO FQ 875 608)	Small unmarked site. Restricted area encompasses 100 m from listed point. Use limited to roads & trails. Rest of NTA 16 is open to normal training.	Protected Area
NTA 20 K.P. Lakes, Area N. of Gridline 62, W. of Wakeley Br. Rd., E. and S. of CR 612	Foot traffic only, no bivouac, no vehicles	Private Property
NTA 23 (IVO FQ 881 629 Bear Lake)	Small marked site with signs. Use limited to roads & trails. Rest of NTA 23 is open to normal training.	Protected Area
NTA 28 (Powerline road east of Guthrie Lakes)	Avoid road use. Alternative routes have been identified	Safety Restrictions
NTA 29 (IVO 952 725)	Small unmarked site. Use limited to roads and trails 100 m from listed point. Rest of NTA 29 is open to normal training	Protected Area

2. Use of Blanks, Smoke Grenades, Trip Flares and all other types of Pyrotechnics will not be allowed at the Grayling Army Airfield or Camp Grayling JMTC cantonment area due to safety restrictions.

3. Range 30 Complex limitations:
Maneuvering inside of the fence is restricted to existing roads and trails. Bivouac sites for unit maintenance and range personnel in direct support of live fire activities, must be submitted to Range Control for approval. No other bivouacking is authorized.

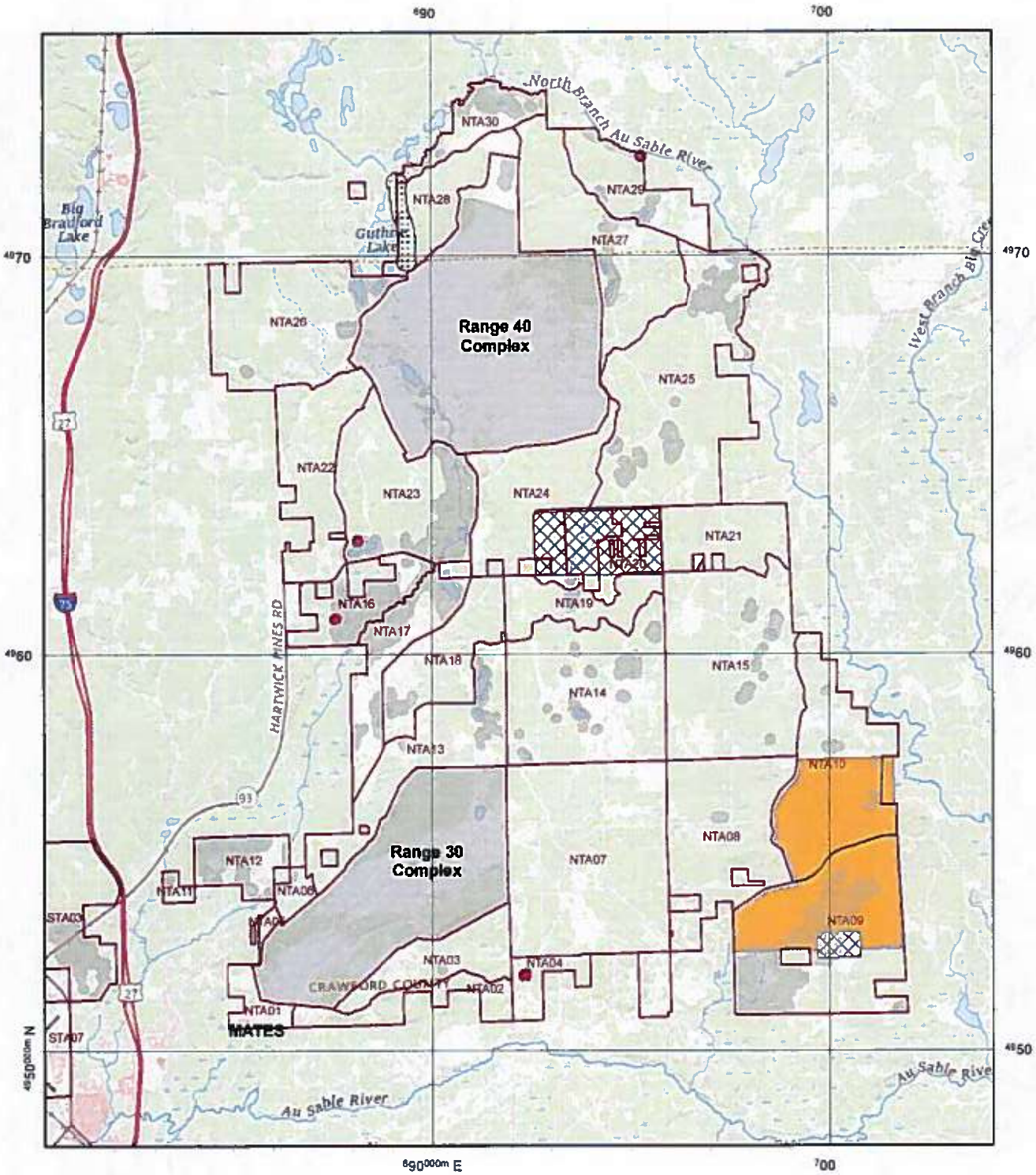
4. Maps of these limitations, South Camp and North Camp are included with this memorandum.

5. POC is Camp Grayling Environmental Department at (989) 344-6175/6176/6179 or Range Control Fire Desk at (989) 344-6156.

Brian K. Burrell
Lieutenant Colonel,
Deputy Garrison Commander

Attachments: South Camp
North Camp

Camp Grayling 2020
Limitations to Training
North Camp



- Power Line - safety restrictions
- Foot traffic only, no bivouac, no vehicles
- Protected area, use limited to roads & trails
- Seasonal restrictions, see memo for specifics
- No digging or earth moving of any kind; all other locations contact the Enivronmental Office for digging or earth moving requests

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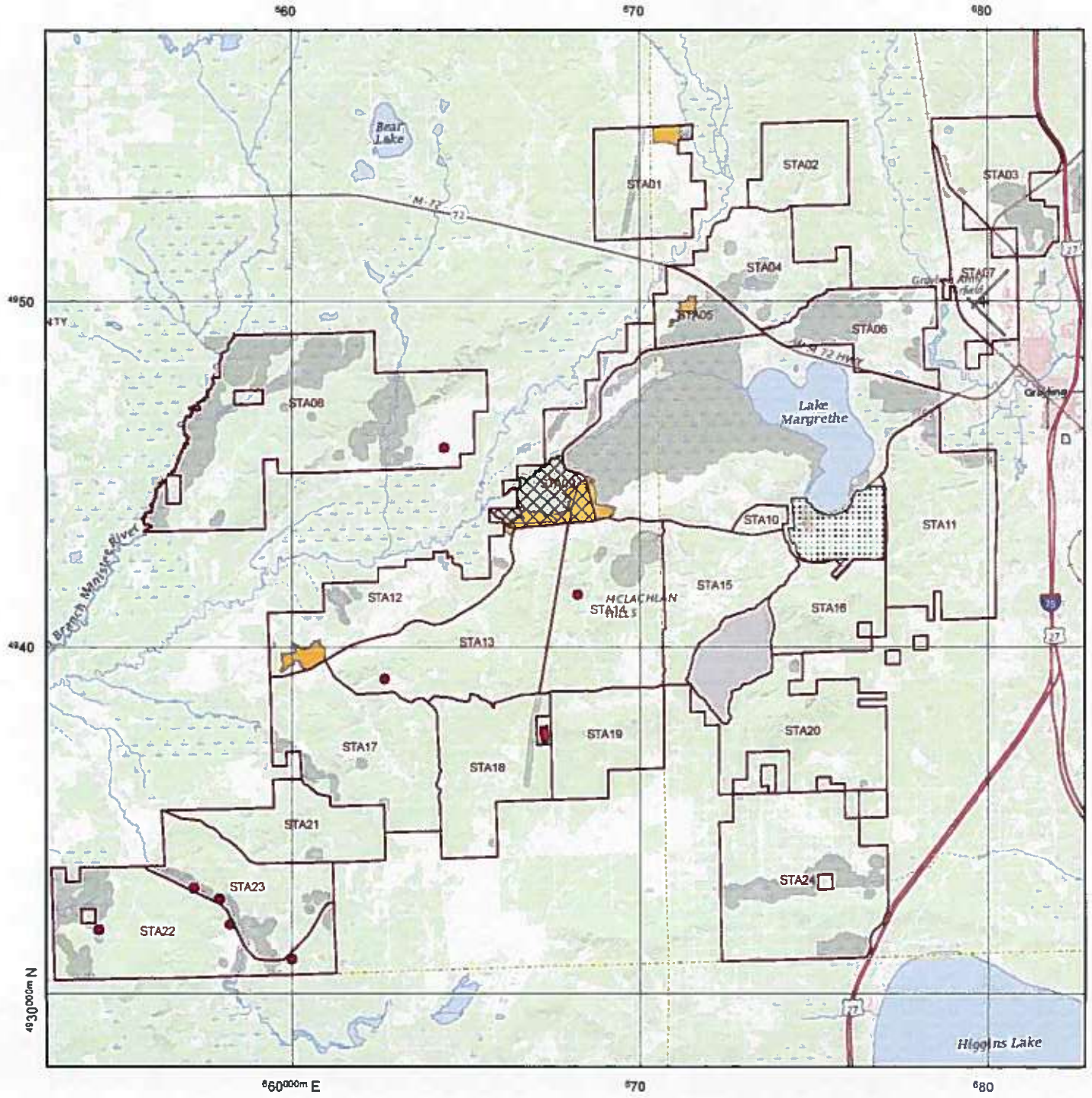
Camp Grayling 2020 Limitation to Training South Camp



- Fenced Cantonment
- Foot traffic only, no bivouac, no vehicles
- Protected area, use limited to roads & trails
- Seasonal restrictions, see memo for specifics
- No digging or earth moving of any kind; all other locations contact the Enivronmental Office for digging or earth moving requests

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limitations20_south

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APPENDIX I
IMPLEMENTATION TABLES

Table C-1. Routine MDMVA Activities for Camp Grayling INRMP Implementation

Activity		Priority	Objective(s) in Section 3	MDMVA Program	Timing	Annual Man-Hours	Completed										
							FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
PM1.1	Annually review and update the INRMP, incorporating management changes as necessary per adaptive management and any new information, in cooperation with USFWS and MDNR	0	PM1	ENV	Annually												
PM1.2	Maintain correspondence with USFWS and MDNR regarding updates to federal and state threatened, endangered, and species of concern lists	0	PM1	ENV	As Needed												
PM1.3	Annually submit funding requests	0	PM1	ENV	Annually												
PM1.4	Coordinate annually (or quarterly) with MDNR regarding upcoming natural resources management	0	PM1, VE2	ENV	Annually												
PM1.5	Respond to data requests/calls regarding projects and implementation	0	PM1	ENV	As Needed												
PM1.6	Coordinate and integrate INRMP with other plans for Camp Grayling	0	PM1	ENV	As Needed												
PM1.7	Continue EQCC at MDMVA headquarters to provide command visibility of environmental issues	0	PM1	Multiple	As Needed												
PM1.8	Coordinate periodic internal meetings to monitor progress in reaching INRMP goals and objectives, and discuss potential operational changes that could impact those goals and objectives	0	PM1	ENV	As Needed												
PM1.9	Update INRMP implementation tables and INRMP appendices annually	0	PM1	ENV	Annually												
PM1.10	Complete Review for Operation and Effect with USFWS and MDNR every 5 years	0	PM1	ENV	Every 5 years					X							
PM1.11	Monitor populations (e.g., rare species, target wildlife species) or areas where management has been undertaken to ensure the management target is achieved and modify projected management as needed	1	PM1	ENV	As Needed												
PM1.12	Provide continuing education to natural resources and other environmental staff to recognize sensitive resources and improve management	0	PM1, All objectives	ENV, MDNR	As Needed												
PM2.1	Review proposed activities in known or potential jurisdictional waters of the US, including wetlands and floodplains	0	PM2	ENV	As Needed												
PM2.2	Obtain EGLE Section 404 permits for activities that impact waters of the US	0	PM2	ENV, ITAM, DPW	As Needed												
PM2.3	Provide assistance in determining need for BASH-related depredation permits	0	PM2	ENV, GAAF	Annually												
PM2.4	Maintain any USFWS or MDNR permits required for T&E species, for recovery actions, section 7 authorization, section 10a1b permits for incidental take, etc.	0	PM2	ENV	As Needed												
PM2.5	Assist Range Control with site clearance	0	PM2	ENV	As Needed												
PM2.6	Facilitates the implementation of the Integrated Training Area Management (ITAM)	0	PM2	ENV	As Needed												
PM2.7	Develops procedures, policies, and protocols relating to natural resource management; and, oversees and/or manage spill responses and confirms remediation is complete.	0	PM2	ENV	As Needed												
PM3.1	Maintain internal awareness materials and update	0	PM3	ENV	As Needed												
PM3.2	Update "Training and the Environment: Field Guide" every 5 years	0	PM3	ENV	Every 5 years												
PM3.3	Post awareness materials in relevant locations and update posters as needed	0	PM3	ENV	As Needed												
PM3.4	Complete UECO certification courses annually	0	PM3	ENV	Annually												
PM3.5	Provide materials to users (soldiers and recreation users) related to potential diseases and hazardous wildlife	0	PM3	ENV, ITAM	As Needed												
PM3.6	Provide materials for users to reduce risk of spread of invasive species	0	PM3	ENV, ITAM	As Needed												
PM3.7	Develop educational materials related to natural resources management, sensitive resources, and operational policies	0	PM3	ENV, ITAM	As Needed												

Table C-1. Routine MDMVA Activities for Camp Grayling INRMP Implementation

Activity		Priority	Objective(s) in Section 3	MDMVA Program	Timing	Annual Man-Hours	Completed										
							FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
PM4.1	Use programs, events, and news releases to publicize natural resources management	0	PM4	ENV	As Needed												
PM4.2	Develop environmental education programs and/or sponsor events in cooperation with local educational institutions, conservation organizations, and public service agencies	0	PM4	ENV	As Needed												
PM5.1	Participate in partnerships with agencies (i.e., federal, state, local, or non-profit) and other groups engaged in natural resources management	0	PM5	ENV	As Needed												
PM5.2	Cooperate with landowners and other agencies to facilitate compatible land uses	0	PM5	ENV	As Needed												
PM5.3	Cooperate with other agencies to communicate FireWise principles to private landowners	0	PM5	ENV	As Needed												
PM5.4	Cooperate with MDNR to post and/or provide information to recreational users about sensitive resources (i.e., soils, water resources, rare species, not spreading invasive species)	0	PM5	ENV, DNR	As Needed												
PM6.1	Continually identify and develop digital information that will assist with natural resources management decisions and environmental impact analysis	0	PM6	ENV, ITAM	As Needed												
PM6.2	Ensure that all management activities are documented in GIS with sufficient metadata about date, management accomplished, lead organization, etc	0	PM6	ENV, ITAM	As Needed												
PM6.3	Provide GIS data and related maps showing relevant natural resources for MDMVA decision makers.	0	PM6	ENV, ITAM	As Needed												
SO1.1	Manage the repair of existing roads and firebreaks following appropriate BMP Manual(s)	0	SO1	ENV, ITAM, DPW	Ongoing												
SO1.2	Minimize impacts from stream crossings by following regional BMPs available for culvert design and culvert maintenance	0	SO1	ENV, ITAM, DPW	As Needed												
SO1.3	Provide training on use of BMPs and appropriate maintenance to Camp Grayling staff	0	SO1	ENV, ITAM, DPW	As Needed												
SO1.4	Reviews Soil Erosion and Sedimentation Control (SESC) plans, and issues SESC permits and authorizations																
SO2.1	Monitor erosion prone areas and coordinate with appropriate entity to correct any erosion documented	0	SO2	ENV, ITAM, DPW	Annually												
SO2.2	Track known problem areas and identify priority locations for closure, implementation of BMPs, and/or revegetation	0	SO2	ENV, ITAM, DPW	Annually												
SO2.3	Provide a system for users to report erosion problems	0	SO2	ENV, ITAM, DPW	Ongoing												
SO3.1	Minimize pollution into surface and ground waters through the implementation of BMPs and existing plans	0	SO3	ENV, DPW	Ongoing												
WA1.1	Implement all stormwater and pollution prevention plans	0	WA1	ENV, DPW	Ongoing												
WA2.1	Update the water resources map after any permitted base projects impact or change water resources boundaries	0	WA2	ENV	As Needed												
WA2.2	If impacts to jurisdictional waters are found to be necessary, obtain appropriate permits	0	WA2	ENV	As Needed												
WA2.3	Regularly inspect buffers, wetlands, other water resources, and riparian corridors for evidence of erosion and other adverse impacts	0	WA2, VE3	ENV	Annually												
VE1.1	Monitor changes in vegetation following prescribed fire, invasive plant removals, and forestry operations and modify management targets as needed	0	VE1, VE2, VE3, VE4	ENV	As Needed												
VE2.1	Review MDNR updates to recommendations for forest stands for consistency with military training and other MDMVA activities	0	VE2	ENV, RC	Annually												
VE2.2	Follow MDNR Forestry BMPs to minimize negative environmental impacts	0	VE2	ENV	Ongoing												
VE2.3	Follow guidelines or restrictions associated with listed species during forestry operations	0	VE2	ENV, MDNR	Ongoing												

Table C-1. Routine MDMVA Activities for Camp Grayling INRMP Implementation

Activity		Priority	Objective(s) in Section 3	MDMVA Program	Timing	Annual Man-Hours	Completed										
							FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
VE3.1	Maintain buffers, particularly around wetlands and for riparian corridors, around water resources	0	VE3	ENV, MDNR	Ongoing												
VE4.1	Follow beneficial landscaping practices (site analysis, careful plant selection, appropriate mulching and trimming, etc.) to reduce maintenance, reduce water use, limit invasive plants, and increase health of plants	0	VE5	ENV, DPW	Ongoing												
VE4.2	Ensure that new or renovated landscaping uses plants that are regionally native and provide a wildlife benefit, when possible	0	VE5	ENV, DPW	As Needed												
VE4.3	Coordinate with MDNR to identify and remove potential safety hazards from trees associated with military training, infrastructure, or recreation	0	VE5, RE1	ENV, DPW, MDNR	As Needed												
FI1.1	Implement IWFMP, including all training, processes, and reporting requirements and update as needed	0	FI1, FI2	ENV, DPW, MDNR, RC	Ongoing												
FI1.2	Complete required training and equipment maintenance related to wildland fire	0	FI1, FI2	ENV, DPW, MDNR, RC	Annually												
FI1.3	Ensure all fire-related equipment is clean before and after use to prevent spread of invasive species and tree diseases	0	FI1, FI2	ENV, DPW, MDNR, RC	Ongoing												
FI1.4	Maintain Fire Log, including fire date, fire intensity, location on base, and number of acres burned (including GIS data when possible)	0	FI1, FI2	ENV, DPW, MDNR, RC	Annually												
FI1.5	Coordinate with MDNR to manage military roads and trails, forest access roads, and other features as effective firebreaks	0	FI1	ENV, DPW, ITAM, MDNR	Ongoing												
FI1.6	Coordinate with MDNR to monitor vegetation after each fire and document whether management target was achieved and modify future fires accordingly	0	FI1, FI2	ENV, MDNR	Ongoing												
FI1.7	Coordinate with MDNR and other partners to promote greater wildland fire fighting capability in local firefighters	0	FI1	ENV, DPW, MDNR	As Needed												
FI1.8	Establish/maintain MOAs and interagency agreements with surrounding jurisdictions for mutual assistance during wildland fire activities	0	FI1, FI2	ENV, DPW	As Needed												
FI1.9	With input from all stakeholders and based on field conditions, identify high priority areas for burning and fuels management every year, based on the 5-year evaluation	0	FI1, F2	ENV, RC, MDNR	As Needed												
FI2.1	When wildfires occur, evaluate whether the wildfire can be managed to achieve a management target as a controlled burn	0	FI1, FI2	ENV, DPW, MDNR, RC	As Needed												
FI2.2	Coordinate with MDNR to minimize smoke impacts on neighbors and maintain GIS data of sensitive receptors	0	FI1, FI2	ENV, DNR	As Needed												
FI2.3	Coordinate with MDNR to negotiate with objectors to establish a feasible set of conditions under which prescribed fires can be conducted without complaints	0	FI1, FI2	ENV, DNR	As Needed												
FI2.4	Coordinate with MDNR and other partners for potential prescribed fires ahead of time to ensure that any pre-fire preparations are identified (i.e., invasive plant treatments, mechanical thinning, firebreaks, etc.)	0	FI1, FI2	ENV	Annually												
IN1.1	Implement IPMP and complete annual update	0	IN1, IN2	ENV, DPW	Annually												
IN1.2	Complete annual reporting requirements, including herbicide applications for invasive plant control	0	IN1, IN2	ENV	Annually												
IN1.3	Ensure all pest managers are trained and certified for the techniques used	0	IN1, IN2	ENV	Ongoing												
IN1.4	Pursue opportunities for cost sharing or grants for invasive plant management, when they are available	0	IN1, IN2	ENV	As Needed												
IN1.5	Verify and update priority invasive species lists annually	0	IN1, IN2	ENV	Annually												
IN2.1	Use certified weed-free sources for revegetation and sediment control	0	IN2	ENV, DPW, ITAM	As Needed												
IN2.2	Implement policy for cleaning/inspection of any vehicles entering Camp Grayling to prevent new infestations	0	IN2	ENV, DPW	Ongoing												
IN2.3	In addition to any contracted monitoring, monitor areas of ground disturbance, prior natural resources management, and access roads for invasive plants requiring treatment	0	IN1, IN2	ENV	As Needed												

Table C-1. Routine MDMVA Activities for Camp Grayling INRMP Implementation																	
							Completed										
Activity		Priority	Objective(s) in Section 3	MDMVA Program	Timing	Annual Man-Hours	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
IN2.4	Coordinate with MDNR to evaluate any signs of forest pests and determine action needed and participate in regional initiatives to monitor forest pests	0	IN2	ENV, MDNR	As Needed												
IN2.5	When necessary, create and provide awareness materials to Camp Grayling users to reduce risk from disease vectors	1	IN2	ENV	As Needed												
FW1.1	Review game species data with MDNR annually to identify any changes needed	0	FW1	ENV	Annually												
FW2.1	Coordinate with MDNR, Range Control, and Operations to minimize conflicts and maximize implementation of projects	0	FW1, FW2, FW3	ENV	As Needed												
FW3.1	Ensure that prescribed fires and timber harvests support wildlife habitat targets for each forest stand	0	FW1, FW2, FW3	ENV	As Needed												
FW3.2	Follow all measures for water resources protection as essential fish and wildlife habitat and corridors	0	FW1, FW2, FW3	ENV	As Needed												
FW3.3	During coordination with MDNR, identify target cover types and acres in each forest stand to support wildlife habitat and to support military training	0	FW3	ENV	Annually												
FW4.1	Particpate in implementation of BASH Plan, including planning, coordination, permitting, and reporting requirements	0	FW4	ENV, GAAF	Annually												
FW4.2	Report any wildlife strikes in the appropriate database	0	FW4	GAAF	As Needed												
TE1.1	Review list of potential federal and state listed species annually	0	TE1, TE2	ENV	Annually												
TE1.2	During any biological surveys, ensure field crews are aware of any known or potential T&E species and documents any sightings or potential habitat	0	TE1, TE2	ENV	As Needed												
TE1.3	Maintain restricted areas/uses and update Limitations Memo annually	0	TE1, TE2	ENV	Annually												
TE1.4	Review any proposed actions (construction, land management, ground disturbance, prescribed fire, vegetation management, etc) for potential to impact listed species and their habitat and work with proponent to limit impacts	0	TE1, TE2	ENV	As Needed												
TE1.5	Complete Section 7 consultations with USFWS for federally listed species when necessary	0	TE1	ENV	As Needed												
TE1.6	Implement equipment decontamination protocols as necessary to protect listed species	0	TE1, TE2	ENV, DPW	As Needed												
TE1.7	Work with stakeholders to manage water levels associated with overwintering EMR to minimize adverse effects	0	TE1, TE2	ENV	Annually												
TE2.1	Coordinate with MDNR to implement management of state-listed species	0	TE2	ENV	Annually												
TE3.1	implement management for other species of conservation concern		TE3	ENV													
RE1.1	Coordinate limitations or improvements related to outdoor recreation with MDNR as appropriate	0	RE1	ENV	As Needed												
RE1.2	Monitor for impacts (military and environmental) from recreational activities and coordinate with MDNR to mitigate	0	RE1	ENV	As Needed												
CC1.1	Incorporate climate change adaptation strategies into management	0	CC1	ENV													
CC2.1	Continue participating in regional efforts to improve climate resiliency	0	CC1, CC2	ENV	Annually												

Table C-2. Proposed Projects for Camp Grayling INRMP Implementation

Project		Priority	Objective(s) in Section 3	Funding Source	Projected Date	Project Funding (Completed for Past FY, Estimated for Future FY)											
						Project Number	TBD FY	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
PM3.8	Continue to maintain internal environmental awareness materials, develop new materials as necessary	0	PM3, SO1, SO2, SO3, WA2, VE4, TE1, TE2, TE3	ENV, ITAM	As Needed												
PM4.3	Develop educational public outreach materials and notification tools highlighting success stories, sensitive resource management, noise management, and similar items	0	PM4, WA3, VE2, VE3, FI1,FI2, IN1, FW1, FW2, FW3, TE1, TE2, TE3, RE1	ENV	As Needed												
PM5.5	Working with partners, assess development of an ACUB proposal to ensure compatible uses on inholdings and surrounding areas	1	PM5, WA3, VE1, FI1, FI2, IN1, IN2, FW2, FW3, TE1, TE2, TE3	ENV	As Needed												
SO1.5	Inventory and map roads and trails for erosion and stormwater drainage, prioritize and develop management recommendations	1	PM6, SO1, SO2, WA2, FW3, RE1	ENV, DPW	2023												
SO1.6	Restore erosion, particularly at priority sites, using soil stabilization and revegetation	1	SO1, SO2, WA1, WA2, FW3, TE1, TE2, TE3, RE1	ENV, ITAM, DPW	Annually												
WA1.2	Implement portions of the Lake Margrethe Watershed Management Plan	1	PM5, WA1, WA2, WA3, IN1, IN2, FW3, RE1, CC1	ENV	As Needed												
WA1.3	Conduct surface water monitoring to assess water quality in relation to overall condition and sensitive resources	1	WA1, WA2, WA3, FW3, TE1, TE2, TE3, CC1	ENV	As Needed												
WA1.4	Provide environmental support services to CFMO for future construction activities at the water control structure for Lake Margrethe	1	PM2, PM5, WA1, WA3, FW3, TE1, TE2, TE3, CC1	ENV, DPW	As Needed												
WA2.4	Inventory water resources (for erosion, sedimentation, invasive plants, etc), document current functions and values, prioritize areas for restoration and develop management recommendations	1	PM2, SO1, SO2, WA1, WA2, WA3, VE1, IN1, IN2, FW3, TE1, TE2, TE3, RE1, CC1	ENV	2023												
WA2.5	Inventory stream crossings and wetland crossings/equalization structures to identify those needing maintenance and those needing upgrades/replacement.	1	PM6, SO1, SO2, WA1, WA2, WA3, VE1, FW3, TE1, TE2, TE3, RE1, CC1	ENV, DPW	2021												
WA3.1	Restore or enhance priority water resources, including fish and wildlife habitat values	1	PM2, WA1, WA2, WA3, VE1, VE2, IN1, IN2, FW3, TE1, TE2, TE3, CC1	ENV, MDNR	Annually												
VE1.2	Assess HQNAs, prioritize and update management recommendations	1	VE1, VE2, VE3, IN1, IN2, FW3, TE1, TE2, TE3, RE1, CC1	ENV, MDNR	As Needed												
VE1.3	Conduct plant surveys/ inventories	1	VE1, VE2, VE3, VE4, IN1, IN2, FW3, TE1, TE2, TE3, CC1	ENV	2023												
VE1.4	Identify opportunites and implement recommendations to improve habitat connectivity across the Howe's Lake Complex	1	VE1, VE3, FW3, TE1, TE2, TE3, RE1	ENV, MDNR	2023												
VE1.5	Prioritize and implement invasive plant control in HQNA's	1	VE1, VE2, VE3, IN1, IN2, FW3, TE1, TE2, TE3	ENV	Annually												
VE1.6	Implement prescribed fires to reduce woody encroachment and other negative impacts on HQNAs	1	PM5, VE1, VE2, VE3, FI1, FI2, FW3, TE1, TE2, TE3	ENV, MDNR	Annually												
VE1.7	Assess condition of wetland crossing in HQNA Cantonment Area, implement BMP's as needed	1	PM2, WA1, WA3, VE1, VE3, FW2, TE1, TE2, TE3, CC1	ENV	2025												
VE1.8	Manage red maple encroachment into HQNA Crawford Red Pines	1	PM5, VE1, VE2, FI1, FI2, FW3, TE2, TE3, CC1	ENV, MDNR	2023												
VE1.9	Manage pine encroachment into HQNA Lake Margrethe North	1	PM5, VE1, VE2, VE3, FI1, FI2, FW3, TE1, TE2, TE3	ENV, MDNR	2024												
VE2.4	Update Pine Barrens Management Plan	1	PM5, VE1, VE2, VE3, FI1, FI2, FW2, FW3, TE1, TE2, TE3, CC1	ENV, MDNR	2021												
VE2.5	Implement Pine Barrens Management Plan	1	PM5, VE1, VE2, VE3, FI1, FI2, FW2, FW3, TE1, TE2, TE3, CC1	ENV, MDNR	Annually												
VE2.6	Support the implementation of forest management projects (i.e., harvests, thinning, replanting, etc)		PM5, VE1, VE2, VE3, FI1, FI2, IN1, IN2, FW3, TE1, TE2, TE3, CC1	ENV, MDNR, RC	As Needed												
VE2.7	Implement Cantonment Forest Management Plan	1	PM5, VE2, VE4, FI1, FI2, IN1, IN2, FW3, CC1	ENV, MDNR, DPW, RC	As Needed												
VE3.2	Implement vegetation restoration or additional buffers needed to protect and enhance wetlands	1	PM5, WA1, WA2, WA3, VE1, VE2, FW3, TE1, TE2, TE3, CC1	ENV, MDNR	As Needed												

Table C-2. Proposed Projects for Camp Grayling INRMP Implementation

Project		Priority	Objective(s) in Section 3	Funding Source	Projected Date	Project Funding (Completed for Past FY, Estimated for Future FY)										
						Project Number	TBD FY	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
FI1.10	Conduct Fire Risk Assessment and implement recommendations	1	PM4, PM5, FI1, FI2, CC1	ENV, MDNR, DPW, RC	2023												
FI1.11	Implement IWFMP	0	PM5, VE1, VE2, VE3, FI1, FI2, CC1	ENV, MDNR, DPW, RC	As Needed												
FI2.5	Conduct prescribed fires annually to manage for rare species, military use, and specific habitats	1	PM5, VE1, VE2, VE3, FI1, FI2, , FW3, TE1, TE2, TE3, CC1	ENV, MDNR, DPW, RC	Annually												
FI2.6	Evaluate wildfire areas and restore erosion and vegetation damage as needed	1	SO2, WA1, FI1, FI2, IN1, IN2, FW3, TE1, TE2, TE3, RE1	ENV, MDNR, DPW, RC	As Needed												
IN2.6	Develop and implement annual work plan for surveys, control activities, and monitoring of invasive species at priority locations	1	VE1, VE2, IN1, IN2, TE1, TE2, TE3, RE1	ENV	Annually												
IN2.7	Identify vectors and pathways (boat ramps, water access points, roads, and trails) for introduction and spread of invasive plants and identify mitigation measures	1	VE1, VE2, IN1, IN2, TE1, TE2, TE3, RE1	ENV	Annually												
IN2.8	Complete forest pest surveys and identify problem species/areas, implement actions to mitigate impacts, in collaboration with MDNR	1	PM5, VE1, VE2, VE4, IN1, IN2, CC1	ENV, MDNR	Annually												
FW1.2	Conduct mammal surveys and research	1	FW1, FW2, TE1, TE2, TE3, CC1	ENV	2023												
FW1.3	Assess impacts of deer herbivory on forest composition and structure, particularly in and around the Hanson Refuge	1	VE2, FW1, FW3,	ENV	2020												
FW2.2	Conduct comprehensive bird surveys, rotating areas throughout Camp Grayling, which should include targeted surveys	1	FW2, TE1, TE3, TE5, CC1	ENV	Annual												
FW2.3	Conduct bat survey (acoustic and mistnetting)	1	FW2, TE1, TE2, TE3, CC1	ENV	2020												
FW2.4	Conduct comprehensive reptile and amphibian surveys	1	FW2, TE1, TE2, TE3, CC1	ENV	2022												
FW2.5	Conduct a fish (non-game) and aquatic mollusk survey	1	FW2, TE1, TE2, TE3, CC1	ENV	2022												
FW2.6	Conduct insect surveys, with a focus on pollinators, and rare species	1	FW2, TE1, TE2, TE3, CC1	ENV	2025												
FW2.7	Implement BMP's for pollinators, with a focus on species of concern (monarch butterfly, dusted skipper, etc)	1	FW2, TE1, TE2, TE3, CC2	ENV	2025												
FW3.4	Evaluate and repurpose Lake Margrethe pike marsh in coordination with MDNR	1	PM5, FW1, FW3	ENV, MDNR	2022												
FW4.4	Support implementation of BASH plans at GAAF and the 40 Complex	1	FW4	ENV	As Needed												
TE1.3	Conduct survey for potential T&E species and their habitat	0	TE1, TE2, TE3, CC1	ENV	2022												
TE1.4	Continue annual surveys and data collection for EMR; update management recommendations	0	PM5, TE1, TE2, TE3, CC1	ENV	Annually												
TE1.5	Continue assessment of relationship between water levels in Portage Creek and EMR overwintering habitat	1	WA3, FW3, TE1, TE2, CC1	ENV	2019												
TE1.6	Continue data collection for snake fungal disease in EMR habitat to assess transmission pathways, implement management recommendations as needed	1	TE1	ENV	As Needed												
TE1.7	Develop work plan to assess EMR habitat management (i.e., timber harvest, fires, etc), climate data and relationship to EMR populations, using historical data and continuing with annual correlations (reword to include research needs of scientific community)	1	TE1	ENV	As Needed												
TE2.2	Continue Kirtland's warbler surveys	0	TE2	ENV, MDNR	Annually												
TE2.3	Conduct surveys for state listed species	1	TE2	ENV	As Needed												
TE2.4	Continue listed and rare turtle surveys and life history research	1	PM5, TE2, TE3	ENV	Annually												
TE2.5	Conduct bald eagle presence survey and potential nests	0	PM5, TE2, TE4	ENV	As Needed												
RE1.3	Continue to collaborate with MDNR to address incompatible recreation activities that are impacting natural resource values and military training, and provide necessary materials as appropriate	0	PM5, SO1, SO2, WA1, WA3, VE1, VE2, IN1, IN2, FW3, TE1, TE2, TE3, RE1	ENV, MDNR, DPW, RC	Annually												
CC1.2	Conduct a vulnerability assessment to identify species and natural communities that are resilient or vulnerable to potential climate change projections. Identify management actions and projects to mitigate adverse effects of climate change	1	PM5, FW1, FW2 TE1, TE2, TE3, CC1, CC2	ENV	2023												

Table C-3. Summary of Goals, Objectives and Criteria for Camp Grayling INRMP

						Review for Operation and Effect (Green, Amber, Red)						
	Objective	Criteria: Green	Criteria: Amber	Criteria: Red	Data Source(s)	FY23	FY28	FY33	FY38	FY43	Notes	Recommended Edits
Goal PM: Manage natural resources compatible with and supporting the military mission while complying with applicable federal, military, and state laws, regulations, and policies												
PM1	Implement INRMP to enhance the land and military mission.	INRMP reviews completed on schedule; maintain above 95% obligation rate; no vacant positions in natural resources; no additional restrictions on training lands from natural resources	INRMP reviews less than 6 months overdue; maintain above 60% obligation rate; temporary vacant position in natural resources; temporary or small (less than 10 acres) additional restriction on training lands from natural resources	INRMP annual review or ROE more than 6 months overdue; less than 60% obligation rate; vacant position in natural resources for more than 6 months; permanent or large (greater than 10 acres) additional restriction on training lands from natural resources								
PM2	Maintain appropriate state and federal permits related to natural resources management, including water and wildlife management issues	No permit violations, notice of violations, or lack of permits when necessary	Temporary permit violation, corrected notice of violation, or missing permit obtained	Permit violation, lack of permit when needed, uncorrected notice of violation								
PM3	Continue internal environmental awareness program to minimize adverse environmental impacts	All materials current and readily available; all requested/required training conducted; all UECOs certified	More than 50% requested/required training completed; more than 75% of UECOs certified	Materials out of date; less than 50% of requested/required training completed; less than 75% of UECOs certified								
PM4	Educate the public, as appropriate, on the importance and purpose of managing each natural resource element, and continue public outreach initiatives in collaboration with other regional entities, as available.	All materials current and readily available; present during at least 1 public event annually	n/a	Materials out of date or not available to the public; no public presentations within last 18 months								
PM5	Continue to collaborate with other agencies and local landowners on regional land and natural resources management efforts	Participate in regional meetings/planning (at least 2 annually); undertake at least 1 cooperative project annually	Participated in only one regional meeting annually	No participation in any regional efforts or cooperative projects								
PM6	Maintain and improve GIS data and accessibility to inform CGJMTC Environmental staff and other stakeholder entities, such as DOTS, MDNR, USFWS, etc.	All natural resources GIS data is current and updated in master database	Less than 3 natural resources datasets are outdated	More than 3 natural resources datasets are outdated								
Goal SO: Manage Camp Grayling soils to prevent sediment loss, minimize erosion, and support military mission												
SO1	Manage construction sites, roads, trails, and slopes to comply with regulations and permits, maintain alignment with the Operational Range Sustainability Program, and provide direction to the Range Training Land Assessment (RTLA) program.	All exposed soils are managed with appropriate BMPs; no erosion is resulting in sediment loss; no notice of violations	Temporary (less than one week) failure of a BMP before correction; small (less than 1/10 acre) erosion feature resulting in sediment loss no more than 20 feet from site; only one notice of violation, corrected within one week	Long-term (more than one week) failure of BMP; large (greater than 1/10 acre) erosion feature resulting in sediment loss extending more than 20 feet from site; one or more notices of violation and/or not corrected within one week								
SO2	Manage soil erosion and promote awareness of erosion and sedimentation controls to ensure the long-term use of military training areas.	Total area impacted by erosion not increased, including streambanks; no area closures due to erosion; all awareness materials include soil conservation	Small (less than 1 acre) increase in area impacted by erosion; only temporary closure (less than one year) due to erosion	Large (greater than 1 acre) increase in area impacted by erosion; long-term closure (more than one year) of area to military training due to erosion; soil conservation lacking in key awareness materials								
SO3	Continue spill prevention and pollution prevention programs to prevent contamination of soils and water resources.	No violations of SWPPP, ICPs, or other pollution prevention	Violation of SWPPP, ICPs, or other pollution prevention but in process of correction	Uncorrected violation SWPPP, ICPs, or other pollution prevention								
Goal WA: Protect water quality and manage water resources, including wetlands, so they remain resilient and with no net loss of acreage or functions and values												
WA1	Continue to attain water quality standards in accordance with applicable regulations and designated potable and non-potable uses.	No violations of surface water quality standards	Violation(s) of surface water quality standards but in process of correction	Uncorrected violation(s) of surface water quality standards								
WA2	Avoid and minimize impacts to water resources resulting from military training or construction activities, and comply with applicable laws and regulations	No impacts to water resources and all necessary permits obtained	Impact to water resources, but in process of mitigation and/or permitting	Loss of water resources due to military training or development and/or uncorrected impacts without a permit								
WA3	Preserve water resources to protect associated functions and values.	No loss of area or functions and values (per Section 404 criteria); no loss of fish and wildlife habitat; no negative change in native communities	Temporary loss of area or functions and values (per Section 404 criteria); temporary loss of fish and wildlife habitat; temporary negative change in native communities	Uncorrected/permanent loss of area or functions and values (per Section 404 criteria); temporary loss of fish and wildlife habitat; temporary negative change in native communities								
Goal VE: Manage different habitats (grasslands, wetlands, and forests) to promote native species, resilient communities, and support military training												
VE1	Maintain HQNAs to promote and maximize habitat for rare and sensitive species and natural communities	No loss of rare species or communities; no decline in key attributes	Temporary or reversible loss of rare species or decline in key attributes, with a plan to mitigate adverse effect	Permanent loss of rare species or decline/loss of key attribute; temporary loss but with no plans to mitigate adverse effect								
VE2	Promote natural resource sustainability and conservation, and support the military mission by collaborating with the MDNR regarding forest management	No military training conflicts or loss of biodiversity/ecosystem service	Temporary (scheduling or less than one year) military training conflict or loss of biodiversity/ecosystem service, with a plan to mitigate adverse effect	Forest area unsuitable for military training (for more than a year) as a result of forestry or long-term loss of biodiversity/ecosystem service								

Table C-3. Summary of Goals, Objectives and Criteria for Camp Grayling INRMP

	Objective	Criteria: Green	Criteria: Amber	Criteria: Red	Data Source(s)	Review for Operation and Effect (Green, Amber, Red) FY23	FY28	FY33	FY38	FY43	Notes	Recommended Edits
VE3	Maintain open landscapes to support the military mission and promote habitat diversity, with special attention to the Pine Barrens management area and ranges	No loss of rare species or communities; no decline in key attributes	Temporary or reversible loss of rare species or decline in key attributes, with a plan to mitigate adverse effect	Permanent loss of rare species or decline/loss of key attribute; temporary loss but with no plans to mitigate adverse effect								
VE4	Ensure grounds maintenance, new construction, and landscaping activities do not promote pests (e.g., oak wilt) or invasive species (e.g., spotted knapweed)	No new invasive plants present in maintained areas	Increase in invasive plants, but a plan developed to address the increase	Increase in invasive plants that are impacting native vegetation and no plan to address them								
Goal FI: Manage wildland fire to support military training while reducing risks and maintaining ecological health, ecosystem services, native biodiversity, and structural diversity												
FI1	Implement the IWFMP and continue to coordinate wildland fire activities efforts with MDNR, and other partners	All standards met; all records complete and updated; all staffing and training requirements completed; regular (quarterly) coordination with MDNR completed	Some standards, recordkeeping, staffing, or training not fully implemented but there is a plan to remedy within 1 year	One or more requirements are not being met and there is no plan to remedy within the next year								
FI2	Use prescribed fire to support military training, ecological health, biodiversity, and rare species	Camp Grayling equipment and personnel meet standards; all wildfires are managed with no escapes	Camp Grayling equipment and/or personnel do not meet standards, but plan to remedy is in place; uncontrolled wildfire(s) but caused no damage to people or infrastructure	Camp Grayling equipment and/or personnel do not meet standards and no plans to remedy; uncontrolled wildfire(s) that caused damage to people or infrastructure								
Goal IN: Minimize impacts of invasive and pest species using an integrated pest management approach												
IN1	Continue early detection and rapid response to reduce and eliminate new invasive species in both aquatic and terrestrial areas.	No new invasive species detected and/or established; annual monitoring completed	New invasive species detected but treatment underway; annual monitoring completed	New invasive species detected and either no treatment or treatment unsuccessful; annual monitoring not completed								
IN2	Minimize impacts of invasive species and pests on the military mission, native species, and sensitive natural resources.	Complete at least 90% of planned annual treatment of priority species and areas	Complete at least 50% of planned annual treatment of priority species and areas	Complete less than 50% of planned treatment of priority species and areas								
Goal FW: Manage fish and wildlife, including game species, and their habitat to maintain healthy populations without interfering with the military mission												
FW1	Monitor populations of priority game species as part of regional management plans, in coordination with MDNR.	All game species populations are healthy, no concerns have been identified by MDNR, and no conflicts with military training or infrastructure have occurred	One or more game species populations are either too high or too low, MDNR has identified a need for a management change, or mission activities have been temporarily impacted by a game species or its management	Multiple game species populations are either too high or too low, MDNR has identified a need for a management change and that change cannot be implemented, or mission activities have been impacted significantly by a game species or its management								
FW2	Monitor populations of fish and wildlife species, with targeted monitoring for priority species.	Surveys indicate healthy populations of diverse native species, species management actions implemented as planned, and no conflicts with military training or infrastructure have occurred	Species surveys and/or species management temporarily delayed (less than 5 years), or mission activities have been temporarily impacted by a non-game species or its management	Species surveys and/or species management delayed more than 5 years, or mission activities have been impacted significantly by a non-game species or its management								
FW3	Manage fish and wildlife habitat and promote landscape scale connectivity.	Surveys indicate appropriate mix of habitat and corridors, habitat management actions implemented as planned, and no conflicts with military training or infrastructure have occurred	Habitat surveys and/or habitat management temporarily delayed (less than 5 years), or mission activities have been temporarily impacted by habitat management	Habitat surveys and/or habitat management delayed more than 5 years, or mission activities have been impacted significantly by habitat management								
FW4	Provide support services to GAAF and the 40 Complex personnel in their implementation of the respective BASH plans.	No BASH-related conflicts and all planned management implemented	Minor BASH conflict; at least 75% of planned management implemented	BASH conflict that impacted training; less than 75% of planned management implemented								
Goal TE: Manage threatened and endangered listed species using an ecosystem approach, while supporting the military mission												
TE1	Maintain federally listed species, minimize impacts to federally listed species, and complete required consultations, while minimizing impacts to military mission.	No decline of populations, loss of core habitat, compliance with all Section 7 requirements, and no loss of military training/land	Temporary decline of population(s) or core habitat, temporary non-compliance with all Section 7 requirements, and/or temporary loss of military training/land	Permanent decline of population(s) or core habitat, notice of violation from USFWS, and/or permanent loss of military training/land								

Table C-3. Summary of Goals, Objectives and Criteria for Camp Grayling INRMP												
						Review for Operation and Effect (Green, Amber, Red)						
	Objective	Criteria: Green	Criteria: Amber	Criteria: Red	Data Source(s)	FY23	FY28	FY33	FY38	FY43	Notes	Recommended Edits
TE2	Monitor and maintain state-listed species and cooperate with MDNR for management, while minimizing impacts to military mission.	No decline of populations, loss of core habitat, and no loss of military training/land	Temporary decline of population(s) or core habitat and/or temporary loss of military training/land	Permanent decline of population(s) or core habitat and/or permanent loss of military training/land								
TE3	Monitor populations of other species of conservation concern and manage the habitats to avoid further population declines	No decline of populations, no additional species listed	Temporary decline of population(s) habitat	Permanent decline of population(s) or core habitat and/or additional species listed								
Goal RE: Provide recreational opportunities for social and economic benefit to the public without interfering with the military mission or causing damage to sensitive natural or cultural resources												
RE1	Coordinate with the MDNR to ensure safe recreational land use by the public does not conflict with military training opportunities or natural resource management, and to resolve any known potential conflicts between authorized recreational land use and military land use.	No decline in recreational availability; no damage to sensitive resources from recreation; no conflicts with military training; more than 80% planned activities completed annually	Temporary closures to recreation outside of the Recreation Plan; temporary damage to sensitive resources; no conflicts with military training; more than 50% planned activities completed annually	Loss of recreational availability; permanent damage to sensitive resources; conflicts with military training; less than 50% planned activities completed annually								
Goal CC: Mitigate the effects of climate change on the natural resources at Camp Grayling and increase resiliency in order to support the military mission												
CC1	Protect natural resources sensitive to climate change and increase ecological resiliency on CGJMTC.	No loss of rare species or habitats; no decline in formerly common species; implement at least 80% of planned actions related to climate resilience	Reduction of a climate sensitive species or habitat; small decline in a formerly common species; implement less than 80% of planned actions relating to climate resilience	Loss of a climate sensitive species or habitat; major decline in a formerly common species; implement less than 50% of planned actions relating to climate resilience								
CC2	Continue participating in regional efforts to increase resiliency in all arenas to support the military mission.	Participate in at least 1 regional planning effort related to climate resilience	n/a	No participation in any regional planning efforts related to climate resilience								

Level 0 – Recurring conservation requirements that maintain compliance with federal laws and regulations; funding likely
Level 1 – Non-recurring conservation requirements that fix noncompliance; funding possible
Level 2 – Non-recurring conservation requirement that prevent noncompliance; generally not funded
Level 3 – Non-recurring conservation requirement that enhance the environment; generally not funded
It is important to note, that on a yearly basis, only Level 0 and 1 are generally considered for funding; Level 1s are less likely to get funded than Level 0s, which have a high likelihood of being funded.

Goals and Objectives Abbreviations
PM=Program Management
SO=Soils Management
WA=Water Resources Management
VE= Vegetation Management
FI=Wildland Fire Management
IN=Invasive Species Management
FW=Fish and Wildlife Management
TE=Rare Species Management
RE=Recreation
CC=Climate Change/Resiliency

Priority
0 = Recurring
1 =
2 =
3 =

Potential Agencies
Indicates the agency(agencies) that could lead the project. This could be as sole lead or as cost-share or co-lead relationship. In the case of Camp Grayling, it is often parcel dependent, if not a facility-wide effort.

APPENDIX J

LIST OF SPECIES

Notes abbreviations used in the tables:
FE = Federally Endangered
FT = Federally Threatened
SE = State Endangered
ST = State Threatened
SC = State Species of Concern
BGEPA = Bald and Golden Eagle Protection Act

S1 = critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state.
S2 = imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.
S3 = rare or uncommon in state (21 to 100 occurrences).

NN = Non-native (but not considered invasive at Camp Grayling)
IN = Non-native and considered invasive at Camp Grayling
WL = Watch list
PR = Prohibited
RE = Restricted
NX = Noxious weed

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Adoxaceae	*Sambucus canadensis*	Common Elder, Elderberry	
Adoxaceae	*Sambucus racemosa*	Red-Berried Elder, Red Elderberry	
Adoxaceae	*Viburnum acerifolium*	Maple-Leaved Viburnum	
Adoxaceae	*Viburnum cassinoides*	Wild-Raisin	
Adoxaceae	*Viburnum lentago*	Nannyberry	
Adoxaceae	*Viburnum trilobum*	American Highbush-Cranberry	
Alismataceae	*Alisma triviale*	Northern Water-Plantain	
Alismataceae	Sagittaria latifolia	Wapato, Duck-Potato, Common Arrowhead	
Alliaceae	*Allium tricoccum*	Ramps, Wild Leek	
Amaranthaceae	*Amaranthus albus*	Tumbleweed	
Amaranthaceae	*Amaranthus powellii*	Tall Amaranth	IN
Amaranthaceae	*Amaranthus retroflexus*	Rough Amaranth	NN
Amaranthaceae	*Chenopodium album*	Lambs-Quarters, Pigweed	NN
Amaranthaceae	*Chenopodium capitatum*	Strawberry Blite	
Amaranthaceae	*Chenopodium simplex*	Maple-Leaved Goosefoot	
Amaranthaceae	*Corispermum pallasii*	Bugseed	
Amaranthaceae	*Cycloloma atriplicifolium*	Winged Pigweed	NN
Amaranthaceae	*Salsola tragus*	Russian-Thistle	NN
Anacardiaceae	*Rhus aromatica*	Fragrant Sumac	
Anacardiaceae	*Rhus typhina*	Staghorn Sumac	
Anacardiaceae	*Toxicodendron rydbergii*	Poison Ivy	
Apiaceae	*Angelica atropurpurea*	Purplestem Angelica	
Apiaceae	*Cicuta bulbifera*	Water Hemlock	
Apiaceae	*Cicuta maculata*	Water Hemlock	
Apiaceae	*Daucus carota*	Wild Carrot, Queen-Anne's-Lace	NN
Apiaceae	*Osmorhiza claytonii*	Hairy Sweet-Cicely	
Apiaceae	*Sanicula marilandica*	Black Snakeroot	
Apiaceae	*Sium suave*	Water-Parsnip	
Apiaceae	*Torilis japonica*	Hedge-Parsley	NN
Apocynaceae	*Apocynum androsaemifolium*	Spreading Dogbane	
Apocynaceae	*Asclepias exaltata*	Poke Milkweed	
Apocynaceae	*Asclepias incarnata*	Swamp Milkweed	
Apocynaceae	*Asclepias syriaca*	Common Milkweed	
Apocynaceae	*Asclepias tuberosa*	Butterfly-Weed	
Apocynaceae	*Vinca minor*	Common Periwinkle	IN
Aquifoliacea	*Ilex mucronata*	Mountain Holly	
Aquifoliacea	*Ilex verticillata*	Michigan Holly, Winterberry, Black-Alder	
Araceae	*Arisaema triphyllum*	Jack-In-The-Pulpit, Indian-Turnip	
Araceae	*Calla palustris*	Wild Calla	
Araceae	*Spirodela polyrhiza*	Greater Duckweed	
Araceae	*Symplocarpus foetidus*	Skunk-Cabbage	
Araliaceae	*Aralia hispida*	Bristly Sarsaparilla	
Araliaceae	*Aralia nudicaulis*	Wild Sarsaparilla	

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Araliaceae	*Aralia racemosa*	Spikenard	
Araliaceae	*Hydrocotyle americana*	Water-Pennywort	
Araliaceae	*Panax trifolius*	Dwarf Ginseng	
Asteraceae	*Achillea millefolium*	Yarrow, Milfoil	
Asteraceae	*Ambrosia artemisiifolia*	Common Ragweed	
Asteraceae	*Ambrosia psilostachya*	Western Ragweed	NN
Asteraceae	*Anaphalis margaritacea*	Pearly Everlasting	
Asteraceae	*Antennaria howellii*	Small Pussytoes	
Asteraceae	*Antennaria parlinii*	Smooth Pussytoes	
Asteraceae	*Arctium minus*	Common Burdock	NN
Asteraceae	*Artemisia campestris*	Wild Wormwood	
Asteraceae	*Bidens beckii*	Water-Marigold	
Asteraceae	*Bidens cernua*	Nodding Beggar-Ticks	
Asteraceae	*Bidens frondosa*	Common Beggar-Ticks	
Asteraceae	*Centaurea diffusa*	Tumble Knapweed, White-Flowered Knapweed	NN
Asteraceae	*Centaurea stoebe*	Spotted Knapweed	IN, PR/NX
Asteraceae	*Cichorium intybus*	Chicory, Blue-Sailors	NN
Asteraceae	*Cirsium arvense*	Canada Thistle, Field Thistle	NN
Asteraceae	*Cirsium hillii*	Hill's Thistle	SC
Asteraceae	*Cirsium muticum*	Swamp Thistle	
Asteraceae	*Cirsium palustre*	Marsh Thistle, European Swamp Thistle	IN
Asteraceae	*Cirsium vulgare*	Bull Thistle	NN
Asteraceae	*Conyza canadensis*	Horseweed	
Asteraceae	*Coreopsis lanceolata*	Sand Coreopsis	
Asteraceae	*Crepis tectorum*	Hawk's Beard	NN
Asteraceae	*Doellingeria umbellata*	Flat-Topped White Aster	
Asteraceae	*Erechtites hieraciifolius*	Fireweed	
Asteraceae	*Erigeron annuus*	Daisy Fleabane	
Asteraceae	*Erigeron philadelphicus*	Common Fleabane, Philadelphia Fleabane	
Asteraceae	*Erigeron strigosus*	Daisy Fleabane	
Asteraceae	*Eupatorium perfoliatum*	Boneset	
Asteraceae	*Eurybia macrophylla*	Large-Leaved Aster, Big-Leaved Aster	
Asteraceae	*Euthamia graminifolia*	Grass-Leaved Goldenrod	
Asteraceae	*Eutrochium maculatum*	Joe-Pye-Weed	
Asteraceae	*Gnaphalium uliginosum*	Low Cudweed	
Asteraceae	*Grindelia squarrosa*	Gumweed	NN
Asteraceae	*Helenium flexuosum*	Sneezeweed	NN
Asteraceae	*Helianthus annuus*	Common Sunflower	NN
Asteraceae	*Helianthus divaricatus*	Woodland Sunflower	
Asteraceae	*Helianthus maximiliani*	Maximilian Sunflower	NN
Asteraceae	*Helianthus occidentalis*	Western Sunflower	
Asteraceae	*Heliopsis helianthoides*	False Sunflower	

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Asteraceae	*Hieracium aurantiacum*	Orange Hawkweed, Devil's-Paintbrush	NN
Asteraceae	*Hieracium caespitosum*	King Devil, Yellow Hawkweed	NN
Asteraceae	*Hieracium gronovii*	Hairy Hawkweed	
Asteraceae	*Hieracium kalmii*	Canada Hawkweed, Kalm's Hawkweed	
Asteraceae	*Hieracium pilosella*	Mouse-Ear Hawkweed	NN
Asteraceae	*Hieracium piloselloides*	King Devil, Yellow Hawkweed	NN
Asteraceae	*Hieracium scabrum*	Rough Hawkweed	
Asteraceae	*Hieracium venosum*	Rattlesnake-Weed, Veined Hawkweed	
Asteraceae	*Hypochaeris radicata*	Cat's-Ear	NN
Asteraceae	*Krigia biflora*	False Dandelion	
Asteraceae	*Krigia virginica*	Dwarf Dandelion	
Asteraceae	*Lactuca biennis*	Tall Blue Lettuce	
Asteraceae	*Lactuca canadensis*	Wild Lettuce, Tall Lettuce	
Asteraceae	*Leucanthemum vulgare*	Ox-Eye Daisy	NN
Asteraceae	*Liatris cylindracea*	Cylindrical Blazing-Star	
Asteraceae	*Liatris scariosa*	Northern Blazing-Star	
Asteraceae	*Matricaria discoidea*	Pineapple-Weed	NN
Asteraceae	*Packera aurea*	Golden Ragwort	
Asteraceae	*Packera paupercula*	Northern Ragwort, Balsam Ragwort	
Asteraceae	*Petasites frigidus*	Sweet-Coltsfoot	
Asteraceae	*Prenanthes alba*	White Lettuce	
Asteraceae	*Pseudognaphalium macounii*	Clammy Cudweed	
Asteraceae	*Rudbeckia hirta*	Black-Eyed Susan	
Asteraceae	*Rudbeckia laciniata*	Tall Coneflower, Cut-Leaf Coneflower	
Asteraceae	*Senecio vulgaris*	Common Groundsel	NN
Asteraceae	*Solidago altissima*	Tall Goldenrod	
Asteraceae	*Solidago canadensis*	Canada Goldenrod	
Asteraceae	*Solidago gigantea*	Late Goldenrod	
Asteraceae	*Solidago hispida*	Hairy Goldenrod	
Asteraceae	*Solidago juncea*	Early Goldenrod	
Asteraceae	*Solidago nemoralis*	Gray Goldenrod, Old-Field Goldenrod	
Asteraceae	*Solidago patula*	Rough-Leaved Goldenrod, Swamp Goldenrod	
Asteraceae	*Solidago ptarmicoides*	Sneezewort Goldenrod, Upland White Goldenrod	
Asteraceae	*Solidago rugosa*	Rough-Leaved Goldenrod	
Asteraceae	*Solidago simplex*	Gillman's Goldenrod	
Asteraceae	*Solidago speciosa*	Showy Goldenrod	
Asteraceae	*Solidago uliginosa*	Bog Goldenrod	
Asteraceae	*Solidago vossii*	Voss's goldenrod	FT
Asteraceae	*Sonchus arvensis*	Field Sow-Thistle, Perennial Sow-Thistle	NN

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Asteraceae	*Sonchus oleraceus*	Common Sow-Thistle	NN
Asteraceae	*Symphyotrichum boreale*	Rush Aster, Northern Bog Aster	
Asteraceae	*Symphyotrichum sericeum*	Silky aster, wester silver-leaved aster	
Asteraceae	*Symphyotrichum shortii*	Short's aster	
Asteraceae	*Symphyotrichum subulatum*	Saltmarsh aster	
Asteraceae	*Tragopogon dubius*	Goat's Beard	NN
Asteraceae	*Tragopogon pratensis*	Common Goat's Beard	NN
Athyriaceae	*Athyrium filix-femina*	Lady Fern	
Balsaminaceae	*Impatiens capensis*	Spotted Touch-Me-Not	
Berberidaceae	*Caulophyllum thalictroides*	Blue Cohosh	
Betulaceae	*Alnus incana*	Speckled Alder	
Betulaceae	*Betula alleghaniensis*	Yellow Birch	
Betulaceae	*Betula papyrifera*	Paper Birch, White Birch, Canoe Birch	
Betulaceae	*Betula pumila*	Bog Birch, Dwarf Birch	
Betulaceae	*Carpinus caroliniana*	Hornbeam, Blue-Beech	
Betulaceae	*Corylus cornuta*	Beaked Hazelnut	
Betulaceae	*Ostrya virginiana*	Ironwood, Hop-Hornbeam	
Boraginaceae	*Lithospermum caroliniense*	Hairy Puccoon, Yellow Puccoon, Plains Puccoon	
Boraginaceae	*Myosotis arvensis*	Field Scorpion-Grass	NN
Brassicaceae	*Alliaria petiolata*	Garlic Mustard	IN
Brassicaceae	*Alyssum alyssoides*	Pale Alyssum	NN
Brassicaceae	*Arabidopsis thaliana*	Mouse-Ear Cress	NN
Brassicaceae	*Barbarea vulgaris*	Yellow Rocket	NN
Brassicaceae	*Berteroa incana*	Hoary Alyssum	NN
Brassicaceae	*Boechera stricta*	Drummond Rock Cress	
Brassicaceae	*Brassica rapa*	Field Mustard, Turnip	NN
Brassicaceae	*Capsella bursa-pastoris*	Shepherd's-Purse	NN
Brassicaceae	*Cardamine diphylla*	Two-Leaved Toothwort	
Brassicaceae	*Cardamine pensylvanica*	Pennsylvania Bitter Cress	
Brassicaceae	*Cardamine pratensis*	Cuckoo-Flower	
Brassicaceae	*Erysimum cheiranthoides*	Wormseed Mustard	NN
Brassicaceae	*Lepidium campestre*	Field Cress	NN
Brassicaceae	*Lepidium densiflorum*	Small Peppergrass	NN
Brassicaceae	*Nasturtium officinale*	Watercress	
Brassicaceae	*Raphanus raphanistrum*	Wild Radish	NN
Brassicaceae	*Rorippa palustris*	Yellow Cress	
Brassicaceae	*Sinapis arvensis*	Charlock, Wild Mustard	NN
Brassicaceae	*Sisymbrium altissimum*	Tumble Mustard	NN
Brassicaceae	*Sisymbrium officinale*	Hedge Mustard	NN
Brassicaceae	*Thlaspi arvense*	Penny Cress	NN
Brassicaceae	*Turritis glabra*	Tower Mustard	
Cabombaceae	*Brasenia schreberi*	Water-Shield	
Campanulaceae	*Campanula aparinoides*	Marsh Bellflower	

Table J-1. Plant Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Campanulaceae	*Campanula rapunculoides*	Roving Bellflower, Creeping Bellflower	NN
Campanulaceae	*Campanula rotundifolia*	Bluebell, Harebell	
Campanulaceae	*Lobelia cardinalis*	Red Lobelia, Cardinal-Flower	
Campanulaceae	*Lobelia inflata*	Indian-Tobacco	
Campanulaceae	*Lobelia kalmii*	Kalm's Lobelia, Brook Lobelia, Bog Lobelia	
Campanulaceae	*Lobelia siphilitica*	Great Blue Lobelia	
Campanulaceae	*Lobelia spicata*	Pale Spiked Lobelia	
Cannabaceae	Humulus lupulus L.	Common Hops, Hops	
Caprifoliaceae	*Lonicera* ×	Hybrid Honeysuckle	IN
Caprifoliaceae	*Lonicera canadensis*	Canadian Fly Honeysuckle	
Caprifoliaceae	*Lonicera oblongifolia*	Swamp Fly Honeysuckle	
Caprifoliaceae	*Symphoricarpos albus*	Snowberry	
Caprifoliaceae	*Symphoricarpos albus*	Snowberry	
Caprifoliaceae	*Symphoricarpos occidentalis*	Wolfberry	
Caryophyllaceae	*Agrostemma githago*	Corn-Cockle	NN
Caryophyllaceae	*Arenaria serpyllifolia*	Thyme-Leaved Sandwort	NN
Caryophyllaceae	*Cerastium fontanum*	Mouse-Ear Chickweed	NN
Caryophyllaceae	*Cerastium semidecandrum*	Small Mouse-Ear Chickweed	NN
Caryophyllaceae	*Dianthus armeria*	Deptford Pink	NN
Caryophyllaceae	*Dianthus plumarius*	Garden Pink, Grass Pink	NN
Caryophyllaceae	*Saponaria officinalis*	Bouncing Bet, Soapwort	NN
Caryophyllaceae	*Scleranthus annuus*	Knawel	NN
Caryophyllaceae	*Silene antirrhina*	Sleepy Catchfly	
Caryophyllaceae	*Silene dichotoma*	Forked Catchfly	NN
Caryophyllaceae	*Silene latifolia*	White Cockle, White Campion	NN
Caryophyllaceae	*Silene vulgaris*	Bladder Campion	NN
Caryophyllaceae	*Spergula arvensis*	Spurrey	NN
Caryophyllaceae	*Spergularia rubra*	Sand Spurrey	NN
Caryophyllaceae	*Stellaria crassifolia*	Fleshy Stitchwort	SE
Caryophyllaceae	*Stellaria graminea*	Starwort	NN
Caryophyllaceae	*Stellaria longifolia*	Long-Leaved Chickweed	
Celastraceae	*Celastrus scandens*	Climbing Bittersweet, American Bittersweet	
Celastraceae	*Euonymus alatus*	Winged Euonymus	NN
Ceratophyllaceae	*Ceratophyllum demersum*	Coontail	
Cistaceae	*Lechea intermedia*	Intermediate Pinweed	
Cleomaceae	*Polanisia dodecandra*	Clammy-Weed	
Convallariaceae	*Clintonia borealis*	Corn-Lily, Bluebead-Lily	
Convallariaceae	*Maianthemum canadense*	Canada Mayflower, False Solomon-Seal	
Convallariaceae	*Maianthemum racemosum*	False Spikenard	
Convallariaceae	*Medeola virginiana*	Indian Cucumber-Root	
Convallariaceae	*Polygonatum pubescens*	Downy Solomon Seal	
Convallariaceae	*Streptopus lanceolatus*	Rose Twisted-Stalk	
Convallariaceae	*Uvularia grandiflora*	Bellwort	

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Convolvulaceae	*Calystegia spithamaea*	Low Bindweed	
Cornaceae	*Cornus alternifolia*	Alternate-Leaved Dogwood, Pagoda Dogwood	
Cornaceae	*Cornus amomum*	Pale Dogwood, Silky Dogwood	
Cornaceae	*Cornus canadensis*	Bunchberry, Dwarf Cornel	
Cornaceae	*Cornus foemina*	Gray Dogwood	
Cornaceae	*Cornus rugosa*	Round-Leaved Dogwood	
Cornaceae	*Cornus sericea*	Red-Osier	
Crassulaceae	*Hylotelephium telephium*	Live Forever	NN
Cupressaceae	*Thuja occidentalis*	Arbor Vitae, White-Cedar, Cedar	
Cyperaceae	*Bolboschoenus fluviatilis*	Bulrush	
Cyperaceae	*Carex adusta*	Sedge	
Cyperaceae	*Carex albursina*	Sedge	
Cyperaceae	*Carex aquatilis*	Sedge	
Cyperaceae	*Carex arctata*	Sedge	
Cyperaceae	*Carex argyrantha*	Sedge	
Cyperaceae	*Carex atherodes*	Sedge	
Cyperaceae	*Carex aurea*	Sedge	
Cyperaceae	*Carex bebbii*	Sedge	
Cyperaceae	*Carex brunnescens*	Sedge	
Cyperaceae	*Carex buxbaumii*	Sedge	
Cyperaceae	*Carex canescens*	Sedge	
Cyperaceae	*Carex castanea*	Sedge	
Cyperaceae	*Carex chordorrhiza*	Sedge	
Cyperaceae	*Carex communis*	Sedge	
Cyperaceae	*Carex comosa*	Sedge	
Cyperaceae	*Carex conoidea*	Beauty Sedge	
Cyperaceae	*Carex crawei*	Sedge	
Cyperaceae	*Carex crawfordii*	Sedge	
Cyperaceae	*Carex crinita*	Sedge	
Cyperaceae	*Carex cryptolepis*	Sedge	
Cyperaceae	*Carex cumulata*	Sedge	
Cyperaceae	*Carex debilis*	Swamp Sedge	
Cyperaceae	*Carex deflexa*	Sedge	
Cyperaceae	*Carex deweyana*	Sedge	
Cyperaceae	*Carex diandra*	Sedge	
Cyperaceae	*Carex disperma*	Sedge	
Cyperaceae	*Carex echinata*	Sedge	
Cyperaceae	*Carex flava*	Sedge	
Cyperaceae	*Carex foenea*	Sedge	
Cyperaceae	*Carex gracillima*	Sedge	
Cyperaceae	*Carex granularis*	Sedge	
Cyperaceae	*Carex gynandra*	Sedge	
Cyperaceae	*Carex hystericina*	Sedge	
Cyperaceae	*Carex interior*	Sedge	
Cyperaceae	*Carex intumescens*	Sedge	

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Cyperaceae	*Carex lacustris*	Sedge	
Cyperaceae	*Carex lasiocarpa*	Sedge	
Cyperaceae	*Carex leptalea*	Sedge	
Cyperaceae	*Carex leptonervia*	Sedge	
Cyperaceae	*Carex limosa*	Bog Sedge	
Cyperaceae	*Carex livida*	Sedge	
Cyperaceae	*Carex lucorum*	Sedge	
Cyperaceae	*Carex lupulina*	Sedge	
Cyperaceae	*Carex magellanica*	Sedge	
Cyperaceae	*Carex muehlenbergii*	Sedge	
Cyperaceae	*Carex oligosperma*	Sedge	
Cyperaceae	*Carex ormostachya*	Sedge	
Cyperaceae	*Carex pauciflora*	Sedge	
Cyperaceae	*Carex peckii*	Sedge	
Cyperaceae	*Carex pedunculata*	Sedge	
Cyperaceae	*Carex pellita*	Sedge	
Cyperaceae	*Carex pensylvanica*	Sedge	
Cyperaceae	*Carex plantaginea*	Sedge	
Cyperaceae	*Carex prairea*	Sedge	
Cyperaceae	*Carex projecta*	Sedge	
Cyperaceae	*Carex pseudocyperus*	Sedge	
Cyperaceae	*Carex retrorsa*	Sedge	
Cyperaceae	*Carex rosea*	Curly-Styled Wood Sedge	
Cyperaceae	*Carex scabrata*	Sedge	
Cyperaceae	*Carex stipata*	Sedge	
Cyperaceae	*Carex stricta*	Sedge	
Cyperaceae	*Carex tenera*	Sedge	
Cyperaceae	*Carex tenuiflora*	Sedge	
Cyperaceae	*Carex tonsa*	Sedge	
Cyperaceae	*Carex trisperma*	Sedge	
Cyperaceae	*Carex tuckermanii*	Sedge	
Cyperaceae	*Carex umbellata*	Sedge	
Cyperaceae	*Carex vaginata*	Sedge	
Cyperaceae	*Carex vesicaria*	Sedge	
Cyperaceae	*Carex viridula*	Sedge	
Cyperaceae	*Carex vulpinoidea*	Sedge	
Cyperaceae	*Cladium mariscoides*	Twig-Rush	
Cyperaceae	*Cyperus bipartitus*	Brook Nut Sedge	
Cyperaceae	*Cyperus houghtonii*	Smooth Sand Sedge	
Cyperaceae	*Cyperus schweinitzii*	Rough Sand Sedge	
Cyperaceae	*Dulichium arundinaceum*	Three-Way Sedge	
Cyperaceae	*Eleocharis acicularis*	Spike-Rush	
Cyperaceae	*Eleocharis elliptica*	Golden-Seeded Spike Rush	
Cyperaceae	*Eleocharis erythropoda*	Spike-Rush	
Cyperaceae	*Eleocharis flavescens*	Spike-Rush	
Cyperaceae	*Eleocharis intermedia*	Spike-Rush	

Table J-1. Plant Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Cyperaceae	*Eleocharis obtusa*	Spike-Rush	
Cyperaceae	*Eleocharis palustris*	Spike-Rush	
Cyperaceae	*Eriophorum angustifolium*	Narrow-Leaved Cotton-Grass	
Cyperaceae	*Eriophorum tenellum*	Cotton-Grass	
Cyperaceae	*Eriophorum vaginatum*	Cotton-Grass	
Cyperaceae	*Eriophorum virginicum*	Tawny Cotton-Grass	
Cyperaceae	*Eriophorum viridicarinatum*	Green-Keeled Cotton-Grass	
Cyperaceae	*Rhynchospora alba*	Beak-Rush	
Cyperaceae	*Rhynchospora fusca*	Beak-Rush	
Cyperaceae	*Schoenoplectus acutus*	Hardstem Bulrush	
Cyperaceae	*Schoenoplectus pungens*	Threesquare	
Cyperaceae	*Schoenoplectus tabernaemontani*	Softstem Bulrush	
Cyperaceae	*Scirpus atrovirens*	Bulrush	
Cyperaceae	*Scirpus cyperinus*	Wool-Grass	
Cyperaceae	*Scirpus hattorianus*	Mosquito Bulrush	
Cyperaceae	*Scirpus pendulus*	Bulrush	
Cyperaceae	*Trichophorum alpinum*	Bulrush	
Cyperaceae	*Trichophorum clintonii*	Clinton's Bulrush	SC
Cystopteridaceae	*Cystopteris bulbifera*	Bulblet Fern	
Cystopteridaceae	*Gymnocarpium dryopteris*	Oak Fern	
Dennstaedtiaceae	*Pteridium aquilinum*	Bracken Fern	
Diervillaceae	*Diervilla lonicera*	Bush Honeysuckle	
Droseraceae	*Drosera intermedia*	Spatulate-Leaved Sundew	
Droseraceae	*Drosera rotundifolia*	Round-Leaved Sundew	
Dryopteridaceae	*Dryopteris carthusiana*	Spinulose Woodfern	
Dryopteridaceae	*Dryopteris cristata*	Crested Shield Fern	
Dryopteridaceae	*Dryopteris intermedia*	Evergreen Woodfern	
Elaeagnaceae	*Elaeagnus angustifolia*	Russian-Olive	NN
Elaeagnaceae	*Elaeagnus umbellata*	Autumn-Olive	IN, PR
Equisetaceae	*Equisetum arvense*	Common Horsetail	
Equisetaceae	*Equisetum fluviatile*	Water Horsetail	
Equisetaceae	*Equisetum hyemale*	Scouring Rush	
Equisetaceae	*Equisetum scirpoides*	Dwarf Scouring Rush	
Equisetaceae	*Equisetum sylvaticum*	Woodland Horsetail	
Ericaceae	*Andromeda glaucophylla*	Bog-Rosemary	
Ericaceae	*Arctostaphylos uva-ursi*	Bearberry, Kinnikinick	
Ericaceae	*Chamaedaphne calyculata*	Leatherleaf	
Ericaceae	*Chimaphila umbellata*	Pipsissewa, Prince's-Pine	
Ericaceae	*Epigaea repens*	Trailing-Arbutus	
Ericaceae	*Gaultheria hispidula*	Creeping-Snowberry	
Ericaceae	*Gaultheria procumbens*	Teaberry, Wintergreen	
Ericaceae	*Gaylussacia baccata*	Huckleberry, Crackleberry	
Ericaceae	*Hypopitys monotropa*	Pinesap, False Beech-Drops	
Ericaceae	*Kalmia angustifolia*	Sheep-Laurel, Lambkill	
Ericaceae	*Kalmia polifolia*	Pale-Laurel, Bog-Laurel	

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Ericaceae	*Monotropa uniflora*	Indian-Pipe	
Ericaceae	*Pyrola asarifolia*	Pink Pyrola	
Ericaceae	*Pyrola elliptica*	Large-Leaved Shinleaf	
Ericaceae	*Rhododendron groenlandicum*	Labrador-Tea	
Ericaceae	*Vaccinium angustifolium*	Low Sweet Blueberry	
Ericaceae	*Vaccinium macrocarpon*	Large Cranberry	
Ericaceae	*Vaccinium myrtilloides*	Velvetleaf Blueberry, Canada Blueberry	
Ericaceae	*Vaccinium oxycoccos*	Small Cranberry	
Eriocaulaceae	*Eriocaulon aquaticum*	Pipewort	
Euphorbiaceae	*Euphorbia corollata*	Flowering Spurge	
Euphorbiaceae	*Euphorbia cyparissias*	Cypress Spurge	NN
Euphorbiaceae	*Euphorbia glyptosperma*	Ridge-Seeded Spurge	NN
Euphorbiaceae	*Euphorbia maculata*	Spotted Spurge	
Euphorbiaceae	*Euphorbia virgata*	Leafy Spurge	IN, PR/NX
Fabaceae	*Lathyrus latifolius*	Perennial Pea, Everlasting Pea	NN
Fabaceae	*Lathyrus sylvestris*	Perennial Pea, Everlasting Pea	NN
Fabaceae	*Lotus corniculatus*	Birdfoot Trefoil	NN
Fabaceae	*Medicago lupulina*	Black Medick	NN
Fabaceae	*Medicago sativa*	Alfalfa	NN
Fabaceae	*Melilotus albus*	White Sweet-Clover	IN
Fabaceae	*Melilotus officinalis*	Yellow Sweet-Clover	IN
Fabaceae	*Robinia pseudoacacia*	Black Locust	NN
Fabaceae	*Securigera varia*	Crown-Vetch	NN
Fabaceae	*Trifolium arvense*	Rabbitfoot Clover	NN
Fabaceae	*Trifolium aureum*	Hop Clover	NN
Fabaceae	*Trifolium hybridum*	Alsike Clover	NN
Fabaceae	*Trifolium pratense*	Red Clover	NN
Fabaceae	*Trifolium repens*	White Clover	NN
Fabaceae	*Vicia cracca*	Bird Vetch	NN
Fabaceae	*Vicia villosa*	Hairy Vetch	NN
Fagaceae	*Fagus grandifolia*	American Beech	
Fagaceae	*Quercus alba*	White Oak	
Fagaceae	*Quercus ellipsoidalis*	Hill's Oak	
Fagaceae	*Quercus rubra*	Red Oak	
Fagaceae	*Quercus velutina*	Black Oak	
Gentianaceae	*Bartonia virginica*	Screw-Stem	
Gentianaceae	*Gentiana rubricaulis*	Red-Stemmed Gentian, Great Lakes Gentian	
Gentianaceae	*Halenia deflexa*	Spurred Gentian	
Geraniaceae	*Erodium cicutarium*	Stork's-Bill, Alfileria	NN
Geraniaceae	*Geranium bicknellii*	Northern Crane's-Bill	
Geraniaceae	*Geranium robertianum*	Herb Robert	
Grossulariaceae	*Ribes americanum*	Wild Black Currant	
Grossulariaceae	*Ribes cynosbati*	Wild Gooseberry, Prickly Gooseberry	
Grossulariaceae	*Ribes glandulosum*	Skunk Currant	

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Grossulariaceae	*Ribes hirtellum*	Swamp Gooseberry	
Grossulariaceae	*Ribes triste*	Swamp Red Currant	
Haloragaceae	*Myriophyllum spicatum*	Eurasian Water-Milfoil	IN, RE
Haloragaceae	*Myriophyllum tenellum*	Water-Milfoil	
Haloragaceae	*Proserpinaca palustris*	Mermaid-Weed	
Hamamelidaceae	*Hamamelis virginiana*	Witch-Hazel	
Hydrocharitaceae	*Elodea canadensis*	Common Waterweed	
Hydrocharitaceae	*Najas flexilis*	Slender Naiad	
Hydrocharitaceae	*Vallisneria americana*	Tape-Grass, Wild-Celery, Eel-Grass	
Hypericaceae	*Hypericum boreale*	Northern St. John's-Wort	
Hypericaceae	*Hypericum kalmianum*	Kalm's St. John's-Wort	
Hypericaceae	*Hypericum majus*	Larger Canada St. John's-Wort	
Hypericaceae	*Hypericum perforatum*	Common St. John's-Wort	IN
Hypericaceae	*Hypericum punctatum*	Spotted St. John's-Wort	
Hypericaceae	*Triadenum fraseri*	Marsh St. John's-Wort	
Iridaceae	*Iris versicolor*	Wild Blue Flag	
Iridaceae	*Sisyrinchium montanum*	Mountain Blue-Eyed-Grass	
Iridaceae	*Sisyrinchium mucronatum*	Slender Blue-Eyed-Grass	
Juncaceae	*Juncus alpinoarticulatus*	Rush	
Juncaceae	*Juncus articulatus*	Jointed Rush	
Juncaceae	*Juncus balticus*	Rush	
Juncaceae	*Juncus brachycephalus*	Rush	
Juncaceae	*Juncus brevicaudatus*	Rush	
Juncaceae	*Juncus bufonius*	Toad Rush	
Juncaceae	*Juncus canadensis*	Canadian Rush	
Juncaceae	*Juncus dudleyi*	Dudley's Rush	
Juncaceae	*Juncus effusus*	Soft-Stemmed Rush	
Juncaceae	*Juncus greenei*	Greene's Rush	
Juncaceae	*Juncus nodosus*	Joint Rush	
Juncaceae	*Juncus pelocarpus*	Brown-Fruited Rush	
Juncaceae	*Juncus tenuis*	Path Rush	
Juncaceae	*Juncus vaseyi*	Vasey's Rush	ST
Juncaceae	*Luzula acuminata*	Hairy Wood Rush	
Juncaginaceae	*Triglochin maritima*	Common Bog Arrow-Grass	
Lamiaceae	*Clinopodium acinos*	Mother-Of-Thyme, Basil-Thyme	NN
Lamiaceae	*Clinopodium vulgare*	Wild-Basil, Dog-Mint	
Lamiaceae	*Glechoma hederacea*	Ground-Ivy, Creeping Charlie	NN
Lamiaceae	*Leonurus cardiaca*	Motherwort	NN
Lamiaceae	*Lycopus americanus*	Common Water Horehound	
Lamiaceae	*Lycopus uniflorus*	Northern Bugle Weed	
Lamiaceae	*Mentha × gracilis*	Gingermint	NN
Lamiaceae	*Mentha × piperita*	Peppermint	NN
Lamiaceae	*Mentha canadensis*	Wild Mint	
Lamiaceae	*Monarda fistulosa*	Wild-Bergamot	
Lamiaceae	*Monarda punctata*	Dotted Mint, Horse Mint	

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Lamiaceae	*Nepeta cataria*	Catnip, Catmint	NN
Lamiaceae	*Prunella vulgaris*	Self-Heal, Heal-All	
Lamiaceae	*Scutellaria galericulata*	Marsh Skullcap	
Lamiaceae	*Scutellaria lateriflora*	Mad-Dog Skullcap	
Lamiaceae	*Teucrium canadense*	Wood-Sage	
Lentibulariaceae	*Utricularia cornuta*	Horned Bladderwort	
Lentibulariaceae	*Utricularia geminiscapa*	Bog Bladderwort	
Lentibulariaceae	*Utricularia gibba*	Humped Bladderwort	
Lentibulariaceae	*Utricularia intermedia*	Flat-Leaved Bladderwort	
Lentibulariaceae	*Utricularia minor*	Small Bladderwort	
Lentibulariaceae	*Utricularia vulgaris*	Common Bladderwort	
Liliaceae	*Erythronium americanum*	Yellow Trout Lily	
Liliaceae	*Lilium philadelphicum*	Wood Lily	
Linnaeaceae	*Linnaea borealis*	Twinflower	
Lycopodiaceae	*Dendrolycopodium dendroideum*	Tree Clubmoss	
Lycopodiaceae	*Dendrolycopodium hickeyi*	Pennsylvania Clubmoss	
Lycopodiaceae	*Dendrolycopodium obscurum*	Ground-Pine	
Lycopodiaceae	*Diphasiastrum complanatum*	Ground-Cedar	
Lycopodiaceae	*Diphasiastrum digitatum*	Ground-Cedar	
Lycopodiaceae	*Diphasiastrum tristachyum*	Ground-Cedar	
Lycopodiaceae	*Huperzia lucidula*	Shining Clubmoss	
Lycopodiaceae	*Lycopodiella subappressa*	Northern Bog clubmoss	SC
Lycopodiaceae	*Lycopodiella inundata*	Bog Clubmoss	
Lycopodiaceae	*Lycopodium clavatum*	Running Ground-Pine	
Lycopodiaceae	*Spinulum annotinum*	Stiff Clubmoss	
Lythraceae	*Decodon verticillatus*	Whorled Loosestrife, Swamp Loosestrife	
Lythraceae	*Lythrum salicaria*	Purple Loosestrife	IN, RE
Malvaceae	*Malva moschata*	Musk Mallow	NN
Malvaceae	*Malva neglecta*	Common Mallow, Cheeses	NN
Malvaceae	*Tilia americana*	Basswood, Linden	
Melanthiaceae	*Anticlea elegans*	White Camas	
Menyanthaceae	*Menyanthes trifoliata*	Buckbean, Bogbean	
Molluginaceae	*Mollugo verticillata*	Carpetweed	NN
Montiaceae	*Claytonia caroliniana*	Carolina Spring-Beauty	
Myricaceae	*Comptonia peregrina*	Sweetfern	
Myricaceae	*Myrica gale*	Sweet Gale	
Myrsinaceae	*Lysimachia ciliata*	Fringed Loosestrife	
Myrsinaceae	*Lysimachia quadrifolia*	Whorled Loosestrife, Four-Leaved Loosestrife	
Myrsinaceae	*Lysimachia quadriflora*	Prairie Loosestrife, Four-Flowered Loosestrife	
Myrsinaceae	*Lysimachia terrestris*	Swamp-Candles	
Myrsinaceae	*Lysimachia thyrsiflora*	Tufted Loosestrife	
Myrsinaceae	*Trientalis borealis*	Star-Flower	
Nyctaginaceae	*Mirabilis nyctaginea*	Wild Four-O'Clock	NN

Table J-1. Plant Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Nymphaeaceae	*Nuphar variegata*	Yellow Pond-Lily	
Nymphaeaceae	*Nymphaea odorata*	Sweet-Scented Waterlily	
Oleaceae	*Fraxinus americana*	White Ash	
Oleaceae	*Fraxinus nigra*	Black Ash	
Oleaceae	*Ligustrum vulgare*	Common Privet	NN
Oleaceae	*Syringa vulgaris*	Common Lilac	NN
Onagraceae	*Chamaenerion angustifolium*	Fireweed	
Onagraceae	*Circaea alpina*	Small Enchanter's-Nightshade	
Onagraceae	*Circaea canadensis*	Enchanter's-Nightshade	
Onagraceae	*Epilobium ciliatum*	Willow-Herb	
Onagraceae	*Epilobium coloratum*	Cinnamon Willow-Herb	
Onagraceae	*Epilobium leptophyllum*	Fen Willow-Herb	
Onagraceae	*Epilobium parviflorum*	Willow-Herb	NN
Onagraceae	*Ludwigia palustris*	Water-Purslane	
Onagraceae	*Oenothera biennis*	Common Evening-Primrose	
Onagraceae	*Oenothera parviflora*	Evening-Primrose	
Onagraceae	*Oenothera perennis*	Small Sundrops	
Onocleaceae	*Matteuccia struthiopteris*	Ostrich Fern	
Onocleaceae	*Onoclea sensibilis*	Sensitive Fern	
Ophioglossaceae	*Botrychium angustisegmentum*	Lance-Leaved Moonwort	
Ophioglossaceae	*Botrychium campestre*	Prairie Moonwort	ST
Ophioglossaceae	*Botrychium matricariifolium*	Daisy-Leaved Moonwort	
Ophioglossaceae	*Botrychium michiganense*	Michigan Moonwort	
Ophioglossaceae	*Botrychium minganense*	Mingan Moonwort	
Ophioglossaceae	*Botrychium simplex*	Least Moonwort	
Ophioglossaceae	*Botrypus virginianus*	Rattlesnake Fern	
Ophioglossaceae	*Ophioglossum pusillum*	Northern Adder's-Tongue	
Ophioglossaceae	*Sceptridium multifidum*	Leather Grape-Fern	
Ophioglossaceae	*Sceptridium oneidense*	Blunt-Leaved Grape-Fern	
Orchidaceae	*Arethusa bulbosa*	Arethusa, Dragon's Mouth	
Orchidaceae	*Corallorhiza maculata*	Spotted Coral-Root	
Orchidaceae	*Corallorhiza odontorhiza*	Fall Coral-Root	
Orchidaceae	*Corallorhiza trifida*	Early Coral-Root	
Orchidaceae	*Cypripedium acaule*	Moccasin Flower, Pink Lady-Slipper, Stemless Lady-Slipper	
Orchidaceae	*Cypripedium parviflorum*	Yellow Lady-Slipper	
Orchidaceae	*Cypripedium reginae*	Showy Lady-Slipper, Queen's Lady-Slipper	
Orchidaceae	*Epipactis helleborine*	Helleborine	NN
Orchidaceae	*Goodyera tesselata*	Tesselated Rattlesnake Plantain	
Orchidaceae	*Isotria verticillata*	Whorled Pogonia	ST
Orchidaceae	*Malaxis monophyllos*	White Adder's-Mouth	
Orchidaceae	*Neottia cordata*	Heartleaf Twayblade	
Orchidaceae	*Platanthera clavellata*	Club-Spur Orchid, Small Green Wood Orchid	
Orchidaceae	*Platanthera dilatata*	Tall White Bog Orchid, Bog-Candle	

Table J-1. Plant Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Orchidaceae	*Platanthera lacera*	Ragged Fringed Orchid, Green-Fringed Orchid	
Orchidaceae	*Platanthera obtusata*	Blunt-Leaved Orchid	
Orchidaceae	*Platanthera orbiculata*	Round-Leaved Orchid	
Orchidaceae	*Platanthera psycodes*	Purple Fringed Orchid	
Orchidaceae	*Pogonia ophioglossoides*	Rose Pogonia	
Orchidaceae	*Spiranthes casei*	Case's Ladies'-Tresses	
Orchidaceae	*Spiranthes cernua*	Nodding Ladies'-Tresses	
Orchidaceae	*Spiranthes lacera*	Slender Ladies'-Tresses	
Orchidaceae	*Spiranthes romanzoffiana*	Hooded Ladies'-Tresses	
Orobanchaceae	*Agalinis purpurea*	Purple False Foxglove	
Orobanchaceae	*Aureolaria flava*	Smooth False Foxglove	
Orobanchaceae	*Conopholis americana*	Squaw-Root	
Orobanchaceae	*Epifagus virginiana*	Beech-Drops	
Orobanchaceae	*Melampyrum lineare*	Cow-Wheat	
Osmundaceae	*Osmunda claytoniana*	Interrupted Fern	
Osmundaceae	*Osmunda regalis*	Royal Fern	
Osmundaceae	*Osmundastrum cinnamomeum*	Cinnamon Fern	
Oxalidaceae	*Oxalis acetosella*	Northern Wood-Sorrel	
Oxalidaceae	*Oxalis stricta*	Yellow Wood-Sorrel	
Papaveraceae	*Capnoides sempervirens*	Pink Corydalis, Rock Harlequin, Pale Corydalis	
Papaveraceae	*Dicentra canadensis*	Squirrel-Corn	
Papaveraceae	*Dicentra cucullaria*	Dutchman's-Breeches	
Parnassiaceae	*Parnassia glauca*	Grass-Of-Parnassus	
Phrymaceae	*Mimulus glabratus*	James' Monkey-Flower	
Phrymaceae	*Mimulus ringens*	Monkey-Flower	
Pinaceae	*Abies balsamea*	Balsam Fir	
Pinaceae	*Larix laricina*	Larch, Tamarack	
Pinaceae	*Picea glauca*	White Spruce	
Pinaceae	*Picea mariana*	Black Spruce	
Pinaceae	*Pinus banksiana*	Jack Pine	
Pinaceae	*Pinus resinosa*	Red Pine	
Pinaceae	*Pinus strobus*	White Pine	
Pinaceae	*Pinus sylvestris*	Scots Pine, Scotch Pine	NN
Pinaceae	*Tsuga canadensis*	Hemlock	
Plantaginaceae	*Chaenorhinum minus*	Dwarf-Snapdragon	NN
Plantaginaceae	*Chelone glabra*	Turtlehead	
Plantaginaceae	*Linaria vulgaris*	Butter-And-Eggs	NN
Plantaginaceae	*Nuttallanthus canadensis*	Blue Toadflax	
Plantaginaceae	*Plantago lanceolata*	Buckhorn, Narrow-Leaved Plantain	NN
Plantaginaceae	*Plantago major*	Common Plantain	NN
Plantaginaceae	*Plantago rugelii*	Rugel's Plantain, Red-Stalked Plantain	
Plantaginaceae	*Veronica anagallis-aquatica*	Water Speedwell	
Plantaginaceae	*Veronica arvensis*	Field Speedwell, Corn Speedwell	

Table J-1. Plant Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Plantaginaceae	*Veronica beccabunga v. americana*	Brooklime, American Brooklime	
Plantaginaceae	*Veronica beccabunga v. beccabunga*	Brooklime, American Brooklime	
Plantaginaceae	*Veronica dillenii*	Speedwell	NN
Plantaginaceae	*Veronica officinalis*	Common Speedwell	NN
Plantaginaceae	*Veronica peregrina*	Purslane Speedwell, Neckweed	
Plantaginaceae	*Veronica scutellata*	Marsh Speedwell	
Plantaginaceae	*Veronica verna*	Spring Corn Speedwell	NN
Poaceae	*Agropyron cristatum*	Crested Wheatgrass	NN
Poaceae	*Agrostis capillaris*	Colonial Bent, Rhode Island Bent	NN
Poaceae	*Agrostis gigantea*	Redtop	NN
Poaceae	*Agrostis perennans*	Autumn Bent, Upland Bent	
Poaceae	*Agrostis scabra*	Ticklegrass	
Poaceae	*Alopecurus pratensis*	Meadow Foxtail	NN
Poaceae	*Andropogon gerardii*	Big Bluestem, Turkey Foot	
Poaceae	*Anthoxanthum hirtum*	Sweet Grass	
Poaceae	*Aristida basiramea*	Fork-Tipped Three-Awned Grass	
Poaceae	*Avena sativa*	Oats	NN
Poaceae	*Avenella flexuosa*	Hair Grass	
Poaceae	*Brachyelytrum aristosum*	Northern wood grass, northern shorthusk	
Poaceae	*Bromus ciliatus*	Fringed Brome	
Poaceae	*Bromus inermis*	Smooth Brome, Hungarian Brome	NN
Poaceae	*Bromus japonicus*	Japanese Brome	NN
Poaceae	*Bromus kalmii*	Prairie Brome	
Poaceae	*Bromus squarrosus*	Brome	NN
Poaceae	*Bromus tectorum*	Downy Chess, Cheat Grass	NN
Poaceae	*Calamagrostis canadensis*	Blue-Joint	
Poaceae	*Calamagrostis stricta*	Narrow-Leaved Reedgrass	
Poaceae	*Cenchrus longispinus*	Sandbur, Sandspur	
Poaceae	*Cinna latifolia*	Wood Reedgrass	
Poaceae	*Dactylis glomerata*	Orchard Grass	NN
Poaceae	*Danthonia spicata*	Poverty Grass, Oatgrass	
Poaceae	*Deschampsia cespitosa*	Hair Grass	
Poaceae	*Dichanthelium boreale*	Northern Panic Grass	
Poaceae	*Dichanthelium columbianum*	Panic Grass	
Poaceae	*Dichanthelium depauperatum*	Panic Grass	
Poaceae	*Dichanthelium implicatum*	Panic Grass	
Poaceae	*Dichanthelium latifolium*	Broad-Leaved Panic Grass	
Poaceae	*Dichanthelium linearifolium*	Slender-Leaved Panic Grass	
Poaceae	*Dichanthelium meridionale*	Mat Panic Grass	
Poaceae	*Dichanthelium oligosanthes*	Panic grass	
Poaceae	*Dichanthelium xanthophysum*	Panic Grass	
Poaceae	*Digitaria ischaemum*	Smooth Crab Grass	NN
Poaceae	*Digitaria sanguinalis*	Hairy Crab Grass	NN

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Poaceae	*Echinochloa muricata*	Barnyard Grass	
Poaceae	*Elymus canadensis*	Canada Wild Rye	
Poaceae	*Elymus hystrix*	Bottlebrush Grass	
Poaceae	*Elymus repens*	Quack Grass	NN
Poaceae	*Elymus trachycaulus*	Slender Wheatgrass	
Poaceae	*Elymus virginicus*	Virginia Wild-Rye	
Poaceae	*Eragrostis minor*	Low Love Grass	NN
Poaceae	*Eragrostis pectinacea*	Love Grass	
Poaceae	*Eragrostis spectabilis*	Tumble Grass, Purple Love Grass	
Poaceae	*Festuca altaica*	Rough Fescue	ST
Poaceae	*Festuca rubra*	Red Fescue	NN
Poaceae	*Festuca subverticillata*	Nodding Fescue	
Poaceae	*Festuca trachyphylla*	Sheep Fescue	NN
Poaceae	*Glyceria borealis*	Northern Manna Grass	
Poaceae	*Glyceria canadensis*	Rattlesnake Grass	
Poaceae	*Glyceria grandis*	Reed Manna Grass	IN
Poaceae	*Glyceria striata*	Fowl Manna Grass	
Poaceae	*Hordeum jubatum*	Squirrel-Tail Grass	NN
Poaceae	*Koeleria macrantha*	June Grass	
Poaceae	*Leersia oryzoides*	Cut Grass	
Poaceae	*Lolium arundinaceum*	Tall Fescue	NN
Poaceae	*Lolium perenne*	Ryegrass	NN
Poaceae	*Milium effusum*	Wood Millet	
Poaceae	*Muhlenbergia glomerata*	Marsh Wild-Timothy	
Poaceae	*Muhlenbergia mexicana*	Leafy Satin Grass	
Poaceae	*Muhlenbergia uniflora*	Muhly Grass	
Poaceae	*Oryzopsis asperifolia*	Rough-Leaved Rice-Grass	
Poaceae	*Panicum capillare*	Witch Grass	
Poaceae	*Panicum flexile*	Panic Grass	
Poaceae	*Panicum virgatum*	Switch Grass	
Poaceae	*Phalaris arundinacea*	Reed Canary Grass	IN
Poaceae	*Phleum pratense*	Timothy	NN
Poaceae	*Phragmites australis*	Invasive Phragmites, Giant Reed	IN, RE
Poaceae	*Piptatheropsis canadensis*	Canada Rice-Grass	ST
Poaceae	*Piptatheropsis pungens*	Rice-Grass	
Poaceae	*Poa annua*	Annual Bluegrass	NN
Poaceae	*Poa bulbosa*	Bluegrass	NN
Poaceae	*Poa compressa*	Canada Bluegrass	IN
Poaceae	*Poa palustris*	Fowl Meadow Grass	
Poaceae	*Poa pratensis*	Kentucky Bluegrass	NN
Poaceae	*Poa saltuensis*	Bluegrass	
Poaceae	*Schizachne purpurascens*	False Melic	
Poaceae	*Schizachyrium scoparium*	Little Bluestem	
Poaceae	*Secale cereale*	Rye	NN
Poaceae	*Setaria italica*	Foxtail, Hungarian Millet	NN
Poaceae	*Setaria viridis*	Green Foxtail	NN

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Poaceae	*Sorghastrum nutans*	Indian Grass	
Poaceae	*Spartina pectinata*	Cordgrass	
Poaceae	*Sphenopholis intermedia*	Slender Wedgegrass	
Poaceae	*Sporobolus cryptandrus*	Sand Dropseed	
Poaceae	*Sporobolus heterolepis*	Sand Dropseed, Prairie Dropseed	
Poaceae	*Sporobolus neglectus*	Small Rush Grass	
Poaceae	*Sporobolus vaginiflorus*	Sheathed Rush Grass	
Poaceae	*Torreyochloa fernaldii*	Fernald's False Mannagrass	
Poaceae	*Torreyochloa pallida*	Pale False Mannagrass	
Poaceae	*Zizania palustris*	Northern Wild-Rice, Wild-Rice	
Polygalaceae	*Polygala paucifolia*	Fringed Polygala, Gay-Wings, Flowering-Wintergreen	
Polygalaceae	*Polygala polygama*	Racemed Milkwort	
Polygonaceae	*Fallopia cilinodis*	Fringed False Buckwheat	
Polygonaceae	*Fallopia convolvulus*	Black-Bindweed, False Buckwheat	NN
Polygonaceae	*Persicaria amphibia*	Water Smartweed	
Polygonaceae	*Persicaria hydropiper*	Water-Pepper	
Polygonaceae	*Persicaria lapathifolia*	Willow-Weed, Nodding Smartweed	
Polygonaceae	*Persicaria maculosa*	Heart's-Ease, Lady's-Thumb	NN
Polygonaceae	*Persicaria perfoliata*	Mile-a-minute weed	
Polygonaceae	*Persicaria pensylvanica*	Pinkweed, Bigseed Smartweed	
Polygonaceae	*Persicaria punctata*	Smartweed	
Polygonaceae	*Persicaria sagittata*	Arrow-Leaved Tear-Thumb	
Polygonaceae	*Persicaria virginiana*	Jumpseed	
Polygonaceae	*Polygonum achoreum*	Smartweed	
Polygonaceae	*Polygonum articulatum*	Jointweed	
Polygonaceae	*Polygonum sachalinense*	Giant knotweed	IN
Polygonaceae	*Polygonum cuspidatum*	Japanese Knotweed	IN, PR
Polygonaceae	*Polygonum aviculare*	Knotweed	NN
Polygonaceae	*Polygonum douglasii*	Western Smartweed	
Polygonaceae	*Rumex acetosella*	Red Sorrel, Sheep Sorrel	NN
Polygonaceae	*Rumex crispus*	Sour Dock, Curly Dock	NN
Polygonaceae	*Rumex obtusifolius*	Bitter Dock	NN
Polygonaceae	*Rumex orbiculatus*	Great Water Dock	
Portulacaceae	*Portulaca oleracea*	Purslane, Pusley	
Potamogetonaceae	*Potamogeton alpinus*	Pondweed	
Potamogetonaceae	*Potamogeton amplifolius*	Large-Leaved Pondweed	
Potamogetonaceae	*Potamogeton berchtoldii*	Pondweed	
Potamogetonaceae	*Potamogeton epihydrus*	Ribbon-Leaved Pondweed	
Potamogetonaceae	*Potamogeton foliosus*	Leafy Pondweed	
Potamogetonaceae	*Potamogeton friesii*	Fries's Pondweed	
Potamogetonaceae	*Potamogeton gramineus*	Pondweed	
Potamogetonaceae	*Potamogeton illinoensis*	Illinois Pondweed	
Potamogetonaceae	*Potamogeton natans*	Pondweed	
Potamogetonaceae	*Potamogeton nodosus*	Pondweed	
Potamogetonaceae	*Potamogeton praelongus*	White-Stemmed Pondweed	

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Potamogetonaceae	*Potamogeton richardsonii*	Richardson's Pondweed	
Potamogetonaceae	*Potamogeton zosteriformis*	Flat-Stemmed Pondweed	
Potamogetonaceae	*Stuckenia pectinata*	Sago Pondweed	
Pteridaceae	*Adiantum pedatum*	Maidenhair Fern	
Ranunculaceae	*Actaea pachypoda*	White Baneberry, Doll's-Eyes	
Ranunculaceae	*Actaea rubra*	Red Baneberry	
Ranunculaceae	*Anemone canadensis*	Canada Anemone	
Ranunculaceae	*Anemone cylindrica*	Thimbleweed	
Ranunculaceae	*Anemone quinquefolia*	Wood Anemone	
Ranunculaceae	*Anemone virginiana*	Thimbleweed	
Ranunculaceae	*Aquilegia canadensis*	Wild Columbine	
Ranunculaceae	*Caltha palustris*	Marsh-Marigold, Cowslip	
Ranunculaceae	*Clematis virginiana*	Virgin's Bower	
Ranunculaceae	*Coptis trifolia*	Goldthread	
Ranunculaceae	*Hepatica acutiloba*	Sharp-Lobed Hepatica	
Ranunculaceae	*Hepatica americana*	Round-Lobed Hepatica	
Ranunculaceae	*Ranunculus abortivus*	Small-Flowered Buttercup	
Ranunculaceae	*Ranunculus acris*	Common Buttercup, Tall Buttercup	NN
Ranunculaceae	*Ranunculus gmelinii*	Yellow Water Crowfoot	
Ranunculaceae	*Ranunculus hispidus*	Swamp Buttercup	
Ranunculaceae	*Ranunculus longirostris*	White Water Crowfoot	
Ranunculaceae	*Ranunculus pensylvanicus*	Bristly Crowfoot	
Ranunculaceae	*Ranunculus recurvatus*	Hooked Crowfoot	
Ranunculaceae	*Ranunculus sceleratus*	Cursed Crowfoot	
Ranunculaceae	*Thalictrum dasycarpum*	Purple Meadow-Rue	
Rhamnaceae	*Ceanothus americanus*	New Jersey Tea	
Rhamnaceae	*Ceanothus herbaceus*	New Jersey Tea	
Rhamnaceae	*Rhamnus alnifolia*	Alder-Leaved Buckthorn	
Rhamnaceae	*Rhamnus cathartica*	Common buckthorn	IN
Rosaceae	*Agrimonia gryposepala*	Tall Agrimony	
Rosaceae	*Amelanchier arborea*	Juneberry	
Rosaceae	*Amelanchier laevis*	Smooth Shadbush	
Rosaceae	*Amelanchier sanguinea*	Round-Leaved Serviceberry	
Rosaceae	*Amelanchier spicata*	Shadbush Serviceberry	
Rosaceae	*Aronia prunifolia*	Chokeberry	
Rosaceae	*Comarum palustre*	Marsh Cinquefoil	
Rosaceae	*Crataegus chrysocarpa*	Hawthorn	
Rosaceae	*Dasiphora fruticosa*	Shrubby Cinquefoil	
Rosaceae	*Fragaria virginiana*	Wild Strawberry	
Rosaceae	*Geum aleppicum*	Yellow Avens	
Rosaceae	*Geum canadense*	White Avens	
Rosaceae	*Geum rivale*	Purple Avens	
Rosaceae	*Malus pumila*	Apple	NN
Rosaceae	*Physocarpus opulifolius*	Ninebark	
Rosaceae	*Potentilla anserina*	Silverweed	
Rosaceae	*Potentilla argentea*	Silvery Cinquefoil	NN

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Rosaceae	*Potentilla canadensis*	Dwarf Cinquefoil	SC
Rosaceae	*Potentilla norvegica*	Rough Cinquefoil	
Rosaceae	*Potentilla recta*	Rough-Fruited Cinquefoil	NN
Rosaceae	*Potentilla simplex*	Old-Field Cinquefoil, Common Cinquefoil	
Rosaceae	*Prunus avium*	Sweet Cherry	NN
Rosaceae	*Prunus pensylvanica*	Fire Cherry, Pin Cherry	
Rosaceae	*Prunus pumila*	Sand Cherry	
Rosaceae	*Prunus serotina*	Wild Black Cherry	
Rosaceae	*Prunus umbellata*	Alleghany Plum	SC
Rosaceae	*Prunus virginiana*	Choke Cherry	
Rosaceae	*Rosa acicularis*	Wild Rose	
Rosaceae	*Rosa blanda*	Wild Rose	
Rosaceae	*Rosa multiflora*	Multiflora Rose	IN
Rosaceae	*Rosa palustris*	Swamp Rose	
Rosaceae	*Rosa rugosa*	Japanese Rose	NN
Rosaceae	*Rubus allegheniensis*	Common Blackberry	
Rosaceae	*Rubus flagellaris*	Northern Dewberry	
Rosaceae	*Rubus hispidus*	Swamp Dewberry	
Rosaceae	*Rubus pensilvanicus*	Dewberry	
Rosaceae	*Rubus pubescens*	Dwarf Raspberry	
Rosaceae	*Rubus setosus*	Bristly Blackberry	
Rosaceae	*Rubus strigosus*	Wild Red Raspberry	
Rosaceae	*Sibbaldiopsis tridentata*	Three-Toothed Cinquefoil	
Rosaceae	*Sorbaria sorbifolia*	False Spiraea	NN
Rosaceae	*Sorbus americana*	American Mountain-Ash	
Rosaceae	*Spiraea alba*	Meadowsweet	
Rubiaceae	*Galium asprellum*	Rough Bedstraw	
Rubiaceae	*Galium labradoricum*	Bog Bedstraw	
Rubiaceae	*Galium lanceolatum*	Yellow Wild Licorice	
Rubiaceae	*Galium tinctorium*	Stiff Bedstraw	
Rubiaceae	*Galium triflorum*	Fragrant Bedstraw	
Rubiaceae	*Houstonia longifolia*	Long-Leaved Bluets	
Rubiaceae	*Mitchella repens*	Partridge-Berry	
Rutaceae	*Zanthoxylum americanum*	Prickly-Ash	
Salicaceae	*Populus alba*	White Poplar, Silver Poplar	NN
Salicaceae	*Populus balsamifera*	Balsam Poplar, Hackmatack	
Salicaceae	*Populus deltoides*	Cottonwood	
Salicaceae	*Populus grandidentata*	Large-Tooth Aspen, Big-Tooth Aspen	
Salicaceae	*Populus tremuloides*	Quaking Aspen	
Salicaceae	*Salix alba*	White Willow	NN
Salicaceae	*Salix bebbiana*	Beaked Willow, Bebb's Willow	
Salicaceae	*Salix candida*	Sage Willow, Hoary Willow	
Salicaceae	*Salix discolor*	Pussy Willow	
Salicaceae	*Salix eriocephala*	Willow	

Table J-1. Plant Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Salicaceae	*Salix euxina*	Brittle Willow, Crack Willow	NN
Salicaceae	*Salix exigua*	Sandbar Willow	
Salicaceae	*Salix humilis*	Upland Willow, Prairie Willow	
Salicaceae	*Salix lucida*	Shining Willow	
Salicaceae	*Salix pedicellaris*	Bog Willow	
Salicaceae	*Salix petiolaris*	Slender Willow, Meadow Willow	
Salicaceae	*Salix serissima*	Autumn Willow	
Santalaceae	*Comandra umbellata*	Bastard-Toadflax, Star-Toadflax	
Sapindacae	*Acer rubrum*	Red Maple	
Sapindacae	*Acer saccharum*	Sugar Maple, Hard Maple	
Sarraceniaceae	*Sarracenia purpurea*	Pitcher-Plant	
Saxifragaceae	*Chrysosplenium americanum*	Golden Saxifrage	
Saxifragaceae	*Mitella diphylla*	Bishop's-Cap	
Saxifragaceae	*Mitella nuda*	Naked Miterwort	
Saxifragaceae	*Tiarella cordifolia*	Foamflower, False Miterwort	
Scheuchzeriaceae	*Scheuchzeria palustris*	Arrow-Grass	
Scrophulariaceae	*Scrophularia lanceolata*	Early Figwort	
Scrophulariaceae	*Verbascum thapsus*	Mullein, Flannel Plant, Common Mullein	NN
Selaginellaceae	*Selaginella rupestris*	Sand Club Moss	
Smilacaceae	*Smilax hispida*	Bristly Greenbrier	
Solanaceae	*Physalis virginiana*	Virginia Ground-Cherry	
Solanaceae	*Solanum dulcamara*	Bittersweet Nightshade, European Bittersweet	NN
Solanaceae	*Solanum ptychanthum*	Black Nightshade	
Thelypteridaceae	*Phegopteris connectilis*	Northern Beech-Fern	
Thelypteridaceae	*Thelypteris noveboracensis*	New York Fern	
Thelypteridaceae	*Thelypteris palustris*	Marsh Fern	
Trilliaceae	*Trillium cernuum*	Nodding Trillium	
Trilliaceae	*Trillium grandiflorum*	Common Trillium	
Typhaceae	*Sparganium americanum*	American Bur-Reed	
Typhaceae	*Sparganium natans*	Small Bur-Reed	
Typhaceae	*Typha angustifolia*	Narrow-Leaved Cat-Tail	NN
Typhaceae	*Typha latifolia*	Common Cat-Tail, Broad-Leaved Cat-Tail	
Ulmaceae	Ulmus americana L.	American Elm	
Urticaceae	*Pilea fontana*	Bog Clearweed	
Urticaceae	*Urtica dioica*	Stinging Nettle	
Valerianaceae	*Valeriana uliginosa*	Swamp Valerian	
Verbenaceae	*Verbena bracteata*	Prostrate Vervain, Creeping Vervain	NN
Verbenaceae	*Verbena hastata*	Blue Vervain	
Verbenaceae	*Verbena stricta*	Hoary Vervain	NN
Violaceae	*Viola adunca*	Sand Violet	
Violaceae	*Viola affinis*	Le Conte's Violet	
Violaceae	*Viola blanda*	Sweet White Violet	
Violaceae	*Viola canadensis*	Canada Violet	

Table J-1. Plant Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Violaceae	*Viola cucullata*	Marsh Violet	
Violaceae	*Viola labradorica*	Dog Violet	
Violaceae	*Viola lanceolata*	Lance-Leaved Violet	
Violaceae	*Viola macloskeyi*	Smooth White Violet	
Violaceae	*Viola nephrophylla*	Northern Bog Violet	
Violaceae	*Viola novae-angliae*	New England Blue Violet	ST
Violaceae	*Viola pedata*	Birdfoot Violet	
Violaceae	*Viola primulifolia*	Primrose-Leaved Violet	
Violaceae	*Viola pubescens*	Yellow Violet	
Violaceae	*Viola rostrata*	Long-Spurred Violet	
Violaceae	*Viola sagittata*	Arrow-Leaved Violet	
Vitaceae	*Parthenocissus quinquefolia*	Virginia Creeper	
Vitaceae	*Vitis riparia*	River-Bank Grape	

Sources: MNFI 1994; Cohen et al. 2005; Higman et al. 2005; DLZ 2006, 2018; Koziatek and Wilson 2016, 2017

Table J-2. Lichen Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Acarosporaceae	*Acarospora immersa*	Water cracked lichen	
Arthoniaceae	*Arthonia caesia*	Dot lichen	
Bacidiaceae	*Bacidia schweinitzii*	Schweinitz's dotted lichen	
Bacidiaceae	*Hypocenomyce anthracophila*		
Candelariaceae	*Candelaria concolor*	Lemon lichen	
Candelariaceae	*Candelariella aurella*	Hidden goldspeck	
Candelariaceae	*Candelariella efflorescens*	eggyolk Lichen	
Candelariaceae	*Candelariella vitellina*	eggyolk Lichen	
Candelariaceae	*Candelariella xanthostigma*	eggyolk Lichen	
Cladoniaceae	*Cladina mitis*	Reindeer lichen	
Cladoniaceae	*Cladina rangiferina*	Greygreen reindeer lichen	
Cladoniaceae	*Cladina stellaris*	Star reindeer lichen	
Cladoniaceae	*Cladonia cervicornis verticillata*	Cup Lichen	
Cladoniaceae	*Cladonia cristatella*	Bristish soldier lichen	
Graphidaceae	*Graphis scripta*	pencilmark lichen	
Gyalectaceae	*Gyalecta truncigena*	dimple lichen	
Lecanoraceae	*Scoliciosporum chlorococcum*	Scoliciosporum lichen	
Lecanoraceae	*Lecanora impudens*	Rim lichen	
Lecideaceae	*Hypocenomyce friesii*	Fries' cockleshell lichen	
Lecideaceae	*Hypocenomyce scalaris*	Cockleshell Lichen	
Lobariaceae	*Lobaria pulmonaria*	Lung lichen	
Opegraphaceae	*Cresponea chloroconia*		
Parmeliaceae	*Bryoria furcellata*	Horsehair lichen	
Parmeliaceae	*Platismatia tuckermanii*	Tuckerman's ragged liched	
Parmeliaceae	*Pseudevernia consocians*	light and dark lichen	
Parmeliaceae	*Punctelia rudecta*	Punctelia	
Parmeliaceae	*Cetraria fendleri*	Fendler's tuckermannopsis lichen	

Table J-2. Lichen Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Parmeliaceae	*Cetraria halei*	American tuckermannopsis lichen	
Parmeliaceae	*Cetraria oakesiana*		
Parmeliaceae	*Vulpicida pinastri*		
Parmeliaceae	*Tuckermannopsis sepincola*	tuckermannopsis lichen	
Parmeliaceae	*Cetrelia olivetorum*	Giant shield lichen	
Parmeliaceae	*Evernia mesomorpha*	Ring Lichen	
Parmeliaceae	*Flavoparmelia caperata*	flavoparmelia lichen	
Parmeliaceae	*Flavopunctelia soredica*	flavoparmelia lichen	
Parmeliaceae	*Hypogymnia physodes*	Tube Lichen	
Parmeliaceae	*Imshaugia aleurites*	Imshaugia lichen	
Parmeliaceae	*Imshaugia placorodia*	Imshaugia lichen	
Parmeliaceae	*Melanelia septentrionalis*	Melanelia lichen	
Parmeliaceae	*Melanelia subaurifera*	Melanelia lichen	
Parmeliaceae	*Parmelia squarrosa*	Shield Lichen	
Parmeliaceae	*Parmelia sulcata*	Shield Lichen	
Parmeliaceae	*Parmeliopsis ambigua*	Ambiguous bran lichen	
Parmeliaceae	*Parmeliopsis hyperopta*	Bran Lichen	
Parmeliaceae	*Parmotrema crinitum*	Parmotrema Lichen	
Peltigeraceae	*Peltigera canina*	Felt lichen	
Peltigeraceae	*Peltigera didactyla*	Felt lichen	
Peltigeraceae	*Peltigera eisabethae*	Elizabeth's Felt lichen	
Peltigeraceae	*Peltigera lepidophora*	Felt lichen	
Peltigeraceae	*Peltigera rufescens*	Felt lichen	
Pertusariaceae	*Ochrolechia arborea*	Tree crabseye lichen	
Pertusariaceae	*Pertusaira amara*	Pore Lichen	
Phlyctidaceae	*Phlyctis argena*	blemished lichen	
Physciaceae	*Phaeophyscia rubropulchra*	Wreath lichen	
Physciaceae	*Physcia adscendens*	Rosette lichen	
Physciaceae	*Physcia aipolia*	Rosette lichen	
Physciaceae	*Physcia millegrana*	Rosette lichen	
Physciaceae	*Physcia stellaris*	Starry rosette lichen	
Physciaceae	*Physconia detersa*	Frosted lichen	
Physciaceae	*Pyxine sorediata*	Pyxine lichen	
Physciaceae	*Heterodermia speciosa*	Shield Lichen	
Physciaceae	*Phaeophyscia pusilloides*	Wreath Lichen	
Ramalinaceae	*Ramalina intermedia*	Intermediate cartilage lichen	
Teloschistaceae	*Caloplaca cerina*	Orange lichen	
Teloschistaceae	*Caloplaca chrysophthalama*	Orange lichen	
Teloschistaceae	*Caloplaca holocarpa*	Orange lichen	
Teloschistaceae	*Xanthoria fallax*	Orange Wall lichen	
Teloschistaceae	*Xanthoria polycarpa*	Orange Wall lichen	
Thelotremataceae	*Diploschistes scruposus*	Crater Lichen	
Trapeliaceae	*Trapelia involuta*	Disk lichen	
Trapeliaceae	*Trapeliopsis granulosa*	Granular trapeliopsis lichen	

Source: MNFI 1994

Table J-3. Fish Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Amiidae	*Amia calva*	Bowfin	
Atherinidae	*Labidesthes sicculus*	Brook Silverside	
Catostomidae	*Carpiodes cyprinus*	Quillback Carpsucker	
Catostomidae	*Catostomus catostomus*	Longnose Sucker	
Catostomidae	*Catostomus commersoni*	White Sucker	
Catostomidae	*Hypentelium nigricans*	Northern Hogsucker	
Catostomidae	*Moxostoma anisurum*	Silver Redhorse	
Catostomidae	*Moxostoma erythrurum*	Golden Redhorse	
Catostomidae	*Moxostoma macrolepidotum*	Shorthead Redhorse	
Catostomidae	*Moxostoma sp.*	Redhorse spp.	
Catostomidae	*Moxostoma valenciennesi*	Greater Redhorse	
Centrarchidae	*Ambloplites rupestris*	Rock Bass	
Centrarchidae	*Lepomis cyanellus*	Green Sunfish	
Centrarchidae	*Lepomis gibbosus*	Pumpkinseed	
Centrarchidae	*Lepomis macrochirus*	Bluegill	
Centrarchidae	*Lepomis megalotis*	Longear Sunfish	
Centrarchidae	*Lepomis sp.*	Hybrid Sunfish	
Centrarchidae	*Micropterus dolomieu*	Smallmouth Bass	
Centrarchidae	*Micropterus salmoides*	Largemouth Bass	
Centrarchidae	*Pomoxis nigromaculatus*	Black Crappie	
Clupeidae	*Dorosoma cepedianum*	Gizzard Shad	
Cottidae	*Cottus bairdi*	Mottled Sculpin	
Cottidae	*Cottus cognatus*	Slimy Sculpin	
Cyprinidae	*Campostoma anomalum*	Central Stoneroller	
Cyprinidae	*Cyprinella spiloptera*	Spotfin Shiner	
Cyprinidae	*Cyprinus carpio*	Common Carp	
Cyprinidae	*Hybognathus hankinsoni*	Brassy Minnow	
Cyprinidae	*Luxilus cornutus*	Common Shiner	
Cyprinidae	*Margariscus margarita*	Pearl Dace	
Cyprinidae	*Nocomis biguttatus*	Hornyhead Chub	
Cyprinidae	*Nocomis micropogon*	River Chub	
Cyprinidae	*Notemigonus crysoleucas*	Golden Shiner	
Cyprinidae	*Notropis atherinoides*	Emerald Shiner	
Cyprinidae	*Notropis heterodon*	Blackchin Shiner	
Cyprinidae	*Notropis heterolepis*	Blacknose Shiner	
Cyprinidae	*Notropis hudsonius*	Spottail Shiner	
Cyprinidae	*Notropis rubellus*	Rosyface Shiner	
Cyprinidae	*Notropis stramineus*	Sand Shiner	
Cyprinidae	*Notropis volucellus*	Mimic Shiner	
Cyprinidae	*Phoxinus eos*	Northern Redbelly Dace	
Cyprinidae	*Phoxinus neogaeus*	Finescale Dace	
Cyprinidae	*Pimephales notatus*	Bluntnose Minnow	
Cyprinidae	*Pimephales promelas*	Fathead Minnow	
Cyprinidae	*Rhinichthys atratulus*	Blacknose Dace	
Cyprinidae	*Rhinichthys cataractae*	Longnose Dace	

Table J-3. Fish Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Cyprinidae	*Semotilus atromaculatus*	Creek Chub	
Esocidae	*Esox lucius*	Northern Pike	MDNR
Esocidae	*Esox masquinongy*	Muskellunge	MDNR
Esocidae	*Esox masquinongy x Esox lucius*	Tiger Muskellunge	
Fundulidae	*Fundulus diaphanus*	Banded Killifish	
Gadidae	*Lota lota*	Burbot	
Gasterosteidae	*Culaea inconstans*	Brook Stickleback	
Gasterosteidae	*Pungitius pungitius*	Ninespine Stickleback	
Ictaluridae	*Ameiurus melas*	Black Bullhead	
Ictaluridae	*Ameiurus natalis*	Yellow Bullhead	
Ictaluridae	*Ameiurus nebulosus*	Brown Bullhead	
Ictaluridae	*Ameiurus sp.*	Bullhead spp.	
Ictaluridae	*Ictalurus punctatus*	Channel Catfish	
Lepisosteidae	*Lepisosteus osseus*	Longnose Gar	
Osmeridae	*Osmerus mordax*	Rainbow Smelt	NN
Percidae	*Etheostoma caeruleum*	Rainbow Darter	
Percidae	*Etheostoma exile*	Iowa Darter	
Percidae	*Etheostoma nigrum*	Johnny Darter	
Percidae	*Perca flavescens*	Yellow Perch	
Percidae	*Percina caprodes*	Logperch	
Percidae	*Percina maculata*	Blackside Darter	
Percidae	*Stizostedion vitreum*	Walleye	MDNR
Percopsidae	*Percopsis omiscomaycus*	Trout-Perch	
Petromyzontidae	*Ichthyomyzon castaneus*	Chestnut Lamprey	
Petromyzontidae	*Ichthyomyzon fossor*	Northern Brook Lamprey	
Petromyzontidae	*Ichthyomyzon unicuspis*	Silver Lamprey	
Petromyzontidae	*Lampetra appendix*	American Brook Lamprey	
Salmonidae	*Coregonus artedi*	Lake Herring, Cisco	MDNR
Salmonidae	*Coregonus clupeaformis*	Lake Whitefish	MDNR
Salmonidae	*Oncorhynchus mykiss*	Rainbow Trout	NN, MDNR
Salmonidae	*Prosopium cylindraceum*	Round Whitefish	
Salmonidae	*Salmo trutta*	Brown Trout	NN, MDNR
Salmonidae	*Salvelinus fontinalis*	Brook Trout	MDNR
Salmonidae	*Salvelinus fontinalis x Salvelinus namaycush*	Splake	
Salmonidae	*Salvelinus namaycush*	Lake Trout	MDNR
Sciaenidae	*Aplodinotus grunniens*	Freshwater Drum	
Umbridae	*Umbra limi*	Central Mudminnow	

Sources: Rozich 1998; Tonello 2007, 2009; MDNR 2016

Table J-4. Amphibian Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Ambystomatidae	*Ambystoma laterale*	Blue-Spotted Salamander	
Ambystomatidae	*Ambystoma maculatum*	Spotted Salamander	
Bufonidae	*Anaxyrus americanus americanus*	Eastern American Toad	
Hylidae	*Hyla versicolor*	Eastern Gray Treefrog	
Hylidae	*Pseudacris crucifer crucifer*	Northern Spring Peeper	
Hylidae	*Pseudacris triseriata*	Western Chorus Frog	
Plethodontidae	*Plethodon cinereus*	Red-Backed Salamander	
Proteidae	*Necturus maculosus maculosus*	Mudpuppy	SC
Ranidae	*Lithobates catesbeianus*	Bullfrog	
Ranidae	*Lithobates clamitans*	Green Frog	
Ranidae	*Lithobates palustris*	Pickerel Frog	
Ranidae	*Lithobates pipiens*	Northern Leopard Frog	
Ranidae	*Lithobates sylvaticus*	Wood Frog	
Salamandridae	*Notophthalmus viridescens*	Eastern Newt	

Sources**:** MNFI 1994; Schreiber and Anderson 1997; Manning et al 2006, DLZ 2018; Ravesi, pers. obs. 2018

Table J-5. Reptiles Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Chelydridae	*Chelydra serpentina*	Snapping Turtle	
Colubridae	*Diadophis punctatus edwardsi*	Northern Ringneck Snake	
Colubridae	*Heterodon platyrhinos*	Eastern Hognose Snake	
Colubridae	*Lampropeltis triangulum triangulum*	Eastern Milk Snake	
Colubridae	*Nerodia sipedon sipedon*	Northern Water Snake	
Colubridae	*Opheodrys vernalis*	Smooth Green Snake	SC
Colubridae	*Storeria dekayi*	Dekay's Brown Snake	
Colubridae	*Storeria occipitomaculata*	Red-Bellied Snake	
Colubridae	*Thamnophis sauritus septentrionalis*	Northern Ribbon Snake	
Colubridae	*Thamnophis sirtalis sirtalis*	Eastern Garter Snake	
Emydidae	*Chrysemys picta*	Painted Turtle	
Emydidae	*Glyptemys insculpta*	Wood Turtle	SC
Emydidae	*Emydoidea blandingii*	Blanding's Turtle	SC
Scincidae	*Plestiodon fasciatus*	Five-Lined Skink	
Viperidae	*Sistrurus catenatus*	Eastern Massasauga Rattlesnake	FT, SC,

Sources: MNFI 1994; Schreiber and Anderson 1997; Manning et al 2006, DLZ 2018;

Table J-6. Mammal Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Canidae	*Canis latrans*	Eastern Coyote	
Canidae	*Vulpes vulpes*	Red Fox	
Castoridae	*Castor canadensis*	American Beaver	
Cervidae	*Odocoileus virginiatus*	White-tailed Deer	
Cricetidae	*Microtus pennsylvanicus*	Meadow Vole	
Cricetidae	*Myodes gapperi*	Southern Red-backed Vole	
Cricetidae	*Ondatra zibethicus*	Common Muskrat	
Cricetidae	*Peromyscus leucopus*	White-footed Deermouse	
Cricetidae	*Peromyscus maniculatus*	North American Deermouse	
Cricetidae	*Synaptomys cooperi*	Southern Bog Lemming	

Table J-6. Mammal Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Erethizontidae	*Erethizon dorsatum*	Common Porcupine	
Leporidae	*Lepus americanus*	Snowshoe Hare	
Leporidae	*Sylvilagus floridanus*	Eastern Cottontail	
Mephitidae	*Mephitis mephitis*	Striped Skunk	
Mustelidae	*Mustela nivalis*	Least Weasel	
Mustelidae	*Neovison vison*	American Mink	
Mustelidae	*Taxidea taxus*	American Badger	
Procyonidae	*Procyon lotor*	Raccoon	
Sciuridae	*Galucomys sabrinus*	Northern Flying Squirrel	SC
Sciuridae	*Glaucomys volans*	Southern Flying Squirrel	
Sciuridae	*Ictidomys tridecemlineatus*	Thirteen-lined Ground Squirrel	
Sciuridae	*Marmota monax*	Woodchuck	
Sciuridae	*Sciurus carolinensis*	Eastern Gray Squirrel	
Sciuridae	*Sciurus niger*	Eastern Fox Squirrel	
Sciuridae	*Tamias striatus*	Eastern Chipmunk	
Sciuridae	*Tamiasciurus hudsonicus*	North American Red Squirrel	
Soricidae	*Blarina brevicauda*	Northern Short-tailed Shrew	
Soricidae	*Sorex cinereus*	Masked Shrew	
Ursidae	*Ursus americanus*	Black Bear	
Vespertilionidae	*Eptesicus fuscus*	Big Brown Bat	
Vespertilionidae	*Lasionycteris noctivagans*	Silver-haired Bat	
Vespertilionidae	*Lasiurus borealis*	Eastern Red Bat	
Vespertilionidae	*Lasiurus cinereus*	Hoary Bat	
Vespertilionidae	*Myotis lucifugus*	Little Brown Bat	SC
Vespertilionidae	*Myotis septentrionalis*	Northern Long-eared Bat	FT, SC
Vespertilionidae	*Nycticeius humeralis*	Evening Bat	ST
Vespertilionidae	*Perimyotis subflavus*	Eastern Pipistrelle	SC

Sources: MNFI 1994; Schreiber and Anderson 1997; Higman et al. 2005; CEC 2016; USDA 2017; DLZ 2018; Ravesi, pers. obs. 2018

Table J-7. Bird Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Accipitridae	*Accipiter striatus*	Sharp-shinned Hawk	
Accipitridae	*Buteo jamaicensis*	Red-tailed Hawk	
Accipitridae	*Buteo lagopus*	Rough-legged Hawk	
Accipitridae	*Buteo lineatus*	Red-shouldered Hawk	ST
Accipitridae	*Buteo platypterus*	Broad-winged Hawk	
Accipitridae	*Haliaeetus leucocephalus*	Bald Eagle	SC, BGEPA
Alaudidae	*Eremophila alpestris*	Horned Lark	
Alcedinidae	*Megaceryle alcyon*	Belted Kingfisher	
Anatidae	*Aix sponsa*	Wood Duck	
Anatidae	*Anas discors*	Blue-winged Teal	
Anatidae	*Anas americana*	American widgeon	
Anatidae	*Anas crecca*	Green-winged teal	
Anatidae	*Anas platyrhynchos*	Mallard	
Anatidae	*Anas rubripes*	American Black Duck	

Table J-7. Bird Species Documented on Camp Grayling

Family	Scientific Name	Common Name	Notes
Anatidae	*Branta canadensis*	Canada Goose	
Anatidae	*Bucephala clangula*	Common Goldeneye	
Anatidae	*Cygnus buccinator*	Trumpeter Swan	ST
Anatidae	*Lophodytes cucullatus*	Hooded merganser	
Anatidae	*Mergus merganser*	Common Merganser	
Anatidae	*Mergus serrator*	Red-breasted Merganser	
Apodidae	*Chaetura pelagica*	Chimney Swift	
Ardeidae	*Ardea herodias*	Great Blue Heron	
Ardeidae	*Botaurus lentiginosus*	American Bittern	SC
Ardeidae	*Butorides virescens*	Green Heron	
Ardeidae	*Nycticorax nycticorax*	Black-crowned Night-Heron	SC
Bombycillidae	*Bombycilla cedrorum*	Cedar Waxwing	
Calcariidae	*Plectrophenax nivalis*	Snow Bunting	
Caprimulgidae	*Antrostomus vociferus*	Eastern Whip-poor-will	SC
Caprimulgidae	*Chordeiles minor*	Common Nighthawk	SC
Cardinalidae	*Cardinalis cardinalis*	Northern Cardinal	
Cardinalidae	*Passerina cyanea*	Indigo Bunting	
Cardinalidae	*Pheucticus ludovicianus*	Rose-breasted Grosbeak	
Cardinalidae	*Piranga olivacea*	Scarlet Tanager	
Cathartidae	*Cathartes aura*	Turkey Vulture	
Certhiidae	*Certhia americana*	Brown Creeper	
Charadriidae	*Charadrius vociferus*	Killdeer	
Columbidae	*Zenaida macroura*	Mourning Dove	
Corvidae	*Corvus brachyrhynchos*	American Crow	
Corvidae	*Corvus corax*	Common Raven	
Corvidae	*Cyanocitta cristata*	Blue Jay	
Cuculidae	*Coccyzus americanus*	Yellow-billed Cuckoo	
Cuculidae	*Coccyzus erythropthalmus*	Black-billed Cuckoo	
Falconidae	*Falco sparverius*	American Kestrel	
Fringillidae	*Coccothraustes vespertinus*	Evening Grosbeak	
Fringillidae	*Haemorhous mexicanus*	House Finch	
Fringillidae	*Haemorhous purpureus*	Purple Finch	
Fringillidae	*Spinus tristis*	American Goldfinch	
Gaviidae	*Gavia immer*	Common Loon	ST
Gruidae	*Antigone canadensis*	Sandhill Crane	
Hirundinidae	*Hirundo rustica*	Barn Swallow	
Hirundinidae	*Progne subis*	Purple Martin	
Hirundinidae	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow	
Hirundinidae	*Tachycineta bicolor*	Tree Swallow	
Icteridae	*Agelaius phoeniceus*	Red-winged Blackbird	
Icteridae	*Dolichonyx oryzivorus*	Bobolink	
Icteridae	*Euphagus cyanocephalus*	Brewer's Blackbird	
Icteridae	*Icterus galbula*	Baltimore Oriole	
Icteridae	*Molothrus ater*	Brown-headed Cowbird	
Icteridae	*Quiscalus quiscula*	Common Grackle	
Icteridae	*Sturnella magna*	Eastern Meadowlark	
Icteriidae	*Icteria virens*	Yellow-breasted Chat	
Laridae	*Chroicocephalus Philadelphia*	Bonaparte's Gull	
Laridae	*Hydroprogne caspia*	Caspian tern	ST

Table J-7. Bird Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Laridae	*Larus argentatus*	Herring Gull	
Laridae	*Larus delawarensis*	Ring-billed Gull	
Mimidae	*Dumetella carolinensis*	Gray Catbird	
Mimidae	*Toxostoma rufum*	Brown Thrasher	
Pandionidae	*Pandion haliaetus*	Osprey	SC
Paridae	*Baeolophus bicolor*	Tufted Titmouse	
Paridae	*Poecile atricapillus*	Black-capped Chickadee	
Parulidae	*Cardellina canadensis*	Canada Warbler	
Parulidae	*Cardellina pusilla*	Wilson's Warbler	
Parulidae	*Geothlypis philadelphia*	Mourning Warbler	
Parulidae	*Geothlypis trichas*	Common Yellowthroat	
Parulidae	*Mniotilta varia*	Black-and-white Warbler	
Parulidae	*Oporornis agilis*	Connecticut Warbler	
Parulidae	*Oreothlypis peregrina*	Tennessee Warbler	
Parulidae	*Oreothlypis ruficapilla*	Nashville Warbler	
Parulidae	*Seiurus aurocapilla*	Ovenbird	
Parulidae	*Setophaga americana*	Northern Parula	
Parulidae	*Setophaga caerulescens*	Black-throated Blue Warbler	
Parulidae	*Setophaga coronata*	Yellow-rumped Warbler	
Parulidae	*Setophaga fusca*	Blackburnian Warbler	
Parulidae	*Setophaga kirtlandii*	Kirtland's Warbler	SE
Parulidae	*Setophaga pensylvanica*	Chestnut-sided Warbler	
Parulidae	*Setophaga petechia*	Yellow Warbler	
Parulidae	*Setophaga pinus*	Pine Warbler	
Parulidae	*Setophaga ruticilla*	American Redstart	
Parulidae	*Setophaga tigrina*	Cape May Warbler	
Parulidae	*Setophaga virens*	Black-throated Green Warbler	
Parulidae	*Vermivora chrysoptera*	Golden-winged Warbler	SC
Parulidae	*Vermivora cyanoptera*	Blue-winged Warbler	
Passerellidae	*Junco hyemalis*	Dark-eyed Junco	
Passerellidae	*Melospiza georgiana*	Swamp Sparrow	
Passerellidae	*Melospiza lincolnii*	Lincoln's Sparrow	
Passerellidae	*Melospiza melodia*	Song Sparrow	
Passerellidae	*Passerculus sandwichensis*	Savannah Sparrow	
Passerellidae	*Pipilo erythrophthalmus*	Eastern Towhee	
Passerellidae	*Pooecetes gramineus*	Vesper Sparrow	
Passerellidae	*Spizella pallida*	Clay-colored Sparrow	
Passerellidae	*Spizella passerina*	Chipping Sparrow	
Passerellidae	*Spizella pusilla*	Field Sparrow	
Passerellidae	*Zonotrichia albicollis*	White-throated Sparrow	
Passerellidae	*Zonotrichia leucophrys*	White-crowned Sparrow	
Passeridae	*Passer domesticus*	House Sparrow	NN
Phalacrocoracidae	*Phalacrocorax auritus*	Double-crested Cormorant	
Phasianiidae	*Bonasa umbellus*	Ruffed Grouse	
Phasianiidae	*Meleagris gallopavo*	Wild Turkey	
Picidae	*Colaptes auratus*	Northern Flicker	
Picidae	*Dryocopus pileatus*	Pileated woodpecker	
Picidae	*Melanerpes carolinus*	Red-bellied Woodpecker	

Table J-7. Bird Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Picidae	*Melanerpes erythrocephalus*	Red-headed Woodpecker	SC
Picidae	*Picoides pubescens*	Downy Woodpecker	
Picidae	*Picoides villosus*	Hairy Woodpecker	
Picidae	*Sphyrapicus varius*	Yellow-bellied Sapsucker	
Podicipedidae	*Podilymbus podiceps*	Pied-billed Grebe	
Polioptilidae	*Polioptila caerulea*	Blue-gray Gnatcatcher	
Scolopacidae	*Actitis macularius*	Spotted Sandpiper	
Scolopacidae	*Bartramia longicauda*	Upland Sandpiper	
Scolopacidae	*Gallinago delicata*	Wilson's Snipe	
Scolopacidae	*Scolopax minor*	American Woodcock	
Scolopacidae	*Tringa melanoleuca*	Greater yellowlegs	
Scolopacidae	*Tringa solitaria*	Solitary Sandpiper	
Sittidae	*Sitta canadensis*	Red-breasted Nuthatch	
Sittidae	*Sitta carolinensis*	White-breasted Nuthatch	
Strigidae	*Strix varia*	Barred Owl	
Sturnidae	*Sturnus vulgaris*	European Starling	NN
Trochilidae	*Archilochus colubris*	Ruby-throated Hummingbird	
Troglodytidae	*Cistothorus platensis*	Sedge Wren	
Troglodytidae	*Thryothorus ludovicianus*	Carolina Wren	
Troglodytidae	*Troglodytes aedon*	House Wren	
Troglodytidae	*Troglodytes hiemalis*	Winter Wren	
Turdidae	*Catharus fuscescens*	Veery	
Turdidae	*Catharus guttatus*	Hermit Thrush	
Turdidae	*Hylocichla mustelina*	Wood Thrush	
Turdidae	*Sialia sialis*	Eastern Bluebird	
Turdidae	*Turdus migratorius*	American Robin	
Tyrannidae	*Contopus virens*	Eastern Wood-Pewee	
Tyrannidae	*Empidonax alnorum*	Alder Flycatcher	
Tyrannidae	*Empidonax flaviventris*	Yellow-bellied Flycatcher	
Tyrannidae	*Empidonax minimus*	Least Flycatcher	
Tyrannidae	*Empidonax traillii*	Willow Flycatcher	
Tyrannidae	*Empidonax virescens*	Acadian Flycatcher	
Tyrannidae	*Myiarchus crinitus*	Great Crested Flycatcher	
Tyrannidae	*Sayornis phoebe*	Eastern Phoebe	
Tyrannidae	*Tyrannus tyrannus*	Eastern Kingbird	
Vireonidae	*Vireo flavifrons*	Yellow-throated Vireo	
Vireonidae	*Vireo gilvus*	Warbling Vireo	
Vireonidae	*Vireo olivaceus*	Red-eyed Vireo	
Vireonidae	*Vireo philadelphicus*	Philadelphia Vireo	

Sources: MNFI 1994; Schreiber and Anderson 1997; Higman et al. 2005; DLZ 2006, 2018; USDA 2017; Ravesi, pers. obs. 2018, Kleitch, pers. obs. 2019

Table J-8. Invertebrates Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Acrididae	*Appalachia arcana*	Secretive Locust	SC
Acrididae	*Arphia pseudonietana*	Red-winged Locust	
Acrididae	*Booneacris glacialis canadensis*	Wingless Mountain Grasshopper	
Acrididae	*Camnula pellucida*	Clear-winged Locust	

Table J-8. Invertebrates Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Acrididae	*Chloealtis abdominalis*	Rocky Mountain Sprinkled Locust	
Acrididae	*Chloealtis conspersa*	Sprinkled Locust	
Acrididae	*Chorthippus curtipennis*	Marsh Meadow Locust	
Acrididae	*Hesperotettix viridis*	Purple-striped Locust	
Acrididae	*Melanoplus bivittatus*	Two-striped Locust	
Acrididae	*Melanoplus borealis*	Northern Locust	
Acrididae	*Melanoplus bruneri*	Bruner's Locust	
Acrididae	*Melanoplus confusus*	Little Locust	
Acrididae	*Melanoplus dawsoni*	Dawson's Locust	
Acrididae	*Melanoplus fasciatus*	Huckleberry Locust	
Acrididae	*Melanoplus femurrubrum*	Red-legged Locust	
Acrididae	*Melanoplus huroni*	Huron Short-winged Locust	
Acrididae	*Melanoplus islandicus*	Forest Locust	
Acrididae	*Melanoplus keeleri*	Broad-necked Locust	
Acrididae	*Melanoplus punctulatus punctulatus*	Grizzly Grasshopper	
Acrididae	*Melanoplus viripides*	Green-legged Locust	
Acrididae	*Orphulella speciosa*	Pasture Locust	
Acrididae	*Phoetaliotes nebrascensis*	Large-headed Locust	
Acrididae	*Pseudopomala brachyptera*	Bunch Grass Locust	
Acrididae	*Spharagemon bolli*	Boll's Locust	
Acrididae	*Spharagemon collare*	Mottled Sand Locust	
Alydidae	*Protenor belfragei*	Broad Headed Bug	
Buprestidae	*Agrilus planipennis*	Emerald ash borer	IN, PR
Cercopidae	*Lepyrania quadrangularis*	Diamond-backed Spittlebug	
Cercopidae	*Prosapia ignipectus*	Red-legged spittlebug	
Cicadellidae	*Amplicephalus osiborn*	Leafhopper	
Cicadellidae	*Athysanus argentarius*	Leafhopper	
Cicadellidae	*Balanocerus provancheri*	Leafhopper	
Cicadellidae	*Balclutha punctata*	Leafhopper	
Cicadellidae	*Chlorotettix unicolor*	Leafhopper	
Cicadellidae	*Cicadula melanogaster*	Leafhopper	
Cicadellidae	*Cicadula saliens*	Leafhopper	
Cicadellidae	*Cicadula smithi*	Leafhopper	
Cicadellidae	*Cicadula subcupraea*	Leafhopper	
Cicadellidae	*Draeculacephala manitobiana*	Leafhopper	
Cicadellidae	*Draeculacephala noveboracensis*	Leafhopper	
Cicadellidae	*Elymana sp.*	Leafhopper	
Cicadellidae	*Erythroneura maritima*	Leafhopper	
Cicadellidae	*Forcipata frigida*	Leafhopper	
Cicadellidae	*Graphocephala coccinea*	Leafhopper	
Cicadellidae	*Gyponana salsa*	Leafhopper	
Cicadellidae	*Gyponana serpenta*	Leafhopper	
Cicadellidae	*Helochara communis*	Leafhopper	
Cicadellidae	*Idiocerus lunaris*	Leafhopper	

Table J-8. Invertebrates Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Cicadellidae	*Idiodonus aurantiacus*	Leafhopper	
Cicadellidae	*Kyboasca sp.*	Leafhopper	
Cicadellidae	*Laevicephalus acus*	Leafhopper	
Cicadellidae	*Laevicephalus unicoloratus*	Leafhopper	
Cicadellidae	*Latulus ocellaris*	Leafhopper	
Cicadellidae	*Latulus sayii*	Leafhopper	
Cicadellidae	*Limotettix plutonius*	Leafhopper	
Cicadellidae	*Limotettix vaccinii*	Leafhopper	
Cicadellidae	*Macropsis quadrimaculata*	Leafhopper	
Cicadellidae	*Macrosteles binotata*	Leafhopper	
Cicadellidae	*Macrosteles quadrilineata*	Leafhopper	
Cicadellidae	*Neokolla hieroglyphica*	Leafhopper	
Cicadellidae	*Notus sp.*	Leafhopper	
Cicadellidae	*Paluda gladiola*	Leafhopper	
Cicadellidae	*Scaphoides sp.*	Leafhopper	
Cicadellidae	*Scaphytopius acutus*	Leafhopper	
Cicadellidae	*Scaphytopius angustatus*	Leafhopper	
Cicadellidae	*Scaphytopius magdalensis*	Leafhopper	
Cicadellidae	*Stirellas bicolor*	Leafhopper	
Delphacidae	*Anakelisia n. sp.*	Planthopper	
Delphacidae	*Kelisia pectinata*	Planthopper	
Delphacidae	*Megamelus sp.*	Planthopper	
Delphacidae	*Pissonotus sp.*	Planthopper	
Delphacidae	*Stenocranus felti*	Planthopper	
Delphacidae	*Stenocranus sandersoni*	Planthopper	
Dreissenidae	*Dreissena polymorpha*	Zebra Mussel	IN, RE
Erebidae	*Lymantria dispar*	Gypsy moth	IN
Gryllidae	*Allonemobius allardi*	Allard's Ground Cricket	
Gryllidae	*Allonemobius griseus*	Gray Ground Cricket	
Gryllidae	*Neonemobius palustris*	Sphagnum Cricket	
Haliplidae	*Brychius hungerfordi*	Hungerford’s crawling water beetle	FE, SE
Hesperiidae	*Amblyscirtes vialis*	Roadside Skipper	
Hesperiidae	*Atrytonopsis hianna*	Dusted Skipper	SC
Hesperiidae	*Erynnis sp.*	Duskywing Skipper	
Hesperiidae	*Hesperia metea*	Cobweb Skipper	
Issidae	*Aphelonema histrionica*	Planthopper	
Issidae	*Bruchomorpha dorsata*	Planthopper	
Issidae	*Bruchomorpha jocosa*	Planthopper	
Issidae	*Bruchomorpha pallidipes*	Planthopper	
Issidae	*Bruchomorpha tristis*	Planthopper	
Lycaenidae	*Celastrina lucia*	Northern Spring Azure	
Lycaenidae	*Incisalia Niphon*	Eastern Pine Elfin	
Lycaenidae	*Lycaena phlaeas americana*	American Copper	
Lygaeidae	*Kleidocerys resedae*	Lygaeid Bug	
Lygaeidae	*Neortholomus scolopax*	Lygaeid Bug	
Miridae	*Stenodema trispinosa*	Leaf Bug	

Table J-8. Invertebrates Species Documented on Camp Grayling			
Family	**Scientific Name**	**Common Name**	**Notes**
Miridae	*Stenodema vicina*	Leaf Bug	
Miridae	*Trigonotylus coelistialium*	Leaf Bug	
Nabidae	*Nabis roseipennis*	Damsel bug	
Nabidae	*Nabis rufusculus*	Damsel bug	
Nymphalidae	*Boloria bellona*	Meadow Fritillary	
Nymphalidae	*Danaus plexippus*	Monarch	
Nymphalidae	*Oensis chryxus*	Chryxus Arctic	
Papilionidae	*Papilio candensis*	Canadian Tiger Swallowtail	
Pentatomidae	*Euschistus servus*	Stink Bug	
Pentatomidae	*Podisus serieventris*	Stink Bug	
Pieridae	*Colias interior*	Pink-edged Sulphur	
Pieridae	*Euchloe olympia*	Olympia Marblewing	
Rhaphidophoridae	*Ceuthopilus guttulosus*	Camel Cricket	
Scutelleridae	*Eurygaster alternatus*	Shield-backed Bug	
Tetrigidae	*Nomotettix cristatus*	Northern Crested Grouse Locust	
Tetrigidae	*Tetrix arenosa*	Obscure Grouse Locust	
Tetrigidae	*Tettigidea lateralis*	Sedge Grouse Locust	
Tettigoniidae	*Atlanticulus testaceus*	Short-legged Shield-bearer	
Tettigoniidae	*Conocephalus saltans*	Prairie Meadow Katydid	
Tettigoniidae	*Orchemilum gladiator*	Gladiator Meadow Katydid	
Tettigoniidae	*Scudderia curvicaudea*	Curve-tailed Bush Katydid	

Sources: MNFI 1994, 2005; Koziatek and Wilson 2016, 2017, DLZ 2019

APPENDIX K

LIST OF SURVEYS

Targeted Group / Species		Survey Reference*
Multi-Taxa	Rare Species (birds, insects, and plants)	Higman P, Cuthrell D, Montfils M. 2005. Re-assessment of Known Occurrences and Additional Surveys for Rare Species at Camp Grayling Maneuver Training Center (Report No. 2005-07). Michigan Natural Features Inventory, Lansing, MI. Available from https://mnfi.anr.msu.edu/reports/2005-07%20Camp%20Grayling.pdf.
	Comprehensive	MNFI. 1994. Final Report for a Floristic and Natural Features Inventory of Camp Grayling Military Reservation. Michigan Natural Features Inventory, Lansing, MI.
	Comprehensive	Schreiber ER, Anderson AB. 1997. Camp Grayling LCTA Wildlife Analyses. Army Environmental Center, San Antonio, TX.
	Comprehensive	DLZ Michigan, Inc. 2006. Natural Resources Inventory, Ranges 13 and 40. Page 13. In cooperation with the US Army Corps of Engineers, Detroit District. Camp Grayling Maneuver Training Center, Grayling, MI.
	Arthropods and Rodents [as disease vectors]	USACHPPM. 1997. Arthropod and Rodent-Borne Disease Profile No. 18-NF-5971-97, Camp Grayling National Guard Military Reservation, Grayling, MI, 7-11 July 1997. US Army Center for Health Promotion and Preventative Medicines, Fort George Meade, MD.
	Plants, macroinvertebrates, and water quality	Zimmerman G, Moerke A. 2005. Ecological Integrity of a Wetland at Camp Grayling. Pages 1–3. Department of Biology, Lake Superior State University, Camp Grayling National Guard Military Reservation, Grayling, MI.
	Rare species (birds, insects, mammals)	DLZ Michigan, Inc. 2018. Camp Grayling Joint Maneuver Training Center: Fauna Survey. DLZ Michigan, Inc. Lansing, MI. (DRAFT)
Herptiles	Comprehensive	Manning J, Sage J, Kingsbury B. 2006. Herpetofaunal Sampling at Camp Grayling. Center for Reptile and Amphibian Conservation and Management, Indiana-Purdue University, Fort Wayne, IN.
	Eastern Milksnake	Ravesi MJ, Tetzlaff SJ, Allender MC., Kingsbury BA. 2016. Detection of Snake Fungal Disease from a *Lampropeltis*

Targeted Group / Species		Survey Reference*
		triangulum (Eastern Milksnake) in Northern Michigan. Notes of the Northeastern Naturalist 23:N18–N21.
	Eastern Massasauga	Bieser N. 2008. Spatial Ecology and Survival of Resident Juvenile and Headstarted Eastern Massasauga (*Sistrurus catenatus catenatus*) in Northern Michigan. Purdue University, Fort Wayne, IN. (see DeGregorio et al. paper)
	Eastern Massasauga	DeGregorio BA. 2008. Response of the Eastern Massasauga Rattlesnake (*Sistrurus c. catenatus*) to Clear-Cutting. Purdue University, Fort Wayne, IN.
	Eastern Massasauga	Smith C. 2009. Hibernation of the Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*) in Northern Michigan. Purdue University, Fort Wayne, IN.
	Eastern Massasauga	DeGregorio BA, Manning, JV, Bieser, N, Kingsbury BA. 2011. The Spatial Ecology of the Eastern Massasauga (*Sistrurus c. catenatus*) in Northern Michigan. Herpetologica 67:71–79.
	Eastern Massasauga	Tetzlaff SJ, Ravesi MJ, Kingsbury BA. 2014. Natural History Notes: *Sistrurus catenatus* (Eastern Massasauga) Diet. Herpetological Review 45:712–713.
	Eastern Massasauga	Ravesi MJ, Forley M, Tetzlaff SJ, Kingsbury BA, Parker JM. 2015. Natural History Notes: *Sistrurus catenatus* (Massasauga). Diet. Herpetological Review 46:453–454.
	Eastern Massasauga	Ravesi MJ, Tetzlaff SJ, Kingsbury BA, Walker JM. 2015. Natural History Notes: *Sistrurus catenatus* (Massasauga). Overwintering Pipe. Herpetological Review 46:454.
	Eastern Massasauga	Tetzlaff S. 2015. To Forage, Mate or Thermoregulate? Influence of Food Supplementation on Behavior of the Rattlesnake *Sistrurus catenatus*. Purdue University, Fort Wayne, IN. (see Tetzlaff et al. paper)
	Eastern Massasauga	Tetzlaff SJ, Allender MC., Ravesi MJ, Smith J, Kingsbury BA. 2015. First report of snake fungal disease from Michigan, USA involving Massasaugas, *Sistrurus catenatus* (Rafinesque 1818). Herpetology Notes 8:31–33.
	Eastern Massasauga	Tetzlaff SJ, Ravesi MJ, Parker JM, Forzley M, Kingsbury BA. 2015. Feeding and breeding: a northern population of Massasauga Rattlesnakes, *Sistrurus catenatus* (Rafinesque 1818), continues to hunt during the mating season. Herpetology Notes 8:277–280.
	Eastern Massasauga	MDNR. 2016. Candidate Conservation Agreement with Assurances for the Eastern Massasauga Rattlesnake in Michigan.
	Eastern Massasauga	Ravesi MJ. 2016. Timber Harvest and Prescribed Fire as Tools for Massasauga Conservation. Purdue University, Fort Wayne, IN.

APPENDIX K: LIST OF SURVEYS

Targeted Group / Species		Survey Reference*
	Eastern Massasauga	Ravesi MJ, Tetzlaff SJ, Kingsbury BA. 2016. Natural History Notes: *Sistrurus catenatus* (Massasauga). Diet. Herpetological Review 47:153–154.
	Eastern Massasauga	Tetzlaff SJ, Ravesi MJ, Kingsbury BA. 2016. Natural History Notes: *Sistrurus catenatus* (Massasauga). Activity Range Lengths. Herpetological Review 47:154.
	Eastern Massasauga	Hileman ET, Allender MC., Bradke DR, Faust LJ, Moore JA, Ravesi MJ, Tetzlaff SJ. 2017. Estimation of *Ophidiomyces* prevalence to evaluate snake fungal disease risk. Journal of Wildlife Management 82:173–181.
	Eastern Massasauga	Tetzlaff SJ, Carter ET, DeGregorio BA, Ravesi MJ, Kingsbury BA. 2017. To forage, mate, or thermoregulate: Influence of resource manipulation on male rattlesnake behavior. Ecology and Evolution:1–8.
Birds	Comprehensive	Williams D. 2017. Grayling Army Airfield: Status Report on Seasonal ARNG BASH Surveys. USDA APHIS Wildlife Services, Gaylord, MI.
	Kirtland's Warbler	Perez R, Huntington G. 1986. Cooperative Agreement Between Michigan Department of Natural Resources and Department of Military Affairs: Implementation of a Management Plan for the Range 30 Complex (Tank Range). Michigan Department of Natural Resources and Michigan Department of Military Affairs.
	Kirtland's Warbler	USFWS. 1997. Biological Opinion for Amendment to Camp Grayling Kirtland's Warbler Habitat Management Plan for the Range 30 Complex. East Lansing, MI: US Fish & Wildlife Service. http://www.dodpif.org/kiwa/kw-plans/1997%20USFWS.%20Camp%20Grayling%20BiOp%20Range%2030%20Complex.pdf.
Invertebrates	Snails	Raffel TR, Messner M, Sckrabulis J. 2017. Progress Report: Michigan Swimmer's Itch Survey 2016. Oakland University, Michigan. (progress report, not final)
	Ticks	USACHPPM. 2007. Vector-Borne Disease Surveillance Report. Department of Defense, US Army Center for Health Promotion and Preventative Medicine, Camp Grayling National Guard Military Reservation, Grayling, MI.
Mammals	Bats	CEC. 2016. Findings Report for a Survey of Bat Species Composition. Civil & Environmental Consultants, Inc. CEC Project 160-768. Camp Grayling Joint Maneuver Training Center, Crawford, Kalkaska, and Otsego Counties, Michigan.
Fish	Comprehensive	MDNR. 2016. Portage Creek Fish Sampling Summary. Michigan Department of Natural Resources.

Targeted Group / Species		Survey Reference*
Vegetation	Comprehensive	DLZ Michigan, Inc. 2018. Camp Grayling Joint Maneuver Training Center: Flora Survey. DLZ Michigan, Inc. in cooperation with Michigan Natural Features Inventory, Lansing, MI.
	Comprehensive and Invasive Species	Tanis M, Stegink D. 2003. Land Condition-Trend Analysis Installation Report, 1992–2001 of Camp Grayling Maneuver Training Center. Envirologic Technologies, Inc., Kalamazoo, MI.
	Vegetation Communities	Kost M, Cohen J. 2005. A Reassessment of High Quality Natural Communities on Camp Grayling. Michigan Natural Features Inventory, Lansing, MI. Available from https://mnfi.anr.msu.edu/reports/2005-11%20Reassessment%20of%20Communities%20on%20Camp%20Grayling.pdf.
	Vegetation Communities	DLZ Michigan, Inc. 2018. Camp Grayling Joint Maneuver Training Center High Quality Natural Areas Reassessment. DLZ Michigan, Inc. DLZ Michigan, Inc. in cooperation with Michigan Natural Features Inventory, Lansing, MI.
	Rare Plants	Higman P, Cuthrell D, Montfils M. 2005. Re-assessment of Known Occurrences and Additional Surveys for Rare Species at Camp Grayling Maneuver Training Center (Report No. 2005-07). Michigan Natural Features Inventory, Lansing, MI. Available from https://mnfi.anr.msu.edu/reports/2005-07%20Camp%20Grayling.pdf.
	Pine Barrens (North Camp)	Cohen J, Enander H, Kost M. 2005. Mapping Plant Alliances of the Pine Barrens Management Opportunity Area (Report No. 2005-04). 2005–04. Michigan Natural Features Inventory, Lansing, MI. Available from https://mnfi.anr.msu.edu/reports/2005-04%20Plant%20Alliances%20of%20Pine%20Barrens.pdf.
	Pine Barrens	Kost M, Higman P, Cuthrell D, Cooper J. 2000. North Camp Grayling Pine Barrens Management Plan. 2000–02. Michigan Natural Features Inventory, Lansing, MI. Available from https://mnfi.anr.msu.edu/reports/2000-02.pdf.
	Invasive Species	Higman PJ, Schools EL, Enander H. 2005. Invasive Plant Species Survey and Management Recommendations for Camp Grayling Maneuver Training Center (MNFI Report No. 2005-12). Michigan Natural Features Inventory, Lansing, MI.
	Invasive Species	Koziatek R, Wilson C. 2016. 2016 Management Report: Camp Grayling Maneuver Area. Invasive Plant Species Survey and Removal, The Kalamazoo Nature Center's Great Lakes Ecological Management. Michigan Department of Military and Veterans Affairs, Camp

Targeted Group / Species		Survey Reference*
		Grayling, Crawford County and Fort Custer Training Center, Calhoun County.
	Invasive Species	Koziatek R, Wilson C. 2018. 2017 Management Report: Camp Grayling Maneuver Area. Great Lakes Ecological Management, Kalamazoo Nature Center, Kalamazoo, MI.
	Vegetation Change	Tweddale S, Emrick V, Jackson W. 2001. Integrating remote sensing and field data to monitor changes in vegetative cover on a multipurpose range complex and adjacent training lands at Camp Grayling, Michigan. ERDC/CERL TR-01-45. US Army Corps of Engineers, Construction Engineering Research Laboratory, Champaign, IL. Available from http://hdl.handle.net/11681/19709.
	Streambank Erosion	Williams J. 2016. An assessment of streambank erosion on Portage Creek. Gahagan Nature Preserve.
	Watershed	UMRA. 2017. Portage Creek Watershed Plan Report (includes Portage Creek Resource Inventory and Planning Project by Sendek, 2017; Portage Creek Project Report by Luttenton and Wegner, 2017; and An Assessment of Streambank Erosion on Portage Creek by Williams, 2016). Upper Manistee River Association, Grayling, MI.
	Wetland	Zimmerman G, Moerke A. 2005. Ecological Integrity of a Wetland at Camp Grayling. Pages 1–3. Department of Biology, Lake Superior State University, Camp Grayling National Guard Military Reservation, Grayling, MI.
* Reports can be obtained through Camp Grayling Environmental Office if a website was not provided.		

APPENDIX L
THREATENED AND ENDANGERED SPECIES

APPENDIX L: THREATENED AND ENDANGERED SPECIES

L.1 DOCUMENTED ANIMALS

This section summarizes those federal and state listed animal species that have been documented on Camp Grayling. While several surveys have been completed since the 1990s, some taxa have not been surveyed comprehensively and/or consistently. In particular, invertebrates and aquatic species have not been targeted for baseline surveys at this time. See Appendix K for a summary of surveys completed. Following the summary of documented animal species presented in Table L-1, a summary by species is presented discussing habitat preferences and history of documentation on Camp Grayling.

Table L-1. Threatened, Endangered, and Special Concern Animals Documented on CGMTC

Species	Status	Comments/Habitat
Mammals		
Northern long-eared bat*[2] *Myotis septentrionalis*	FT, SC, S1	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
Little brown bat[1,2,3] *Myotis lucifugus*	SC, S1	Hibernates in caves and mines in the winter (early September – mid-May). Roosts and forages in day and night roosts in spring, summer, and fall.
Eastern pipistrelle *Perimyotis subflavus*	SC, S1	Hibernates in caves, mines, and deep crevices in winter (end October – April). Forages over the open water and forest edges and roosts within 30 miles of hibernacula in summer.
Evening bat *Nycticeius humeralis*	ST, S2	In old and mature forests, this species prefers to roost behind loose bark during the nonbreeding season, frequently moving between large snags located near one another, and in spacious cavities during the maternity period (Kunz and Lumsden 2003, Pierson 1998, Texas Parks and Wildlife Department 1999). Where such conditions are not available, evening bats will roost in wooden structures, such as attics and barns. Foraging habitat includes open areas above water and forest clearings and edges.
Northern flying squirrel *Glaucomys sabrinus*	SC, S5	Prefer closed canopy boreal or mixed hardwood-coniferous forests and establish dens in previously excavated voids (e.g. from woodpeckers) or in exterior areas 3-30 feet from the ground.
Birds		
Kirtland's warbler*[1,2,3] *Setophaga kirtlandii*	SE, S3	Nests in young stands of jack pine, often following burns.
Red-shouldered hawk[1,2,3] *Buteo lineatus*	ST, S4	Nest in a variety of habitats but seem to be closely associated with mature forests in or adjacent to wet meadows and swamps.

Table L-1. Threatened, Endangered, and Special Concern Animals Documented on CGMTC		
Species	**Status**	**Comments/Habitat**
Common loon[1,2,3] *Gavia immer*	ST, S3	Nest in sheltered islands on large, undeveloped inland lakes, although they may nest in lakes as small as 11 acres (4.5 hectares). Preferred nest sites are on small islands or bog mats, at the water's edge. Nursery areas - quiet, shallow, sheltered coves - are important for rearing chicks.
Bald eagle[1,2,3] *Haliaeetus leucocephalus*	SC, S4, BGEPA	Wide variety of habitats that provide suitable nest sites close to open water. Nests may be placed in snags or large live trees as well as on constructed platforms or utility poles. They are resident (stay year-round) as long as there is open water where they can forage.
American bittern[2] *Botaurus lentiginosus*	SC, S3	Nest and forage in a wide variety of wet to wet-mesic habitats with herbaceous or herbaceous-shrub cover. They are area-dependent and are typically found only in the larger wetlands.
Trumpeter swan[2] *Cygnus buccinator*	ST, S3	Use a variety of wetland types such as marshes, ponds, and lakes with nests frequently placed on muskrat houses.
Black-crowned night-heron *Nycticorax nycticorax*	SC, S3	Nesting typically occurs near the coast of the Great Lakes but adults may forage inland during the nestling stage and both adults and immature birds may show up during migration.
Eastern whip-poor-will *Antrostomus vociferus*	SC, S3	Use open dry, predominantly deciduous woodlands (DeGraaf and Rudis 1983) with well spaced trees and a low canopy. Uncommon in mature forests.
Common nighthawk *Chordeiles minor*	SC, S3	Open country in general; often seen in the air over cities and towns. Inhabits any kind of open or semi-open terrain, including clearings in forest, open pine woods, prairie country, farmland, suburbs and city centers.
Caspian tern *Hydroprogne caspia*	ST, S2	Nests in colonies. Typically found in the vicinity of large expanses of open water.
Osprey[1,2] *Pandion haliaetus*	SC, S4	Nest in trees or snags as well as some man-made structures such as utility poles and towers, chimneys, windmills, buoys, and platforms. Preferred nest sites are above or near water
Golden-winged warbler *Vermivora chrysoptera*	SC, S5	Deciduous woodlands, usually in dry uplands or areas of thick undergrowth in swampy areas" (Confer et al. 1992). They are found in early successional vegetation: old fields, power line corridors, stream borders, alder and coniferous (spruce/tamarack) bogs (Dunn and Garrett 1997)

Table L-1. Threatened, Endangered, and Special Concern Animals Documented on CGMTC		
Species	**Status**	**Comments/Habitat**
Red-headed woodpecker *Melanerpes erythrocephalus*	SC, S3	Open woodlands, especially with oak, open areas with scattered trees.
Reptiles		
Eastern massasauga* [1,2] *Sistrurus catenatus*	FT, SC, S3	Generally, appear to be characterized by open, sunny areas intermixed with shaded areas, presumably for thermoregulation; presence of the water table near the surface for hibernation; and variable elevations between adjoining lowland and upland habitats.
Smooth green snake[1,2,3] *Opheodrys vernalis*	SC, S3	Prefers moist grassy areas including prairies and savannas, meadows, old fields, pastures, roadsides, and marsh and lake edges. Also occur in open deciduous or pine forests and along woodland borders.
Blanding's turtle[1,2,3] *Emydoidea blandingii*	SC, S2S3	Clean, shallow waters with abundant aquatic vegetation and soft muddy bottoms over firm substrates; found in ponds, marshes, swamps, bogs, wet prairies, river backwaters, embayments, sloughs, slow-moving rivers, and lake shallows and inlets; occupy terrestrial habitats in the spring and summer during the mating and nesting seasons and in the fall to a lesser extent.
Wood turtle[1,2,3] *Glyptemys insculpta*	SC, S2	Found in or near moving water and associated riparian habitats in clear, medium-sized (range 7-100 ft / 2.1-30.5 m), hard-bottomed streams and rivers with sand and/or gravel substrates and moderate flow; require partially shaded, wet-mesic herbaceous vegetation.
Amphibians		
Mudpuppy *Necturus maculosus*	SC, S2	Species of salamander that is entirely aquatic. Found in lakes, rivers, and ponds.
Insects		
Hungerford's crawling water beetle* [1, 2] *Brychius hungerfordi*	FE, SE, S1	Inhabits relatively cool (15-25 degrees C), fast flowing alkaline streams with sand and gravel substrates, often occurring in reaches with an open to partially open canopy just below beaver dams or similar human-made structures.
Secretive locust[1,2,3] *Appalachia arcana*	SC, S2	Primarily inhabit open leatherleaf-dominated sphagnum bogs surrounded by jack pine. It has also been found in open groves of aspen and pines, in

Table L-1. Threatened, Endangered, and Special Concern Animals Documented on CGMTC		
Species	**Status**	**Comments/Habitat**
		shrubby undergrowth of jack pine barrens, in early shrub-thicket stages of second growth northern hardwoods. Experts speculate that oviposition may occur in upland soil adjacent to bogs. This is the only grasshopper endemic to Michigan.
Dusted skipper[1,2,3] *Atrytonopsis hianna*	SC, S3	Dry open fields; eggs are laid on bluestem grasses (*Andropogon* sp.) and adults feed on these grasses. Oak-pine barrens, prairies, rights-of-way in sandy areas and roadsides and adults nectar on blackberry (*Rubus* sp.), cinquefoil (*Potentilla* sp.), lupine (*Lupinus* sp.), puccoon (*Lithospermum* sp.), vetch (*Vicia* sp.) and yarrow (*Achillea* sp.). Specific Habitat Needs: Host plant needed in Oak-pine barrens, Pine barrens, Mesic sand prairie, Mesic prairie, Dry-mesic prairie, Dry sand prairie

Sources: *USFWS Crawford County, Kalkaska County, and Otsego County lists; USFWS IPaC Report for Camp Grayling; Michigan County Elements Data for Crawford[1], Kalkaska[2], and Otsego[3] Counties; MNFI Rare Species Explorer for Crawford, Kalkaska, and Otsego Counties.

FE=federally endangered, FT=federally threatened, BGEPA = Bald and Golden Eagle Protection Act
SE=state endangered, ST=state threatened, SC = state species of special concern (see S RANK).

S RANK: The priority assigned by MNFI based upon the element's status within the state.
S1 = critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state.
S2 = imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.
S3 = rare or uncommon in state (on the order of 21 to 100 occurrences).
S4 = apparently secure in state, with many occurrences.
S5 = demonstrably secure in state and essentially ineradicable under present conditions.
Multiple ranks (e.g. S2S3) = rank intermediate between the two ranks.

S1, S2, S3 all indicate state Species of Conservation Concern

Note: Unlike other SC species, amphibians and reptiles are protected by MDNR Director's Order No. FO-224.13.

L.1.1 Mammals

Northern long-eared bat (*Myotis septentrionalis*): The northern long-eared bat is a medium-sized bat 3 to 3.7 inches in length with a wingspan of 9 to 10 inches. It is named for its long ears (longer than others in its genus). This species has declined dramatically in the northeastern US due white-nose syndrome, a fungal disease (USFWS 2016). The northern long-eared bat hibernates in caves and mines and roosts and forages in upland forests during spring and summer.

An acoustic bat survey completed on Camp Grayling in 2016 confirmed the presence of at least one northern long-eared bat (CEC 2016). Results from this survey indicate that NLEB, as well as other *Myotis* species, are present but rare on CGMTC.

Little brown bat (*Myotis lucifugus*): The little brown bat weighs between 0.2 and 0.5 ounces, with a body length between 2.3 and 4 inches and is dark to olive brown in color. Females are larger than males. They occupy day and night roosts in the spring, summer, and fall. Day roosts are dark and provide shelter, while night roosts are in confined spaces where several bats can cluster together. Day and night roosts can be in buildings, trees, under rocks, and in wood piles. This species occupies hibernation roosts in the winter (early September – mid-May). They feed primarily on aquatic insects in wooded areas, fields, and over water. (Havens 2017)

Suitable summer roosting habitat may be present in North Camp on Camp Grayling, given the predominant hardwood species in that area, rather than South Camp which is primarily conifer trees. Presence/absence surveys have not been completed for little brown bat on Camp Grayling. However, an acoustic study was completed in 2016 which documented little brown bat on Camp Grayling; this same study noted that *Myotis* species are uncommon and make up less than 1% of identified bat species (CEC 2016).

Eastern pipistrelle (*Perimyotis subflavus*): The eastern pipistrelle is a small bat (2.8 - 3.2 in/7 - 8 cm long) with golden to reddish brown fur, light brown hairs on the top of the feet, and naked black wing membranes which contrast with the reddish forearm. The individual hairs of its fur are actually tricolored, being dark at the base and tip, but yellow in the middle.

Evening bat (*Nycticeius humeralis*): The evening bat reaches an average length of 3.6 inches, with both forearm and tail measuring about 1.5 inches. Hair is sparse and dark brown, with individual hairs being black at the base, while the underside is of a much lighter shade. Wings, tail, muzzle and small ears are thick, leathery and black. This bat is distinguished from other similar species by its rounded, forward curving tragus (skin flap at front of ear) and number of upper incisors (two instead of four). As the evening bat forages for insects both high and low to the ground, its flight pattern is slow and steady.

Northern flying squirrel (G*laucomys sabrinus):* The northern flying squirrel is 10-14 inches in body length and brownish-gray in color, with white-tipped fur on its underside, large black eyes, rounded ears and a flattened tail (MNFI 2018a). A gliding membrane (patagium) bordered with dark gray to black fur connects wrists to ankles. Northern flying squirrels molt every autumn. During winter they appear lighter in color, and with fur on the soles of their feet.

The northern flying squirrel was documented in 1997 LCTA report (Schreiber & Anderson 1997).

L.1.2 Birds

Kirtland's warbler (*Dendroica kirtlandii*): The Kirtland's warbler is less than 6 inches long. Males and females have different summer plumage, with the male having bright yellow breast color streaked in black with bluish gray back feathers, a dark face mask with white eye rings, and a bobbing tail. The female's plumage coloration is less bright, and she has no face mask (USFWS 2017). This songbird has a small and specialized breeding habitat, nesting in 5- to 20-year-old jack pine stands, formerly nesting only in the northeastern part of Michigan's Lower Peninsula but now known to nest also in the Upper Peninsula and also in Wisconsin and Canada (USFWS 2017). Camp Grayling is located near the western edge of that range and has historically contained a significant percentage of breeding birds. This breeding habitat was created naturally through the regeneration of jack pine by fire. More recently, an increasing amount of this habitat

has been developed through specialized planting of jack pine, with larger tracts being most successful. Relatively little is known about the bird's wintering range in the Bahama Islands. The Kirtland's warbler was first listed as endangered on March 11, 1967 and there is no critical habitat designated for this species (USFWS 2017).

Kirtland's warblers have been documented on Camp Grayling since the 1950s. In 1986 a Cooperative Agreement between MDNR and MDMVA was signed that outlines Kirtland's warbler management in the Range 30 area. A related Biological Opinion was issued by USFWS in 1997 for amendments to the 1986 agreement. Various US Forest Service, MDNR, and USFWS surveys in the region included Camp Grayling at times, but those surveys are not currently available to summarize here. Camp Grayling Enivronmental staff have conducted annual Kirtland's warbler surveys since 1999. Currently Camp Grayling lands are included in the DNR's Kirtlands warbler survey. In addition, Camp Grayling staff conducts presence-absence surveys to confirm the location of occupied habitat. This information is incorporated annually into the 200-1 Limitations Memo to reduce potential conflicts and impacts in occupied nesting areas. Available documentation includes:

- 1938: Three nests near Howe's Lake on Camp Grayling were reported by Walkinshaw 1988 (USFWS 1997a).
- 1951: Sixty-five singing male Kirtland's warblers were found on Camp Grayling during the first census of singing male warblers (432 total were found) (USFWS 1997).
- 1988: Large Kirtland's warbler nesting colonies were located on Camp Grayling as recently as 1988 (USFWS 1997).
- 1988, 1996: Large colony was found in the Bald Hill Burn, which occupied portions of the Down River Road KWMA. This colony peaked with 53 singing males in 1988, but held only 2 birds in 1996.
- 1980, 1988: Another large colony (Artillery Range North) on Camp Grayling reached a maximum of 54 singing males in 1980 and was last occupied by 3 males in 1988.
- 1971-1996 summary

Singing Males	1971	1975	1980	1984	1985	1988	1992	1993	1994	1995	1996
Total	201	179	243			215	398	485	633	766	692
CGMTC Total	66	50	54	65	64	53	16	11	5	13	10
CGMTC %	33	28	22	30	30	25	4	2	< 1	2	2

- 1989-1995: The warbler population has been increasing since 1989. It reached historic record high numbers in 1994 and 1995 while the percentage of birds on Camp Grayling has diminished markedly (USFWS 1997a).
- Seven birds were documented in 1993 and one was documented in 1994 (Schreiber & Anderson 1997)
- 2006: The censused population of Kirtland's warbler was the largest ever recorded, at 1,478 singing males, with approximately 25 of those on Camp Grayling. This was up from a total of only 167 singing males in 1987.

Red-shouldered hawk (*Buteo lineatus*): The red-shouldered hawk's red shoulders are not visible, but adults have a reddish coloration of their underparts and wing linings and their five to

six narrow, white tail bands. In flight, they show crescent-shaped translucent patches lining the bases of the primaries (Cooper 1999). This hawk frequents mature forested floodplains and mature deciduous forests with nearby intact wetlands (Cooper 1999). Wetlands are used for foraging and large, mature trees are needed for nesting. Red-shouldered hawks that breed in Michigan migrate south for the winter.

Red-shouldered hawks have been documented on Camp Grayling in the following reports:

- Recorded during LCTA bird surveys in 1992 (1 bird documented), 1993 (3 birds documented) and 1994 (3 birds documented) (Schreiber & Anderson 1997)
- Four active nests were found in 2004 (Higman et al. 2005)

Common loon (*Gavia immer*): This bird is goose-sized and long bodied, with a stout, sharp beak. Breeding adults have black heads and necks with a "necklace" of black and white stripes, black and white checked back and wings and a white breast (MDNR 2017a). This diving, fish-eating bird breeds primarily in northern North America, roughly coinciding with the extent of the boreal coniferous northern hardwood forests. They winter in southern North America. Nesting begins in May and nests are usually located in isolated areas along heavily vegetated shore areas and/or islands (MDNR 2017a).

The common loon has been spotted on numerous lakes within Camp Grayling, including Lake Margrethe. They have been documented in the following reports:

- One occurrence found in 2004 (Higman et al. 2005)
- Documented in the 2017-2018 fauna surveys (DLZ Michigan, Inc. 2018a)

Bald eagle (*Haliaeetus leucocephalus*): This bird is protected by the Bald and Golden Eagle Protection Act (BGEPA) and is a Michigan state species of special concern. The bald eagle weighs up to 16 pounds, with adults having a white head and neck and brown body and wings (MDNR 2017b). Bald eagles are typically a summer resident in the northern half of Michigan and usually seen along lakes and streams or where waterfowl congregate. Typical bald eagle habitat includes land within one-quarter mile of a major river or prey-supporting lakes larger than 40 acres, with mature or super-canopy trees located at the edge of a forest stand with clear flight paths (USFWS 2007). There are approximately 4,200 acres of potential habitat on Camp Grayling, according to these criteria. Nesting begins in February and young fledge in summer. Nests for bald eagles are added to each year and can be as large as 20 feet wide (MDNR 2017b).

Historically there have been several active eagle nesting areas in and around Camp Grayling. The bald eagle has been monitored over the years by various agencies, but the data are not readily available.

Trumpeter Swan (*Cygnus buccinator*): Trumpeter swans are the largest swan in North America. They are best distinguished from Tundra swans by their lower pitched nasal honking and their bill, defined by a straight edge at the gape and pointed border between the eyes. They have been reintroduced at a number of places throughout the state.

American bittern (*Botaurus lentiginosus*): This bird is brown and 23 – 33 inches in length with a stout body and neck and relatively short legs. A long black patch extends from below the eyes down each side of the neck, which is a unique identifying characteristic. The American Bittern is a wetland-dependant bird that often inhabits wetlands or other wet areas with herbaceous and herbaceous-shrub cover (MNFI 2007a).

The American bittern has been documented on Camp Grayling in the following surveys:

- Documented in 1992, 1993, and 1994 (Schreiber & Anderson 1997)
- One occurrence found in South Camp in 2004 (Higman et al. 2005)

Black-crowned night heron (*Nycticorax nycticorax*): The Black-crowned night-heron is a medium-sized heron, with a stocky build, relatively short neck and legs, and sexually monomorphic plumage. Adults are easily identified by their black cap, upper back, and shoulders, gray wings, rump, and tail, and white to pale gray underparts. The bill is stout and black, eyes are red, and legs are yellow-green for most of the year, but pink during the height of the breeding season (Monfils, M.J. 2004).

Eastern whip-poor-will (*Antrostomus vociferus*): Eastern Whip-poor-wills are medium-sized birds with a large, rounded head and a stout chest that tapers to a long tail and wings. They are found in eastern forests with open understories. They can be found in both purely deciduous and mixed deciduous-pine forests, often in areas with sandy soil.

Common nighthawk (*Chordeiles minor*): Typically seen catching flying insects in the air. Found in open country in general; often seen in the air over cities and towns. Inhabits any kind of open or semi-open terrain, including clearings in forest, open pine woods, prairie country, farmland, suburbs and city centers.

Caspian tern (*Hydroprogne caspia*): The Caspian tern is the largest of the terns, with a wingspan averaging 31 inches (79 cm). Its size, stout red bill, and lack of a deeply forked tail distinguishes it from other white terns found in the state. Its black cap, large red bill, and tern-like habit of flying slowly with its bill pointed downward separates it from the gulls. The orange feet of immature birds distinguish them from fall-plumaged adults which have black feet (Hyde D.A. 1996).

Osprey (*Pandion haliaetus*): The Osprey is a large (22 -25 in / 56 - 64 cm) hawk with long, narrow wings, dark brown upper parts and white under parts. Its head is white with a dark eye streak. The dark "wrist" patches on the underside of its wings are visible in flight. Females may have dark streaking around their necks and immature bards have pale buff edging on the dark feathers of their upper surface (Gibson J.M. 2007)).

Golden-winged warbler (*Vermivora chrysoptera*): A warbler with a black-and-white face pattern with yellow crown and large yellow patch on wing. Female is a washed-out version of male. Frequently hybridizes with Blue-winged Warbler. Found in shrubby habitats near the edge of taller forest, often close to water.

L.1.3 Reptiles

Eastern massasauga (*Sistrurus catenatus*): This federally threatened snake is Michigan's only venomous snake. Adults can range in size from 1.5 to 3 feet in length and have a segmented rattle. Massasaugas body markings are black splotches edged in white; below the head these markings may resemble video game controllers or bowties (MDNR 2017c). It was listed as federally threatened on October 31, 2016 (USFWS 2016) and is a Michigan species of Special Concern. Michigan's only venomous snake has declined in numbers throughout its range. The primary causes of decline are habitat loss and persecution (MDNR 2016). This snake requires wetland fringes for overwintering. During the active season, individuals will utilize open and forested wetlands and adjacent open and forested upland habitat.

Soldiers and field workers report a few sightings on Camp Grayling every year. They are common throughout South Camp. Numerous radio telemetry, disease, and ecological studies focused on this species have occurred since 2002 at Camp Grayling, and a long-term mark-recapture study was initiaed in spring 2018. The eastern massasauga has been documented in the following reports:

- Massasaugas were documented in the 1992/1993 surveys along Portage Creek (MNFI 1994)
- Herpetofaunal Sampling Survey (Manning et al. 2006)
- Documented in the 2017-2018 fauna survey (DLZ Michigan, Inc. 2018a)
- Theses and publications (Bieser 2008; DeGregorio et al. 2011; Tetzlaff et al. 2014, 2015b, 2015a, 2016; Ravesi et al. 2015b, 2015a, 2016a, 2016b; Tetzlaff 2015; Ravesi 2016; Hileman et al. 2017)

Smooth green snake (*Opheodrys vernalis*): Only bright green snake in Michigan. Prefers moist grassy areas including prairies and savannas, meadows, old fields, pastures, roadsides, and marsh and lake edges. Also occur in open deciduous or pine forests and along woodland borders (Mifsud D. 2019).

Blanding's turtle (*Emydoidea blandingii*): The Blanding's turtle is a medium-sized turtle with an elongated, dome-like carapace and a long neck. This turtle is fairly common in parts of the Lower Peninsula, but it is rare and local in the Upper Peninsula. Blanding's turtles inhabit shallow bodies of water with some aquatic plant growth and a muddy bottom, such as marshes, ponds, and river backwaters. Mating occurs in water in the spring. A radio telemetry study of Blanding's turtles was initiated in spring 2018.

The Blanding's turtle has been documented on Camp Grayling in the following reports:

- Herpetofaunal Sampling Survey (2006)
- Documented in the 2017-2018 fauna survey (DLZ Michigan, Inc. 2018a)

Wood turtle (*Glyptemys insculpta*): The wood turtle ranges in length from 6 to 10 inches, and its top shell is brown or grayish brown with yellow and black radiating lines on the ridges; it has a ridge running along its length (MNFI 2007b). Wood turtles occur in and near rivers and streams of the north woods and depend largely on concealment for protection. Wood turtles feed on

insects, worms, slugs, snails, carrion, algae, berries, willow leaves and numerous other items and courtship and mating can occur from spring through fall. A radio telemetry study of wood turtles was initiated in spring 2018.

Wood turtles have been documented on Camp Grayling in the following reports:

- Herpetofaunal Sampling Survey (Manning et al. 2006)

L.1.4 Amphibians

Mudpuppy (*Necturus maculosus*): Large aquatic salamander with reddish gills behind its head that may resemble dog ears. Gills may be larger in warm, oxygen depleted water and smaller in cooler, oxygen-rich watersAre fully aquatic and live in permanent waters, such as rivers, reservoirs, inland lakes, and Great Lakes bays and shallows (Mifsud D. 2019)

L.1.5 Insects

Hungerford's crawling water beetle (*Brychius hungerfordi*): The Hungerford's crawling water beetle is a small, yellowish brown beetle (3.8 - 4.3 mm long) with irregular dark markings and narrow, longitudinal, finely perforated stripes on the elytra (wing coverings). In addition, the sides of the pronotum (dorsal plate behind the head) are nearly parallel for the basal two-thirds and are widened laterally (Hyde, D, and M. Smar. 2000).

Secretive locust (*Appalachia arcana*): This small, short-winged grasshopper is the only grasshopper endemic to Michigan and does not sing or fly (MNFI 2007c). It is found mainly in bogs, intermittent wetlands, and associated uplands, and can be found in shrubby underbrush of jack pine forests.

The secretive locust has been documented in the following reports.

- Five occurrences were documented in the MNFI Survey Report, some in habitats that were not previously thought to be utilized (MNFI 1994)
- Documented during surveys in the Pine Barrens in 1999 (Kost et al. 2000)
- One site was newly documented, and another was reconfirmed. Reconfirmed site was expanded in its extent (Higman et al. 2005 p. 200).
- Documented in the 2017-2018 fauna survey (DLZ Michigan, Inc. 2018a)

Dusted skipper (*Atrytonopsis hianna*): This is a large, dark butterfly with frosted margins on the underside of hindwing and usually at least one white dot at the wing base (MNFI 2007d). The dusted skipper inhabits dry open fields containing the larval host plant, little bluestem (*Andropogon scoparius*) or big bluestem (*Andropogon gerardii*) (MNFI 2007d). The site in Kalkaska County is the only known location in the county for this species.

The dusted skipper has been documented in the following reports:

- Documented 7 sites on Camp Grayling in June 2004 (Higman et al. 2005)
- Documented in the 2017-2018 fauna survey (DLZ Michigan, Inc. 2018a)

L.2 DOCUMENTED PLANTS

This section summarizes those federally and state listed plant species that have been documented on Camp Grayling. Following the summary of documented plant species presented in Table L-2, a summary by species is presented discussing habitat preferences and history of documentation on Camp Grayling.

Table L-2. Threatened, Endangered, and Special Concern Plants Documented on CGMTC

Species	Status	Comments/Habitat
Voss's goldenrod *Solidago vossii*	FT, SNR	Included in *S. houghtonii* in *Michigan Flora.* Moist (at least in the spring) swales in sandy jack pine stands; very local and endemic to Michigan. This is a unique octoploid, resembling a large *S. houghtonii*
Prairie moonwort[1] *Botrychium campestre*	ST, S2	More commonly occurs on perched sand dunes in northern Lake Michigan, but inland population occurs on Camp Grayling in Crawford County. Dry prairies and disturbed sites, such as roadsides, are suitable.
Allegheny or Sloe plum[1,3] *Prunus umbellate* var. *davisii*	SC, S3	Found in pine barrens, oak-pine savanna, and oak savanna remnants. It often occurs along road right-of-ways, driveway cuts, and edges of more closed canopy forest.
Hill's thistle[1,2,3] *Cirsium hillii*	SC, S3	Found primarily in pine barrens in northern Lower Michigan, but also occurring in other savanna and prairie types, openings within coniferous and oak forests, and on limestone pavement.
Rough fescue[1,3] *Festuca scabrella*	ST, S2S3	Found in jack pine openings with other grasses, often in logged or burned sites.
Vasey's rush[1,2] *Juncus vaseyi*	ST, S1S2	Intermittent wetlands of various types, including wet prairies, moist sandy barrens and open marshy flats or swales.
Fleshy stitchwort[1] *Stellaria crassifolia*	SE, S1	Found in cold springs and seepy areas along river edges.
Prairie dropseed[1,2] *Sporobolus heterolepis*	SC, S3	Known from a variety of habitats, including prairie fens in the southern Lower Peninsula, in mesic sand prairies surrounded by pine barrens in the northern Lower Peninsula, and in alvar grasslands in the Upper Peninsula, where this species comprises an important portion of the thin turfs formed over limestone and dolomite bedrock.

Table L-2. Threatened, Endangered, and Special Concern Plants Documented on CGMTC		
Species	**Status**	**Comments/Habitat**
Clinton's bulrush[1,2] *Trichophorum clintonii*	SC, S3	Found in seasonally moist to wet sandplains in the central and eastern Upper Peninsula, and wet to wet-mesic prairies in Lower Michigan.
New England violet[1,2] *Viola novae-angliae*	ST, S2	Occurs primarily in low open ground with exposed limestone along rivers in the Upper Peninsula. In northern Lower Michigan, it is found in wet-mesic sand prairies in small to large swales within pine barrens complexes.
Canada rice grass[2] *Piptatherum canadense*	ST, S2	Especially in sandy, moist areas that have recently been cleared of their jack pine cover, often on the margins of small depressions or within large peatland complexes.
Whorled pogonia[2] *Isotria verticillata*	ST, S2	Successional bogs in southern Lower Michigan, such as in alkaline kettleholes where bog succession is occurring with the advent of sphagnum and other acid-loving species. It also occurs in successional oak and red maple forest in lower slope position and in seasonally inundated, acid hardwood swamps with diverse microtopography (hummocks and hollows), within a matrix of upland oak forest.
Northern appressed clubmoss[1] *Lycopodiella subappressa*	SC, S2	Found in seasonally flooded wetlands in shallow depressions and potholes in glacial lakeplain landscapes.
Canada cinquefoil[1] *Potentilla canadensis*	SC, SNR	Found in dry to moist open savannas. Prefers sandy soils.
Sources: *USFWS Crawford County, Kalkaska County, and Otsego County lists; USFWS IPaC Report for Camp Grayling; Michigan County Elements Data for Crawford[1], Kalkaska[2], and Otsego[3] Counties; MNFI Rare Species Explorer for Crawford, Kalkaska, and Otsego Counties. FE=federally endangered, FT=federally threatened, BGEPA = Bald and Golden Eagle Protection Act SE=state endangered, ST=state threatened, SC = state species of special concern (see S RANK). SNR = State Not Ranked (usually not enough data is available to determine the S-RANK) S RANK: See Table K-1 for explanation. S1, S2, S3 all indicate state Species of Conservation Concern		

Voss's goldenrod (*Solidago vossii*): Previously thought to be Houghton's goldenrod (*Solidago houghtonii*), genetics work in 2010 revealed the occurrence on CGMTC to be the only known population of a new species, Voss's goldenrod. It is a perennial with an upright stem bearing many small, bright yellow flower heads arranged in a flat-topped cluster that bloom in late August and early September. The narrow leaves are up to 4.5 inches long (USFWS 2015).

On Camp Grayling, it has been found in a mesic sand prairie natural community type (Higman et al. 2005). This is also referred to as Howes Lake-Portage Creek complex where other rare

species are found. This rare community type is characterized by marked water table fluctuations, seasonally inundated conditions and sandy, strongly acid soils. It has also been found in a northern wet-mesic prairie wetland complex identified in 1992-1993.

- 1992-1993: Three total occurrences (2 small populations and 1 metapopulation) in the Prairie Wetland Complex (MNFI 1994)
- 1993: co-occurrence of Voss's goldenrod and prairie dropseed in scattered population (dirt mounds) in a band running from the north shore of Howes Lake to northeast of the confluence of Portage Creek and the Manistee River in South Camp
- 1995: small occurrence on the north side of M-93, but in subsequent surveys was found to have been destroyed by an ORV trail
- 2004: small occurrence near the old north side of M-93 population
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Prairie moonwort (*Botrychium campestre*): Prairie moonwort is a small and inconspicuous fern, which is why it was not discovered until the 1980s. It has a single, fleshy leaf that emerges from the ground and is only about 1.6 inches long and 0.5 inches wide that emerges in the early spring (Minnesota DNR 2016). More commonly occurs on perched sand dunes in northern Lake Michigan, but an inland population occurs on Camp Grayling in Crawford County. In inland areas, dry prairies and disturbed sites, such as roadsides, are suitable habitat (Higman & Penskar 1999).

Prairie moonwort has been documented on Camp Grayling in the following surveys:

- Two small populations found in the survey in an old apple orchard on Grayling (MNFI 1994)
- Not seen again in the 2004 survey (Kost & Cohen 2005)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Allegheny or Sloe plum (*Prunus umbellata*): Allegheny plum is a thorny shrub in the rose family that occurs in thickets or as a single plant, often having many dead and darker branches remaining in place. It has narrow, elliptic leaves 3 – 6 cm long and flowers are white with darkening pink stamens, blooming in June (Higman & Penskar 1996b). Its habitat is pine barrens, oak-pine savanna, and oak savanna remnants. It often occurs along road right-of-ways, driveway cuts, and edges of more closed canopy forest.

A significant population of Allegheny plum was documented in a portion of the Range 30 Complex along the southern edge of the pine barrens complex of North Camp, and the other an isolated occurrence aJong County Road 612 (MNFI 1994). Allegheny plum has been found in the following surveys:

- Two populations (one small population and one metapopulation) were documented in the 1992/1993 survey (MNFI 1994)
- An observation was made in the 2004 survey (Higman et al. 2005)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Hill's thistle (*Cirsium hillii*): Hill's thistle is 10-23 inches tall with leafy stems and a single, pink flower head that blooms June through August (P. J. Higman and Penskar 1996a). It occupies dry-mesic prairies, savannas, open woods, and alvar communities and is found on moraines and outwash plains in both openings and shade of aspen and/or jack pine dominated forests. This species shows the greatest habitat variation of all the rare plant species encountered on Camp Grayling and is found at numerous locations in the Range 30 complex and elsewhere on camp, including smaller occurrences in Luzerne, Grayling, Lake Margrethe, KP Lake, Big Bradford Lake, Cote Dame Marie, and Pere Cheney quadrangles (MNFI 1994).

Hill's thistle has been documented on Camp Grayling in the following surveys:

- Seven occurrences were found in the 1992/1993 surveys (MNFI 1994)
- Occurrences were reconfirmed in the 1995 surveys (Higman & Penskar 1996c)
- Found in the 1999 Pine Barrens survey (Kost et al. 2000)
- Four new occurrences were found in the 2004 survey and 9 were reconfirmed (6 with expanded size) (Kost & Cohen 2005)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Rough fescue (*Festuca scabrella*): This grass grows in thick tussocks and is distinguishable from similar species by its leaves that break off at the sheath. It blooms from June to August and the inflorescent stems are 8-10 milimeters long (Higman & Penskar 1996a). Rough fescue inhabits sandy jack pine forest openings and benefits from fire and logging (Higman & Penskar 1996a). Prior to the 1992/1993 survey, this species was not documented on Camp Grayling.

Rough fescue has been documented on Camp Grayling in the following surveys:

- Three populations were disovered in 1992/1993 (two metapopulations in Pine Barrens complex and one isolated colony (MNFI 1994)
- Found in the 1999 Pine Barrens survey (Kost et al. 2000)
- Five new occurrences were documented in 2004 and the two metapopulations identified in 1992/1993 were thriving (Higman et al. 2005)
- Identified in the 2005-2007 Reassessment of Rare Species report (Kost & Cohen 2005)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Vasey's rush (*Juncus vaseyi*): Vasey's rush is a flowering plant that requires moist soils and blooms early July through late August. This species on Camp Grayling is associated with the mesic sand prairie community type, which is found as pockets within open jack pine areas. It is known to occur alongside many other rare plant species in the Howes Lake-Portage Creek mesic sand prairie complex, where semi-contiguous colonies form a metapopulation (MNFI 1994).

Vasey's rush has been identified in the following surveys:

- One metapopulation was documented in the 1992/1993 survey (MNFI 1994)
- Reconfirmed in 2004 (Higman et al. 2005)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Fleshy stitchwort (*Stellaria crassifolia*): This aquatic plant is a small mat-forming forb with stems often low and prostrate with opposite, linear leaves (MNFI 2018b). Flowers are white. Fleshy stitchwort was found on Camp Grayling along a seepy area on the northern shoreline of the Au Sable River (MNFI 1994). The presence of fleshy stitchwort in 1992/1993 surveys is significant because it is the only known population between southwestern Lower Michigan and Luce county in the Upper Peninsula, and one of the only three known extant populations in Michigan (MNFI 1994).

Fleshy stitchwort has been found in the following surveys:

- One population was documented in 1992/1993 surveys (MNFI 1994)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Prairie dropseed (*Sporobolus heterolepis*): This densely tufted grass is associated with the mesic sand prairie habitat at Camp Grayling and is associated with the pine barrens. This plant is found in the vicinity of Portage Creek, where the mesic sand prairie occurs on base. Howes Lake-Portage Creek complex is a mesic sand prairie where many rare species have been documented on CGMTC. One occurrence is in Kalkaska County, which in 1992/1993 was a small population inhabiting some dirt mounds in association with a disturbed area (MNFI 1994). The Crawford County occurrence, constituting the major population in the Camp, is contiguous with Ranges 18 and 19 and extends in the boundary adjacent to Range 19 and in scattered areas within Range 19 itself (indicating the population was larger prior to establishment of the range) (MNFI 1994).

Prairie dropseed has been found in the following surveys:

- Discovery of one population of prairie dropseed (one small population and one metapopulation) was one of the most significant discoveries of the 1992/1993 survey (MNFI 1994)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Clinton's bulrush (*Trichophorum clintonii*): This plant is found in wet prairies in clusters (30 cm) and has slender stems topped by an orange spikelet (MNFI 2007e). An extensive metapopulation of this species has been located in mesic sand prairie habitat on Camp Grayling. This is the unique habitat throughout the Howes Lake-Portage Creek mesic sand prairie complex (MNFI 1994), where several other rare species have been found.

Clinton's bulrush has been documented in the following surveys:

- An occurrence was documented in the 1992/1993 survey (MNFI 1994)
- An occurrence was reconfirmed in the 2004 survey (Higman et al. 2005)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

New England violet (*Viola novae-angliae*): The New England violet is a small and low-growing, stemless plant with narrow, heart-shaped leaves and blue flowers (MNFI 2007f). The New

England violet is only found where forest openings have been maintained; in Michigan's Lower Peninsula, it occurs in openings in pine barrens complexes on swales (MNFI 2007f). On Camp Grayling, this species consists of a large metapopulation restricted to the Howes Lake-Portage Creek mesic sand prairie complex (MNFI 1994) where other rare species tend to occur.

The New England violet has been documented in the following surveys:

- One population was documented in 1992/1993 (MNFI 1994)
- Reconfirmed in the 2004 survey (Higman et al. 2005)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Canada rice grass (*Piptatheropsis canadensis*): This is an early-successional grass affiliated with disturbances such as timber harvests and fire. It is restricted to disturbed, wet sand and is the only known extant occurrence for this species in the Lower Peninsula. It has slender basal leaves with a flowering stalk and can be observed from June through September (Penskar & Crispin 2009). On Camp Grayling, it is found in second-growth jack pine on seasonally wet sand. In 1992/1993, it was found less than ½ mile north of Howe's Road in a moist, sandy opening along an old logging two-track through second-growth jack pine (MNFI 1994).

Canada rice grass has been documented on Camp Grayling in the following surveys:

- An occurrence was documented in the 1993 survey (MNFI 1994)
- Not rediscovered in 2004 survey (Kost & Cohen 2005)

Whorled pogonia (*Isotria verticillata*): This small orchid is 20-40 cm tall with 5-6 whorled leaves and a stalked purple flower. It inhabits dry-mesic forests, swamp borders, and bogs in southern Lower Michigan, such as in alkaline kettleholes where bog succession is occurring in acidic soils. It also occurs in successional oak and red maple forest in lower slope position and in seasonally inundated, acid hardwood swamps with diverse microtopography (hummocks and hollows), within a matrix of upland oak forest. (MNFI 2007g)

Whorled pogonia is considered a significant discovery in the plant surveys that have taken place on Camp Grayling, as it is one of the northern-most colonies in North America west of New York and one of the few upland sites known for this species. On base, it occurs in dry-mesic northern forests of South Camp (MNFI 1994). Whorled pogonia has been documented on Camp Grayling in the following surveys:

- One population documented in 1992/1993 survey (MNFI 1994)
- Not rediscovered in 2004 survey (Kost & Cohen 2005)
- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

Northern appressed clubmoss (*Lycopodiella subappressa*): This clubmoss has a relatively tall and upright stem (15 cm) that dies back in the fall but is visible in the summer through early fall. The northern appressed clubmoss typically forms large colonies and co-occurs and frequently occurs and hybridizes with *Lycopodiella inundata*. It occurs primarily along the coast of Lake

Michigan, although it is known to occur in inland areas where soil is moist, acidic, and sandy, in early-successional and herbaceous plant communities (Penskar & Higman 1996).

In 1992/1993, the species was documented in a conifer swamp in a two-track opening (MNFI 1994). Northern appressed clubmoss has been documented on Camp Grayling in the following surveys:

- One population was documented in 1992/1993 surveys (MNFI 1994)
- Not rediscovered in 2004 survey (Kost & Cohen 2005)

Canada cinquefoil (*Potentilla canadensis*): Canada cinquefoil is a low, spreading plant with silvery-downy stems and yellow flowers and palmate leaves (TWC 2010). In Michigan, it occurs in open savannas in sandy soils that tend to be dry and is sometimes confused for *Potentilla simplex* (Rezniek et al. 2011). Unlike *P. simplex*, dwarf cinquefoil is a more delicate plant, with stems less than 1 mm thick and prostrate; it also flowers earlier than *P. simplex*, with the leaves less than half grown at flowering time, sometimes before the stem elongates (Rezniek et al. 2011). Crawford County is the northernmost occurrence of dwarf cinquefoil in lower Michigan.

This species was documented on Camp Grayling in the following survey:

- Documented in the 2017-2018 flora survey (DLZ Michigan, Inc. 2018b)

L.3 POTENTIAL THREATENED AND ENDANGERED SPECIES

Table L-3 summarizes those federally and state listed species with potential to occur on Camp Grayling, but which have not yet been documented. These species may be documented in future surveys as potential habitat occurs on site.

Table L-3. Threatened and Endangered Species with Potential to Occur on Camp Grayling.

Species	Status	Comments/Habitat
Birds		
Northern goshawk[1,2,3] *Accipiter gentilis*	SC, S3	Very likely but not yet documented. Wide range of forested habitats ranging from boreal forests to northern hardwoods and occasionally pine plantations. In Michigan, goshawk nests occur most often in deciduous trees such as aspen, birch, beech, and maple and less frequent in conifers such as white pine, red pine, and jack pine.
Grasshopper sparrow[3] *Ammodramus savannarum*	SC, S4	Found in a wide variety of grasslands, cultivated fields, hayfields, and old fields and seem to prefer drier sites as long as there is tall dense grassy vegetation.
Spruce grouse[1] *Falcipennis canadensis*	SC, S2	Occur throughout the Upper Peninsula and parts of the Northern Lower Peninsula in areas dominated by coniferous forests such as jack pine, black and white spruce, and tamaracks. Ideal habitat occurs where black

		spruce and jack pine mix with scattered small openings with scattered decaying logs and stumps.
Fish		
Lake herring or Cisco[1,2] *Coregonus artedi*	ST, S3	Deep inland lakes as well as the Great Lakes at depths ranging from 18 to 53 meters. They can be found in shallower depths (9-12 m) when spawning over rocky substrates.
Mollusks		
Slippershell[1] *Alasmidonta viridis*	ST, S2S3	Creeks and headwaters of rivers in sand or gravel substrates. Occasionally in larger rivers and lakes and in mud substrates.
Spike-lip crater[3] *Appalachina sayanus*	SC, S1	Snail found in moist leaf litter and near logs on wooded hillsides in mesic to wet-mesic deciduous forests, slopes, and areas with calcareous soils, often adjacent to cedar swamps, forested floodplains, or lowland hardwoods.
Great Lakes physa[1] *Physella magnalacustris*	SC, SNR	Snail that occurs in shallow water along the rocky shorelines of large lakes.
Broadshoulder physa[1] *Physella parkeri*	ST, SNR	The broadshoulder physa snail occurs in medium to large lakes of clean and cold water and substrates of sand or marl, where it is often found clinging to stones.
Eastern flat-whorl[2] *Planogyra asteriscus*	SC, S2S3	Snail that inhabits calcareous wetlands with northern white-cedar, tamarack, speckled alder and sedges. The species is apparently not found in sphagnum-dominated wetlands and also is found on slopes and cliffs with white-cedar.
River fingernail clam[1] *Sphaerium fabale*	SC, SNR	This species prefers coarse sand or gravel in both creeks and rivers and in the Great Lakes.
Deepwater pondsnail[1] *Stagnicola contracta*	SE, SH	Found in medium sized to large lakes in northern Michigan at depths of approximately 33 feet (10 meters).
Insects		
Yellow banded bumblebee[1,2,3] *Bombus terricola*	SC, SNR	This species has been found most often in or around wooded areas.
Boreal brachionyncha[1,3] *Brachionycha borealis*	SC, S1S2	Associated with oak-pine barrens, savannas, dry hardwood forests, mesic conifer forests, dry conifer forests, and forest openings. The larval hosts for this species are oaks and lowbush blueberries (*Vaccinium* sp.). Little is known about this species' status, distribution, life history and ecology.
Henry's elfin[1] *Incisalia henrici*	ST, S2S3	Open oak-pine barrens, forest openings and edges, and swamp borders. Shady deciduous forests. Adults have been observed feeding on nectar of bearberry and chokecherry. Caterpillars are found on maple-leaved viburnum. They are also reported to feed on holly (*Ilex opaca*), huckleberry and redbud (*Cercis canadensis*).

		Adults have been observed near wild raisin and Michigan holly.
Doll's merolonche[3] *Merolonche dolli*	SC, S2S3	Moth found in areas with acidic soil and typically found in pine barrens, bogs, pine/scrub oak habitat.
Grizzled skipper[1,3] *Pyrgus wyandot*	SC, S1S2	Large open areas in oak-pine barrens, disturbed areas and along trails. Adults have been observed nectaring on bearberry, blueberry, dandelion, wild strawberry, and birdfoot violet. Eggs are laid on wild strawberry.
Plants		
Prairie or pale agoseris[1,3] *Agoseris glauca*	ST, S2	Pine barrens, jack pine savanna, jack pine-red oak savanna, and open shrub-grassland in central northern Lower Michigan.
Goblin moonwort [1,3] *Botrychium mormo*	ST, S2	Occurs in mature as well as second growth mesic northern hardwood forests and, much less commonly, in coniferous forests in soil with a rich humus layer. Reportedly sometimes so small that it may not even rise much above the leaf litter.
Calypso or fairy-slipper[1] *Calypso bulbosa*	ST, S2	Spruce-balsam-cedar swamps, moist coniferous forests with cool soils, and Great Lakes shoreline forests dominated by spruce, cedar, fir, and paper birch. It is especially found on calcareous substrates.
Ram's head lady's-slipper[3] *Cypripedium arietinum*	SC, S3	Found primarily on cedar-fir-spruce beach ridges and in forests along the Great Lakes shoreline in northern Michigan. Also occurs in upland jack, red, and white pine forests, in conifer-dominated swamps, and at the margins of bedrock glades.
False violet[1] *Dalibarda repens*	ST, S1S2	Moist, acid duff within mature pine stands, usually in somewhat hummocky terrain with moist depressions.
Ginseng[1,2] *Panax quinquefolius*	ST, S2S3	Found in rich shaded forests with loamy soils and heavy canopies. This species is highly threatened from collection of the root, commonly used in herbal remedies. Large colonies have completely vanished due to illegal poaching.
Hill's pondweed[2,3] *Potamogeton hillii*	ST, S2	Cold, alkaline streams on sandy, mucky, and marly substrates, usually in water up to one meter in depth.
Yellow pitcher plant[3] *Sarracenia purpurea f. heterophylla*	ST, S1	Acid bogs in northern Lower Michigan. It may also be found in interdunal areas along northern Lake Huron.

Sources: *USFWS Crawford County, Kalkaska County, and Otsego County lists; USFWS IPaC Report for Camp Grayling; Michigan County Elements Data for Crawford[1], Kalkaska[2], and Otsego[3] Counties; MNFI Rare Species Explorer for Crawford, Kalkaska, and Otsego Counties.
SE=state endangered, ST=state threatened, SC = state species of special concern (see S RANK).
SNR = State Not Ranked (usually not enough data is available to determine the S-RANK)
SH = Occurred historically, and could be found with additional surveys

S RANK: See Table K-1 for explanation. S1, S2, S3 all indicate state Species of Conservation Concern

APPENDIX M
BEST MANAGEMENT PRACTICES

APPENDIX M: BEST MANAGEMENT PRACTICES

M.1 BEST MANAGEMENT PRACTICES FOR SOIL CONSERVATION

General soil conservation management recommendations are compiled in the BMP Manuals from MDNR, Michigan Department of Transportation (MDOT), EGLE and MDMVA for soil and water quality document. The following sources can be used to identify BMPs that are proven in Michigan.

- *MDMVA Soil Erosion and Sedimentation Control Guidebook* (Revised 2018) recommends SOPs and protocols that must be followed by CGMTC Environmental staff who are state-certified MDMVA SESC inspectors and permit writers, pursuant to the MDMVA's APA status. The guidebook describes BMPs and industry practices for construction and earth-moving at MDMVA installations.
- *Michigan Forestry Best Management Practices for Soil and Water Quality* (2018) recommends BMPs, and associated laws and regulations that can apply to soil conservation. Types of BMPs described include but are not limited to pre-harvest planning, harvesting in riparian zones, harvest techniques, reforestation, and wildfire damage control.

  https://www.michigan.gov/documents/dnr/IC4011_SustainableSoilAndWaterQualityPracticesOnForestLand_268417_7.pdf
- *EGLE Nonpoint Source Best Management Practices Manual* recommends BMPs that prevent sediment from entering surface water (the process of sedimentation). Types of BMPs described include but are not limited to dust control, soil management to encourage vegetation growth, grading management, land clearing management, streambank stabilization, and sediment basins. https://www.michigan.gov/egle/0,9429,7-135-3313_71618_3682_3714-118554--,00.html
- *Soil Erosion and Sedimentation Control Manual* (2006) recommends BMPs that prevent soil erosion and sedimentation. Types of BMPs described include but are not limited to vegetated buffer strips, intercepting ditches, energy dissipaters, stream relocation, and check dams. https://www.michigan.gov/documents/2006_SESC_Manual_165226_7.pdf

General Approach

- Continue the environmental briefings to ensure transient troops are aware of what is expected of them.
- Continue the Site Clearance Program to ensure transient units aspire to leave no trace.
- Continue to follow and implement all permitting requirements for earth moving, in accordance with Act 451, Part 91, and utilize physical and procedural controls to manage soil and eliminate sedimentation:
    - Physical controls regarding standard soil conservation, soil erosion control, and sedimentation prevention practices at CGMTC include critical area seeding using native species whenever possible, storm water retention, culvert systems, and catch basins.

    - Procedural controls regarding soil management are spill prevention/response and strict adherence to the state's SESC procedures.
        - Spill prevention and response protocols protect surfaces and subsoils from contamination, which in turn protects against contaminants leaching from surface soil and subsoils into the underlying groundwater.
        - SESC plan reviews by state-certified Environmental Department staff and the issuance of SESC permits protect against soil erosion throughout the 147,000 acres. SESC BMPs also prevent soil from leaving a construction or maneuver site and entering a water body through the process of sedimentation.
- Integrate the general approach of soil management with water resources management and implement all appropriate BMPs:
    - Ensure wildlife-friendly erosion control methods are used, such as woven natural fiber, biodegradable polyesters, etc.
    - Utilize non-invasive, and preferably native seed to stabilize exposed soils.
    - Employ green infrastructure to address potential impacts associated with storm water management
- Identify any sensitive resources (i.e., steep slopes, unstable soil, water resources) and incorporate buffers wherever possible.
- Monitor soil erosion and effectiveness of BMPs.

Maneuver Trail and Road Maintenance

- Repair, re-route or close maneuver trails and roads with soil erosion issues, failed bridges or culverts, or other safety issues.
- Exercise caution when maintaining trails within 400 feet of water resources, especially if using calcium chloride for fugitive dust control.
- Conduct routine inspections and monitor routine maneuver trail maintenance.

Stabilization and Revegetation

- Ensure that adequate soil cover is in place in the short term through revegetation and soil stabilization following any soil disturbance.
- Prevent or minimize erosion to the maximum extent possible, use native plants for erosion control where possible.
- Address erosion areas with routine, low cost maintenance efforts, such as temporary closure, application of hay or other stabilization materials, and revegetation.
- Pre-harvest planning and land clearing should include a thorough site assessment and tree tagging for those trees to be removed.
- Phase large-scale sites to minimize disturbance and revegetate areas as the project progresses.

- Riparian zones should be protected with multi-zoned filter strips when possible. Filter strips should be planted and/or maintained with native species.
- New plantings should take into consideration soil conditions and should occur in the spring or fall with native species. Ground cover and new planting protections should be maintained.
- For all new projects, design infrastructure and projects to avoid problems by choosing appropriate materials, grading and protecting the site properly, etc.
- Stage and schedule projects with consideration to weather and site conditions, use diversions to prevent water entering site from causing erosion, and prevent off-site sedimentation with silt fencing, grade stabilization structures, or sediment basins around the perimeter of construction sites.
- Water crossings and bridge deployment are allowed only at approved designated streams and banks listed in the CGMTC 200-1.
- No vehicles are allowed on wetlands unless on an existing road or bridge.
- No new roads can be constructed across wetlands without MDNR approval and EGLE permitting.
- SESC plan reviews by SESC-certified Environmental Department staff and the issuance of SESC permits protect against soil erosion throughout the 147,000 acres. SESC BMPs also prevent soil from leaving a construction or maneuver site and entering a water body through the process of sedimentation.
- In accordance with Act 451 Part 91, an SESC permit must be issued by the CGMTC Environmental Department for any earth work being conducted within 500 feet of a water body (lake, pond, stream, river, saturated wetland or unsaturated wetland), or if the site is equal or greater than one acre.

M.2 BEST MANAGEMENT PRACTICES FOR SURFACE WATER

General management guidelines are derived from EGLE, MDNR and USEPA. BMPs are implemented to ensure that soil-disturbing projects do not contribute sediment to water bodies. The following sources can be used to identify BMPs that are proven in Michigan.

- *MDMVA Soil Erosion and Sedimentation Control Guidebook* (Revised 2018) recommends SOPs and protocols that must be followed by CGMTC Environmental staff who are state-certified MDMVA SESC inspectors and permit writers, pursuant to the MDMVA's APA status. The guidebook describes BMPs and industry practices for construction and earth-moving at MDMVA installations.
- *Michigan Forestry Best Management Practices for Soil and Water Quality* (2018) recommends BMPs, and associated laws and regulations that can apply to soil conservation. Types of BMPs described include but are not limited to pre-harvest planning, harvesting in riparian zones, harvest techniques, reforestation, and wildfire damage control.

  https://www.michigan.gov/documents/dnr/IC4011_SustainableSoilAndWaterQualityPracticesOnForestLand_268417_7.pdf

- *EGLE Nonpoint Source Best Management Practices Manual* recommends BMPs that prevent sediment from entering surface water (the process of sedimentation). Types of BMPs described include but are not limited to dust control, soil management to encourage vegetation growth, grading management, land clearing management, streambank stabilization, and sediment basins. https://www.michigan.gov/egle/0,9429,7-135-3313_71618_3682_3714-118554--,00.html
- *Soil Erosion and Sedimentation Control Manual* (2006) recommends BMPs that prevent soil erosion and sedimentation. Types of BMPs described include but are not limited to vegetated buffer strips, intercepting ditches, energy dissipaters, stream relocation, and check dams. https://www.michigan.gov/documents/2006_SESC_Manual_165226_7.pdf
- Utilize the SWAS program and MiRAM tool, as applicable.

General Approach

- Continue the environmental briefings to ensure transient troops are aware of what is expected of them.
- Site clearance program to ensure transient units leave no trace
- Integrate water resources management with fish and wildlife management, operational range sustainability program management, RTLA management, and the threatened and endangered species management.
- Maintain geomorphic and biological characteristics of special aquatic features (e.g., wetlands, important in-stream habitat, nursery habitat in lakes), including the hydrologic connectivity between watersheds and within surface waters, to provide for the needs of aquatic-dependent species.
- Prohibit or mitigate ground-disturbing activities that adversely affect hydrologic processes that maintain water flow, water quality, or water temperature.
- Identify measures to protect water resources from proposed activities during project planning and environmental review.
- Undertake ecological restoration, when possible, to maintain, restore or enhance water quality and riparian and aquatic habitat.
- Identify appropriate restoration methods in: (1) areas with excessive compaction, (2) areas with lowered water tables, or (3) areas that are either actively down cutting or that have historic gullies.
- Identify management practices (e.g., road maintenance, recreational use, timber harvest techniques) that may be contributing any observed degradation and coordinate to modify practices to reduce impacts.
- Continue coordinating with MDNR and the river/lake associations to jointly implement BMPs, retrofit/upgrade existing infrastructure, and identify other actions that will improve the water resources on and adjacent to CGMTC.
- Educate military users and visitors on CGMTC about the benefits of healthy water resources.
- Protect the groundwater-surface water interface.

- Protect vulnerable and ecologically important habitats such as isolated wetlands and headwater streams.
- Surface waters are likely to be impacted by climate change through increases in average water temperature (as well as changes in extreme temperatures). As climate projections improve, evaluate which surface waters are most likely to be impacted and identify potential mitigation actions.

Rivers, Streams, and Banks

- Any management of/changes to stream banks should use practices based on natural plantings and biodegradable materials.
- Restore and improve habitat for native fish and trout streams.
- Support implementation of the Au Sable River Natural River Plan (MDNR 1987) https://www.michigan.gov/documents/dnr/AuSable_plan_233514_7.pdf.
- Support implementation of the Upper Manistee River Natural River Plan (MDNR 2003) https://www.michigan.gov/documents/dnr/NR-UpperManistee-Plan_616468_7.pdf.
- Forestry equipment or skid logs must be moved across a stream only on a permitted bridge, culvert, or ford crossing, per MDNR requirements. Sizing and detailing of these structures should follow MDNR and EGLE BMPs.
- Stream crossings should be constructed using a pipe culvert installation or a portable bridge, if possible, and crossings should occur at right angles, preferably at a riffle (i.e., the shallow areas of the stream).
- Permits from the state (EGLE and MDNR) are required for stream crossings (permit application and review process www.michigan.gov/jointpermit
- Extra precaution will be used when carrying out timber harvests and other forest management in riparian management zones (RMZs), including both sides of streams and around the perimeter of bodies of open water.

Vernal Pools

- Conduct surveys to determine presence, distribution, and status of vernal pools.
- During harvesting or other forest management activity disturbance to the vernal pool depression should be entirely avoided (including all equipment and fallen trees).
- Within 100 feet of the pool, it is important to avoid deep ruts which can interfere with the movement of associated wildlife to and from the pools. Equipment should generally only be used when the soil is in a dry or frozen condition.

Wetlands

- Harvest activity immediately adjacent to fens, bogs, and other rare wetlands may encounter weak soils that are highly susceptible to rutting. When timber harvesting

occurs adjacent to these features, ground and vegetation disturbance within the wetland area should be avoided.

- To prevent sedimentation or excessive nutrient delivery into a rare wetland, timber harvests should be avoided along slopes immediately above and leading into a rare wetland.

Construction, Restoration, Monitoring and Maintenance

- An SESC permit is required to move earth within 500 feet of a surface water body or wetland; the SESC permit should eliminate or mitigate any activities that could adversely affect streams and long-term declines.
- Adhere to land contours and keep slopes between 2% to 10%. Soils with severe erosion hazard should be kept to a grade of 8% or less. Greater slopes should be kept to very short distances (see BMP manuals for guidance).
- Monitoring of the surface water quality, groundwater quality, water table elevation, shoreline and streambank stability, and habitat conditions within streams, lakes and wetlands should be a regularly scheduled and programmatic occurrence.
- Where possible, maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows, wetlands, and other special aquatic features.

M.3 BEST MANAGEMENT PRACTICES FOR VEGETATION MANAGEMENT

Vegetation management on CGMTC must support the military mission while maintaining compliance and cooperation with the MDNR's forestry management plans. Overall management recommendations for vegetation management at CGMTC include introducing more frequent disturbance into the landscape, such as fire, to encourage a variety of successional states, diverse species composition, and balanced age and size class structure while enhancing biological diversity. Managing invasive plants and forest pests are an important part of managing vegetation on CGMTC.

Forest Management

Much of the forested land at CGMTC is state forest. These lands are sustainably managed for multiple economic, recreational and environmental values. Management includes an ecosystem-based approach in a way that meets current forest needs while not compromising the needs of future generations (MDNR 2013).

MDNR has state forest plans as well as regional plans that guide their activities. Most forestry management is done through a combination of harvesting, revegetation/replanting, thinning, invasive plant management, and prescribed burning. Prescribed burning and invasive species management are strategies that are integrated into the vegetation management program.

The MDNR Forest Resources Division manages forests using a 3-tiered planning structure: statewide, regional, and unit levels. Operational plans provide landscape-level analyses and

direction for management of forest stands and compartments. The Grayling Management Area covers state forest lands of CGMTC and associated training lands (MDNR 2018). Below are management recommendations for the seven harvestable forest communities in the Grayling Management Area (MDNR 2018).

- Oak
    - Advanced age due to landscape changes in the last several decades have limited regeneration; management should focus on maintaining oak in mixed ages and stands in more open grassland communities.
    - Red pine can be planted in young oak stands to protect from late spring freezes.
    - Harvesting older pine in stands with maturing oak can release the oaks to mature more quickly.
    - Monitor older oak stands on an annual basis for signs of oak wilt; the advanced age and condition of oaks constitutes a high risk of oak wilt.
- Aspen
    - Regeneration harvests should continue to balance age-class.
- Jack Pine
    - Reestablishment of jack pine should consider the fire implications (e.g. military use restrictions).
    - Emphasize natural regeneration since plantings may experience restrictions depending on agency responsibilities.
    - Monitor older jack pine stands for jack pine budworm.
- Red Pine
    - Military use restrictions should be considered before reestablishing red pine due to fire restrictions.
    - Follow MDNR Red Pine Management Plan when considering harvest and regeneration (https://www.michigan.gov/documents/Red-Pine-Lite_96501_7.pdf).
- Upland Open/Semi-Open Lands (combination of herbaceous land, shrubland, and low-density trees)
    - Continue management to maintain and increase acreage of this vegetation type.
    - Jack pine and red pine are expected to be converted to this vegetation type as a result of military activity (i.e., primarily as a result of wildfires from ranges).
    - Protect stands from unauthorized ORV use by monitoring for, closing, and revegetating unauthorized trails.
    - Protect stands from invasive species by monitoring and treating invasive plant species rapidly.
- Lowland open/semi-open lands (combination of lowland shrub, marsh, and forested bog)
    - Management of these areas are to remain minimal, focusing on maintaining hydrology and open characteristics.
    - Protect stands from unauthorized ORV use by monitoring for, closing, and revegetating unauthorized trails.
    - Protect stands from invasive species by monitoring and treating invasive plant species rapidly.
- Other (combination of northern hardwood, mixed upland deciduous, and lowland conifers)

    - Continue management to provide forest products, wildlife habitat, and recreational opportunities.
    - Consider methods to encourage regeneration of lowland types.
    - Monitor for branch mortality of seedling and sapling white pine along and adjacent to river corridors which may be caused by pine spittlebug feeding and various fungal pathogens.
- Young Forests (Derosier et al. 2015, MI WAP, see Section 1.5.4)
    - Implement Green-Tree retention in harvest units where there are opportunities during harvest; if these areas are adjacent to occupied habitat, be creative with management practices to approximate preferred breeding habitat structure.
    - When feasible, leave tops of trees and drumming logs on the forest floor; also leave mast producing trees and shrubs after harvest.
    - Promote tree and shrub diversity in forest management.
- Pre-harvest planning and land clearing should include a thorough site assessment and tree tagging for those trees to be removed.
- Phase large-scale sites to minimize disturbance and revegetate areas as the project progresses.
- Riparian zones should be protected with multi-zoned filter strips when possible. Filter strips should be planted and/or maintained with native species.

High Quality Natural Areas (HQNA's)

CCGMTC's seventeen HQNAs have been categorized into high, medium, and low based on immediate management needs in Table 3.1.

- High priority areas are those that require regular, often annual, management to maintain them and they provide either local or regional significantly high-quality habitat, including for listed species.
- Medium priority areas are those that have a management need but it may be not an annual or frequently recurring management need.
- Low priority areas are those that have minimal management needs.

Table M-1 lists the HQNAs and the current management recommendations.

Table M-1. Management Recommendations for High Quality Natural Areas on CGMTC

Name	Acres	Management Recommendation(s)
High Priority Management Needs		
Pine Barrens	4,959	▪ Implement Pine Barrens Management Plan (Kost et al. 2000). ▪ Contain large areas of open grassland with scattered pine. ▪ Limit soil disturbances ▪ Reintroduce fire ▪ Plant red and white pine

Table M-1. Management Recommendations for High Quality Natural Areas on CGMTC

Name	Acres	Management Recommendation(s)
		▪ Control spotted knapweed ▪ Reduce dense jack pine forest
Portage Creek-Howes Lake Complex (mesic sand prairie)	77	▪ Establish upland buffer areas (100-200 meters) that exclude military and recreational activity ▪ Limit soil disturbances ▪ Avoid additional roads in this area ▪ Monitor for and remove invasive species; immediate management is needed in dense stands of leafy spurge that are in the swales near Ranges 18 and 19 ▪ Conduct prescribed burns on an occasional basis ▪ Monitor population of Voss's goldenrod
Frog Lake Complex (intermittent wetland)	17	▪ Monitor for and remove invasive species in upland areas ▪ Limit vehicle use to currently existing roads and block ORV tracks to interior ▪ Maintain vegetated upland buffer of at least 100 meters around each depression and monitor for aquatic invasive plants ▪ Conduct prescribed fire in adjacent uplands on an occasional basis and allow it to carry into the wetlands
Medium Priority Management Needs		
Beaver Creek (northern shrub thicket)	41	▪ To reset the succession from shrub thicket to poor conifer swamp, consider conducting prescribed fire in some portions of the adjacent uplands on an occasional basis and allowing fire to spread into wetland ▪ If oil and gas wells preclude use of prescribed fire, consider removing woody vegetation through mechanical methods. ▪ Monitor for and remove invasive species ▪ Install and maintain equalization culverts at all logging and oil/gas access roads where they cross wetlands
Cannon Creek Meadow (northern wet meadow)	149	▪ Invasive species require immediate management action: narrow-leaved cattail, reed canary grass, hybrid cattail, and reed ▪ Monitor for and remove other invasive species ▪ Maintain 200-meter vegetated buffer around wetland ▪ Conduct prescribed fire in adjacent uplands on an occasional basis and allow fire to spread into wetland
Cantonment Area	25	▪ Removal of the road bisecting the area or monitoring of the culverts to maintain water flows. ▪ Monitor and manage for invasive species
Crawford Red Pines (dry northern forest)	14	▪ Immediate need for increased fire management; apply prescribed fire on an occasional basis ▪ Remove red maple either through cutting and herbicide or repeated prescribed fires ▪ Consider developing integrated management that includes Crawford Red Pines, Best Bog, and Barker Creek Fen ▪ Monitor for and remove invasive species
Lake Margrethe North (intermittent	237	▪ Manage succession by removing woody plant species (i.e. pines) ▪ Conduct prescribed burn on an occasional basis utilizing road network as firebreaks

Table M-1. Management Recommendations for High Quality Natural Areas on CGMTC

Name	Acres	Management Recommendation(s)
wetland)		
Low Priority Management Needs		
Barker Creek Fen (northern fen)	31	▪ Consider applying prescribed fire to reduce litter layer ▪ Allow fires occurring in the surrounding uplands to carry into wetland ▪ Prevent off-road vehicle use in wetland
Best Bog (bog)	25	▪ Monitor for and remove invasive species ▪ Maintain culverts in road at south end of the wetland in order to manage water level
C-shaped depression (northern fen)	8	▪ Monitor for and remove invasive species, particularly reed canary grass and common reed ▪ Conduct prescribed fire in adjacent uplands on an occasional basis and allow fire to carry into wetland/allow range fires to carry into the area
Chub Creek Swamp (northern shrub thicket)	123	▪ Monitor for and remove invasive species ▪ Maintain 100-meter vegetated buffer around wetland ▪ Allow fires occurring in adjacent upland to carry into wetland (to control woody encroachment)
Lovells Bog (bog)	42	▪ Monitor for and remove invasive species ▪ Conduct prescribed fire in adjacent uplands on an occasional basis and allow fire to spread into wetland ▪ Maintain vegetated upland buffer for approximately 200 meters ▪ Monitor for vehicle activity and remove access if occurring
Lovells Fen (poor fen)	27	▪ Monitor for and remove invasive species, particularly reed canary grass ▪ Allow fires occurring in the surrounding uplands to carry into wetland; monitor fires to ensure frequency is adequate ▪ Prevent off-road vehicle use in wetlands
The Doughnut (intermittent wetland)	9	▪ Prevent use of off-road vehicles in wetland. ▪ Conduct prescribed fire in adjacent uplands and allow fire to carry into wetland ▪ Maintain vegetated upland buffer for at least 100 meters ▪ Monitor for and remove invasive species in uplands
Watson Swamp (rich conifer swamp)	305	▪ Monitor for and remove invasive species, especially along Mecum Road ▪ Maintain culvert along Mecum Road to allow natural water flow through the wetland
Lewiston Grade Swamp & Fen	329	Additional work needed to assess current condition and determine management recommendations.
Sources: Higman et al. 1994; MNFI 1994; Kost et al. 2000; Kost & Cohen 2005; DLZ 2018		

Climate change may influence surface water elevations, precipitation, changing temperatures, and humidity which may in turn impact water table elevations, biodiversity and the density of invasive plant species at the HQNAs. It is expected that the monitoring and frequency with which the HQNA and vegetative cover is surveyed will need to increase in order to proactively manage the HQNAs and vegetative cover at CGMTC.

Revegetation, Landscaping and Ecological Restoration

Revegetation of disturbed areas and ecological restoration of larger areas are important parts of long-term vegetation management. Depending on whether the goal is forest or grassland, there are different recommendations. Below are management recommendations for revegetation, restoration, and landscaping.

- Continued maintenance of openings with wildlife benefits, where appropriate
- Continued implementation of the site clearance program to ensure transient troops leave no trace
- Revegetate with native plants after a disturbance (e.g. forest management, fire, or military training)
- Emphasize native plants and minimize invasive plants through planning and quick action following a disturbance event such as timber harvesting, wildfire, or construction
- Use porous pavement when possible to support water infiltration, where possible
- Do not use seed-bearing or fruiting plants that provide food for wildlife and wildlife habitat in areas near GAAF
- Landscaping on the Cantonment should be consistent with the Facilities Master Plan and the Cantonment Forestry Management Plan

The invasive plants listed for the Northern Lower Peninsula in *Meeting the Challenge of Invasive Plants: A Framework for Action* (Higman & Campbell 2009) and on the Prohibited Species List (MDARD et al. 2019) are not acceptable for landscaping planting within CGMTC; both documents are available at http://www.michigan.gov/dnr/0,4570,7-153-10370_12146_12214---,00.html. All non-native grasses (except those used for lawns) are also not acceptable for landscape planting. Suitable native grass/grass-like species can be found at http://nativeplants.msu.edu/local_info/north_lower_peninsula/ or http://www.plantnative.org/rpl-mimnwi.htm. Additional information can be found at http://nativeplants.msu.edu/.

Vegetation Management regarding BASH Programs

There are two BASH programs being implemented at CGMTC, one for the GAAF and one for the 40 Complex. Vegetation management at the GAAF is a core component of the BASH program. Sandy soils and native grasses of northern Michigan characterize the 921-acre GAAF. The grasses surrounding the operational regions of GAAF (pavement, runways, aprons, signs, lights, support buildings, and helipads) are maintained at approximately ankle height. The grasses on the periphery are maintained at approximately 12”-14”. Periodically, trees are trimmed or removed from residential properties to maintain a safe approach. Management recommendations for the GAAF include:

- Continue to follow Federal Aviation Administration (FAA) and DoD guidelines
- Continue to maintain grasses at the specified heights
- Continue to maintain community relations with residents to enable tree trimming or removal, as needed

- Reduce the mowing and vegetation maintenance level of effort by identifying native grasses that grow the maximum heights of 6" for the operational regions of GAAF, and 12'-14" for the peripheral regions of GAAF and collaborate with GAAF personnel to implement the seeding
- Continue to maintain the BASH program and review the BASH Plan annually in collaboration with the CGMTC Environmental Department

The air-to-ground impact zone (40 Complex) is jointly managed by the MIANG and CGMTC MIARNG. The BASH activities at the 40 Complex are included in a joint BASH plan for the Combat Readiness Training Center in Alpena. The plan is implemented by MIANG.

Monitoring throughout the Installation

Long-term vegetation monitoring occurs at CGMTC. The MDNR Forest Resources Division conducts forest inventories on 10% of state forest lands per year. This is part of a comprehensive review to inventory the entire forest system on a 10 year cycle. Information from forest inventories is used to propose management actions for forest health, timber production, wildlife, and recreation.

Detrimental effects to vegetation from training and from invasive plants should be addressed early and proactively. Monitoring for signs of invasive plants and pest invasion (e.g. oak wilt, emerald ash borer [EAB], etc) should occur during the course of normal activity as a routine part of assessing ecosystem health and carrying out adaptive management.

Of special note for monitoring and potential vegetation management issues are the following:

- Continue the environmental briefings to ensure transient troops are aware of what is expected of them
- Site clearance program to ensure transient units leave no trace
- If rare plants and community composition are being affected by deer, instituting management of the deer population in these restricted areas may need to be implemented
- In HQNAs, changes in species composition should be monitored to track the rare plant species present, detect changes that might indicate disease, note early instances of non-native species establishment, and record disturbance regimes (e.g. fire).
- The Pine Barrens and Portage Creek-Howes Lake Complex, as high priority areas, should be monitored more regularly for impacts and changes.
- Detection of invasive plants should be identified early through regular monitoring, especially in open grassland areas and in high quality natural areas.
- Continue to monitor the vegetation at training areas to ensure there are no long-term adverse effects from training.
- Coordinate with MDNR to monitor forest conditions and understory development, particularly in areas essential for military training.

M.4 BEST MANAGEMENT PRACTICES FOR WILDLAND FIRE

General recommendations for wildland fire management on CGMTC are compiled from the *Michigan State Forest Plan* and *Northern Lower Peninsula Regional State Forest Management Plan* (MDNR 2008, 2013), and various DoD, US Army, and NGB policies.

Priority areas for the use of prescribed fire include the Pine Barrens, Range 30 Complex, Range 40 Complex, Range 13, many of the small arms ranges, and listed species habitats. Range-related burns have dual benefits of reducing fuel loading and fire risk from military training but also ecological benefits for maintaining open landscapes in a region where forests dominate the landscape. Many of the rare species and habitats on CGMTC are fire-dependent and benefit from the use of prescribed fire. Given the typical fire return intervals for the region and the habitats at CGMTC, approximately 10,000 acres have been determined as high priority burn areas, and burned in rotation. Some areas will be burned more often than others due to either the military use (e.g., range complexes) or the vegetation type (e.g., Pine Barrens).

General Approach

- Maintain high quality natural areas.
- Implement Pine Barrens Management Plan
- Post-wildfire management activities should emphasize enhancing native vegetation cover, addressing soil erosion, addressing habitat fragmentation, and minimizing adverse effects from the existing road network

Wildfire Response

- Follow the CGMTC IWFMP.
- Conduct a quick and safe response, notify all personnel required, and request assistance when needed.
- Recognize that increased urbanization in close proximity and within the management area will present more wildland/urban interface challenges to wildfire suppression.

Prescribed Fire for Mission and Ecological Purposes

- When feasible, reintroduce fire in the oak/pine areas to encourage regeneration and to discourage competition.
- When feasible, incorporate fire as a tool to restore or maintain managed openings.
- Develop a comprehensive fire break system to minimize the risk of fire spread in areas of high-potential ignition (e.g., military ranges).
- Determine prescribed fire and fuel load management needs based on vegetation community, rare species, and military use and prioritize necessary actions annually.
- Conduct prescribed fires on a rotating basis to reduce fuel loads and maintain fire breaks. Provide adjacent refugia for impacted, fire sensitive species and a seed source for flora.

- Use prescribed fires in the forest stands to reduce competition for the growth of desired herbaceous and woody vegetation and for site preparation for forest regeneration.
- Use prescribed fires in grassland areas to control encroachment of woody vegetation.
- Use prescribed fires in conjunction with silvicultural prescriptions to reduce fuel loads, especially to reduce the potential for large crown fires in conifer cover types.
- In burn plans, identify mitigation measures to minimize the spread of fire into riparian vegetation. In determining which mitigation measures to adopt, weigh the potential harm of mitigation measures. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could be damaging to habitat or long-term function of the riparian community.

Fuel Loading and Firebreak Management

- Reduce excessive fuel loads for priority community types to reduce the risk of catastrophic wildfires.
- Fuel reduction in coniferous forests should focus on ladder fuels and dead and down wood.
- Snags and large woody debris management should be a balance of ecological benefit and reducing fuel loads.
- Avoid excessive mechanical earth moving.

M.5 BEST MANAGEMENT PRACTICES FOR INVASIVE SPECIES

The State of Michigan has an invasive species program that is implemented by the Michigan Departments of Agriculture & Rural Development (MDARD), MDNR, and EGLE. This program aims to prevent new introductions, limit the spread of established species, detect and respond to new invasions, and manage and control established species (Michigan's Invasive Species Program 2018). Michigan's Aquatic Invasive Species (AIS) and Terrestrial Invasive Species (TIS) state management plans serve as the foundation for this work (MDEQ et al. 2013; MDARD et al. 2018). The state maintains a watch list of current invasive species by taxa and partners with many local agencies and nonprofit groups to conduct monitoring and control activities.

CCGMTC follows the MIARNG IPMP when carrying out activities to control animal and plant pest species on the installation (MDMVA 2014). The IPMP emphasizes prevention and control of pests through a wide range of options, with pesticide application being a last resort. As with all invasive species and pests, coordination and cooperation with regional and state groups, including MDNR and the Midwest Invasive Species Information Network (MISIN) (https://www.misin.msu.edu/), are cost- and time-effective when conducting monitoring and implementing control activities. Due to the diversity of types of management, recommendations are broken into five sections: terrestrial plants, forest pests, pest-borne diseases, aquatic pests, and other pests. A summary of priority species and potential species is provided in Appendix F.

General Approach

- Work with adjacent property owners to stay abreast of regional issues and pool resources when attempting to detect invasions early on.
- Implement control measures as adaptive management results in updated priorities and new methods are developed.
- Develop an internal policy to manage invasive seeds and other propagules related to military equipment entering CGMTC.

Terrestrial Plants

The purpose of terrestrial invasive plant management is to reduce threats to natural communities and native species. General management recommendations are compiled from the Draft Michigan's Terrestrial Invasive Species State Management Plan (MDARD et al. 2018), CGMTC reports (Higman et al. 2005b; Kost & Cohen 2005; Koziatek & Wilson 2016, 2018), priority lists, and the various DoD, MDMVA, and CGMTC policies, as applicable. The current list of invasive plant species that are priorities for management due to the ecological threats they pose is provided in Appendix F. A list of the terrestrial priority invasive plants that have been documented as present on CGMTC is presented in Table M-2.

Table M-2. Documented Terrestrial Priority Invasive Plant Species for CGMTC

Scientific Name	Common Name	State Rank[1]
Terrestrial Plants		
Alliaria petiolata	Garlic mustard	-
Centaurea stoebe	Spotted knapweed	Prohibited, Noxious Weed
Cirsium palustre	Swamp thistle	-
Elaeagnus angustifolia	Russian olive	-
Elaeagnus umbellata	Autumn olive	Prohibited
Euphorbia esula	Leafy spurge	Prohibited, Noxious Weed
Fallopia japonica	Japanese knotweed	Prohibited
Hypericum perforatum	St. John's'wort	-
Lonicera x bella	Hybrid honeysuckle	-
Phalaris arundinacea	Reed canary grass	-
Phragmites australis	Invasive phragmites, giant reed	Restricted
Poa compressa	Canada bluegrass	-
Rosa multiflora	Multiflora rose	-
Vinca minor	Common periwinkle	-

[1] State Rankings are provided by Michigan Department of Agriculture under the Natural Resources and Environmental Protection Act (451 of 1994, as amended); Part 413, Section 324.41301 defines prohibited and restricted species in Michigan and limits the possession, import or sale of such species; Part 33, Section 33 defines permitted actions and procedures for the treatment of aquatic nuisance species; Noxious Weeds under Michigan Law: Michigan Seed Law (Act 329 of 1965) and Regulations 715 (Under Act 329) Seed Law Implementation.

Sources: (DLZ 2018; Koziatek & Wilson 2018).

Invasive species management on CGMTC has historically focused on riparian and wetland habitats and will continue to focus in those areas in the next few years. Recent control efforts have occurred in four high quality natural areas: 1) Frog Lake Complex, 2) Portage Creek-Howes Lake complex, 3) Lovell's Fen, and 4) Cannon Creek (Koziatek & Wilson 2018). Recent treatments (Koziatek & Wilson 2018) have focused on:

- leafy spurge
- St. John's wort
- spotted knapweed
- garlic mustard
- reed canary grass
- giant reed (phragmites)

Management recommendations for terrestrial invasive plants include:

- Complete surveys annually in order to carry out the early detection and rapid response program for priority invasive plants.
- Particular attention should be paid to roads during monitoring and control efforts, since infestations at access points and smaller order roads will require long-termed management.
- Minimize disturbance of soils, especially in areas where invasive plant species do not have a foothold.
- Continue ongoing efforts to eradicate garlic mustard and reed canary grass by continuing the monitoring and maintenance control for the few individuals remaining on CGMTC.
- Invasive plants in high-quality areas are still minimal in population density and have a high probability of successful management if maintenance control activities continue.
- A reevaluation of the past management recommendations should be conducted within the next few years as funding allows.

Aquatic Plants and Animals

Aquatic invasive species have been a management issue on CGMTC in the past, notably at Lake Margrethe. Other lakes, ponds, and rivers and streams on CGMTC may also be prone to infestation by invasive aquatic flora and fauna. As with terrestrial plants, above, general management recommendations are compiled from the Michigan's Aquatic Invasive Species State Management Plan (EGLE et al. 2013), CGMTC reports (Higman et al. 2005b; Kost & Cohen 2005; Koziatek & Wilson 2016, 2018), priority lists, and the various DoD, MDMVA, and CGMTC policies, as applicable. The current list of invasive aquatic species that are priorities for management due to the ecological threats they pose is provided in Appendix F. A list of the aquatic invasive species that have been documented as present on CGMTC is presented in Table M-3.

Table M-3. Documented Aquatic Priority Invasive Species for CGMTC		
Scientific Name	**Common Name**	**State Rank[1]**
Aquatic Plants		
Lythrum salicaria	Purple loosestrife	Restricted
Myriophyllum spicatum	Eurasian watermilfoil	Restricted
Nitellopsis obtusa[2]	Starry stonewort	Prohibited
Mollusks		
Dreissena polymorpha	Zebra mussel	Restricted

[1] State Rankings are provided by Michigan Department of Agriculture under the Natural Resources and Environmental Protection Act (451 of 1994, as amended); Part 413, Section 324.41301 defines prohibited and restricted species in Michigan and limits the possession, import or sale of such species; Part 33, Section 33 defines permitted actions and procedures for the treatment of aquatic nuisance species.
[2]Starry stonewort has been documented in the wastewater lagoons on Cantonment.
Sources: (DLZ 2018; Koziatek & Wilson 2018).

The MDMVA has partnered with the LMPOA since 2003 to control aquatic plants on Lake Margrethe using selective herbicide treatments. CGMTC provided GIS services and created maps to support permit applications and herbicide placement. Annual monitoring for invasive aquatic pests on Lake Margrethe is ongoing in collaboration with LMPOA, and coordinated control of aquatic pests continues.

- Promote public/private collaboration to leverage expertise and resources as a mechanism to address priorities.
- Continue to monitor Lake Margarethe and other CGMTC lakes for the invasive aquatic species.
- Communicate closely with regional agencies to stay informed on the latest threats, regular monitoring and reporting, and rapid control responses are recommended management activities for aquatic flora and fauna.

Forest Invasive Species

Forest pests have long been an issue for natural resource management on CGMTC, with gypsy moth, oak wilt, and EAB being the historically prominent species. Management recommendations are taken from the Michigan Integrated Pest Management Plan (MDMVA 2014), MDNR. Management recommendations for forest pests include:

- Maintain partnerships with local MDNR forestry staff and participate in regional working groups to stay up-to-date on the latest issues and outbreaks in forest pests.
- Report any disease or pest outbreaks noted immediately to other forest resource specialists and managers and seek their input on management decisions and dilemmas.
- Where disease infestation or fire/wind throw disturbance mortality is extensive, pre-salvage or salvage of forest products may be appropriate within the limits for downed woody debris prescribed by DNR Within-Stand Retention Guidance.
- Use chemical pesticides when they are legal, reasonably cost effective, meet management objectives, and optimize the natural mortality factors in the ecosystem to

reduce or maintain populations of organisms at tolerable or endemic levels. Economic, ecological, and social values will be used in determining tolerable levels.

- Use alternatives to chemical pesticides when they are legal, reasonably cost effective, and available and meet management objectives. When chemical pesticides are used, the least toxic, most effective, narrowest spectrum products labeled for the target species should be selected.
- If using biological controls to kill pests, use only host specific predators, parasites and pathogens with proven effectiveness.
- Use silvicultural management to manipulate the environment to make it more favorable for desirable plant growth and less favorable for pest growth.
- Use cultural controls, such as good site selection, harvesting over-mature jack pine, or planting resistant varieties, to prevent pest populations from building to unacceptable levels.
- Monitor forests annually either specifically for forest pests or during the course of other natural resource management activities.
- Encourage mixed age classes in all vegetation types, but especially in oak stands. Advanced age in oak stands at CGMTC means that oak wilt is a higher risk.
- Monitor for branch mortality of seedling and sapling white pine along and adjacent to river corridors, which may be caused by pine spittlebug feeding and various fungal pathogens.

Other Invasive Species and Pests

Pest-borne diseases of concern at CGMTC have historically been Lyme disease, and West Nile virus. Monitoring and close communication with the Michigan Department of Health and Human Services are important for rapid response when necessary.

Terrestrial invasive animals are currently not a significant concern on CGMTC. However feral hogs (*Sus scrofa*) have the potential to become a major concern. If they do become established in the region, CGMTC and MDNR will implement a management program to prevent damage at CGMTC. Regular monitoring and reporting along with a rapid response are recommended.

M.6 BEST MANAGEMENT PRACTICES FOR FISH AND WILDLIFE

General management recommendations are compiled from the CGMTC Management Area plan, biological reports (Appendix K), and various DoD, MDMVA, and MDNR policies, as applicable. A range of fish and wildlife habitats are maintained by the implementation of the water resources management program and the vegetation management program.

The forest should have an adequate mix of young and mature timber stands, openings, and wetlands. Snag and den trees are important, as well as a variety of shrubs, grasses, and forbs. Both game and non-game species will benefit from these management strategies.

General Approach to Management of Specific Habitats

- Pileated woodpecker: maintain trees >12 inches
- Red-headed woodpecker: retain dead and down woody debris with preference for snags > 12 inches
- White-tailed deer, wild turkey, snowshoe hare and ruffed grouse: maintain upland shrub lands and regenerate oak stands.
- White-tailed deer and wild turkey: maintain and increase openings in vegetation (e.g. grasslands, savannahs, etc.) for raising young and provide forage.
- White-tailed deer: manage cedar and hemlock to improve regeneration on appropriate sites.
- White-tailed deer, snowshoe hare, ruffed grouse and woodcock: continue encouraging mixed stands of aspen.

Game Species

- Assess deer herd for size, age structure, and health
- Manage deer for a population level that prevents ecological damage due to browse
- Implement measures to encourage a reduction of the deer herd
- Maintain and expand aspen to support ruffed grouse, with at least 25 percent of aspen under 10 years old
- Maintain mast trees and fruit-bearing plants with forest openings
- Provide sufficient early spring green-up grasses and herbaceous species in openings, and upland brush for early spring forage.
- Maintain riparian vegetation, and protect wetland areas from ground disturbance and invasive species.
- Implement vegetation management guidelines and type acreage goals for the MDNR Grayling Management Area to maintain the quality, quantity, and diversity of habitats needed
- Protect wetland communities to benefit fish and wildlife
- A reduction in the deer herd should be to be considered if possible to prevent harm to sensitive resources.

Fish Habitat

- Maintain healthy native aquatic plant communities in order to support the populations of native sport fish such as walleye, northern pike, largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), pumpkinseed sunfish, and yellow perch.
- Walleye: Continue to stock Lake Margarethe with spring fingerling walleye (Muskegon River strain) at a rate of 31/acre (or 60,000 fish) every other year, starting in 2017.
- Protect and restore aquatic habitat in warm and coldwater systems by preventing removal of vegetation, erosion, loss of downed timber, warming temperatures, poor water quality, changes in stream flow, and blockage of fish passage.

- Fish and other aquatic species will be particularly vulnerable to climate change due to sensitivity to changes in water temperature, peak flows, and flooding. Vulnerability assessments for these species should be updated as climate projections improve for the region.

M.7 BEST MANAGEMENT PRACTICES FOR SPECIES OF CONSERVATION CONCERN

General Recommendations

- Conduct regular monitoring, based on USFWS and MDNR guidelines and consultation.
- Implement an education and outreach program to educate both users (military and public) of CGMTC and surrounding landowners.
- Cooperate with USFWS, MDNR, and other cooperating partners for surveys, education, and management.
- Consider timing activities to avoid adverse impacts to species of concern. For example conducting activities outside of nesting season for migratory birds (April 15 - Aug 15), and outside of pupping season for bats (June 1 - July 31).
- Implement measures to avoid and minimize adverse impacts to herps as outlined in the Habitat Management Guidelines for Amphibians and Reptiles https://www.mwparc.org/products/habitat/
- Only use pesticides, fertilizers, and other chemicals in accordance with federal and state laws and the MIARNG IPMP.
- Monitor and minimize dispersal of contaminants associated with hazardous waste sites (legal or illegal), permitted releases, and runoff from agricultural areas
- Continue to identify projects that gather more data on federally listed species, particularly when that data can assess potential impacts from military training or if it may modify the conditions placed on military training, cooperating with other agencies as appropriate.
- Review forest management operations for potential conflicts between rare species and proposed forest operations following the guidance in MDNR's *Approach to the Protection of Rare Species on State Forest Lands*, especially when listed species are present or past surveys have indicated a possibility of their presence.
- Employ industry-accepted best management practices to prevent birds from colliding with or being electrocuted by utility lines, towers and poles. If possible, bury utility lines in important eagle areas.

Federally Protected Species – Hungerford's crawling water beetle (HCWB)

Surveys in 2019 confirmed Hungerford's crawling water beetle (*Brychius hungerfordi*) (HCWB) at one location on Portage Creek. Range wide, the species has been found in only a handful of isolated locations in northern Michigan and Ontario. The beetle is typically found in coldwater streams associated with beaver dams or human-made structures that provide similar conditions.

A recovery plan was published by the USFWS in 2006. Measures will be incorporated into planning and implementation to ensure conservation of this species.

- Implement erosion control BMPs for road/stream crossings and other projects to minimize sedimentation, as appropriate
- Conduct in-stream projects such as bank stabilization projects as appropriate
- Conduct other stream and watershed restoration activities that result in benefits to occupied watersheds, as appropriate
- Investigate the potential for transportation of hazardous materials (e.g., oil and other chemicals) on roads within occupied watersheds and potential for spills
- Confirm threats to the species
- Conduct studies to examine population dynamics and demography
- Conduct additional surveys and monitor existing sites

Federally Protected Species – eastern massasauga rattlesnake (EMR)

Several studies of EMR (*Sistrurus catenatus*) have been undertaken on CGMTC since 2001, primarily focusing on aspects of the snake's habitat use, diet, movement, and hibernation. EMRs are found near Portage Creek west of the small arms ranges of South Camp and from the northwest corner of Lake Margrethe north towards Howe Lake (in the Portage Creek-Howes Lake Complex). There is an area that is generally off-limits to most activities, particularly vehicles, to protect eastern massasauga, although that protects other species as well and is largely within the 400-foot buffer around water resources.

An understanding of the relationship between habitat management and EMR populations on CGMTC is important for identifying future management recommendations. As a result, a project to analyze historical data of habitat changes (i.e., fires, floods, timber harvests, thinning, etc.) and correlating with EMR population changes on CGMTC is important; then continuing annually until it is possible to identify the activities and/or seasons to avoid impacts to EMR.

In 2016, MDNR, MDMVA, and USFWS entered into a Candidate Conservation Agreement with Assurances (CCAA) for the eastern massasauga, which provides the ability to manage for the species in enrolled lands under the agreement even if it is federally listed (MDNR 2016). This agreement expires in 2041 and lays out a plan to accomplish conservation goals to benefit the eastern massasauga by restoring habitat on enrolled lands under the CCAA. Participating in the CCAA provides a species with a conservation program and relieves the landowner of uncertainty in land management. In addition to the CCAA, BMP's as outlined in the USFWS's Environmental Screening for Eastern Massasauga Rattlesnake in Michigan (March 14, 2017) will be followed as appropriate.

Management recommendations for eastern massasauga rattlesnake include (Derosier et al. 2015; MDNR 2016; USFWS 2016):

- Continued conservation of wetlands

- Use of prescribed fire with restrictions during emergent season[4].
- Mowing is allowed but with restrictions regarding grass height and emergent season.
- Cultivation is strongly discouraged.
- Water level manipulation (drawdowns and flooding) should be limited during inactive season.
- Broad applications of chemical control products in forests are prohibited.
- Collection, release, relocation, and persecution of this species are prohibited.
- Wetland habitat loss and fragmentation should be avoided.
- Development and new road/trail construction should be avoided in known habitat.
- Avoid altering hydrology that could result in drought or artificial flooding, particularly in overwintering habitat (e.g., along Portage Creek).
- Plan habitat management and forestry carefully to avoid impacting snakes at different stages throughout the year.
- Continue educating users (public and military) and identifying protected areas to minimize incidental take and mortality of individual snakes.
- Maintain and distribute existing eastern massasauga identification and information card for CGMTC.
- Continue to investigate snake fungal disease within eastern massasauga populations at CGMTC with the intent to identify relevant management.
- Continue to implement standard decontamination protocols and update the protocols as needed.

Federally Protected Species – Northern Long-Eared Bat (NLEB)

An acoustic survey for bats at CGMTC in 2016 documented one occurrence of the northern long-eared bay (*Myotis septentrionalis*). Overall the survey results found that Myotis species are not common, with most of the bat calls recorded being from silver-haired bats, big brown bats, and eastern red bats (CEC 2016). Conclusions from this study were that the NLEB is a rare summer roosting and/or foraging bat and would most likely occur in the North Camp portion of CGMTC, where more suitable habitat occurs (CEC 2016). There are no recovery plans for the NLEB, as the species was listed recently (in 2015). Management for the northern long-eared bat (NLEB) is not yet underway, as a clear picture of presence/absence on CGMTC is not available. Management recommendations for northern long-eared bat include (USFWS):

- Conduct additional surveys to determine population status, distribution, and habitat use.
- Where possible and not a safety hazard, leave dead or dying trees to provide roosting habitat.
- Take actions to protect NLEB and their habitat within known NLEB home ranges.

[4] Spring emergence typically starts in late March/early April with increasing ground temperatures.

- Avoid tree clearing and other activities during suitable habitat during pupping season (June 1 - July 31)
- Conduct humane exclusion of NLEB in structures.
- Consider participation in development of Draft Lake State Forest Management Bat Habitat Conservation Plan (HCP).

Federally Protected Species – Bald Eagle

Since 1992, MDNR has notified CGMTC of all active bald eagle (*Haliaeetus leucocephalus*) nest sites immediately after their aerial nest survey and a 1,500 feet vertical and lateral buffer is placed as a restricted area. Based on a protocol agreed to with USFWS, CGMTC immediately contacts USFWS if eagle nesting occurs near aerial or ground operations so that USFWS can advise on appropriate avoidance measures to eliminate potential impacts or nest abandonment. USFWS management recommendations for bald eagles during the nesting season in the Midwest include (USFWS 2018):

- Non-motorized disturbances by humans (e.g., hiking, fishing, or camping) should remain stay at least 330 feet (100 meters) from any nests.
- Motorized activity, such as snowmobiles and ORVs, should stay at least 330 feet (100 meters) from active nests. In open areas with little vegetation and increased visibility and exposure to noise, stay at least 660 feet (200 meters) from the nest.
- Protect and preserve potential roost and nest sites by retaining mature trees and old growth stands, particularly within ½ mile from water.
- Where nests are blown from trees during storms or are otherwise destroyed by the elements, continue to protect the site in the absence of the nest for up to three (3) complete breeding seasons. Many eagles will rebuild the nest and reoccupy the site.
- To avoid collisions, locate any towers and power lines away from nests, foraging areas, and communal roost sites.
- Where bald eagles are likely to nest in human-made structures (e.g., towers), equip the structures with either (1) devices engineered to discourage bald eagles from building nests, or (2) nesting platforms that will safely accommodate bald eagle nests without interfering with structure performance.

State-Listed Species

Kirtland's warbler (*Setophaga kirtlandii*)

As of October 2019, the Kirtland's warbler was officially delisted from its previous federally endangered status. Due to intensive management and conservation efforts, the species met population recovery goals. Kirtland's warbler is still state listed as endangered. This species has been documented at various sites on CGMTC at least since the 1950s. Nesting habitat on CGMTC shifts as jack pine stands are harvested or burned and then proceed through successional changes. Kirtland's warblers generally prefer large, dense jack pine forest habitat at a successional stage occurring early after a fire or timber harvest (around 6 to 24-year-old stands) (USFWS 1997a). The combination of Grayling sand soils and jack pine forests provide optimal habitat and occurs throughout CGMTC. Maintaining the habitat mosaic with frequent

disturbance in the form of fire or clear cutting is necessary. The State of Michigan's WAP describes Kirtland's warbler habitat and its management, particularly using a 50-year harvest rotation (Derosier et al. 2015).

No intentional habitat management for Kirtland's warblers occurred on CGMTC prior to 1986, following the creation of a cooperative agreement. The cooperative agreement addressed land use and military training conflicts with Kirtland's warblers and established a Kirtland's Warbler Management Plan for the Range 30 Complex (Perez & Huntington 1986). Following other activities, an amendment to the management plan and a Biological Opinion form the USWS was issued (USFWS 1997a). The plan laid out then is still in effect today.

Regular annual surveys in the region, which include CGMTC, have been completed by USFWS, MDNR, MDMVA and other cooperating partners. Over time, there has been less jack pine habitat and fewer Kirtland's warblers on CGMTC, while the Kirtland's warbler regional population has increased. As of the writing of this document, occupied Kirtland's warbler habitat exists primarily in South Camp (STA01, STA09, STA12, STA17), as well as pockets of habitat in and adjacent to the Pine Barrens Management Area in North Camp (NTA07, NTA14). Due to the regional effort by many partners, the recovery goals for Kirtland's warbler have been met and there is progress toward delisting the species.

- Management recommendations for Kirtland's warbler on CGMTC include:Conservation and management efforts for this species must continue to ensure its long term recovery and prevent it from returning to the list of species protected under the Endangered Species Act.
- All areas occupied by Kirtland's warblers, as located by spring census, are identified on the annual training area map restrictions overlay and are either not assigned or are scheduled with restrictions. No military activity of any kind 1 May through 15 August. During the remainder of the year areas may be used for foot traffic and wheeled vehicles on existing roads. Restrictions will be covered as part of environmental briefings given to visiting units.
- All restrictions on posted Kirtland's warbler habitat will be followed.
- Aircraft will maintain a minimum elevation of 500 feet over all occupied habitat.
- Areas of jack pine regenerated by fire or timber management will be evaluated on an individual stand basis to identify potential for training conflicts with Kirtland's warbler use.

Cowbird trapping and Kirtland's warbler censusing will be allowed on CGMTC upon coordination with Range Control and Operations.

Red-shouldered hawk (*Buteo lineatus*)

Red-shouldered hawks and active nests have been documented on CGMTC over the years (Higman et al. 2005a). The primary threat to this species is forest disturbance and competition with other birds of prey. Red-shouldered hawks tend to have high fidelity for nesting sites, which tend to be within ¼ mile of wetlands and other water bodies. Suitable nest trees typically exceed 18 inches in diameter and contain a sturdy crotch near the main trunk in the lower portion of the canopy.

Draft management guidelines for red-shouldered hawk include (MDNR 2015):

- Annual nest monitoring.
- No new roads or cutting within 8 acres centered on nest trees of active nests (human disturbance should be avoided in these areas).
- No management activities (e.g. timber felling, road construction, or disruptive activity) within a 16-acre area centered on nest trees between March 15 and July 15 in the northern lower peninsula.
- Maintain 85% canopy closure within 660 feet of nests and 80% canopy closure within 2,310 feet of nests.

Common loon (*Gavia immer*)
Common loons are known to nest in North Camp on the largest of the Frog Lakes and in Bear Lake (Higman et al. 2005a). Additional nest sites are likely on other lakes on CGMTC.

Management guidelines for common loon include (MDNR 2017):

- Minimize maintenance activities within 1/4 mile of active nests during the breeding season (March through August), including nurseries.
- Schedule construction, maintenance, or habitat management activities during the non-breeding season, from September through February.
- Application of herbicide to control aquatic vegetation should only be conducted outside the nesting season on lakes where loons nest.
- Limiting causes of mortality from discarded fishing line by implementing educational outreach and disposal equipment.
- Limiting predation from raccoons and herring gulls.

Annual monitoring of nests to verify occupancy of territories and track productivity. Surveys should include additional lakes with potential for common loon.

Trumpeter swan (*Cygnus buccinators)*
Trumpeter swans use a variety of wetland types such as marshes, ponds, and lakes on CGMTC. Nesting is likely, but has not been confirmed.

Management guidelines for trumpeter swans include (MNFI 2019):

- Nesting areas should be buffered by a no-activity zone to eliminate human disturbance by boats, personal watercraft, and birdwatchers.
- Wetland management that maintains large open water areas required for takeoff and landing as well as the lush emergent and submergent vegetation for cover and food should benefit Trumpeter swans.
- Competition from the Mute swan, a non-native aggressive species, may need to be reduced, eliminated, or controlled.

- Migratory stopover and wintering areas should be protected once identified.

Caspian tern (*Hydroprogne caspia*)
The Caspian tern is the largest of the terns. On CGMTC it is most likely found occasionally feeding and loafing on Lake Margrethe and potentially on other large to medium sized water bodies. It is unlikely that this species nests on CGMTC.

Evening bat (*Nycticeius humeralis*)
Typically found in mature forests, this species was documented at CGMTC in a 2016 bat species composition acoustic survey. CGMTC is considerably north of the documented geographic range for this species. Additional survey effort is needed to verify the presence of this species.

Rough fescue (*Festuca scabrella*)
This species is found in semi-open early successional jack pine forest, similar to those preferred by Kirtland's warbler. Unlike the warbler, repeated fire can have a negative impact, and late spring burns and repeated burning should be avoided (Higman & Penskar 1996). Management should focus on these documented metapopulations and isolated population areas, to include annual surveys. Detailed management guidelines for this species is lacking.

Vasey's rush (*Juncus vaseyi*)
This plant occurs in intermittent wetlands with moist sandy soils.

Management guidelines for Vasey's rush include (MNFI):

- Maintain hydrology and natural disturbance regimes.
- Prevent woody plant encroachment by using prescribed fire, manual brush removal, and selective logging.

Fleshy stitchwort (*Stellaria crassifolia)*
This plant is found in cold springs and seepy areas along river edges, specifically along the northern shoreline of the Au Sable River on CGMTC and in the Portage Creek-Howe's Lake Complex.

Management guidelines for fleshy stitchwort include (MNFI):

- Maintain hydrology

New England violet (*Viola novae-angliae*)
This plant occurs in the Portage Creek-Howes Lake Complex. This species benefits from maintaining open forests and woodlands through selective logging, which creates a variety of successional stages (MNFI 2007a).

Management guidelines for New England violet include (MNFI):

- Maintain moderately open woodlands via selective logging
- Maintain hydrology

Canada rice grass (*Oryzopsis canadensis*)
Canada rice grass requires disturbances, such as fire and logging, in jack pine forests to maintain early-successional habitat. Given its relative rarity (it is the only known extant occurrence for this species in the Lower Peninsula), the area where it was documented in the 1993 survey should be carefully monitored as this species has not been reconfirmed since that survey.

Management guidelines for Canada rice grass include (MNFI):

- Moderate disturbance to create a moist, open, moderately acid substrate.

Whorled pogonia (*Isotria verticillate*)
Whorled pogonia is rare in this region and habitat type. The orchid was originally discovered in the 1993 and was reconfirmed in the 2018 survey.

Management guidelines for whorled pogonia include (MNFI):

- maintaining the hydrologic integrity of the areas where it was known to occur and avoiding timber removal in the immediate area is recommended (MNFI 2007b).
- Annual monitoring.

Michigan Wildlife Action Plan Goals

Goals, threats and actions have been developed for each key habitat/issue listed in the WAP. This INRMP contributes to implementing those items, but they are more general in nature. The goals for each habitat/ issue from the Michigan WAP are included below.

Northern Dry Forests & Pine Barrens

- Goals:
  - Maintain or increase Pine Barrens acreage and quality.
  - Establish an average of 3,830 acres of breeding habitat annually for Kirtland's warbler.
  - Sustain Kirtland's warbler population throughout its known breeding range above 1,000 breeding pairs using an adaptive management framework.
  - Establish sufficient funds to ensure continued management of Kirtland's warbler threats to allow this species to be delisted.
  - Maintain known eastern massasauga populations and continue to identify additional populations.
  - Establish baseline status and distribution for secretive locust.

Young Forests

- Goals:
  - Increase the number of Young Forest projects completed annually using best management practices for golden-winged warbler.

- Maintain or increase Young Forest habitat.
- Stabilize population trend of golden-winged warbler.

Prairies & Savannas

- Goals:
  - Increase quality and maintain existing acres of Prairie and Savanna.
  - Maintain known eastern massasauga populations and continue to identify additional populations.
  - Increase outreach efforts on the monarch butterfly and what people can do to aid conservation.

Great Lakes Marsh & Inland Emergent Wetlands

- Goals:
  - Increase wetland area and quality to achieve population goals for focal species.
  - Collaborate to pursue wetland goals established within other plans including Michigan's North American Waterfowl Management Plan, the Great Lakes Restoration Initiative coastal wetland focus area, the Great Lakes Water Quality Agreement Annexes, and Upper Mississippi River and Great Lakes Region Joint Venture Conservation Strategies.
  - Determine key population limiting factors for black tern and black-crowned night heron.
  - Reverse downward trend and stabilize population of black tern and black-crowned night heron.

Fens

- Goals:
  - Increase or maintain quality of fen habitats.
  - Complete groundwater watershed mapping for fens in southern Lower Peninsula.
  - Maintain known eastern massasauga populations and continue to identify additional populations.

Emerging Diseases **(**Snake fungal disease and white-nose syndrome)

- Goals:
  - Maintain known populations
  - Prevent extirpation
  - Complete an approved bat Habitat Conservation Plan

Partners in Flight (PIF) Species of Concern

PIF is a multi-partner initiative with a mission of keeping common birds common. Planning efforts have provided tools and recommendations to address threats, reduce long-term population declines, and prevent land birds from becoming at risk.

The species of concern list and Bird Conservation Plan for Bird Conservation Region (BCR) 12 (M. Sumner et. al., 2009) identifies priority land bird species and associated habitat types. Of the 39 species in the region identified by PIF, 31 have been documented at CGMTC, as indicated on Table 3.2, and the remaining five species listed on the table are likely to occur. Eight species are highly vulnerable both at the continental and regional scale, and twelve species are of high conservation concern. The remaining species were identified due to having a high proportion of their global population or range within BCR 12 (Matteson et al. 2009). The conservation of these species will be considered as natural resource management activities are planned and implemented.

Preventing further decline of species of concern will work to avoid the potential for additional species to be state or federally listed requiring further regulatory oversite. This is consistent with natural resource management goals as well as with the military mission. General recommendations from the Bird Conservation Plan for BCR12 that are applicable to CGMTC include:

- Identify causal factors and develop strategies to reverse population declines of Belted Kingfisher, Olive-sided Flycatcher, Brown Thrasher, Northern Rough-winged Swallow, Bank Swallow, and Field Sparrow.
- Identify areas appropriate for grassland-shrub management that will not conflict with other grassland priorities. Build public-private partnerships to conserve and restore grassland-shrub habitats in designated areas.
- Determine range of suitable habitats and identify present breeding sites for golden-winged Warbler; verify and refine predictive habitat models for this species.
- Promote structural diversity at the landscape scale, including patches of early-, mid-, and late-successional forest in a range of patch sizes.
- Where possible, maximize the amount of forest interior (and minimize disturbance within it) to benefit area-sensitive and forest-interior species.
- Remove unneeded dams, dikes, or levees to reestablish hydrological connections between riparian and floodplain habitats and provide a greater variety of successional habitats.

M.8 MANAGEMENT RECOMMENDATIONS FOR RECREATION

- Identify recreational uses that may be contributing to environmental and ecological degradation and coordinate with the MDNR to modify practices to reduce impacts.

M.9 BEST MANAGEMENT PRACTICES FOR CLIMATE RESILIENCE

In addition to the *Adaptation Planning for Climate Resilience*, MIARNG has a *Sustainable Energy and Conservation Plan*, which outlines goals for reducing energy and water consumption, reducing greenhouse gas emissions, and provides a plan for energy independence (MIARNG 2014). There are several recommendations and target goals in both documents which provide installation-specific management recommendations for improving resiliency and contributing to changes necessary to cope with climate change.

The primary concerns specifically for natural resources are increased wildfires and the capacity to manage them and the lack of knowledge about which species and communities are most vulnerable to change. Neither of these can be addressed by the MIARNG, MDMVA, or MDNR alone. Regional analysis and responses are necessary to create the resiliency to minimize adverse impacts. In conjunction with staff from Fort Custer (another MIARNG training site), MDNR, US Geological Survey, National Oceanic and Atmospheric Administration, and other cooperating agencies, CGMTC staff are participating in regional planning and cooperative efforts to identify actions that increase resilience. These are important collaborations that will need to continue to protect CGMTC as a resource for military training.

Using the Climate Change Vulnerability Index (CCVI) developed by NatureServe, MNFI's analysis suggests that 17% of terrestrial game species and 61% of terrestrial and aquatic Species of Greatest Conservation Need (SGCN) are vulnerable to climate change (Hoving et al. 2013). As these analyses continue at a regional level, actions should be identified relevant to the species and conditions at CGMTC.

As mentioned in Section 3.5, wildfire is a significant natural hazard on CGMTC in terms of lost training time, public safety, and property damage (MIARNG and LIAA 2016). As forests experience stress and as rainfall patterns and temperatures rise, climate change creates conditions in northern forests that will increase the likelihood of wildfires. Preemptive application of prescribed fire may help reduce the severity of wildfires. An in-house team of wildland fire fighters on CGMTC and robust agreements with cooperating agencies is needed to cope with these changes.

Continued climate changes may present forest managers with challenges to achieving the desired future conditions outlined in state forest management plans. MDNR lists three actions that may be explored when adapting to these changes, including resistance, resilience, and response actions (MDNR 2013a). Actions will need to be taken on a case-by-case basis, as some forests resources may do better with preparation and strengthening their defenses, some forest resources may fare better planning for future projected change, and still others may benefit from a combination of both. Other approaches are possible when considering adaptive management to climate change in the region, and information is constantly being generated to this end.

- Continue regional collaborations with federal, state, local, and non-profit agencies to analyze trends, update models, plan and implement actions.
- As vulnerability assessments are completed, evaluate results for species and communities at CGMTC that might be at risk and identify potential actions.

- Anticipate increased risk of wildfire due to tree mortality (e.g. ladder fuels and increased dead and down woody debris).
- Monitor hydrologic regimes associated with aquatic and riparian habitats.
- Monitor changes in forest health as heat- and water-stressed trees may be more susceptible to forest pests and invasive plant species.
- Identify actions to protect forest resources as climate conditions change.

APPENDIX N

ITAM WORK PLAN

Table N-1 shows the ITAM work plan for Camp Grayling for the Fiscal Year 2020. During ITAM project development, the projects are coordinated to meet the objective of the training mission, environmental sustainability, and promoting natural resources conservation. This coordination is done through the following directors within Camp Grayling: DPOTS, DPW, and ENV. Additional information, including validation status, funding, and project descriptions can be found in Range Complex Master Planning Tool (RCMP-T) in the ITAM work plan section.

Table N-1 FY20 ITAM Work Plan Camp Grayling

Project Number	Project Title / Item
GRY2020001	GIS Admin, Training and Equipment
GRY2020002	ITAM Administration
GRY2020003	GIS Support to Range Control Operations
GRY2020004	GIS for Soldier Support
GRY2020005	GIS data development
GRY2020007	Maintain Bivouac Area in STA 12
GRY2020008	Maintain dust control on 9 miles of trail 3x annually at Camp Grayling
GRY2020009	Maintain Bivouac Area NTA2
GRY2020010	Maintain Bivouac Area NTA18
GRY2020011	Maintain Bivouac Area STA15
GRY2020012	Maintain Firing Points through vegetation control
GRY2020013	Maintain 7 Landing Zones through vegetation control
GRY2020014	Maintain 7 Observation Points through vegetation control
GRY2020015	Repair Maneuver Damage NTA 16
GRY2020016	Repair Maneuver Damage NTA 24
GRY2020017	Reconfigure Bivouac Site NTA 8
GRY2020018	Reconfigure Maneuver Trail and Bivouac site NTA 12
GRY2020019	Repair Maneuver Trail and Bivouac Site NTA 22
GRY2020020	Reconfigure 2 Bivouac Sites in NTA 1
GRY2020021	Reconfigure bivouac sites STA 15
GRY2020022	Reconfigure Bivouac Site in STA14
GRY2020023	Repair 40 Miles of Maneuver Trails
GRY2020024	Ag. Tractor attachment
GRY2020025	GIS support for Range Modification and Construction

The Sustainable Range Awareness (SRA) initiatives, which assist in providing information regarding natural resources suitability and land use to transient troops, is coordinated with Range Control and Environmental. These initiatives include: the Solider Field Card, U.S. Army Europe Soldier Field Card App, and assorted coordination with Range Control staff on Environmental related to troop use and sustainability.

APPENDIX O

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