APPENDIX A
LIST OF CONTACTS

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APPENDIX B
ENVIRONMENTAL PERFORMANCE STANDARDS AS AMENDED ON APRIL 6, 2017

ENVIRONMENTAL PERFORMANCE STANDARDS
APRIL 6, 2017

For Massachusetts National Guard Properties at the Massachusetts Military Reservation

CAMP EDWARDS TRAINING AREA GENERAL PERFORMANCE STANDARDS

None of the following banned military training activities shall be allowed in the Camp Edwards Training Areas:
-Artillery live fire
-Mortar live fire
-Demolition live fire training
-Artillery bag burning
-Non-approved digging, deforestation or vegetation clearing
-Use of' 'CS', riot control, or tear gas for training outside the NBC bunkers
-Use of field latrines with open bottoms
-Vehicle refueling outside designated Combat Service Area and Fuel Pad locations
-Field maintenance of vehicles above operator level

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

- Live weapon fire is prohibited outside of established small arms ranges. Live weapon fire is not allowed on established small arms ranges except in accordance with Environmental Performance Standard 19, other applicable Performance Standards, and a range-specific plan approved through the Environmental Management Commission (EMC).

- Blank ammunition for small arms and simulated munitions may be used in areas outside of the small arms ranges, using only blank ammunition and simulated munitions identified on an approved list of munitions. Joint review and approval for inclusion on the list shall be through by the Environmental & Readiness Center (E&RC) and the EMC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SPECIFIC RESOURCE PERFORMANCE STANDARDS IN THE CAMP EDWARDS TRAINING AREA

1. Groundwater Resources Performance Standards

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

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

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

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

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

1.4 All activities will suppol1 and not interfere with either the Impact Area Groundwater Study and/or the Installation Restoration Program. All activities shall conform to the requirements of Comprehensive Environmental Response, Compensation and Liability Act, the Massachusetts Contingency Plan, and the Safe Drinking Water Act.

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

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

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

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

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

2. Wetlands and Surface Water Performance Standards

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

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

2.3 Wetland area management priorities:

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

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

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

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

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

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

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

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

3. Rare Species Performance Standards

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

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

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

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

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

4. Soil Conservation Performance Standards

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

4.2 Agricultural soil types will be preserved for future use.

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

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

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

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

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

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

5. Vegetation Management Performance Standards

5.1 All planning and management activities impacting vegetation

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

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

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

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

6. Habitat Management Performance Standards

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

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

6.2 The adaptive ecosystem management program will include:

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

7. Wildlife Management Performance Standards

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

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

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

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

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

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

8. Air Quality Performance Standard

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

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

9. Noise Management Performance Standards

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

10. Pest Management Performance Standards

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

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

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

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

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

11. Fire Management Performance Standards

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

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

11 .3 Pre-suppression activities will include strategic firebreaks and other management of vegetation in high risk and high-incidence areas. The Integrated Natural Resource Management Plan and Fire Management Plan will be consulted for proposed actions.

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

12. Stormwater Management Performance Standards

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

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

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

13. Wastewater Performance Standards

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

14. Solid Waste Performance Standards

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

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

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

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

15. Hazardous Materials Performance Standards

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

15 .2 No permanent disposal of hazardous wastes within the Groundwater protection Policy area/Camp Edwards field training areas will be permitted.

15.3 Fuel Management

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

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

15 .3.3 No storage or movement of fuels for supporting field activities, other than in vehicle fuel tanks, will be permitted except in approved containers no greater than five gallons in capacity.

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

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

15.4 Non-fuel Hazardous Material Storage

15.4 .1 No storage above those quantities necessary to support field training activities will be allowed within the Camp Edwards Training Area except where necessary to meet regulatory requirements, and where provided with secondary containment.

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

16. Hazardous Waste Performance Standards

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

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

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

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

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

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

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

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

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

17. Vehicle Performance Standards

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

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

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

18. General Use and Access Performance Standards

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

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

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

18.3. Siting and Design Performance Standards

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

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

19. Range Performance Standards

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

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

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

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

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

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

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

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

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

APPENDIX C
SMALL ARMS RANGE AND SOLDIER VALIDATION LANE INFORMATION

Operations Maintenance and Monitoring Activities

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
TANGO RANGE
TY 2023

Date	Activity
2 Oct 22	Pre/Post Firing Inspection
12 Oct 22	Soil Sampling
13, 15 Oct 22	Pre/Post Firing Inspection
21 Oct 22	Pre/Post Firing Inspection
28, 29 Oct 22	Pre/Post Firing Inspection
3, 6 Nov 22	Pre/Post Firing Inspection
4 Nov 22	EMC/E&RC Inspection
6 Dec 22	Monthly Inspection
17 Jan 23	Monthly Inspection
23 Feb 23	Monthly Inspection
22 Mar 23	Monthly Inspection/Maintenance: Routine Berm Maintenance
23 Mar 23	Pre/Post Firing Inspection
24 Mar 23	EMC/E&RC Inspection
25 Mar 23	Pre/Post Firing Inspection
31 Mar 23	Pre/Post Firing Inspection
21 Apr 23	Pre/Post Firing Inspection
21 Apr 23	EMC/E&RC Inspection
28 Apr 23	Pre/Post Firing Inspection
5 May 23	Pre/Post Firing Inspection
19 May 23	Pre/Post Firing Inspection
26 May 23	Pre/Post Firing Inspection
1, 2 Jun 23	Pre/Post Firing Inspection
3 Jun 23	Pre/Post Firing Inspection
4 Jun 23	Pre/Post Firing Inspection
21, 22 Jun 23	Pre/Post Firing Inspection
23, 24 Jun 23	Pre/Post Firing Inspection
26, 27 Jun 23	Pre/Post Firing Inspection
8 Jul 23	Pre/Post Firing Inspection
20 Jul 23	EMC/E&RC Inspection
5 Aug 23	Pre/Post Firing Inspection
7 Sep 23	EMC/E&RC Backstop Berm Inspection
16 Sep 23	Pre/Post Firing Inspection
22 Sep 23	Pre/Post Firing Inspection
29 Sep 23	Pre/Post Firing Inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
SIERRA RANGE
TY 2023

Date	Activity
02 Oct 22	Pre/Post Firing Inspection
11 Oct 22	Soil, Lysimeter and Groundwater Sampling
13, 16 Oct 22	Pre/Post Firing Inspection
21, 22 Oct 22	Pre/Post Firing Inspection
29 Oct 22	Pre/Post Firing Inspection
30 Oct 22	Pre/Post Firing Inspection
3, 6 Nov 22	Pre/Post Firing Inspection
4 Nov 22	EMC/E&RC Inspection
6 Dec 22	Monthly Inspection
17 Jan 23	Monthly Inspection
23 Feb 23	Monthly Inspection
3 Mar 23	Pre/Post Firing Inspection
10 Mar 23	Pre/Post Firing Inspection
22 Mar 23	Inspection/Maintenance: Routine Berm Maintenance
23 Mar 23	Pre/Post Firing Inspection
24 Mar 23	EMC/E&RC Inspection
26 Mar 23	Pre/Post Firing Inspection
30 Mar 23	Pre/Post Firing Inspection
31 Mar 23	Pre/Post Firing Inspection
7 Apr 23	Pre/Post Firing Inspection
28 Apr 23	Pre/Post Firing Inspection
5, 6 May 23	Pre/Post Firing Inspection
19 May 23	Pre/Post Firing Inspection
26 May 23	Pre/Post Firing Inspection
3 Jun 23	Pre/Post Firing Inspection
2 Jun 23	Pre/Post Firing Inspection
5 Jun 23	Pre/Post Firing Inspection
21, 22 Jun 23	Pre/Post Firing Inspection
23, 27 Jun 23	Pre/Post Firing Inspection
26 Jun 23	Pre/Post Firing Inspection
7 Jul 23	Pre/Post Firing Inspection
8 Jul 23	Pre/Post Firing Inspection
20 Jul 23	EMC/E&RC Inspection
4 Aug 23	Pre/Post Firing Inspection
7 Sep 23	EMC/E&RC Backstop Berm Inspection
15 Sep 23	Pre/Post Firing Inspection
22, 23 Sep 23	Pre/Post Firing Inspection
29 Sep 23	Pre/Post Firing Inspection
30 Sep 23	Pre/Post Firing Inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
INDIA RANGE
TY 2023

Date	Activity
12 Oct 22	Lysimeter Sampling
14 Oct 22	Soil Sampling
28 Oct 22	Pre/Post Firing Inspection
29 Oct 22	Pre/Post Firing Inspection
30 Oct 22	Pre/Post Firing Inspection
15 Nov 22	Monthly Inspection
6 Dec 22	Monthly Inspection
17 Jan 23	Monthly Inspection
15 Feb 23	Monthly Inspection
31 Mar 23	Pre/Post Firing Inspection
21, 22 Apr 23	Pre/Post Firing Inspection
7 May 23	Pre/Post Firing Inspection
1 Jun 23	Pre/Post Firing Inspection
21, 25 Jun 23	Pre/Post Firing Inspection
20 Jul 23	EMC/E&RC Inspection
7 Sep 23	EMC/E&RC Back Stop Berm Inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
ECHO RANGE
TY 2023

Date	Activity
13 Oct 22	Soil Sampling
14 Oct 22	Groundwater Sampling
14 Oct 22	Pre/Post Firing Inspection
21, 22 Oct 22	Pre/Post Firing Inspection
29 Oct 22	Pre/Post Firing Inspection
4, 5 Nov 22	Pre/Post Firing Inspection
4 Nov 22	EMC/E&RC Inspection
6 Nov 22	Pre/Post Firing Inspection
6 Dec 22	Monthly Inspection
17 Jan 23	Monthly Inspection
3, 4 Feb 23	Pre/Post Firing Inspection
23 Feb 23	Monthly Inspection
3 Mar 23	Pre/Post Firing Inspection
23 Mar 23	Maintenance: Routine
24 Mar 23	EMC/E&RC Inspection
31 Mar 23	Pre/Post Firing Inspection
13, 15 Apr 23	Pre/Post Firing Inspection
1 Apr 23	Pre/Post Firing Inspection
21 Apr 23	EMC/E&RC Inspection
22 Apr 23	Pre/Post Firing Inspection
12 May 23	Pre/Post Firing Inspection
19 May 23	Pre/Post Firing Inspection
2 Jun 23	Pre/Post Firing Inspection
3 Jun 23	Pre/Post Firing Inspection
4 Jun 23	Pre/Post Firing Inspection
21 Jun 23	Pre/Post Firing Inspection
20 Jul 23	EMC/E&RC Inspection
4 Aug 23	Pre/Post Firing Inspection
11 Aug 23	Pre/Post Firing Inspection
7 Sep 23	EMC/E&RC Backstop Berm Inspection
15 Sep 23	Pre/Post Firing Inspection
23 Sep 23	Pre/Post Firing Inspection
29 Sep 23	Pre/Post Firing Inspection

OPERATIONS, MAINTENANCE & MONITORING ACTIVITIES
LIMA RANGE
TY 2023

Date	Activity
13 Oct 22	Lysimeter Sampling
14 Oct 22	Soil Sampling
22 Oct 22	Pre/Post Firing Inspection
4 Nov 22	EMC/E&RC Inspection
15 Nov 22	Monthly Inspection
13 Dec 22	Monthly Inspection
10 Jan 23	Monthly Inspection
7 Feb 23	Monthly Inspection
21 Mar 23	Monthly Inspection
11 Apr 23	Monthly Inspection
5 May 23	Pre/Post Firing Inspection
22 Jun 23	Monthly Inspection
19 Jul 23	Monthly Inspection
16 Aug 23	Monthly Inspection
12 Sep 23	Monthly Inspection

Lead Ammunition Use

Echo Range

LEAD AMMUNITION USE HISTORY ECHO RANGE				
Training Year	**.40 Cal Lead**	**12 Gauge Buckshot**	**9 mm Lead**	**Total**
TY 2023	0	30[1]	80,996	81,026
TY 2022	0	0	78,021	78,021
TY 2021	3,476	0	51,438	54,914
TY 2020	0	0	14,308	14,308
TY 2019	0	0	4,350	4,350
TY 2018	0	0	0	0
TY 2017	0	0	0	0
TY 2016	0	0	0	0
TY 2015	0	0	347[2]	347
TY 2008 - TY 2014	0	0	0	0
TY 2007	0	0	100[2]	100
TOTAL	**3,476**	**30**	**229,560**	**233,066**

Notes: Echo Range became operational in Fall 2019.
[1] During TY 2023, 12 Gauge Buckshot was used on Echo Range as part of an approved, non-standard training event.
[2] Firing at Echo Range in TY 2007 and TY 2015 were part of tests for reintroducing lead ammunition.

LEAD AMMUNITION USE HISTORY CUMULATIVE							
Training Year	**Echo Range**	**Sierra Range**	**KD Range**	**Tango Range**	**Juliet[1] Range**	**Kilo[1] Range**	**Total**
TY 2023	81,026	0	0	0	0	0	81,026
TY 2022	78,021	0	0	0	0	0	78,021
TY 2021	54,914	0	0	0	0	0	54,914
TY 2020	14,308	0	0	0	7,690	84,032	106,030
TY 2019	4,350	0	0	0	30,089	81,179	115,618
TY 2018	0	0	0	0	36,583	119,342	155,925
TY 2017	0	0	0	16,495	51,897	115,662	184,054
TY 2016	0	0	0	4,200	61,052	49,638	114,890
TY 2015	347[2]	0	1,993[4]	6,960	65,266	69,973	144,539
TY 2014	0	0	0	3,220	36,937	80,356	120,513
TY 2013	0	0	0	9,950	40,196	73,742	123,888
TY 2012	0	0	0	12,117	31,026	59,912	103,055
TY 2011	0	2,120[3]	0	37,122	63,541	125,154	227,937
TY 2010	0	0	0	90,328	34,371	60,362	185,061
TY 2009	0	0	0	137,362	16,262	29,783	183,407
TY 2008	0	0	0	17,725	0	0	17,725
TY 2007	100[2]	0	0	8,547	0	0	8,647
TOTAL	**233,066**	**2,120**	**1,993**	**344,026**	**474,910**	**949,135**	**2,005,250**

Notes: [1] Juliet and Kilo ranges are currently operationally inactive ranges; their STAPP systems were dismantled in Fall 2020.
[2] Firing at Echo Range in TY 2007 and TY 2015 were part of tests for reintroducing lead ammunition.
[3] Firing at Sierra Range in TY 2011 was part of a Line of Sight Analysis test.
[4] Firing at KD Range in TY 2015 was part of a planning-level noise assessment.

Copper Ammunition Use

Sierra, India, and Tango Ranges

COPPER AMMUNITION USE HISTORY

Training Year	Sierra Range 5.56 Copper	India Range 5.56 Copper	India Range 7.62 Copper	Tango Range[1] 5.56 Copper	ISBC Range 5.56 Copper	Echo Range 5.56 Copper	Total
TY 2023	212,298	26,700	0	80,726	2,620[2]	0	322,344
TY 2022	251,672	41,041	0	56,946	14,098[2]	16,150[3]	379,907
TY 2021	221,756	73,400	0	0	0	19,975[3]	315,131
TY 2020	131,274	90,849	0	0	0	0	222,123
TY 2019	98,426	71,098	0	0	0	0	169,524
TY 2018	98,393	105,143	0	0	0	0	203,536
TY 2017	95,905	105,099	4,793	0	0	0	205,797
TY 2016	80,747	60,571	0	0	0	0	141,318
TY 2015	66,086	12,947	0	0	0	0	79,033
TY 2014	46,804	27,872	0	0	0	0	74,676
TY 2013	34,493	10,918	0	0	0	0	45,411
TY 2012	34,359	6,601	0	0	0	0	40,960
TOTAL	**1372213**	**632,239**	**4,793**	**137,672**	**16,718**	**36,125**	**2,199,760**

Note: [1]Tango Range became operationally active for copper ammunition in TY 2022.

[2]Copper ammunition was used on the operationally inactive ISBC Range for two approved, non-standard training events during TY 2022 and an approved, non-standard training event in TY 2023.

[3]Copper ammunition was used on Echo Range during two non-standard training events in TY 2021 and two approved, non-standard training events in TY 2022.

Small Arms Range Sampling Reports

Soil Sampling Results

Fall 2023

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
SSERNG001_Oct23-10022023	SW6010D	10/27/2023 0:02	280-182584-9	Antimony	1.4	U	0.71	1.4	1.9	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW6010D	10/27/2023 0:02	280-182584-9	Calcium	530		14	48	97	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW9056A	10/25/2023 1:58	280-182584-9	Chloride	30	U	12	30	30	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW6010D	10/27/2023 0:02	280-182584-9	Copper	3.9	J	0.21	0.77	4.8	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW6010D	10/27/2023 0:02	280-182584-9	Iron	8300		8	19	77	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW6010D	10/27/2023 0:02	280-182584-9	Lead	13		0.3	0.77	0.87	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW6010D	10/27/2023 0:02	280-182584-9	Magnesium	680		7.6	19	29	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-9	pH adj. to 25 deg C	6	HF	0.1	0.1	0.1	pH units	pH units
SSERNG001_Oct23-10022023	SW6010D	10/27/2023 0:02	280-182584-9	Phosphorus	260		1.6	5.8	48	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW6010D	10/27/2023 0:02	280-182584-9	Potassium	590		40	150	290	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW6010D	10/27/2023 0:02	280-182584-9	Sodium	84	J	28	97	480	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW9056A	10/27/2023 13:11	280-182584-9	Sulfate	12	J	9.2	25	50	mg/kg	mg/kg
SSERNG001_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-9	Temperature	19.2	HF	1	1	1	deg C	deg C
SSERNG001_RP1_Oct23-10022023	SW6010D	10/27/2023 0:30	280-182584-15	Antimony	1.2	U	0.57	1.2	1.6	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW6010D	10/27/2023 0:30	280-182584-15	Calcium	550		11	39	78	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW9056A	10/25/2023 5:57	280-182584-15	Chloride	12	J	12	30	30	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW6010D	10/27/2023 0:30	280-182584-15	Copper	6.2		0.17	0.62	3.9	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW6010D	10/27/2023 0:30	280-182584-15	Iron	9800		6.4	16	62	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW6010D	10/27/2023 0:30	280-182584-15	Lead	13		0.24	0.62	0.7	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW6010D	10/27/2023 0:30	280-182584-15	Magnesium	670		6.2	16	23	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-15	pH adj. to 25 deg C	5.9	HF	0.1	0.1	0.1	pH units	pH units
SSERNG001_RP1_Oct23-10022023	SW6010D	10/27/2023 0:30	280-182584-15	Phosphorus	270		1.3	4.7	39	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW6010D	10/27/2023 0:30	280-182584-15	Potassium	600		32	120	230	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW6010D	10/27/2023 0:30	280-182584-15	Sodium	78	J	22	78	390	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW9056A	10/27/2023 15:15	280-182584-15	Sulfate	13	JM	9.2	25	50	mg/kg	mg/kg
SSERNG001_RP1_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-15	Temperature	19.6	HF	1	1	1	deg C	deg C
SSERNG001_RP2_Oct23-10022023	SW6010D	10/27/2023 0:35	280-182584-16	Antimony	1.1	U	0.55	1.1	1.5	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW6010D	10/27/2023 0:35	280-182584-16	Calcium	540		11	38	75	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW9056A	10/25/2023 6:14	280-182584-16	Chloride	14	J	11	30	30	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW6010D	10/27/2023 0:35	280-182584-16	Copper	8.4		0.16	0.6	3.8	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW6010D	10/27/2023 0:35	280-182584-16	Iron	8300		6.2	15	60	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW6010D	10/27/2023 0:35	280-182584-16	Lead	13		0.23	0.6	0.68	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW6010D	10/27/2023 0:35	280-182584-16	Magnesium	670		5.9	15	23	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW9045D	10/16/2023 11:16	280-182584-16	pH adj. to 25 deg C	6.1	HF	0.1	0.1	0.1	pH units	pH units
SSERNG001_RP2_Oct23-10022023	SW6010D	10/27/2023 0:35	280-182584-16	Phosphorus	270		1.2	4.5	38	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW6010D	10/27/2023 0:35	280-182584-16	Potassium	580		31	120	230	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW6010D	10/27/2023 0:35	280-182584-16	Sodium	74	J	22	75	380	mg/kg	mg/kg

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
SSERNG001_RP2_Oct23-10022023	SW9056A	10/27/2023 15:27	280-182584-16	Sulfate	11	J	9.1	25	50	mg/kg	mg/kg
SSERNG001_RP2_Oct23-10022023	SW9045D	10/16/2023 11:16	280-182584-16	Temperature	20.6	HF	1	1	1	deg C	deg C
SSERNG002_Oct23-10022023	SW6010D	10/27/2023 0:07	280-182584-10	Antimony	1.3	U	0.62	1.3	1.7	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW6010D	10/27/2023 0:07	280-182584-10	Calcium	530		12	42	84	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW9056A	10/25/2023 2:15	280-182584-10	Chloride	12	J	11	30	30	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW6010D	10/27/2023 0:07	280-182584-10	Copper	4.3		0.18	0.67	4.2	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW6010D	10/27/2023 0:07	280-182584-10	Iron	8200		7	17	67	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW6010D	10/27/2023 0:07	280-182584-10	Lead	12		0.26	0.67	0.76	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW6010D	10/27/2023 0:07	280-182584-10	Magnesium	650		6.7	17	25	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-10	pH adj. to 25 deg C	6	HF	0.1	0.1	0.1	pH units	pH units
SSERNG002_Oct23-10022023	SW6010D	10/27/2023 0:07	280-182584-10	Phosphorus	270		1.4	5.1	42	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW6010D	10/27/2023 0:07	280-182584-10	Potassium	600		35	130	250	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW6010D	10/27/2023 0:07	280-182584-10	Sodium	82	J	24	84	420	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW9056A	10/27/2023 13:22	280-182584-10	Sulfate	11	JM	9.1	25	50	mg/kg	mg/kg
SSERNG002_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-10	Temperature	20.4	HF	1	1	1	deg C	deg C
SSERNG003_Oct23-10022023	SW6010D	10/27/2023 0:12	280-182584-11	Antimony	1.5	U	0.72	1.5	2	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW6010D	10/27/2023 0:12	280-182584-11	Calcium	540		14	49	98	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW9056A	10/25/2023 2:32	280-182584-11	Chloride	30	U	11	30	30	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW6010D	10/27/2023 0:12	280-182584-11	Copper	4.6	J	0.21	0.78	4.9	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW6010D	10/27/2023 0:12	280-182584-11	Iron	8200		8.1	20	78	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW6010D	10/27/2023 0:12	280-182584-11	Lead	12		0.3	0.78	0.88	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW6010D	10/27/2023 0:12	280-182584-11	Magnesium	710		7.8	20	29	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-11	pH adj. to 25 deg C	6.1	HF	0.1	0.1	0.1	pH units	pH units
SSERNG003_Oct23-10022023	SW6010D	10/27/2023 0:12	280-182584-11	Phosphorus	280		1.6	5.9	49	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW6010D	10/27/2023 0:12	280-182584-11	Potassium	620		40	160	290	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW6010D	10/27/2023 0:12	280-182584-11	Sodium	84	J	28	98	490	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW9056A	10/27/2023 13:34	280-182584-11	Sulfate	11	J	9.1	25	50	mg/kg	mg/kg
SSERNG003_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-11	Temperature	19.5	HF	1	1	1	deg C	deg C
SSERNG004_Oct23-10022023	SW6010D	10/27/2023 0:16	280-182584-12	Antimony	1.5	U	0.71	1.5	1.9	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW6010D	10/27/2023 0:16	280-182584-12	Calcium	460		14	49	97	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW9056A	10/25/2023 2:49	280-182584-12	Chloride	30	U	11	30	30	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW6010D	10/27/2023 0:16	280-182584-12	Copper	5.1		0.21	0.78	4.9	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW6010D	10/27/2023 0:16	280-182584-12	Iron	10000		8	19	78	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW6010D	10/27/2023 0:16	280-182584-12	Lead	16		0.3	0.78	0.87	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW6010D	10/27/2023 0:16	280-182584-12	Magnesium	730		7.7	19	29	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-12	pH adj. to 25 deg C	6.1	HF	0.1	0.1	0.1	pH units	pH units
SSERNG004_Oct23-10022023	SW6010D	10/27/2023 0:16	280-182584-12	Phosphorus	230		1.6	5.8	49	mg/kg	mg/kg

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
SSERNG004_Oct23-10022023	SW6010D	10/27/2023 0:16	280-182584-12	Potassium	630		40	160	290	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW6010D	10/27/2023 0:16	280-182584-12	Sodium	88	J	28	97	490	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW9056A	10/27/2023 13:45	280-182584-12	Sulfate	11	J	9.1	25	50	mg/kg	mg/kg
SSERNG004_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-12	Temperature	20.8	HF	1	1	1	deg C	deg C
SSERNG005_Oct23-10022023	SW6010D	10/27/2023 0:21	280-182584-13	Antimony	1.1	U	0.54	1.1	1.5	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW6010D	10/27/2023 0:21	280-182584-13	Calcium	560		10	37	74	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW9056A	10/25/2023 3:06	280-182584-13	Chloride	12	J	11	30	30	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW6010D	10/27/2023 0:21	280-182584-13	Copper	4.5		0.16	0.59	3.7	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW6010D	10/27/2023 0:21	280-182584-13	Iron	8200		6.1	15	59	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW6010D	10/27/2023 0:21	280-182584-13	Lead	14		0.23	0.59	0.67	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW6010D	10/27/2023 0:21	280-182584-13	Magnesium	700		5.9	15	22	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-13	pH adj. to 25 deg C	6.1	HF	0.1	0.1	0.1	pH units	pH units
SSERNG005_Oct23-10022023	SW6010D	10/27/2023 0:21	280-182584-13	Phosphorus	280		1.2	4.5	37	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW6010D	10/27/2023 0:21	280-182584-13	Potassium	610		30	120	220	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW6010D	10/27/2023 0:21	280-182584-13	Sodium	75	J	21	74	370	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW9056A	10/27/2023 13:56	280-182584-13	Sulfate	9.5	J	9.1	25	50	mg/kg	mg/kg
SSERNG005_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-13	Temperature	20.2	HF	1	1	1	deg C	deg C
SSERNG006_Oct23-10022023	SW6010D	10/27/2023 0:26	280-182584-14	Antimony	1.3	U	0.62	1.3	1.7	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW6010D	10/27/2023 0:26	280-182584-14	Calcium	520		12	42	84	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW9056A	10/25/2023 4:15	280-182584-14	Chloride	30	U	12	30	30	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW6010D	10/27/2023 0:26	280-182584-14	Copper	11		0.18	0.67	4.2	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW6010D	10/27/2023 0:26	280-182584-14	Iron	8600		7	17	67	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW6010D	10/27/2023 0:26	280-182584-14	Lead	28		0.26	0.67	0.76	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW6010D	10/27/2023 0:26	280-182584-14	Magnesium	730		6.7	17	25	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-14	pH adj. to 25 deg C	5.9	HF	0.1	0.1	0.1	pH units	pH units
SSERNG006_Oct23-10022023	SW6010D	10/27/2023 0:26	280-182584-14	Phosphorus	250		1.4	5.1	42	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW6010D	10/27/2023 0:26	280-182584-14	Potassium	590		35	130	250	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW6010D	10/27/2023 0:26	280-182584-14	Sodium	83	J	24	84	420	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW9056A	10/27/2023 14:08	280-182584-14	Sulfate	9.2	JM	9.2	25	50	mg/kg	mg/kg
SSERNG006_Oct23-10022023	SW9045D	10/16/2023 11:14	280-182584-14	Temperature	19.6	HF	1	1	1	deg C	deg C
SSIRNG001_Oct23-10032023	SW6010D	10/26/2023 23:58	280-182584-8	Antimony	1.2	U	0.58	1.2	1.6	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW6010D	10/26/2023 23:58	280-182584-8	Calcium	920		11	40	80	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW9056A	10/25/2023 1:41	280-182584-8	Chloride	14	J	12	30	30	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW6010D	10/26/2023 23:58	280-182584-8	Copper	35		0.17	0.64	4	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW6010D	10/26/2023 23:58	280-182584-8	Iron	10000		6.6	16	64	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW6010D	10/26/2023 23:58	280-182584-8	Lead	67		0.25	0.64	0.72	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW6010D	10/26/2023 23:58	280-182584-8	Magnesium	990		6.3	16	24	mg/kg	mg/kg

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
SSIRNG001_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-8	pH adj. to 25 deg C	6.2	HF	0.1	0.1	0.1	pH units	pH units
SSIRNG001_Oct23-10032023	SW6010D	10/26/2023 23:58	280-182584-8	Phosphorus	480		1.3	4.8	40	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW6010D	10/26/2023 23:58	280-182584-8	Potassium	810		33	130	240	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW6010D	10/26/2023 23:58	280-182584-8	Sodium	86	J	23	80	400	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW9056A	10/27/2023 13:00	280-182584-8	Sulfate	9.6	J	9.2	25	50	mg/kg	mg/kg
SSIRNG001_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-8	Temperature	20.6	HF	1	1	1	deg C	deg C
SSLRNG001_Oct23-10032023	SW6010D	10/26/2023 23:35	280-182584-7	Antimony	1.2	U	0.59	1.2	1.6	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW6010D	10/26/2023 23:35	280-182584-7	Calcium	410		11	40	81	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW9056A	10/25/2023 0:50	280-182584-7	Chloride	17	J	12	30	30	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW6010D	10/26/2023 23:35	280-182584-7	Copper	8.3		0.17	0.64	4	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW6010D	10/26/2023 23:35	280-182584-7	Iron	13000		6.7	16	64	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW6010D	10/26/2023 23:35	280-182584-7	Lead	17		0.25	0.64	0.73	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW6010D	10/26/2023 23:35	280-182584-7	Magnesium	1300		6.4	16	24	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-7	pH adj. to 25 deg C	6.2	HF	0.1	0.1	0.1	pH units	pH units
SSLRNG001_Oct23-10032023	SW6010D	10/26/2023 23:35	280-182584-7	Phosphorus	190		1.3	4.8	40	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW6010D	10/26/2023 23:35	280-182584-7	Potassium	930		33	130	240	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW6010D	10/26/2023 23:35	280-182584-7	Sodium	94	J	23	81	400	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW9056A	10/27/2023 12:26	280-182584-7	Sulfate	18	JM	9.2	25	50	mg/kg	mg/kg
SSLRNG001_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-7	Temperature	19.3	HF	1	1	1	deg C	deg C
SSSRNG001_Oct23-10032023	SW6010D	10/26/2023 23:17	280-182584-1	Antimony	2.5		0.54	1.1	1.5	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW6010D	10/26/2023 23:17	280-182584-1	Calcium	890		10	37	74	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW9056A	10/24/2023 23:08	280-182584-1	Chloride	17	J	11	30	30	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW6010D	10/26/2023 23:17	280-182584-1	Copper	38		0.16	0.59	3.7	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW6010D	10/26/2023 23:17	280-182584-1	Iron	8300		6.1	15	59	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW6010D	10/26/2023 23:17	280-182584-1	Lead	19		0.23	0.59	0.66	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW6010D	10/26/2023 23:17	280-182584-1	Magnesium	950		5.8	15	22	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-1	pH adj. to 25 deg C	7.3	HF	0.1	0.1	0.1	pH units	pH units
SSSRNG001_Oct23-10032023	SW6010D	10/26/2023 23:17	280-182584-1	Phosphorus	290		1.2	4.4	37	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW6010D	10/26/2023 23:17	280-182584-1	Potassium	680		30	120	220	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW6010D	10/26/2023 23:17	280-182584-1	Sodium	70	J	21	74	370	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW9056A	10/27/2023 11:18	280-182584-1	Sulfate	11	JM	9.1	25	50	mg/kg	mg/kg
SSSRNG001_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-1	Temperature	21.1	HF	1	1	1	deg C	deg C
SSSRNG002_OCT23-10102023	SW6010D	11/1/2023 20:59	280-183152-4	Antimony	1.2	U	0.58	1.2	1.6	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW6010D	11/1/2023 20:59	280-183152-4	Calcium	590	J1	11	39	78	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW9056A	11/16/2023 13:10	280-183152-4	Chloride	14	JH	11	30	30	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW6010D	11/1/2023 20:59	280-183152-4	Copper	45	J1	0.17	0.63	3.9	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW6010D	11/1/2023 20:59	280-183152-4	Iron	11000	J1	6.5	16	63	mg/kg	mg/kg

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
SSSRNG002_OCT23-10102023	SW6010D	11/1/2023 20:59	280-183152-4	Lead	9.6		0.24	0.63	0.71	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW6010D	11/1/2023 20:59	280-183152-4	Magnesium	960	J1	6.2	16	24	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW9045D	10/26/2023 16:05	280-183152-4	pH adj. to 25 deg C	5.9	HF	0.1	0.1	0.1	pH units	pH units
SSSRNG002_OCT23-10102023	SW6010D	11/9/2023 12:19	280-183152-4	Phosphorus	240	J1	1.2	4.4	37	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW6010D	11/9/2023 12:19	280-183152-4	Potassium	800		30	120	220	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW6010D	11/1/2023 20:59	280-183152-4	Sodium	61	J	23	78	390	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW9056A	11/16/2023 13:10	280-183152-4	Sulfate	14	JH	9.1	25	50	mg/kg	mg/kg
SSSRNG002_OCT23-10102023	SW9045D	10/26/2023 16:05	280-183152-4	Temperature	22	HF	1	1	1	deg C	deg C
SSSRNG003_OCT23-10102023	SW6010D	11/1/2023 21:36	280-183152-5	Antimony	1.2	U	0.59	1.2	1.6	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW6010D	11/1/2023 21:36	280-183152-5	Calcium	790		11	40	80	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW9056A	11/16/2023 13:27	280-183152-5	Chloride	30	UH	12	30	30	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW6010D	11/1/2023 21:36	280-183152-5	Copper	90		0.17	0.64	4	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW6010D	11/1/2023 21:36	280-183152-5	Iron	9500		6.6	16	64	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW6010D	11/1/2023 21:36	280-183152-5	Lead	21		0.25	0.64	0.72	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW6010D	11/1/2023 21:36	280-183152-5	Magnesium	830		6.4	16	24	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW9045D	10/26/2023 16:05	280-183152-5	pH adj. to 25 deg C	6.5	HF	0.1	0.1	0.1	pH units	pH units
SSSRNG003_OCT23-10102023	SW6010D	11/9/2023 12:54	280-183152-5	Phosphorus	270		1.4	5.3	44	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW6010D	11/9/2023 12:54	280-183152-5	Potassium	730		36	140	260	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW6010D	11/1/2023 21:36	280-183152-5	Sodium	64	J	23	80	400	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW9056A	11/16/2023 13:27	280-183152-5	Sulfate	25	UH	9.2	25	50	mg/kg	mg/kg
SSSRNG003_OCT23-10102023	SW9045D	10/26/2023 16:05	280-183152-5	Temperature	21.8	HF	1	1	1	deg C	deg C
SSSRNG004_OCT23-10102023	SW6010D	11/1/2023 21:45	280-183152-6	Antimony	1.2	U	0.57	1.2	1.6	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW6010D	11/1/2023 21:45	280-183152-6	Calcium	1000		11	39	78	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW9056A	11/16/2023 12:53	280-183152-6	Chloride	11	JH	11	30	30	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW6010D	11/1/2023 21:45	280-183152-6	Copper	7.9		0.17	0.63	3.9	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW6010D	11/1/2023 21:45	280-183152-6	Iron	12000		6.5	16	63	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW6010D	11/1/2023 21:45	280-183152-6	Lead	33		0.24	0.63	0.7	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW6010D	11/1/2023 21:45	280-183152-6	Magnesium	1100		6.2	16	23	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW9045D	10/26/2023 16:05	280-183152-6	pH adj. to 25 deg C	6.3	HF	0.1	0.1	0.1	pH units	pH units
SSSRNG004_OCT23-10102023	SW6010D	11/9/2023 13:02	280-183152-6	Phosphorus	250		1.3	4.7	40	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW6010D	11/9/2023 13:02	280-183152-6	Potassium	820		32	130	240	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW6010D	11/1/2023 21:45	280-183152-6	Sodium	79	J	23	78	390	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW9056A	11/16/2023 12:53	280-183152-6	Sulfate	25	UH	9.1	25	50	mg/kg	mg/kg
SSSRNG004_OCT23-10102023	SW9045D	10/26/2023 16:05	280-183152-6	Temperature	21.7	HF	1	1	1	deg C	deg C
SSTRNG001_Oct23-10032023	SW6010D	10/26/2023 23:26	280-182584-5	Antimony	0.68	J	0.5	1	1.4	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW6010D	10/26/2023 23:26	280-182584-5	Calcium	1200		9.5	34	68	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW9056A	10/25/2023 0:16	280-182584-5	Chloride	16	J	12	30	30	mg/kg	mg/kg

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
SSTRNG001_Oct23-10032023	SW6010D	10/26/2023 23:26	280-182584-5	Copper	11		0.15	0.54	3.4	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW6010D	10/26/2023 23:26	280-182584-5	Iron	13000		5.6	14	54	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW6010D	10/26/2023 23:26	280-182584-5	Lead	26		0.21	0.54	0.61	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW6010D	10/26/2023 23:26	280-182584-5	Magnesium	1500		5.4	14	20	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-5	pH adj. to 25 deg C	6.5	HF	0.1	0.1	0.1	pH units	pH units
SSTRNG001_Oct23-10032023	SW6010D	10/26/2023 23:26	280-182584-5	Phosphorus	400		1.1	4.1	34	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW6010D	10/26/2023 23:26	280-182584-5	Potassium	1100		28	110	200	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW6010D	10/26/2023 23:26	280-182584-5	Sodium	88	J	19	68	340	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW9056A	10/27/2023 12:03	280-182584-5	Sulfate	19	JM	9.2	25	50	mg/kg	mg/kg
SSTRNG001_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-5	Temperature	19.5	HF	1	1	1	deg C	deg C
SSTRNG001_RP1_Oct23-10032023	SW6010D	10/27/2023 0:40	280-182584-17	Antimony	0.77	J	0.6	1.2	1.6	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW6010D	10/27/2023 0:40	280-182584-17	Calcium	1300		12	41	82	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW9056A	10/25/2023 6:31	280-182584-17	Chloride	17	J	12	30	30	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW6010D	10/27/2023 0:40	280-182584-17	Copper	11		0.18	0.65	4.1	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW6010D	10/27/2023 0:40	280-182584-17	Iron	13000		6.8	16	65	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW6010D	10/27/2023 0:40	280-182584-17	Lead	26		0.25	0.65	0.74	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW6010D	10/27/2023 0:40	280-182584-17	Magnesium	1600		6.5	16	25	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW9045D	10/16/2023 11:16	280-182584-17	pH adj. to 25 deg C	6.2	HF	0.1	0.1	0.1	pH units	pH units
SSTRNG001_RP1_Oct23-10032023	SW6010D	10/27/2023 0:40	280-182584-17	Phosphorus	410		1.3	4.9	41	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW6010D	10/27/2023 0:40	280-182584-17	Potassium	1200		33	130	250	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW6010D	10/27/2023 0:40	280-182584-17	Sodium	83	J	24	82	410	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW9056A	10/27/2023 15:38	280-182584-17	Sulfate	19	JM	9.2	25	50	mg/kg	mg/kg
SSTRNG001_RP1_Oct23-10032023	SW9045D	10/16/2023 11:16	280-182584-17	Temperature	17.8	HF	1	1	1	deg C	deg C
SSTRNG001_RP2_Oct23-10032023	SW6010D	10/27/2023 1:02	280-182584-18	Antimony	0.83	J	0.61	1.3	1.7	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW6010D	10/27/2023 1:02	280-182584-18	Calcium	1200		12	42	83	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW9056A	10/25/2023 6:48	280-182584-18	Chloride	17	J	11	30	30	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW6010D	10/27/2023 1:02	280-182584-18	Copper	11		0.18	0.67	4.2	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW6010D	10/27/2023 1:02	280-182584-18	Iron	14000	J1	6.9	17	67	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW6010D	10/27/2023 1:02	280-182584-18	Lead	27		0.26	0.67	0.75	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW6010D	10/27/2023 1:02	280-182584-18	Magnesium	1500		6.6	17	25	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW9045D	10/16/2023 11:16	280-182584-18	pH adj. to 25 deg C	6.5	HF	0.1	0.1	0.1	pH units	pH units
SSTRNG001_RP2_Oct23-10032023	SW6010D	10/27/2023 1:02	280-182584-18	Phosphorus	400		1.4	5	42	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW6010D	10/27/2023 1:02	280-182584-18	Potassium	1200		34	130	250	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW6010D	10/27/2023 1:02	280-182584-18	Sodium	88	J	24	83	420	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW9056A	10/27/2023 15:49	280-182584-18	Sulfate	17	J	9.1	25	50	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023	SW9045D	10/16/2023 11:16	280-182584-18	Temperature	20.6	HF	1	1	1	deg C	deg C
SSTRNG001_RP2_Oct23-10032023LR	SW9045D	10/16/2023 11:17	280-182584-18	pH adj. to 25 deg C	6.5		0.1	0.1	0.1	pH units	pH units

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
SSTRNG001_RP2_Oct23-10032023LR	SW9045D	10/16/2023 11:17	280-182584-18	Temperature	20.5		1	1	1	deg C	deg C
SSTRNG001_RP2_Oct23-10032023MS	SW6010D	10/27/2023 1:11	280-182584-18	Antimony	74.7		0.61	1.2	1.7	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023MS	SW6010D	10/27/2023 1:11	280-182584-18	Calcium	5210		12	41	83	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023MS	SW6010D	10/27/2023 1:11	280-182584-18	Copper	86.9		0.18	0.66	4.1	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023MS	SW6010D	10/27/2023 1:11	280-182584-18	Iron	15100	4	6.8	17	66	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023MS	SW6010D	10/27/2023 1:11	280-182584-18	Lead	108		0.26	0.66	0.75	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023MS	SW6010D	10/27/2023 1:11	280-182584-18	Magnesium	5600		6.6	17	25	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023MS	SW6010D	10/27/2023 1:11	280-182584-18	Phosphorus	1980		1.3	5	41	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023MS	SW6010D	10/27/2023 1:11	280-182584-18	Potassium	5730		34	130	250	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023MS	SW6010D	10/27/2023 1:11	280-182584-18	Sodium	3960		24	83	410	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023SD	SW6010D	10/27/2023 1:16	280-182584-18	Antimony	74.7		0.61	1.2	1.7	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023SD	SW6010D	10/27/2023 1:16	280-182584-18	Calcium	5220		12	42	83	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023SD	SW6010D	10/27/2023 1:16	280-182584-18	Copper	87.4		0.18	0.67	4.2	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023SD	SW6010D	10/27/2023 1:16	280-182584-18	Iron	15000	4	6.9	17	67	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023SD	SW6010D	10/27/2023 1:16	280-182584-18	Lead	108		0.26	0.67	0.75	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023SD	SW6010D	10/27/2023 1:16	280-182584-18	Magnesium	5620		6.6	17	25	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023SD	SW6010D	10/27/2023 1:16	280-182584-18	Phosphorus	1990		1.3	5	42	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023SD	SW6010D	10/27/2023 1:16	280-182584-18	Potassium	5730		34	130	250	mg/kg	mg/kg
SSTRNG001_RP2_Oct23-10032023SD	SW6010D	10/27/2023 1:16	280-182584-18	Sodium	3980		24	83	420	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW6010D	10/26/2023 23:31	280-182584-6	Antimony	1.2	U	0.57	1.2	1.6	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW6010D	10/26/2023 23:31	280-182584-6	Calcium	1000		11	39	78	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW9056A	10/25/2023 0:33	280-182584-6	Chloride	15	J	11	30	30	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW6010D	10/26/2023 23:31	280-182584-6	Copper	12		0.17	0.63	3.9	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW6010D	10/26/2023 23:31	280-182584-6	Iron	10000		6.5	16	63	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW6010D	10/26/2023 23:31	280-182584-6	Lead	25		0.24	0.63	0.7	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW6010D	10/26/2023 23:31	280-182584-6	Magnesium	1100		6.2	16	23	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-6	pH adj. to 25 deg C	6.2	HF	0.1	0.1	0.1	pH units	pH units
SSTRNG002_Oct23-10032023	SW6010D	10/26/2023 23:31	280-182584-6	Phosphorus	350		1.3	4.7	39	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW6010D	10/26/2023 23:31	280-182584-6	Potassium	900		32	130	230	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW6010D	10/26/2023 23:31	280-182584-6	Sodium	86	J	23	78	390	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW9056A	10/27/2023 12:14	280-182584-6	Sulfate	12	JM	9.1	25	50	mg/kg	mg/kg
SSTRNG002_Oct23-10032023	SW9045D	10/16/2023 11:14	280-182584-6	Temperature	20	HF	1	1	1	deg C	deg C

Small Arms Range Sampling Reports

Lysimeter Sampling Results

Fall 2023

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
LYIRNG001_Oct23-10042023	SW6020B	10/24/2023 16:02	280-182584-24	Antimony	0.0037		0.0004	0.001	0.002	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW6020B	10/24/2023 16:02	280-182584-24	Calcium	2.6		0.032	0.1	0.2	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW9056A	10/22/2023 6:39	280-182584-24	Chloride	2.2	J	1	2.5	3	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW6020B	10/24/2023 16:02	280-182584-24	Copper	0.012		0.0007	0.002	0.002	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW9060	10/17/2023 14:18	280-182584-24	Dissolved Organic Carbon - Quad	3.7		0.35	0.8	1	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW6020B	10/24/2023 16:02	280-182584-24	Iron	0.12	J	0.0087	0.04	0.2	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW6020B	10/24/2023 16:02	280-182584-24	Lead	0.0039		0.0002	7E-04	0.001	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW6020B	10/24/2023 16:02	280-182584-24	Magnesium	0.59		0.0042	0.015	0.2	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW6010D	10/23/2023 23:20	280-182584-24	Phosphorus	27	J	14	50	3000	ug/l	ug/l
LYIRNG001_Oct23-10042023	SW6020B	10/24/2023 16:02	280-182584-24	Potassium	0.92	J	0.052	0.076	1	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW6020B	10/24/2023 16:02	280-182584-24	Sodium	1.6		0.073	0.15	1	mg/l	mg/l
LYIRNG001_Oct23-10042023	SW9056A	10/22/2023 6:39	280-182584-24	Sulfate	2.5	U	1	2.5	5	mg/l	mg/l
LYIRNG001_Oct23-10042023	SM2320B	10/10/2023 14:38	280-182584-24	Total Alkalinity	11		3.1	6.4	10	mg/l	mg/l
LYIRNG002_OCT23-10102023	SM2320B	10/21/2023 1:32	280-183152-2	Alkalinity, Total	25		3.1	6.4	10	mg/l	mg/l
LYIRNG002_OCT23-10102023	**SW6020B**	**11/8/2023 12:07**	**280-183152-2**	**Antimony**	**0.008**		**0.0004**	**0.001**	**0.002**	**mg/l**	**mg/l**
LYIRNG002_OCT23-10102023	SW6020B	11/8/2023 12:07	280-183152-2	Calcium	14		0.032	0.1	0.2	mg/l	mg/l
LYIRNG002_OCT23-10102023	SW9056A	11/15/2023 11:40	280-183152-2	Chloride	7	HM	1	2.5	3	mg/l	mg/l
LYIRNG002_OCT23-10102023	SW6020B	11/8/2023 12:07	280-183152-2	Copper	0.33		0.0007	0.002	0.002	mg/l	mg/l
LYIRNG002_OCT23-10102023	SW9060	10/26/2023 21:05	280-183152-2	Dissolved Organic Carbon - Quad	16		0.35	0.8	1	mg/l	mg/l
LYIRNG002_OCT23-10102023	SW6020B	11/8/2023 12:07	280-183152-2	Iron	0.02	J	0.0087	0.04	0.2	mg/l	mg/l
LYIRNG002_OCT23-10102023	SW6020B	11/8/2023 12:07	280-183152-2	Lead	0.0003	J	0.0002	7E-04	0.001	mg/l	mg/l
LYIRNG002_OCT23-10102023	SW6020B	11/8/2023 12:07	280-183152-2	Magnesium	3.3		0.0042	0.015	0.2	mg/l	mg/l
LYIRNG002_OCT23-10102023	SW6010D	11/8/2023 13:07	280-183152-2	Phosphorus	8600		14	50	3000	ug/l	ug/l
LYIRNG002_OCT23-10102023	SW6020B	11/8/2023 12:07	280-183152-2	Potassium	1.5		0.052	0.076	1	mg/l	mg/l
LYIRNG002_OCT23-10102023	SW6020B	11/8/2023 12:07	280-183152-2	Sodium	5		0.073	0.15	1	mg/l	mg/l
LYIRNG002_OCT23-10102023	SW9056A	11/15/2023 11:40	280-183152-2	Sulfate	11	H	1	2.5	5	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW6020B	10/24/2023 15:56	280-182584-21	Antimony	0.001	U	0.0004	0.001	0.002	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW6020B	10/24/2023 15:56	280-182584-21	Calcium	2.7		0.032	0.1	0.2	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW9056A	10/22/2023 8:10	280-182584-21	Chloride	3.4		1	2.5	3	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW6020B	10/24/2023 15:56	280-182584-21	Copper	0.0068		0.0007	0.002	0.002	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW9060	10/17/2023 13:14	280-182584-21	Dissolved Organic Carbon - Quad	8.4		0.35	0.8	1	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW6020B	10/24/2023 15:56	280-182584-21	Iron	0.043	J	0.0087	0.04	0.2	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW6020B	10/24/2023 15:56	280-182584-21	Lead	0.0003	J	0.0002	7E-04	0.001	mg/l	mg/l

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
LYLRNG001_Oct23-10042023	SW6020B	10/24/2023 15:56	280-182584-21	Magnesium	0.55		0.0042	0.015	0.2	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW6010D	10/23/2023 23:07	280-182584-21	Phosphorus	140	J	14	50	3000	ug/l	ug/l
LYLRNG001_Oct23-10042023	SW6020B	10/24/2023 15:56	280-182584-21	Potassium	1.9		0.052	0.076	1	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW6020B	10/24/2023 15:56	280-182584-21	Sodium	1.9		0.073	0.15	1	mg/l	mg/l
LYLRNG001_Oct23-10042023	SW9056A	10/22/2023 8:10	280-182584-21	Sulfate	2	J	1	2.5	5	mg/l	mg/l
LYLRNG001_Oct23-10042023	SM2320B	10/10/2023 14:22	280-182584-21	Total Alkalinity	6	J	3.1	6.4	10	mg/l	mg/l
LYLRNG002_Oct23-10042023	**SW6020B**	**10/24/2023 15:58**	**280-182584-22**	**Antimony**	**0.001**	**U**	**0.0004**	**0.001**	**0.002**	**mg/l**	**mg/l**
LYLRNG002_Oct23-10042023	SW6020B	10/24/2023 15:58	280-182584-22	Calcium	16		0.032	0.1	0.2	mg/l	mg/l
LYLRNG002_Oct23-10042023	SW9056A	10/22/2023 7:10	280-182584-22	Chloride	1.6	J	1	2.5	3	mg/l	mg/l
LYLRNG002_Oct23-10042023	SW6020B	10/24/2023 15:58	280-182584-22	Copper	0.0007	J	0.0007	0.002	0.002	mg/l	mg/l
LYLRNG002_Oct23-10042023	SW9060	10/17/2023 13:35	280-182584-22	Dissolved Organic Carbon - Quad	3.8		0.35	0.8	1	mg/l	mg/l
LYLRNG002_Oct23-10042023	SW6020B	10/24/2023 15:58	280-182584-22	Iron	0.027	J	0.0087	0.04	0.2	mg/l	mg/l
LYLRNG002_Oct23-10042023	SW6020B	10/24/2023 15:58	280-182584-22	Lead	0.0007	U	0.0002	7E-04	0.001	mg/l	mg/l
LYLRNG002_Oct23-10042023	SW6020B	10/24/2023 15:58	280-182584-22	Magnesium	0.76		0.0042	0.015	0.2	mg/l	mg/l
LYLRNG002_Oct23-10042023	SW6010D	10/23/2023 23:11	280-182584-22	Phosphorus	50	U	14	50	3000	ug/l	ug/l
LYLRNG002_Oct23-10042023	SW6020B	10/24/2023 15:58	280-182584-22	Potassium	1.3		0.052	0.076	1	mg/l	mg/l
LYLRNG002_Oct23-10042023	SW6020B	10/24/2023 15:58	280-182584-22	Sodium	1.7		0.073	0.15	1	mg/l	mg/l
LYLRNG002_Oct23-10042023	SW9056A	10/22/2023 7:10	280-182584-22	Sulfate	2.5	U	1	2.5	5	mg/l	mg/l
LYLRNG002_Oct23-10042023	SM2320B	10/10/2023 14:27	280-182584-22	Total Alkalinity	50		3.1	6.4	10	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW6020B	10/24/2023 16:00	280-182584-23	Antimony	0.0011	J	0.0004	0.001	0.002	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW6020B	10/24/2023 16:00	280-182584-23	Calcium	20		0.032	0.1	0.2	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW9056A	10/22/2023 10:10	280-182584-23	Chloride	5.8		1	2.5	3	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW6020B	10/24/2023 16:00	280-182584-23	Copper	0.0041		0.0007	0.002	0.002	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW9060	10/17/2023 13:56	280-182584-23	Dissolved Organic Carbon - Quad	8.1		0.35	0.8	1	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW6020B	10/24/2023 16:00	280-182584-23	Iron	0.037	J	0.0087	0.04	0.2	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW6020B	10/24/2023 16:00	280-182584-23	Lead	0.0007	U	0.0002	7E-04	0.001	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW6020B	10/24/2023 16:00	280-182584-23	Magnesium	1.8		0.0042	0.015	0.2	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW6010D	10/23/2023 23:16	280-182584-23	Phosphorus	50	U	14	50	3000	ug/l	ug/l
LYSRNG001_Oct23-10042023	SW6020B	10/24/2023 16:00	280-182584-23	Potassium	0.11	J	0.052	0.076	1	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW6020B	10/24/2023 16:00	280-182584-23	Sodium	5.5		0.073	0.15	1	mg/l	mg/l
LYSRNG001_Oct23-10042023	SW9056A	10/22/2023 10:10	280-182584-23	Sulfate	2	J	1	2.5	5	mg/l	mg/l
LYSRNG001_Oct23-10042023	SM2320B	10/10/2023 14:32	280-182584-23	Total Alkalinity	60		3.1	6.4	10	mg/l	mg/l
LYSRNG002_OCT23-10102023	SM2320B	10/21/2023 1:38	280-183152-3	Alkalinity, Total	7.6	J	3.1	6.4	10	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW6020B	11/8/2023 12:09	280-183152-3	Antimony	0.001	U	0.0004	0.001	0.002	mg/l	mg/l

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
LYSRNG002_OCT23-10102023	SW6020B	11/8/2023 12:09	280-183152-3	Calcium	0.68		0.032	0.1	0.2	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW9056A	11/15/2023 11:51	280-183152-3	Chloride	3	H	1	2.5	3	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW6020B	11/8/2023 12:09	280-183152-3	Copper	0.0013	J	0.0007	0.002	0.002	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW9060	10/26/2023 21:27	280-183152-3	Dissolved Organic Carbon - Quad	2.7		0.35	0.8	1	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW6020B	11/8/2023 12:09	280-183152-3	Iron	0.04	U	0.0087	0.04	0.2	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW6020B	11/8/2023 12:09	280-183152-3	Lead	0.0007	U	0.0002	7E-04	0.001	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW6020B	11/8/2023 12:09	280-183152-3	Magnesium	0.14	J	0.0042	0.015	0.2	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW6010D	11/8/2023 13:11	280-183152-3	Phosphorus	50	U	14	50	3000	ug/l	ug/l
LYSRNG002_OCT23-10102023	SW6020B	11/8/2023 12:09	280-183152-3	Potassium	2.9		0.052	0.076	1	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW6020B	11/8/2023 12:09	280-183152-3	Sodium	1.5		0.073	0.15	1	mg/l	mg/l
LYSRNG002_OCT23-10102023	SW9056A	11/15/2023 11:51	280-183152-3	Sulfate	1.2	JH	1	2.5	5	mg/l	mg/l

Small Arms Range Sampling Reports

Groundwater Sampling Results

Fall 2023

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
MW-465S-OCT23-10102023	SM2320B	10/21/2023 1:43	280-183152-7	Alkalinity, Total	18		3.1	6.4	10	mg/l	mg/l
MW-465S-OCT23-10102023	SW6020B	11/8/2023 12:11	280-183152-7	Antimony	0.001	U	0.0004	0.001	0.002	mg/l	mg/l
MW-465S-OCT23-10102023	SW6020B	11/8/2023 12:11	280-183152-7	Calcium	4.2		0.032	0.1	0.2	mg/l	mg/l
MW-465S-OCT23-10102023	SW9056A	11/15/2023 12:59	280-183152-7	Chloride	5.7	H	1	2.5	3	mg/l	mg/l
MW-465S-OCT23-10102023	SW6020B	11/8/2023 12:11	280-183152-7	Copper	0.0018	U	0.00071	0.0018	0.002	mg/l	mg/l
MW-465S-OCT23-10102023	SW9060	10/26/2023 21:48	280-183152-7	Dissolved Organic Carbon - Quad	0.72	J	0.35	0.8	1	mg/l	mg/l
MW-465S-OCT23-10102023	SW6020B	11/8/2023 12:11	280-183152-7	Iron	0.04	U	0.0087	0.04	0.2	mg/l	mg/l
MW-465S-OCT23-10102023	SW6020B	11/8/2023 12:11	280-183152-7	Lead	0.0007	U	0.00023	0.0007	0.001	mg/l	mg/l
MW-465S-OCT23-10102023	SW6020B	11/8/2023 12:11	280-183152-7	Magnesium	1.9		0.0042	0.015	0.2	mg/l	mg/l
MW-465S-OCT23-10102023	SW6010D	11/8/2023 13:15	280-183152-7	Phosphorus	21	J	14	50	3000	ug/l	ug/l
MW-465S-OCT23-10102023	SW6020B	11/8/2023 12:11	280-183152-7	Potassium	0.5	J	0.052	0.076	1	mg/l	mg/l
MW-465S-OCT23-10102023	SW6020B	11/8/2023 12:11	280-183152-7	Sodium	4.7		0.073	0.15	1	mg/l	mg/l
MW-465S-OCT23-10102023	SW9056A	11/15/2023 12:59	280-183152-7	Sulfate	7.2	H	1	2.5	5	mg/l	mg/l
MW-466S-OCT23-10102023	SM2320B	10/21/2023 1:48	280-183152-8	Alkalinity, Total	30		3.1	6.4	10	mg/l	mg/l
MW-466S-OCT23-10102023	SW6020B	11/8/2023 12:14	280-183152-8	Antimony	0.001	U	0.0004	0.001	0.002	mg/l	mg/l
MW-466S-OCT23-10102023	SW6020B	11/8/2023 12:14	280-183152-8	Calcium	5.9		0.032	0.1	0.2	mg/l	mg/l
MW-466S-OCT23-10102023	SW9056A	11/15/2023 13:44	280-183152-8	Chloride	6	H	1	2.5	3	mg/l	mg/l
MW-466S-OCT23-10102023	SW6020B	11/8/2023 12:14	280-183152-8	Copper	0.0018	U	0.00071	0.0018	0.002	mg/l	mg/l
MW-466S-OCT23-10102023	SW9060	10/26/2023 22:06	280-183152-8	Dissolved Organic Carbon - Quad	0.61	J	0.35	0.8	1	mg/l	mg/l
MW-466S-OCT23-10102023	SW6020B	11/8/2023 12:14	280-183152-8	Iron	0.04	U	0.0087	0.04	0.2	mg/l	mg/l
MW-466S-OCT23-10102023	SW6020B	11/8/2023 12:14	280-183152-8	Lead	0.0007	U	0.00023	0.0007	0.001	mg/l	mg/l
MW-466S-OCT23-10102023	SW6020B	11/8/2023 12:14	280-183152-8	Magnesium	2.7		0.0042	0.015	0.2	mg/l	mg/l
MW-466S-OCT23-10102023	SW6010D	11/8/2023 13:20	280-183152-8	Phosphorus	23	J	14	50	3000	ug/l	ug/l
MW-466S-OCT23-10102023	SW6020B	11/8/2023 12:14	280-183152-8	Potassium	0.63	J	0.052	0.076	1	mg/l	mg/l
MW-466S-OCT23-10102023	SW6020B	11/8/2023 12:14	280-183152-8	Sodium	7.4		0.073	0.15	1	mg/l	mg/l
MW-466S-OCT23-10102023	SW9056A	11/15/2023 13:44	280-183152-8	Sulfate	8	H	1	2.5	5	mg/l	mg/l
MW-4675_OCT23-10112023	SM2320B	10/21/2023 1:27	280-183152-1	Alkalinity, Total	28		3.1	6.4	10	mg/l	mg/l
MW-4675_OCT23-10112023	SW6020B	11/8/2023 12:05	280-183152-1	Antimony	0.00057	J	0.0004	0.001	0.002	mg/l	mg/l
MW-4675_OCT23-10112023	SW6020B	11/8/2023 12:05	280-183152-1	Calcium	4.6		0.032	0.1	0.2	mg/l	mg/l
MW-4675_OCT23-10112023	SW9056A	11/15/2023 14:07	280-183152-1	Chloride	6.6	H	1	2.5	3	mg/l	mg/l
MW-4675_OCT23-10112023	SW6020B	11/8/2023 12:05	280-183152-1	Copper	0.0014	J	0.00071	0.0018	0.002	mg/l	mg/l
MW-4675_OCT23-10112023	SW9060	10/26/2023 19:57	280-183152-1	Dissolved Organic Carbon - Quad	2.4		0.35	0.8	1	mg/l	mg/l
MW-4675_OCT23-10112023	SW6020B	11/8/2023 12:05	280-183152-1	Iron	0.5		0.0087	0.04	0.2	mg/l	mg/l
MW-4675_OCT23-10112023	SW6020B	11/8/2023 12:05	280-183152-1	Lead	0.0017		0.00023	0.0007	0.001	mg/l	mg/l
MW-4675_OCT23-10112023	SW6020B	11/8/2023 12:05	280-183152-1	Magnesium	1.7		0.0042	0.015	0.2	mg/l	mg/l
MW-4675_OCT23-10112023	SW6010D	11/8/2023 13:02	280-183152-1	Phosphorus	30	J	14	50	3000	ug/l	ug/l
MW-4675_OCT23-10112023	SW6020B	11/8/2023 12:05	280-183152-1	Potassium	1.7		0.052	0.076	1	mg/l	mg/l

Sample	Method	Analysis Date	Sample ID	Chemical Name	Result	Qualifier	MDL	RDL	QL	Units	DL Units
MW-4675_OCT23-10112023	SW6020B	11/8/2023 12:05	280-183152-1	Sodium	7		0.073	0.15	1	mg/l	mg/l
MW-4675_OCT23-10112023	SW9056A	11/15/2023 14:07	280-183152-1	Sulfate	6.6	H	1	2.5	5	mg/l	mg/l
MW-469S_OCT23-10112023	SM2320B	10/21/2023 1:54	280-183152-9	Alkalinity, Total	6.9	J	3.1	6.4	10	mg/l	mg/l
MW-469S_OCT23-10112023	SW6020B	11/8/2023 12:16	280-183152-9	Antimony	0.001	U	0.0004	0.001	0.002	mg/l	mg/l
MW-469S_OCT23-10112023	SW6020B	11/8/2023 12:16	280-183152-9	Calcium	2.2		0.032	0.1	0.2	mg/l	mg/l
MW-469S_OCT23-10112023	SW9056A	11/15/2023 13:56	280-183152-9	Chloride	8.5	H	1	2.5	3	mg/l	mg/l
MW-469S_OCT23-10112023	SW6020B	11/8/2023 12:16	280-183152-9	Copper	0.002		0.00071	0.0018	0.002	mg/l	mg/l
MW-469S_OCT23-10112023	SW9060	10/26/2023 22:24	280-183152-9	Dissolved Organic Carbon - Quad	1.1		0.35	0.8	1	mg/l	mg/l
MW-469S_OCT23-10112023	SW6020B	11/8/2023 12:16	280-183152-9	Iron	0.059	J	0.0087	0.04	0.2	mg/l	mg/l
MW-469S_OCT23-10112023	SW6020B	11/8/2023 12:16	280-183152-9	Lead	0.00026	J	0.00023	0.0007	0.001	mg/l	mg/l
MW-469S_OCT23-10112023	SW6020B	11/8/2023 12:16	280-183152-9	Magnesium	1.6		0.0042	0.015	0.2	mg/l	mg/l
MW-469S_OCT23-10112023	SW6010D	11/8/2023 13:24	280-183152-9	Phosphorus	40	J	14	50	3000	ug/l	ug/l
MW-469S_OCT23-10112023	SW6020B	11/8/2023 12:16	280-183152-9	Potassium	0.59	J	0.052	0.076	1	mg/l	mg/l
MW-469S_OCT23-10112023	SW6020B	11/8/2023 12:16	280-183152-9	Sodium	5.5		0.073	0.15	1	mg/l	mg/l
MW-469S_OCT23-10112023	SW9056A	11/15/2023 13:56	280-183152-9	Sulfate	6.9	H	1	2.5	5	mg/l	mg/l

Small Arms Range Sampling Reports

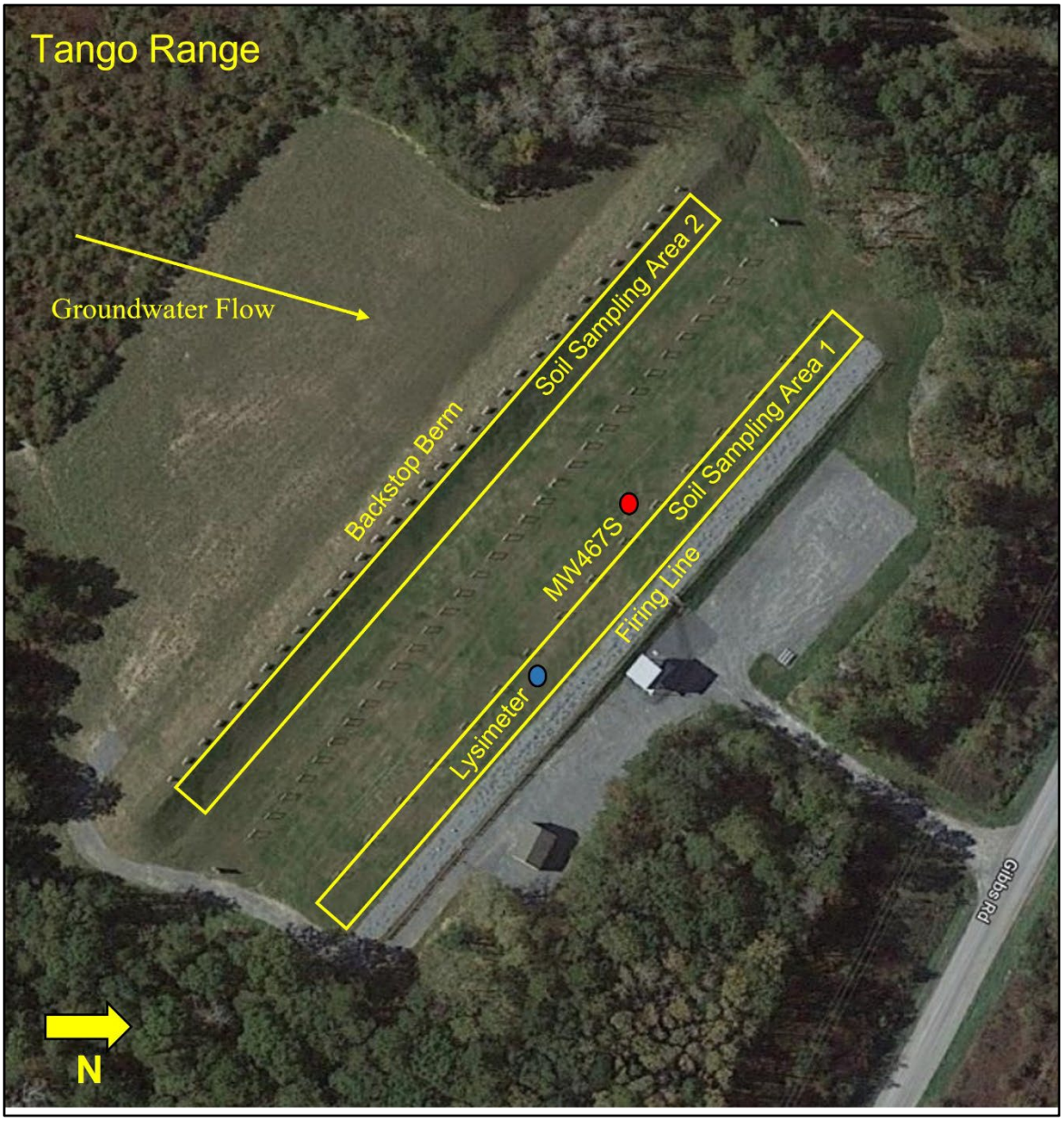
XRF Sampling Results

Fall 2023

Site	Location ID	Date Sampled	Date Analyzed	Test Method	Analyte	Result Value (ppm)
Sierra Range	4	10/10/2023	10/18/2023	XRF	Copper	35
Sierra Range	4	10/10/2023	10/18/2023	XRF	Copper	35
Sierra Range	4	10/10/2023	10/18/2023	XRF	Copper	30
Sierra Range	Lane 6	10/10/2023	10/18/2023	XRF	Copper	38
Sierra Range	Lane 6	10/10/2023	10/18/2023	XRF	Copper	32
Sierra Range	Lane 6	10/10/2023	10/18/2023	XRF	Copper	34
Sierra Range	Lane 4	10/10/2023	10/18/2023	XRF	Copper	ND
Sierra Range	Lane 4	10/10/2023	10/18/2023	XRF	Copper	ND
Sierra Range	Lane 4	10/10/2023	10/18/2023	XRF	Copper	ND

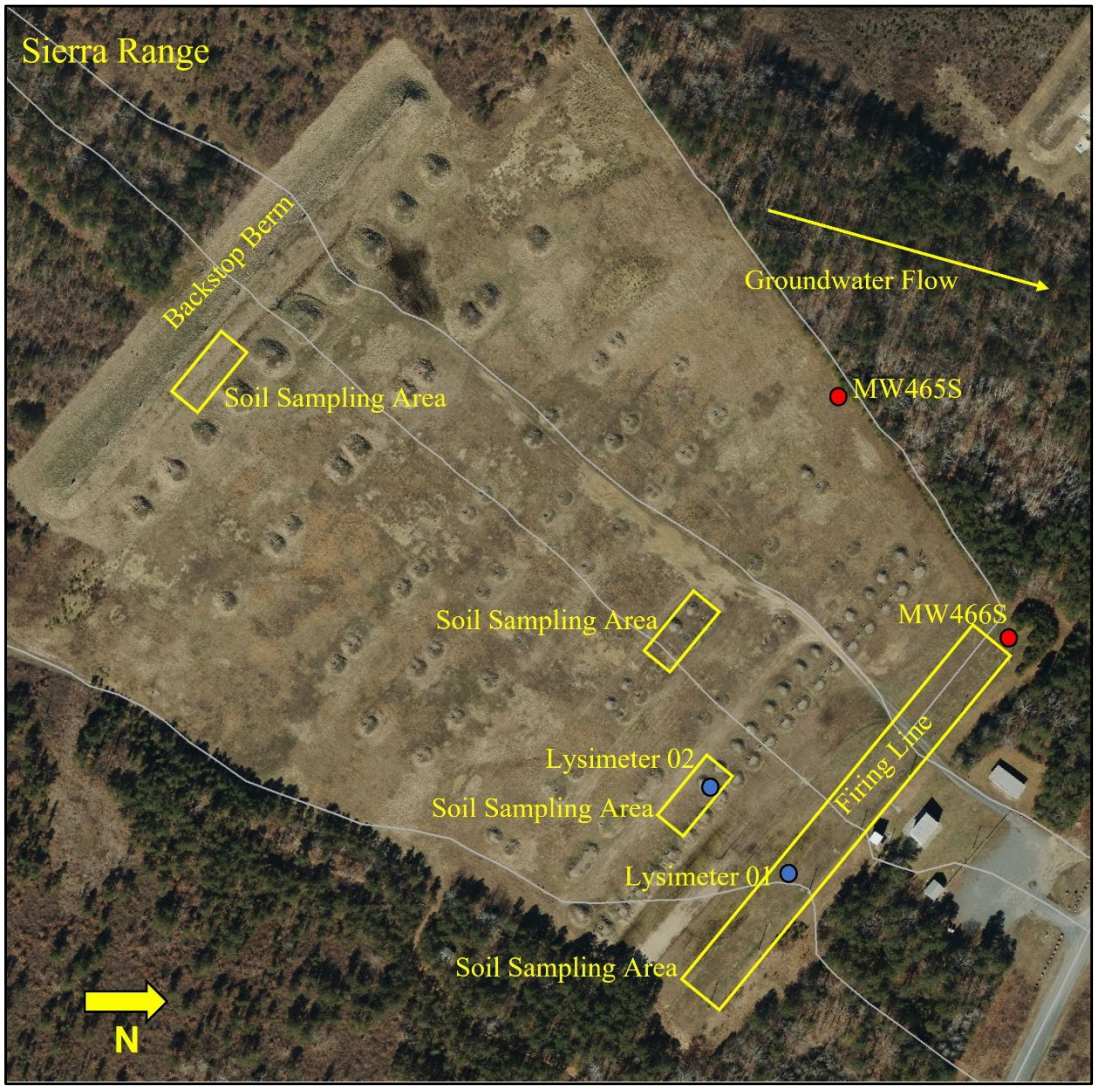
Notes:
m = meter
ppm = parts per million
XRF = X-ray Fluorescence

Small Arms Range Sample Area Figures

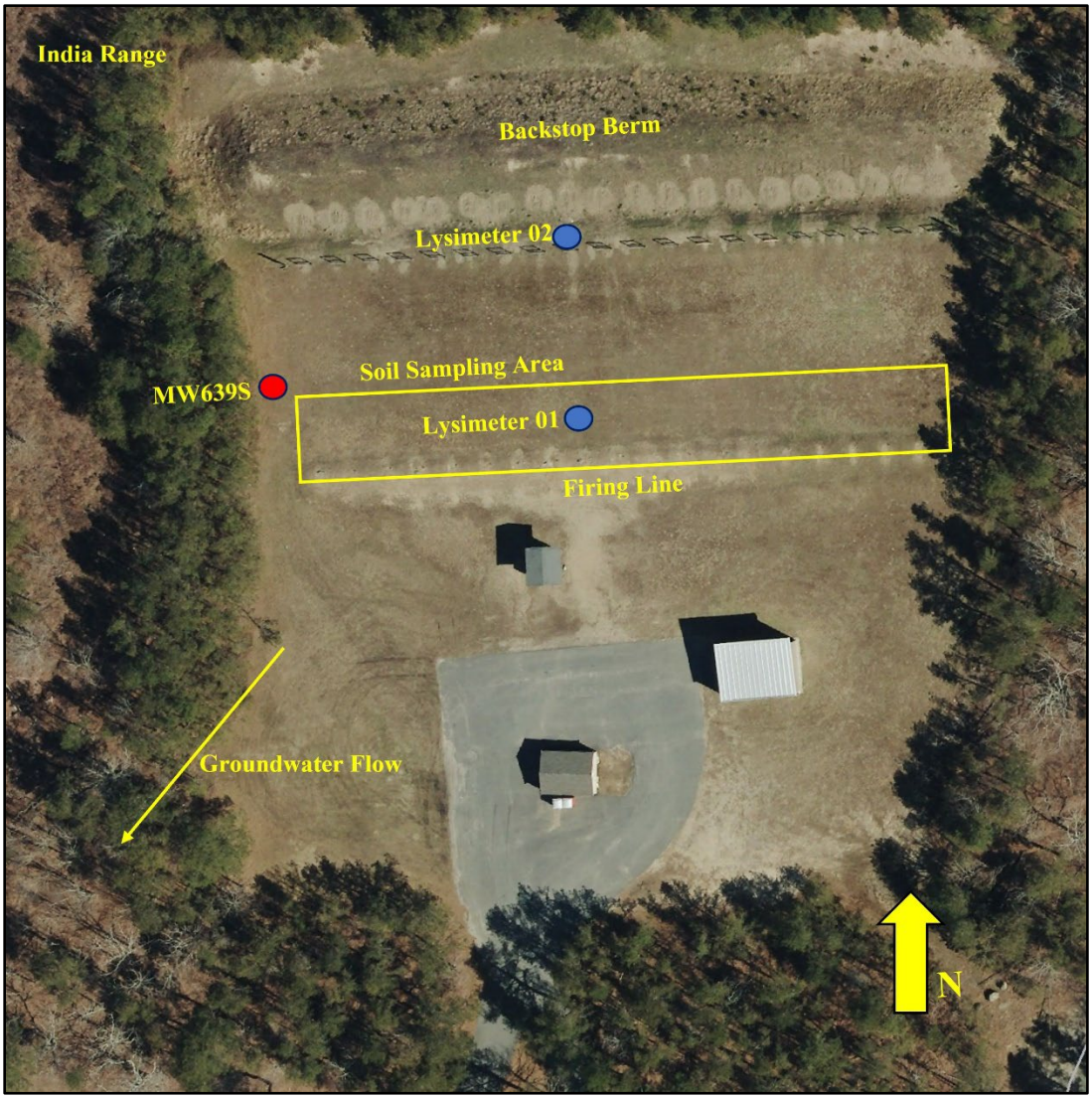


Tango Range (EPR copper only), Structures, and Sampling Areas
Camp Edwards, Massachusetts

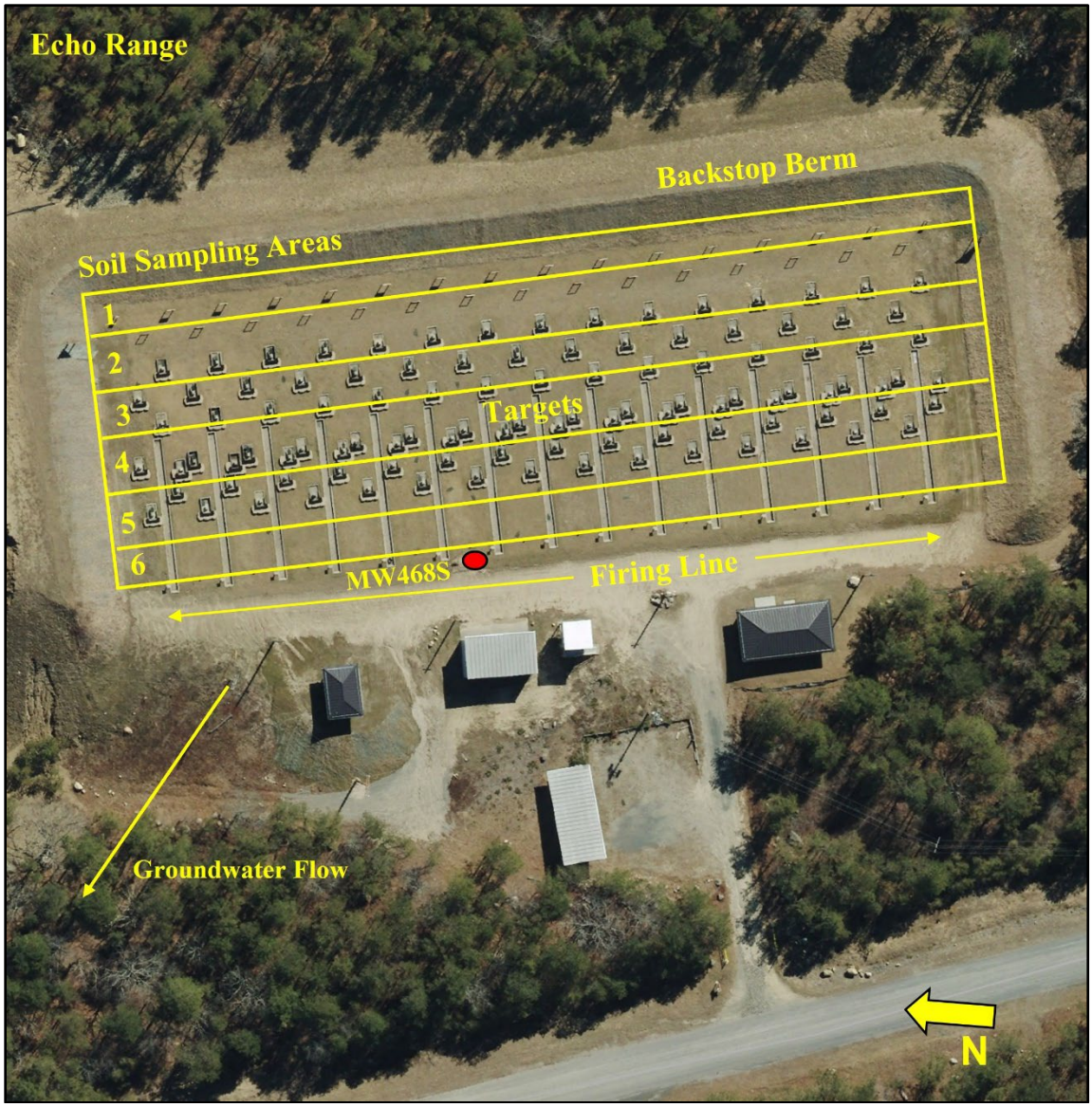
The lysimeter noted on the graphic above was installed November 9, 2023.



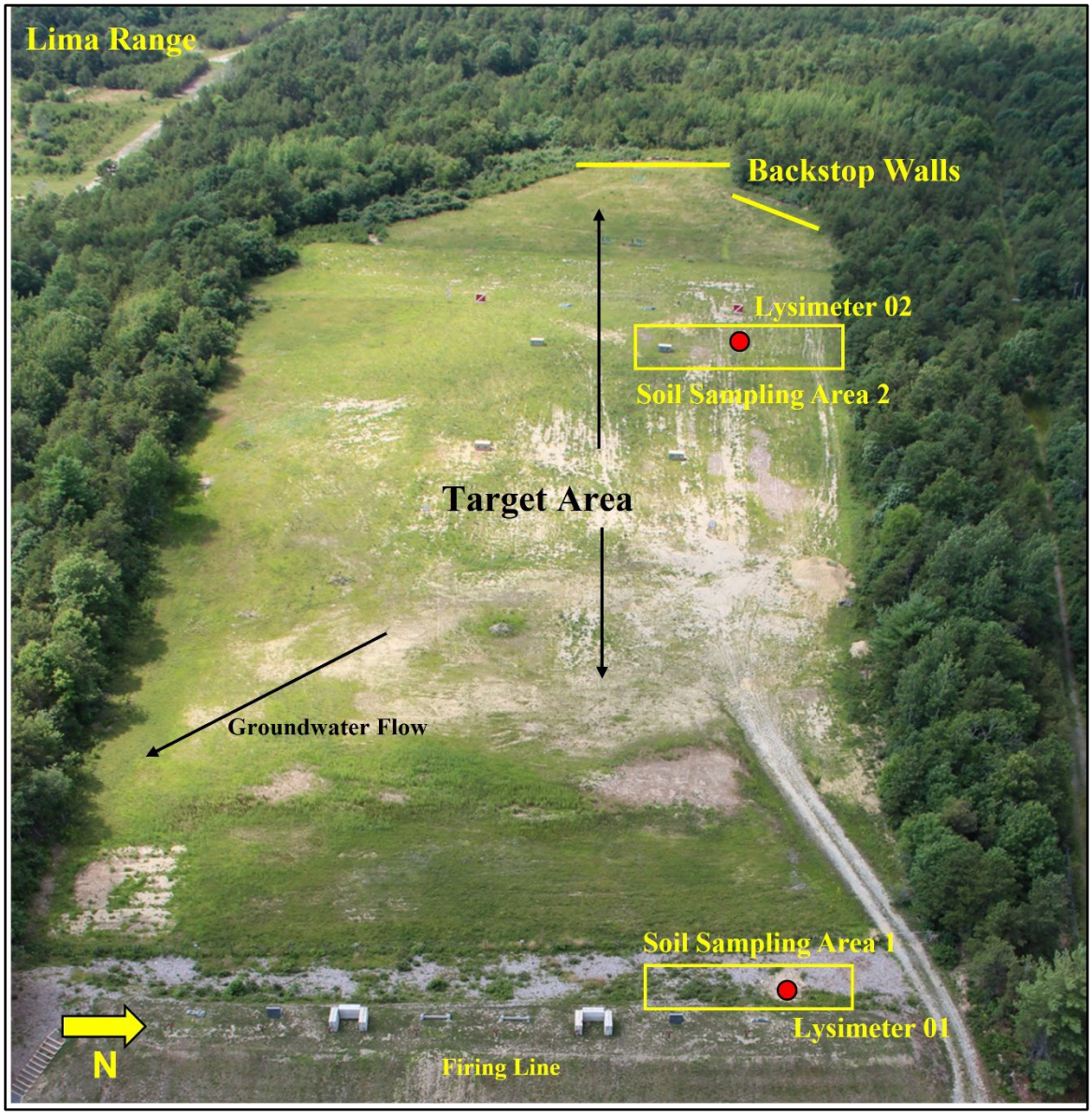
Sierra Range (EPR copper only) Sampling Areas
Camp Edwards, Massachusetts
MW=Monitoring Well



India Range (EPR copper only) Sampling Areas
Camp Edwards, Massachusetts
MW=Monitoring Well



Echo Range Sampling Areas
Camp Edwards, Massachusetts
MW=Monitoring Well



Lima Range
Camp Edwards, Massachusetts.

Soldier Validation Lane Annual Report

Camp Edwards --- Massachusetts Army National Guard

Soldier Validation Lane Annual Monitoring Report

January, 2024

(NHESP Tracking No.: 08-24210)

Soldier Validation Lane Use

No site composition changes occurred in FY23.

SVL Assessments after 2022 Training Season

All sites with containers were visited on December 28th, 2023 to evaluate training impacts during the 2023 training season. The assessment methodology matched the assessment performed in the Baseline Condition Assessment Report and FYs 12-21, to provide a means of comparison. The containers replicate buildings (conex), and prop materials are utilized to create a more realistic setting, such as barrels, bicycles, grills, tires, wall sections, etc. No major changes were made to sites during 2023 and management activity was limited to mowing by the Training Lands Specialist in November 2023.

Conclusion

All regulatory conditions were followed during use of the SVLs and BPs for training. Erosion and rutting impacts have remained static at most sites on the lanes as expected, with regular levels of vehicle use and regular storm water runoff on dirt roads. Some photos of the erosion and rutting have been included below. MAARNG will continue to strive to minimize environmental impacts from these lanes by following the established guidelines.

Photos

Figure 1: SVL1

Figure 2: SVL 2, main entrance (left), rear coming from SVL 1 (right)

Figure 3: NBC Open ground and conex buildings

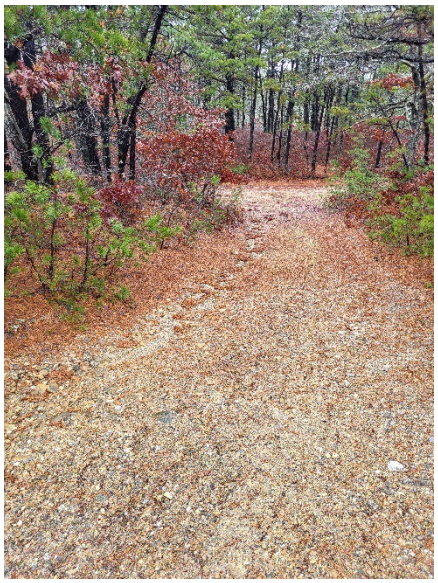


Figure 4: Entrance to BP 12 showing rutting

Figure 5: BP 20 Open ground and conex buildings

Figure 6: BP 24 Showing front (left) and back (right) of conex buildings

APPENDIX D
ENVIRONMENTAL LAWS AND REGULATIONS

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

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

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

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

DOD Regulations include all regulations and directives of the Department of Defense, Department of the Army, and National Guard Bureau.
AR = Army Regulation
CER – Camp Edwards Regulation
CFR – Code of Federal Regulations
CMR - Code of Massachusetts Regulations
DA PAM = Department of Army Pamphlet
EO – Executive Order
M.G.L – Massachusetts General Laws
RCRA – Resource Conservation and Recovery Act

APPENDIX E
WATER SUPPLY INFORMATION

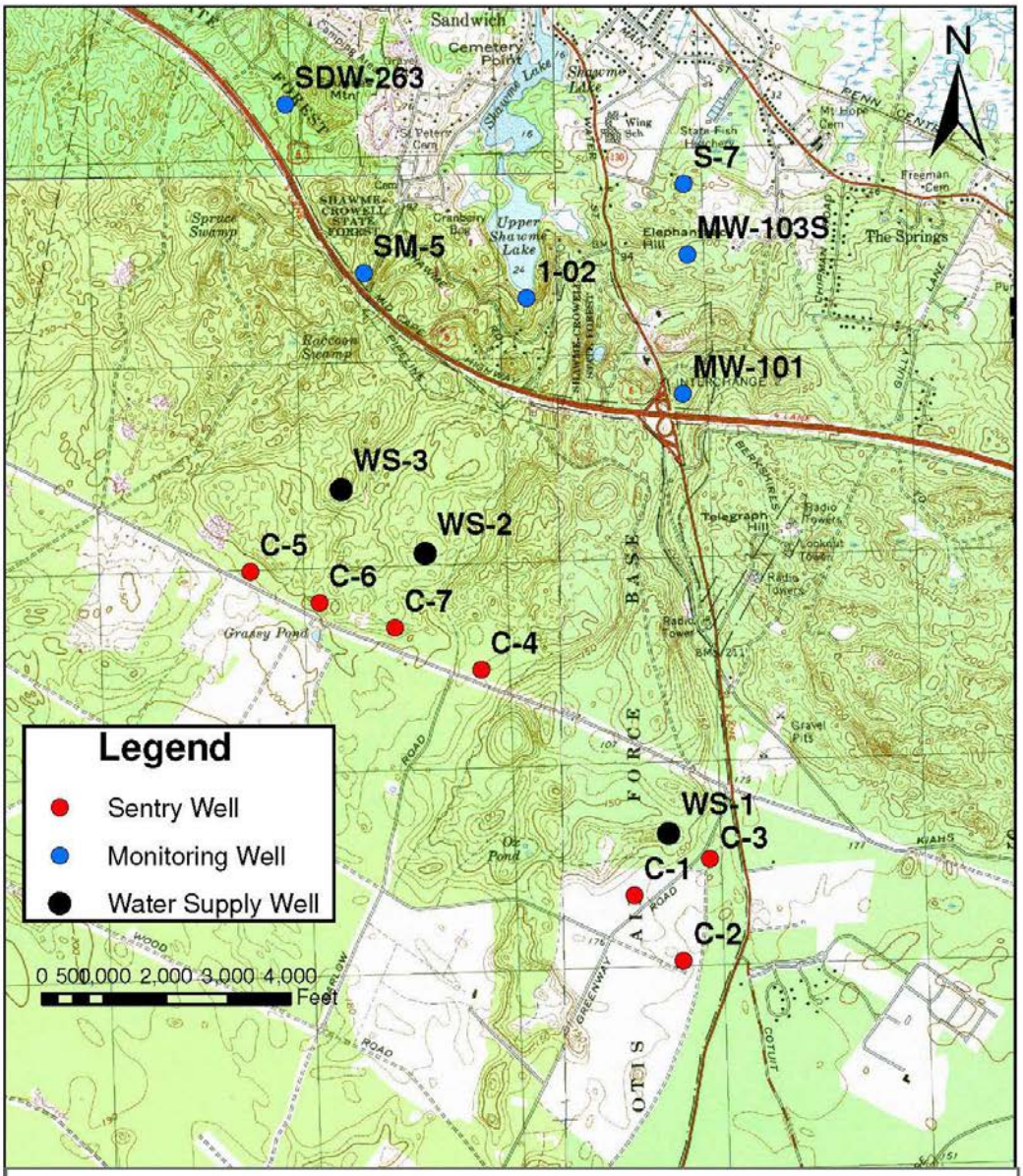


Figure 1
Long-term Monitoring Well Network
Upper Cape Regional Water Supply Cooperative
Cape Cod, Massachusetts

102nd Intelligence Wing
2022 Consumer Confidence Report

2022 Consumer Confidence Report

For
Otis Air National Guard Base
Otis ANGB, Massachusetts
MassDEP PWS ID #4096001

This report is a snapshot of the drinking water quality that we provided last year. Included are details about where your water comes from, what it contains, and how it compares to state and federal standards. We are committed to providing you with this information because informed customers are our best allies.

PUBLIC WATER SYSTEM INFORMATION

Address: 156 Reilly St., Box 12 Otis Air National Guard Base on Joint Base Cape Cod, Massachusetts

Contact Person: Mr. Duarte Corte-Real

Telephone #: (508) 968-4102

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

Opportunities for Public Participation
If you would like to participate in discussions regarding your water quality, you may attend the following meetings or educational events: *Please see the Otis Notice for any future meetings.*

YOUR DRINKING WATER SOURCE

Where Does My Drinking Water Come From?
Your water is provided by the following sources listed below:

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

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

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

1

and to determine if any additional treatment is required. We add a disinfectant to protect you against microbial contaminants.

How Are These Sources Protected?
The Source Water Assessment and Protection (SWAP) Program, established under the federal Safe Drinking Water Act, requires every state to inventory land uses within the recharge areas of all public water supply sources, to assess the susceptibility of drinking water sources to contamination from these land uses, and to publicize the results to provide support for improved protection. MassDEP has prepared a SWAP Report for the water supply source(s) serving this water system. The SWAP Report assesses the susceptibility of public water supplies.

What is My System's Ranking?
A susceptibility ranking of HIGH was assigned to this system due to the absence hydrogeological barriers (i.e., clay) that can prevent contaminant migration.

Where Can I See The SWAP Report?
Information on obtaining the complete SWAP Report is available by contacting the Water Supply Superintendent at (508) 968-4102. To access the SWAP Report on the Internet, go to the Source Water Assessment & Protection (SWAP) Program Website at the following link: *https://www.mass.gov/service-details/the-source-water-assessment-protection-swap-program.*

Members can help protect sources by:
• practicing good septic system maintenance
• proper disposal of hazardous chemicals and materials
• limiting pesticide and fertilizer use, etc.

SUBSTANCES FOUND IN TAP WATER

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

Contaminants that may be present in source water include:

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

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

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

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

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

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

All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More

information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (800-426-4791).

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

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

IMPORTANT DEFINITIONS

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

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

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

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

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

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

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

ppm = parts per million, or milligrams per liter (mg/l)
ppb = parts per billion, or micrograms per liter (ug/l)
ppt = parts per trillion, or nanograms per liter
pCi/l = picocuries per liter (a measure of radioactivity)
NTU = Nephelometric Turbidity Units
ND = Not Detected
N/A = Not Applicable
mrem/year = millirems per year (a measure of radiation absorbed by the body)

WATER QUALITY TESTING RESULTS

What Does This Data Represent?

The water quality information presented in the table is from the most recent round of testing done in accordance with the regulations. All data shown was collected during the last calendar year unless otherwise noted in the table (within the last 5 years).

Substance (unit of measurement)	Date(s) Collected	90TH percentile	Action Level	MCLG	# of sites sampled	# of sites above Action Level	Possible Source of Contamination
Lead (ppb)	28-30 Sep 2021	0.0016	15	0	**40**	**0**	Corrosion of household plumbing systems; Erosion of natural deposits
Copper (ppm)	28-30 Sep 2021	0.44	1.3	1.3	**40**	**0**	Corrosion of household plumbing systems; Erosion of natural deposits; Leaching from wood preservatives

Regulated Contaminant	Date(s) Collected	Highest Amount Detected	Range Detected	MCL (MRDL)	MCLG (MRDLG)	Violation (Y/N)	Possible Source(s) of Contamination
Inorganic Contaminants							
Asbestos (MFL)	2022	ND	N/A	7	7	N	Decay of asbestos cement watermains; Erosion of natural deposits
Barium (ppm)	2021	0.028	0.00-0.028	2	2	N	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Cyanide (ppb)	2021	<0.10	N/A	200	200	N	Discharge from metal factories; discharge from plastic and fertilizer factories
Fluoride* (ppm)	2022	0.10	0.00-0.10	4	4	N	Erosion of natural deposits; water additive which promotes strong teeth; discharge from fertilizer and aluminum factories
*Fluoride also has a secondary contaminant level (SMCL) of 2 ppm.							
Nitrate (ppm)	2022	2.42	0.74-2.42	10	10	N	Runoff from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits
Nitrite (ppm)	2020	0.44	0.00-0.44	1	1	N	Runoff from fertilizer use; leaching from septic tanks; sewage; erosion of natural deposits
Perchlorate (ppb)	2022	ND	N/A	2.0	N/A	N	Rocket propellants, fireworks, munitions, flares, blasting agents

Regulated Contaminant	Date(s) Collected	Highest Amount Detected	Range Detected	MCL (MRDL)	MCLG (MRDLG)	Violation (Y/N)	Possible Source(s) of Contamination
Organic Contaminants							
PFAS6 (ppt)	2022	5.14	0.00-5.14	20	N/A	N	Discharges and emissions from industrial and manufacturing sources associated with the production or use of these PFAS, including production of moisture and oil resistant coatings on fabrics and other materials. Additional sources include the use and disposal of products containing these PFAS, such as fire-fighting foams.
Radioactive Contaminants							
Gross Alpha▲(pCi/l) (minus uranium)	2021	-.461 +/-1.15	N/A	15	0	N	Erosion of natural deposits
▲The MCL for beta particles is 4 mrem/year. EPA considers 50 pCi/L to be the level of concern for beta particles.							
Radium 226 & 228 (pCi/L) (combined values)	2021	-.178 +/-.296	-.000 to -.178	5	0	N	Erosion of natural deposits
Disinfectants and Disinfection By-Products							
Total Trihalomethanes (TTHMs) (ppb)	QTR3 (2022)	22.2	0.01-22.2	80	N/A	N	Byproduct of drinking water chlorination
Haloacetic Acids [HAA5] (ppb)	QTR3 (2022)	6.70	0.01-6.70	60	N/A	N	Byproduct of drinking water disinfection
Chlorine (ppm) (free, total or combined)	Monthly (2022)	2.0	0.01-2.0	4	4	N	Water additive used to control microbes

Unregulated and Secondary Contaminants

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

Unregulated Contaminants	Date(s) Collected	Result or Range Detected	Average Detected	SMCL	ORSG	Possible Source
Bromodichloromethane (ppb)	2022	1.12-6.22	3.67	N/A	N/A	Trihalomethane; by-product of drinking water chlorination
Bromoform (ppb)	2022	0.54-2.04	1.29	N/A	N/A	Trihalomethane; by- product of drinking water chlorination
Chloroform (ppb)	2022	1.51-8.65	5.08	N/A	70	By-product of drinking water chlorination (In non-chlorinated sources it may be naturally occurring)
Dibromochloromethane (ppb)	2022	1.17-5.32	3.24	N/A	N/A	Trihalomethane; By-product of drinking water chlorination
Manganese* (ppb)	2020	<0.005	<0.005	50	300	Erosion of natural deposits
* US EPA has established a lifetime health advisory (HA) value of 300 ppb for manganese to protect against concerns of potential neurological effects, and a one-day and 10-day HA of 1000 ppb for acute exposure.						

Unregulated Contaminants	Date(s) Collected	Result or Range Detected	Average Detected	SMCL	ORSG	Possible Source
Chloride	2022	8.4-9.3	8.85	250	N/A	Runoff and leaching from natural deposits; seawater influence.
Copper	2022	0.010-0.020	0.015	1	N/A	Internal corrosion of household plumbing; erosion of natural deposits
Sulfate	2022	3.1-3.7	3.4	250	N/A	Runoff and leaching from natural deposits; industrial wastes.
Zinc	2022	0.011-0.013	0.012	5	N/A	Corrosion of household plumbing systems; erosion of natural deposits
Sodium (ppm)	2021	18	0.00-18	N/A	20	Discharge from the use and improper storage of sodium-containing de-icing compounds or in water-softening agents

COMPLIANCE WITH DRINKING WATER REGS

Does My Drinking Water Meet Current Health Standards?

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

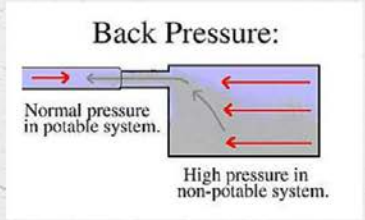
EDUCATIONAL INFORMATON

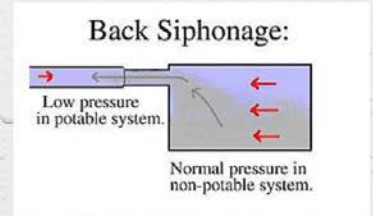
Cross-Connection Control and Backflow Prevention

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

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

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





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

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

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

ADDITIONAL INFORMATION

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

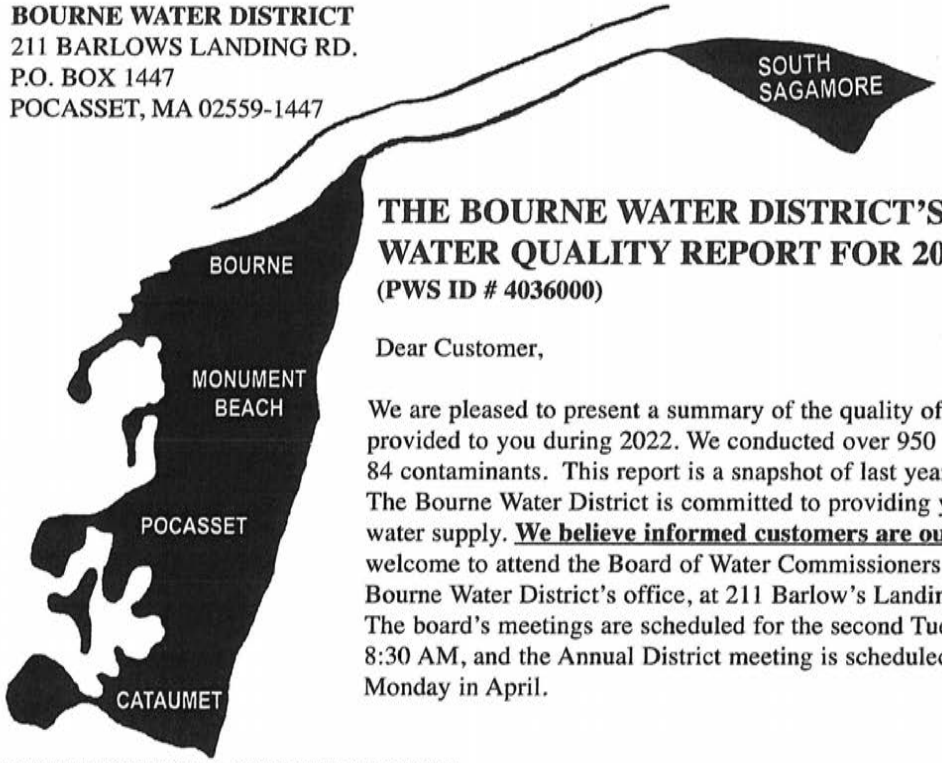
•The water mains, or
•The water pipes in your building

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

When the water is discolored it is recommended to either not wash laundry or to use a rust stain remover or regular detergent but not chlorine bleach as it will react with the iron to form a permanent stain. The other major cause of brown, red, orange or yellow water is rusty water pipes in your building. Water that is being discolored by rusty pipes is not a health hazard.

Bourne Water District
2022 Consumer Confidence Report

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



THE BOURNE WATER DISTRICT'S WATER QUALITY REPORT FOR 2022

(PWS ID # 4036000)

Dear Customer,

We are pleased to present a summary of the quality of the drinking water provided to you during 2022. We conducted over 950 tests for more than 84 contaminants. This report is a snapshot of last year's water quality. The Bourne Water District is committed to providing you with a reliable water supply. **We believe informed customers are our best allies.** You are welcome to attend the Board of Water Commissioners meetings held at the Bourne Water District's office, at 211 Barlow's Landing Road in Pocasset. The board's meetings are scheduled for the second Tuesday of the month at 8:30 AM, and the Annual District meeting is scheduled on the fourth Monday in April.

WATER SOURCES AND TREATMENT

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

WHAT DOES THE FOLLOWING TABLE MEAN?

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

KEY TO TABLE

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

	DISTRIBUTION SYSTEM WATER QUALITY This report summarizes only those items detected during Sampling-not all contaminants that are monitored					
Microbial Results	Highest Detected	Range Detected	MCL	MCLG	Violation	Possible Source of Contamination
Total Coliform Bacteria**	3	0-3	0	0	No	Naturally present in the environment
Fecal Coliform or E. Coli	0	0	0	0	No	Human andAnimal Fecal Waste
*Compliance with the Fecal Coliform/E.Coli MCL is determined upon additional repeat testing						
**Total Coliform:Coliform are bacteria that are naturally present in the environment and are used as an indicator that other potentially harmful bacteria may be present						

Lead and Copper	Dates collected	90th Percentile	Action Level	MCGL	# of sites sampled	# Sites above Action Level	Violation	Possible Source of Contamination
Lead (ppb)	9/1/2022 thru 12/31/2022	0.0023	15	0	30	0	No	Corrosion of household plumbing systems: Erosio of natural deposits
Copper (ppm)	9/1/2022 thru 12/31/2022	0.154	1.3	1.3	30	0	No	Corrosion of household plumbing systems: Erosio of natural deposits

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

Regulated Contaminants	Date(s) collected	Highest Detect Value	Range Detected	MCL	MCGL	Violation	
Inorganic Contaminants:							
Nitrate * (ppm)	2022	0.73	0.06-0.73	10	10	No	Runoff from fertilizer use;leaching from septic tanks;sewage;erosion of natural deposits
Organic Contaminants							
Tetrachloroethylene(PCE)(ppb)	2022	2.54	0-2.54	5	-	No	Discharge from factories and dry cleaners
Chloroform (ppb	2022	1.64	.59-1.64	ORSG 70	NA	No	By-product of drinking water chlorination
CIS-1,2 Dichloroethylene (ppb)	2022	2.01	1.29-2.01	70	NA	No	tanks;sewage;erosion of natural deposits

Secondary Contaminents	Date(s) collected	Highest Detect Value	Range Detected	SMCL	OSRG	Possible Source of Contamination
Magnesium (ppm)	2022	3.3	1.0-3.3	-	-	Natural Mineral and Organis Matter
Chloride (ppm)	2022	36	6.4-36	250	NA	Natural Mineral, Road Salt
Iron (ppb)	2022	0.06	0-.06	300	NA	Erosion of Natural Deposits and oxidation of iron components
Manganese (ppb)*	2022	0.017	0-.017	50	NA	Erosion of Natural Deposits
Potassium (ppm)	2022	1.1	.5-1.1	-	-	Natural Mineral and Organis Matter
Sulfate (ppm)	2022	5.8	2.3-5.8	250	250	Natural Sources
Zinc (ppm)	2022	0.023	.005-.023	5	NA	Erosion of Natural Deposits,and industrial discharge
Aluminum	2022	0.05	.011-.05		0.2	

PER and POLYFLUOROALKYL								
PFOS total of 6 (ppt)	2022	5.03	0-5.03		20 ppt			

NATIONAL PRIMARY DRINKING WATER REGULATION COMPLIANCE

Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, waterborne pathogans may be present or that a potential pathway exits through which contamination may enter the drinking water distribution system. We found coliforms indicating the need to look for potential problems in water treatment or distribution. When this occurs, we are required to conduct assessment(s) to identify problems and to correct any problems that were found during these assessments.

During 2022 we were required to conduct one level 1 assessment. One Level 1 assessment was completed. In addition, we were required to take one corrective action and we completed the action.

During 2022 two Level 2 assessments were required to be completed for our water system. Two Level 2 assessments were completed. In addition, we were required to take six corrective actions and we completed all six of these actions.

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

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

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

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

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

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

(C) Pesticides and herbicides, which may come from a variety of sources such as agriculture, storm water runoff and residential uses.

(D) Organic chemical contaminants, including synthetic and volatile organics which are by-products of industrial processes and petroleum production and can also come from gas stations, urban storm water runoff and septic systems.

(E) Radioactive contaminants, which can be naturally occurring or be the results of oil and gas production and mining activities. In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. FDA regulations establish limits for contaminants in bottled water which must provide the same protec tion for public health.

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

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

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

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

CROSS CONNECTION

A cross connection is a connection between a drinking water pipe and a polluted source. The pollution can come from your own home. For instance, you're going to spray fertilizer on your lawn, and you hook up your hose to the sprayer that contains the fertilizer. If the water pressure drops (say because of a fire hydrant being used or water main break) when the hose is connected to the fertilizer sprayer, the fertilizer may be sucked back into the drinking water pipes through your hose. Using an anti-siphon backflow-prevention device on your sprayer or hose bib can prevent this problem.
The Bourne Water District recommends using devices with an anti-siphon feature or equipping hose bibs with hose bib vacuum breakers to prevent against back flow. For additional information on cross connections and on the status of your water system's cross connection program, please contact Robert Prophett at 508-563-2294.

UPPER CAPE REGIONAL WATER SUPPLY COOPERATIVE
2022 Consumer Confidence Report (PWS ID # 4261024)

The Upper Cape Regional Drinking Water Supply Cooperative consists of three groundwater supply wells located in Sandwich, MA on Joint Base Cape Cod (JBCC). A Board of Managers representing four-member public water supply systems manages the Cooperative. The Cooperative has the capacity to provide a supplemental supply of water to its member public water systems, which include the Town of Falmouth, the Bourne Water District, the Mashpee Water District and the Sandwich Water District. The Cooperative also supplies water to the Otis Air National Guard public water system on JBCC and the Barnstable County Jail.
Wells #1, #2 and #3 are located in a forested area of the northeastern portion of the JBCC. In July 2004, the Department of Environmental Protection completed a source water assessment (SWAP) report for the Cooperative water supply wells. A SWAP report is a planning tool to support local and state efforts to improve water supply protection by identifying land uses within water supply protection areas that may be potential sources of contamination. The report identifies potential sources of contamination including a gas station, a medical facility and a military facility, and helps focus protection efforts on appropriate Best Management Practices. A susceptibility ranking of high was assigned to the Cooperative using information that was collected during the assessment. A copy of the report is available, upon request, from the Cooperative. JBCC has adopted a Groundwater Protection Plan to prohibit inappropriate activities on JBCC property within the Zone II areas of community public water supply wells. In addition, the Environmental Management Commission provides oversight over activities on the northern portion of the JBCC. For questions regarding SWAP or other information contained within this document call Marisa Picone-Devine at 508-888-7262.
Our system, out of an abundance of caution and concerns about PFAS, sampled for PFAS compounds (PFBS, PFHpA, PFHxS, PFNA, PFOA, and PFOS) at all three wells in 2019 and 2020; there were no detections of any of the analytes in any of the samples.

2022 WATER QUALITY DATA

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

Inorganic Contaminants	Year Sampled	Highest Result	Range of Detections	MCL	MCLG	Violation (Y / N)	Possible Sources
Barium	2020	0.002 ppm	0.002 ppm	2 ppm	2 ppm	No	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
Nitrate	2022	0.74 ppm	0.74 ppm	10 ppm	10 ppm	No	Runoff from fertilizer use; Leaching form septic tanks, sewage; Erosion of natural deposits
Radioactive Contaminants	**Year Sampled**	**Highest Result**	**Range of Detections**	**MCL**	**MCLG**	**Violation (Y / N)**	**Possible Sources**
Gross Alpha	2021	-.210 (+- .331) pCi/l	-.210 (+- .331) pCi/l	15 pCi/l	0	No	Erosion of Natural Deposits
Radium 226 & 228	2021	0.377 pCi/L	0 – 0.377 pCi/l	5 pCi/l	0	No	Decay of natural and manmade deposits
Unregulated and Secondary Contaminants	**Year Sampled**	**Amount Detected**	**Range of Detections**	**SMCL**	**ORSG**	**Violation**	**Possible Sources**
Chloroform	2022	2.7 ppb	1.51 -2.7 ppb	NA	70 ppb	No	Trihalomethane: by-product of drinking water chlorination. In non-chlorinated sources, chloroform may be naturally occurring
Chloride	2022	9.3 ppm	8.4 - 9.3 ppm	250 ppm	--	NO	Runoff and leaching from natural deposits; seawater influence
Copper	2022	0.020 ppm	0.010-.020 ppm	1 ppm	--	No	Internal corrosion of household plumbing; erosion of natural deposits
Sodium	2020	5.4 ppm	5.4 ppm	--	20 ppm	No	Natural erosion, road salt
Sulfate	2022	3.7 ppm	3.1 – 3.7 ppm	250 ppm	--	No	Runoff and leaching from natural deposits; industrial wastes
Zinc	2022	0.013 ppm	0.011 – 0.013 ppm	5ppm	--	No	Corrosion of household plumbing systems; erosion of natural deposits

APPENDIX F
CONSERVATION AND MANAGEMENT PERMIT COMPLIANCE AND MITIGATION ACTIONS

Conservation and Management Permit Compliance and Mitigation Actions

Camp Edwards: Fiscal Year 2023

The Massachusetts Army National Guard maintains two Conservation and Management Permits (CMPs) under the Massachusetts Endangered Species Act (MESA, 321 CMR 10.00). The CMPs were developed within the framework of the Integrated Natural Resources Management Plan (INRMP) for Camp Edwards consistent with the Sikes Act and all implementing regulations for the MA Division of Fisheries and Wildlife (MADFW) and MA Army National Guard (MAARNG), including the Upper Cape Water Supply Reserve. The CMPs provide a collaborative and progressive path forward for training and operations at Camp Edwards while ensuring Net Benefit for state-listed species and their habitats at Joint Base Cape Cod (JBCC) directly through CMP associated actions as well as overall natural resources conservation and training lands management at JBCC.

The CMPs are held and administered by MAARNG and the MA Military Division and focus primarily on Camp Edwards' lands and operations. However, the "master plan" CMP was developed collaboratively with MA Air National Guard and includes both past mitigation commitments and implementation, as well as providing for potential future facilities actions for both services. This report includes updates and accomplishments for Fiscal Year 2023 (October of 2022 through September of 2023). Reportable actions include facilities maintenance and development as provided by the permits, construction support actions, mitigation efforts, program administration, and planned activities for the coming fiscal year(s).

Acronyms and Definitions

This report uses many acronyms and abbreviations, as well as specific terms and titles. The majority are included here for clarity.

Acronym	Term
AgCS	Agassiz's Clam Shrimp (MESA fact sheet, NatureServe)
AmCS	American Clam Shrimp (MESA fact sheet, NatureServe)
CMP(s)	Conservation and Management Permit(s) (CMP overview)
CS	Clam Shrimp
CSCRMP	Clam Shrimp Conservation and Road Maintenance Plan
EBT	Eastern Box Turtle (MESA fact sheet)
EMC	Environmental Management Commission
EWPW	Eastern Whip-poor-will MESA overview)
FCRA	Forest Canopy Reserve Area
FY(xx)	Fiscal Year (xx is two digit year); 01 OCT – 30 SEP
IAGWSP	Impact Area Groundwater Study Program (website)
INRMP	Integrated Natural Resources Management Plan (2021 INRMP)
JBCC	Joint Base Cape Cod (JBCC overview)
MA	Massachusetts
MAANG	Massachusetts Air National Guard (website)
MAARNG	Massachusetts Army National Guard (website)
MADFW	Massachusetts Division of Fisheries and Wildlife (website)
MANG	Massachusetts National Guard (joint) (website)
MEPA	Massachusetts Environmental Policy Act (website)
MESA	Massachusetts Endangered Species Act (MESA overview)
MPMG	Multi-Purpose Machine Gun (Range)
NEPA	National Environmental Policy Act (website)
NHESP	Natural Heritage and Endangered Species Program (website)
PBMFA	Pine Barrens Mitigation Focal Area
SGCN	Species of Greatest Conservation Need (State Wildlife Action Plan)
SMRC	Special Military Reservation Commission
UCWSR	Upper Cape Water Supply Reserve
UMass	University of Massachusetts
USFWS	United States Fish and Wildlife Service
UV	Ultraviolet

Cover photos

Top (from left): Eastern Box Turtle (*Terrapene carolina*) by Sophia Roemer; Purple Tiger Beetle (*Cicindela purpurea*) by Jake McCumber; Walsh's Digger Bee (Anthophora walshii) by Jake McCumber.

Bottom: Ripe fruits on Broad Tinker's-weed (*Triosteum perfoliatum*) by Jake McCumber.

A note on photos:

All photos in this report are by MAARNG Natural Resources and Training Lands staff in federal fiscal year 2023 unless otherwise specified. Photographer credits are in italics following captions.

Pelochrista argentifurcatana is a tiny moth found in xeric barrens habitats in northeastern North America. It has very few recorded observations, but is not listed or NatureServe ranked. Four of the ten Massachusetts observations are from Camp Edwards, all within Mitigation Focal Areas. Early-successional habitat patches within pine barrens are critical to maintaining this and many obscure species beyond those listed under the MA Endangered Species Act. A Pitch Pine (*Pinus rigida*) needle provides size reference for this individual at BP10 in 2023. *Jake McCumber*

Agassiz's Clam Shrimp and Training Area Roads Conservation and Management Permit

Conservation Permit #: 018-327.DFW
NHESP Files #: 17-37184
Project: Road Repair and Clam Shrimp Relocation
Date: 08-NOV-2018; amended 14-JUL-2021

Background. A CMP was developed and issued to the MAARNG in 2018 to provide for localized road repair at Camp Edwards while providing for conservation of the Endangered Agassiz's Clam Shrimp (*Eulimnadia agassizii*, AgCS). The original permit allowed for the repair of specific sites (i.e., road puddles) that were known AgCS habitat but required road repair. Three sites were modified *in situ* to improve the road condition, while still providing habitat for clam shrimp. Five sites were repaired with habitat replaced through active construction or repair of vernal pool or road puddle sites and relocation of clam shrimp or sediment. Three years of monitoring, as required by the CMP, were completed for FY18, FY19, and FY20. An additional fourth year of monitoring was completed in FY21 due to the previous year's drought conditions and the focal conservation interest of the species for MAARNG.


Monitoring for Agassiz's Clam Shrimp. *Erin Hilley*

During the FY21 monitoring MAARNG confirmed American Clam Shrimp (*Limnadia lenticularis*, AmCS), a state-listed species of special concern, not previously identified on the base. AmCS were encountered in three monitoring puddles (see FY21 CMP and Mitigation Actions report for more details on this finding).

MAARNG coordinated with MassWildlife in 2021 to amend the CMP to widen the scope of the permit and develop a plan for ongoing necessary road repairs in the Training Area while preserving habitat for rare clam shrimp species long-term. The backbone of the CMP Amendment is the Clam Shrimp Conservation and Road Maintenance Plan (CSCRMP) which carries forward elements of the original CMP, including monitoring and Net Benefit through a combination of clam shrimp relocation and in-place site repair. The updated CMP establishes multiple categories of roads (Critical Roads, Impact Area Interior Roads, and Training Area Roads) and establishes processes and standards for road puddle repair. Additionally, it establishes five zones of the northern training area for supporting a baseline number of puddles within each zone as primary habitat for AgCS and AmCS.

The two primary recurring efforts of the CMP Amendment are annual clam shrimp monitoring and development of annual or semi-annual road work plans submitted to MassWildlife for review and approval. FY23 highlights for both efforts are discussed below.

Annual Monitoring. The sixth consecutive year of annual monitoring was completed in FY23. A subset of twelve puddles situated throughout the northern training area were monitored by MAARNG staff and seasonal field technicians from May through October. Puddles containing standing water were measured for area, depth, temperature and pH, and all aquatic life observed was recorded. Ten of the 12 puddles, or 83 percent, contained Agassiz's clam shrimp. All clam shrimp collected were identified in the lab by Natural Resources staff and field technicians and keyed out to AgCS. Clam shrimp are collected under an annually renewed NHESP Scientific

Collection Permit. Collections are donated to NHESP. This was a productive year for AgCS; up from 67 percent in 2022, and up from all three years previous to 2022 which were at 50 percent and lower. Precipitation was intermittent and consistent through the season, which refreshed puddles for multiple generations of clam shrimp and aided detection for monitoring. In some years, puddles go dry for much of the summer or don't contain water long enough for clam shrimp eggs to hatch and develop. This reduces detection rates even if clam shrimp are present in the form of eggs.

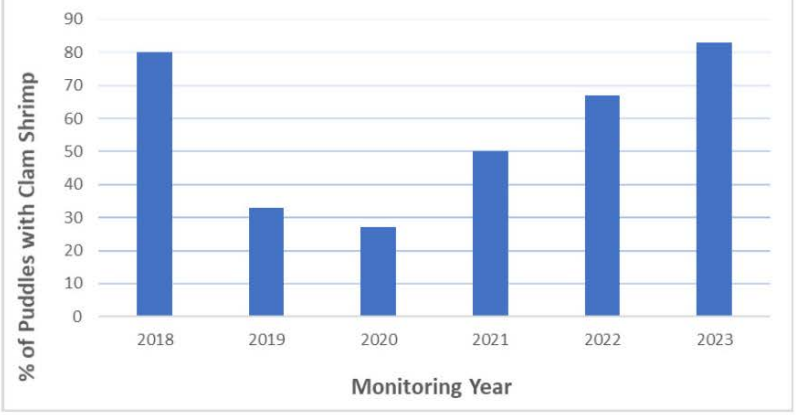


Chart 1. Percentage of puddles with confirmed Agassiz's Clam Shrimp during formal monitoring. A set of puddles is selected annually for iterative surveys following a mutually developed protocol that accounts for mitigation sites, novel sites, and return visits through long-term annual monitoring.

All data and results have been provided separately to MassWildlife and observation reporting through Heritage Hub (https://www.mass.gov/info-details/overview-of-the-heritage-hub) has been completed.

In addition to the positive monitoring findings, additional highlights from TY 2023 underscore the resiliency of AgCS in a dynamic and seemingly inhospitable habitat (i.e., roadway puddles) and shows that soldier training and protection of rare species coexist effectively at Camp Edwards with intentional management.

The FRED (Fredrikson Road) puddle was a focal restoration project for FY2023 highlighted as upcoming work in last year's report. In January 2023 Natural Resources and Training Lands staff worked to drain, fill, and reform FRED with a smaller footprint at the side of the road to allow vehicle passage. Agassiz's Clam Shrimp were documented during puddle monitoring within six months of the restoration. Prior to modifying FRED puddle, two five-gallon buckets were filled with sediment from the puddle, which was added back to the reformed puddle once the work was complete. The sediment contained the durable eggs from the clam shrimp therefore helping to repopulate the puddle and demonstrating successful species, habitat, and road management.

Before and after photos of successfully restored FRED puddle, which was occupied by Agassiz's clam shrimp both prior to and after efforts to restore road access and ephemeral clam shrimp habitat. *Erin Hilley*

During the summer of 2023, AgCS were documented in the PEW (Pew Road) puddle. This puddle had documentation of AgCS in the past, but the puddle was negatively impacted in January 2023 during unapproved road work that resulted from miscommunication. Corrective measures were implemented immediately, including site restoration. The restoration included intended improvements, similar to the FRED restoration, as PEW previously exceeded repair criteria identified in the approved maintenance plan (full road width, very deep). The incident has ultimately been constructive in improving internal communication and understanding of approval processes and clam shrimp persist within the puddle feature.

In another example of AgCS resilience, in FY23, Natural Resources-ITAM seasonal field technicians documented AgCS in a mitigation puddle named WHEE3 (Wheelock Road) two years after the puddle was filled during road grading. In November 2021, the puddle had been graded over. Two years later, the puddle has reformed independently through normal road use and AgCS were found active without further intervention. In the summer/fall of 2021, months prior to being graded over, AgCS were intentionally introduced to the small and nondescript ephemeral puddle. AgCS were observed to be persisting in WHEE3 including following a drying period, meaning that introduced adults successfully reproduced and deposited eggs to hatch in response to precipitation. The rediscovery of AgCS, in a naturally reformed puddle two years after introduction and subsequent filling shows how well adapted they are to this dynamic environment. This series of events prior to rediscovery was documented in more detail in previous reporting.

The above anecdotes demonstrate the complexity of management at Camp Edwards, but also the commitment to continual improvement of processes and communication with the wide array of base users and stakeholders (internal and external). The overall road management and clam shrimp conservation strategy is proving to be highly effective with notably improved training area use and access along with abundant and well distributed clam shrimp and puddle features. Each situation with a communication gap has been directly addressed with responsible parties and others to avoid repeat events. Each event was previously reported and here we are providing the positive results clam shrimp presence thanks to the commitment to conservation.

Road Work Plans. A significant component of the Clam Shrimp Conservation and Roadway Maintenance Plan is the submission of annual road work plans developed by MAARNG for MassWildlife review and approval. This involves internal coordination meetings with Natural Resources, Integrated Training Area Management (ITAM), Impact Area Groundwater Study Program (IAGWSP), Camp Edwards, and the Camp Edwards Department of Facilities and Engineering. Potential impacts to clam shrimp and clam shrimp habitat, as well as other wildlife and natural resources concerns, are evaluated by Natural Resources staff. Required and voluntary mitigation, based on evaluated impacts and a Net Benefit standard, is proposed and included in the road work plan.

Natural Resources Office submitted Road Work Plan 3-Apr2023 in April 2023, which included two puddle improvement projects planned for the fall and winter 2023/24. Both puddles, BP1-1 and BP1-4, have supported AgCS in the past. Their current size has made them nearly impassable at certain times of the year due to water depth, overall size, and permanent to near-permanent inundation. Size, depth, and duration are the three threshold criteria used to determine when a puddle can or should be repaired. The CMP Clam Shrimp Conservation and Roadway Maintenance Plan provides a guide for the type of mitigation required, if any, when repairing puddles with weight given to known clam shrimp sites. BP1-1 and BP1-4 are an obstacle to vehicles but they also attract breeding amphibians including spotted salamanders, resulting in a potential sink when the roads receive increased traffic. MAARNG Natural Resources Program staff will modify BP1-1 and BP1-4 through methods borrowed on in previous projects. A Final Conditions Report is submitted to MassWildlife when work is complete.

The Natural Resources-ITAM Office has coordinated with the internal stakeholders to develop the FY2024 Road Work Plan, which will be submitted in April 2024.

MA National Guard Master Development Plan Conservation and Management Permit

Conservation Permit #: 020-358.DFW
NHESP Files #: 18-37434
Project: Camp Edwards Multi-Purpose Machine Gun (MPMG) Range and Master Development Plan
Date: 29-SEP-2020

Background. The Massachusetts Army National Guard received a Conservation and Management Permit in 2020 that established a master planning framework for projects implemented at Joint Base Cape Cod by both Air and Army National Guard. A comprehensive mitigation plan was developed, including an on-site mitigation bank covering multiple habitats. The primary projects incorporated into the master planning mitigation strategy include MPMG Range at the current KD Range, Infantry Squad Battle Course at the formerly used Infantry Battle Course, expansion of Tango and Sierra ranges, cantonment modernization including a running track and classroom buildings, and potential solar development. The mitigation plan combines project design and impact minimization, take avoidance, land transfers, extensive habitat improvement, and long-term monitoring to provide for Net Benefit of a large number of state-listed species. It also establishes a framework for ongoing site development (including additional or modified projects) and land use planning while providing for proactive mitigation and demonstrable net benefit for state-listed species.

Buck Moth (*Hemileuca maia*) laying eggs in restored Pitch Pine – Scrub Oak habitat in Training Area BA-3, October 2022. Buck Moths were abundant following forestry and prescribed fire that rejuvenated understory scrub oak (*Quercus ilicifolia*) and heath species (*Vaccinium*, etc.). *Jake McCumber*

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

Natural Resources & Training Lands staff conducting state-listed plant surveys within glacial frost bottom habitat surrounded by Pitch Pine – Scrub Oak. *Erin Hilley.*

Real Property Actions. There were no significant real property actions relative to the CMP during FY23. The Military Division State Quartermaster continues to have occasional contact with the Department of Fish and Game relative to Care, Custody, and Control Agreements for parcels previously transferred (Tracts 1-4). The same office is still determining how to meet deed registry requirement for state lands. Finally,

Parcel H of Unit K, (150 of the 195 acres within the Primary Sandplain Grassland Focal Area) remains on the Military Division inventory with transfer to MADFW dependent on construction projects. Habitat mitigation and monitoring activities within the area remain ongoing.

Buck Moth (foreground, right of center) warming in the morning sun in the Primary Sandplain Grassland Mitigation Focal Area; looking north across the western subunits from Grassland Unit (GLU) 4E. October 2022 *Jake McCumber*

Construction Projects. The reporting year did see progress on minor projects under the CMP, but none of the major projects had construction progress to report.

- MultiPurpose Machine Gun (MPMG) Range: Approval and construction of the flagship project under the CMP remains delayed. MAARNG anticipates award of a construction contract during fiscal year 2024. Any firm progress will be communicated along with anticipated timelines and permit compliance elements. This includes updated turtle protection, construction contracts, etc. Turtle protection actions (tracking tagged turtles, efforts to detect new turtles, etc.) remain ongoing.
- Tango Range: Tango Range primary redevelopment was completed at the end of FY21 and minor improvements to support the construction of minor support buildings was completed in FY22, as previously reported. The support buildings are contracted with turtle protection measures applied. Work is anticipated this winter, after which the final compliance report for Tango Range will be submitted. Mitigation acreage (1) is shown in Table 1 under 2022.
- Physical Fitness Track & Field: The construction of the physical fitness track and field was contracted during FY23. MAARNG worked with LEC Environmental Consultants, a subcontractor of the designer, to develop, submit, and implement compliance documents and the turtle protection plan. MADFW approved the work under the permit on October 2nd, 2023. Habitat take associated with this project is shown in Table 1 as a debit of 3 acres relative to the mitigation bank consistent with the proposal in LEC's letter dated September 23rd, 2023. The project scope was reduced, at least at the current time, compared to that included in the original CMP application from 2020 as the turf field was removed from the scope, as was clearing between the track and the gym. As with Tango Range, this project was determined to not be a take of state-listed species or habitat on its own, but has been mitigated and treated as other projects in the CMP for comprehensive conservation.

Tango Range Operations Area with tower at right and storage shed to be replaced at center. The turtle barrier is installed with surveys completed inside during October 2023. *Jake McCumber*

Mitigation Implementation. The framework of the CMP was erected to encourage early and abundant investment in monitoring and active mitigation efforts supporting the overall mitigation bank and evaluation of long-term monitoring results. MAARNG has consistently, effectively, and extensively managed for and monitored state-listed species, their habitats, and overall ecosystem health. CMP reportable and funded actions are a specific subset of MESA-related conservation, which itself is a subset of overall natural resources management and ecosystem sustainability efforts. All of these efforts are guided by and captured within the Camp Edwards Integrated Natural

Resources Management Plan (link below) and frequent coordination with Sikes Act partner agencies (MADFW, US Fish and Wildlife Service), multiple other partner agencies, conservation collaboratives, universities, and others. CMP mitigation actions are implemented within mitigation focal areas (Pine Barrens, Sandplain Grassland, Forest Canopy Reserves). They also meet specified objectives of the CMP, associated plans, and interagency coordination (e.g., annual review meetings). The master development plan CMP effectively doubled the NR-ITAM project budget for active conservation efforts, including monitoring and habitat restoration and management. https://www.massnationalguard.org/ERC/publications/Natural_Cultural/Final-INRMP-21.pdf

Habitat mitigation and management efforts integrate very effectively with other initiatives, including fuel reduction, training support, and even climate considerations as shown in this post-harvest photo in Training Area E-3 south of the frost bottom restoration. *Jake McCumber*

Mitigation investment for specific CMP implementation contracts and projects totaled $334,893 with the bulk of that going towards habitat improvement projects in mitigation focal areas. Some of the monitoring contracts are on rotating schedules, such as two-year contracts so those expenses fluctuate more. An estimated additional $118,000 was invested in internal staff salary supporting mitigation projects within the CMP with primary emphasis on monitoring and overseeing monitoring contracts. This represents a total investment of nearly half a million dollars towards the CMP in FY23. All requested mitigation funding and projects were approved by National Guard Bureau for FY23, but only about 44% of dedicated mitigation funding was received. However, other funds were appropriately used for mitigation projects. Permit requirements were met and management targets were either met or approached being met. Table 1 does not include staff time and salary nor does it include other state-listed species projects not directly associated with the CMP (e.g., bat monitoring, clam shrimp, state-listed species habitat restoration outside the focal areas, etc.).

Several major mitigation efforts were completed, ongoing, and/or initiated in FY23, addressing all the above-listed components of the master CMP. The mitigation actions implemented during FY23 totaled 217.5 acres of active habitat restoration. Little prescribed burning was conducted within mitigation focal areas during FY23 with 10 acres during the fall of 2022 and 2.5 acres during spring of 2023; both in Training Area BA-7. Primary prescribed burns during the reporting year were conducted outside mitigation areas as maintenance and improvement of the general ecosystem is critical at Camp Edwards. Total burn days within the northern training area were limited by a number of factors so annual targets for prescribed burning were not met, but overall achievement and investment in mitigation through fire are well on track. Overall, fire represents approximately 56% and 52% of habitat mitigation in pine barrens and grassland habitat, respectively. Especially early on mechanical restoration (e.g., thinning) is expected to have a relatively large percentage as in many areas it facilitates the use of prescribed fire and meeting overall habitat objectives for structure and diversity. Mitigation implementation in pine barrens habitat for FY23 was nearly evenly split between new restoration (RAW3/E-3 forest thinning) and maintenance in prior restoration areas (C-14 coppice treatment). Extensive resource monitoring, including many in-house efforts, were completed or underway in FY23 in addition to the active habitat management.

Sum of Mitigation Acreage	Fiscal Year					Grand
Project Type	2019	2020	2021	2022	2023	Total
Pine Barrens	520	401	184	188.5	88.5	1395
Construction: Pine Barrens		-6		-1	-3	-10
Mitigation: Initial treatment, fire	448			77.5		525.5
Mitigation: Initial treatment, mechanical	72	106	164	27	49	418
Mitigation: Maintenance treatment, fire			20	85	12.5	117.5
Mitigation: Maintenance treatment, other		40			30	70
Mitigation: Real Property		261				261
Sandplain Grassland	42	80	47	79	113	361
Mitigation: Initial treatment, fire	42			65	33	140
Mitigation: Initial treatment, mechanical		80				80
Mitigation: Maintenance treatment, fire			47			47
Mitigation: Maintenance treatment, other				14	80	94
Grand Total	**562**	**481**	**231**	**267.5**	**201.5**	**1743**

Table 1. Acreage totals for mitigation banking under the Master Plan CMP by federal fiscal year and project type. Maintenance actions meet the perpetual maintenance requirement. Negative numbers represent Take under MESA and draw against the "account" with a coefficient (typically 4x) to account for mitigation ratios. Reported numbers follow formal approval and standards.

Contract Cost	Fiscal Year					Grand
Mitigation Project Type	2019	2020	2021	2022	2023	Total
Administrative	$48,020	$45,169	$11,262	$32,557	$10,000	$147,008
Construction support		$221,876		$540		$222,416
Monitoring	$62,810	$103,248	$123,739	$151,431	$73,893	$515,120
Other		$9,700				$9,700
Initial treatment, fire	$64,480					$64,480
Initial treatment, mechanical	$179,986	$88,458	$148,900		$175,900	$593,244
Maintenance treatment, other		$55,950	$8,000	$118,840	$75,100	$257,890
Grand Total	**$355,295**	**$524,401**	**$291,900**	**$303,368**	**$334,893**	**$1,809,858**

Table 2. Direct contract expenditure on mitigation projects per federal fiscal year implementing the Master Plan CMP. Significant additional expenditure is spent on internal staff time developing, overseeing, and implementing mitigation and monitoring projects under this CMP.

Lush Pitch Pine – Scrub Oak habitat north of I Range in Training Area E-1; summer 2023. This patch, within the MPMG Area Pine Barrens Mitigation Focal Area, has had mastication and prescribed fire to restore a healthy barren that is now thriving with Eastern Whip-poor-wills, frost bottoms, and many other state-listed and federal at-risk species. *Jake McCumber*

Projects undertaken in FY23 as mitigation efforts are summarized below. Projects and efforts that are programmatic in nature or otherwise not specifically meeting requirements of the Permit are not included, but are reported in both the Annual State of the Reservation Report and Camp Edwards INRMP Annual Review. All state-listed species observations are reported through MassWildlife's Heritage Hub database.

- **Species Protection**
  - **MPMG Range** – Extensive Eastern Box Turtle (*Terrapene carolina*) protection planning and effort exists in support of the MPMG Range Project, which has been described in detail in previous reports. In TY 2023 MPMG turtle protection efforts were focused on basic monitoring of area turtles, including opportunistically tagging new turtles found in the area. AECOM (contracted support) tracked turtles outfitted with radio-transmitter tags at the proposed range location to change out transmitters and to get fall hibernacula locations. A summary of their activities will be submitted to Natural Heritage in the winter of 2023-2024.
  - **Tango Range** – No new work was completed during FY23, but turtle protection and surveys were completed at the range operations area at the beginning of FY24 (October) consistent with prior approvals and turtle protection plans.
  - **Track and Field (1800 area)** – LEC Environmental Consultants, Inc. provided turtle protection oversight in coordination with MassWildlife and MAARNG for the physical fitness track and field construction.
- **Species Monitoring (CMP focused)**
  - **Eastern Box Turtle (EBT)**
    - In FY21, MAARNG NR-ITAM contracted the University of Illinois Wildlife Epidemiology Laboratory to implement an intensive box turtle health assessment. Some of the results were published in January 2024 in The Journal of Zoo and Wildlife Medicine entitled "Cutaneous myiasis and its relationship to wellness in eastern box turtles (*Terrapene carolina carolina*) in Cape Cod, Massachusetts."

      https://bioone.org/journals/journal-of-zoo-and-wildlife-medicine/volume-54/issue-4/2022-0173/CUTANEOUS-MYIASIS-AND-ITS-RELATIONSHIP-TO-WELLNESS-IN-EASTERN-BOX/10.1638/2022-0173.short?tab=ArticleLink
    - MAARNG NR-ITAM applied radio transmitters and monitored previously transmittered turtles for an end of year total of 64 EBT during FY23 as part of the long-term box turtle monitoring requirement. This includes oppor-tunistic turtle observations from a number of programs, including NR-ITAM, Camp Edwards Range Control, IAGWSP, other site users, soldiers within training units, and the following projects.
    - Nine EBT mortalities were documented in FY23, including 3 without transmitters. Three were road mortalities and the remainder (6) are unknown. Four of the unknown mortalities were discovered by other researchers and the NR-ITAM Office is awaiting details on any apparent cause of death.

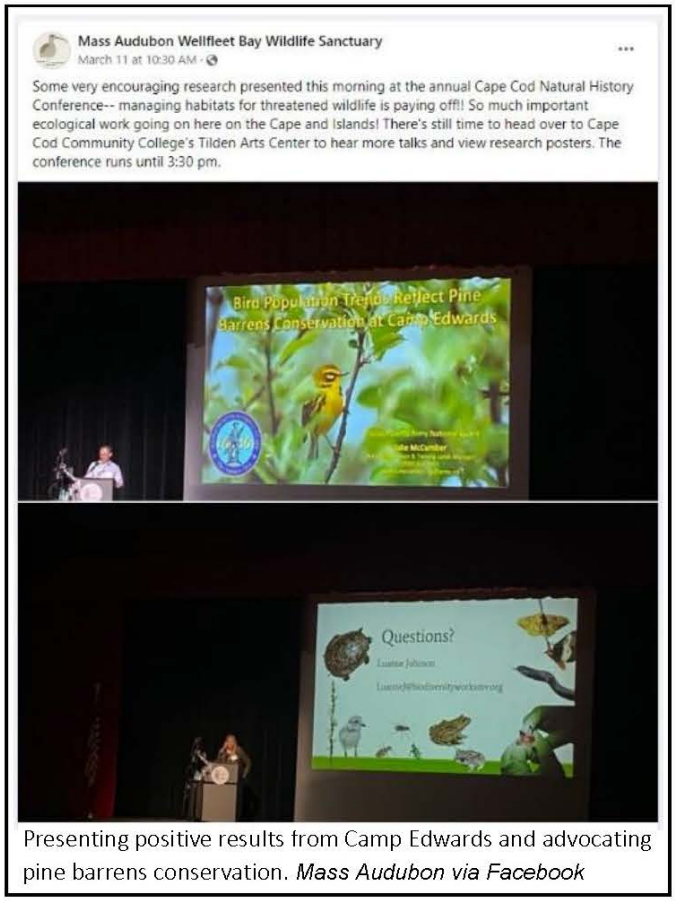
Kristina McEvoy, a 2023 Conservation Technician, with a box turtle newly found in September while conducting status checks for known, tracked turtles in the proposed MPMG Range area. *Jake McCumber*

    - MAARNG NR-ITAM contracted a "planning level survey" effort targeted at providing baseline data on box turtle presence and approximate density in a variety of habitat conditions distributed

throughout Camp Edwards. By the conclusion of surveys in October 2022, 15 EBT were detected and 13 individuals were outfitted with radio transmitters for long-term tracking.

- The Natural Resources Office facilitated a UMass Amherst graduate student's research on dipteran larval infestations in Eastern box turtles on Camp Edwards in FYs 22 and 23. Movements of healthy and infected turtles were compared to determine impacts on mobility from larval infestations. The species of fly infesting box turtles was identified as *Dexosarcophaga cistudinis*. Infection did not affect turtle body condition, habitat use, or movement, but did affect shell temperature. This project included inputs and collaboration from USFWS, USGS, and NHESP. The findings from this research have been submitted for publication in the Northeastern Naturalist, titled "The effect of myiasis on Eastern Box Turtles (*Terrapene carolina carolina*) body condition, movement, and habitat use at Camp Edwards in Massachusetts."
- MAARNG NR-ITAM hosted a PhD student from the University of Massachusetts (UMass) Amherst's Massachusetts Cooperative Fish and Wildlife Research Unit studying prescribed fire influence on EBTs . Unfortunately, this project was canceled due to external circumstances.

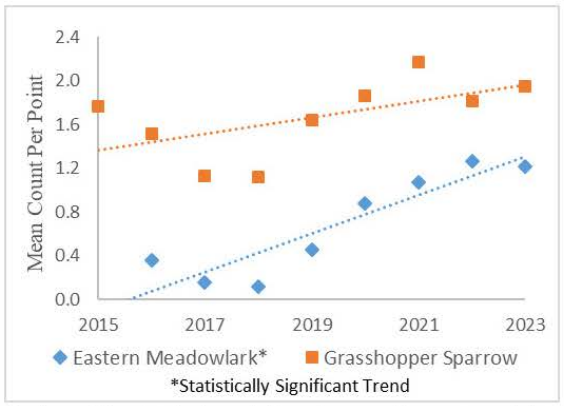
- **Breeding Bird Point-counts** – Point-count surveys were conducted from 22 May through 23 June, 2023. Three surveys were conducted at each of 79 points throughout Camp Edwards, including 14 grassland (cantonment) points and 65 points in the northern training area. This represents a total of 237 individual count surveys events. A total of 83 species were documented during the month of surveys, which was the highest count documented from 1994 through 2023. Mean species count from 1994-2012 was 62.8, which has increased to 72.4 per year (range 60-83) in the 2013 through current period with an updated protocol and static point set. Long-term trend analysis was completed for the newer point-count protocol covering data collected from 2013 through 2022 and provided in the previous report. Trend analysis should be updated in 2024 and will reported at that time. The primary chart for Species of Greatest Conservation Need is still included below. Trend analysis and habitat management efforts for birds, based on this data and the results provided in the FY22 report, was presented at the 2023 Cape Cod Natural History Conference (above), sharing the profound results realized through active habitat stewardship and documented through intensive monitoring efforts.



Presenting positive results from Camp Edwards and advocating pine barrens conservation. *Mass Audubon via Facebook*

  - Grassland birds: Grassland bird trends were updated in FY23 and were presented to the Paskamansett Bird Club in November. Overall, positive and results have been documented within the grasslands. The video is available online at: https://www.youtube.com/watch?v=_LzZFfqJ3N0. Two state-listed species, Grasshopper Sparrow (*Ammodramus savannarum*) and Eastern

Meadowlark (*Sturnella magna*), are showing significant increases within the Camp Edwards grasslands (at left), despite severe declines throughout Massachusetts and the rest of the northeastern United States. Two key species with apparent decreases are Upland Sandpiper (*Bartramia longicauda*) and Horned Lark (*Eremophila alpestris*), but both species have responded very positively to the grassland management on the Coast Guard airfield. The overall Joint Base Cape Cod trends are increasing. This demonstrates effective patch management across grassland areas (e.g., Crane Wildlife Management Area, Camp Edwards grasslands, Air Station Cape Cod) as different zones provide for somewhat different habitat and species providing a more functional and diverse system. Vesper Sparrow (*Pooecetes gramineus*) continues the recent trend of not being detected during surveys at Camp Edwards. It is uncertain if this species might be residing in unsurveyed habitat patches or no longer occurs at Camp Edwards as it has declined throughout the region. It's lack of detection is incongruous with species of similar habitat association that are thriving at Camp Edwards.



Eastern Meadowlark and Grasshopper Sparrow point-count trends using the 14-point subset of monitoring stations within the grasslands habitat.

- **Eastern Whip-poor-will (*Antrostomus vociferous*, EWPW)** – FY23 marked the ten-year point for the current form of nightjar surveys at Camp Edwards with three routes run annually following the Northeast Nightjar Survey protocol and a total of 32 survey locations. A detailed report of the year's results and a ten-year analysis of the data is at the end of this report. In brief summary, the annual per-point count average was 3.8 with an occupancy rate of 0.97, meaning nearly all survey points had calling Eastern Whip-poor-will. The maximum count at a point was 9 birds, representing a remarkable density and this species of significant conservation concern has shown a very positive response to habitat restoration and management, including conservation forestry and prescribed burning. The Eastern Whip-poor-will has a statistically significant increasing trend at Camp Edwards with a slope of 0.19 bird/point/year ($p<0.05$). All zones of the base and all routes have increasing trends.
- **Lepidoptera (Moths and Butterflies)**
  - Pine Barrens Moths: FY23 had the second year of light trap sampling for rare moths following the statistical sampling design developed for the CMP. It also had the third year of annual vegetation sampling associated with the pine barrens moth monitoring. The moth monitoring effort was the second year of a two-year contract with GZA GeoEnvironmental. Seven stations were trapped on four separate nights with blacklight traps. A total of 169 moth species were identified, including two state-listed species: Herodias Underwing (*Catocala Herodias*) and Pink Sallow (*Psectraglaea carnosa*). While the number of state-listed species identified was lower than usual, it is expected for moth populations to fluctuate significantly and the overall sampling rate is fairly low with a focus towards long-term monitoring. The primary impact was likely frequent rain that limited available sampling nights and directly impacted sampling nights through precipitation and fog. Vegetation sampling was contracted with Davey Resource Group and 30 sites were surveyed.
  - Frosted Elfin Butterfly and Slender Clearwing Moth: The Frosted Elfin Butterfly (*Callophrys irus*) is state-listed and being considered for federal listing. The Slender Clearwing Moths (*Hemaris gracilis*) is state-listed and generally overlaps in habitat with the Frosted Elfin. Five sites were surveyed using the US Fish and Wildlife Service "Frosted Elfin Habitat and Butterfly Survey Protocol" in FY23. In general, this protocol has been applied to sample a set of sites regularly while also investigating new locations with the protocol, which combines adult flight surveys, caterpillar surveys, and host plant surveys. Fifteen adult flight surveys were conducted, supplemented by two larval flashlight surveys. Four of the five survey areas had Frosted Elfin present, while the fifth

location had a Frosted Elfin observed nearby, but outside the survey plot. A total of 20 individuals were counted during formal surveys, with an average of one and range from zero to nine. Two of the survey areas detected new population areas for the Frosted Elfin at Camp Edwards, continuing the annual increase of known locations for the species. Of greatest interest is the discovery of active colonization of restored habitat by both the Frosted Elfin and Slender Clearwing. The southern portion of Training Area C-14 has been a focus of Pitch Pine – Scrub Oak habitat restoration since 2018 with a combination of mechanical forestry, prescribed fire, and mechanical/chemical coppice management. Survey efforts in FY23 documented abundant host plants for both species (Wild Indigo [*Baptisia tinctoria*] for Frosted Elfin and Lowbush and Pallid Blueberry [*Vaccinium angustifolium* and *V. pallidum*] for Slender Clearwing). Multiple adult and several larval Frosted Elfin were documented along with multiple Slender Clearwing larvae within the restoration area. The restoration was intentionally designed to expand habitat away from the linear utility rights-of-way and rehabilitate stand structure of the area from the 1990s to support rare species.

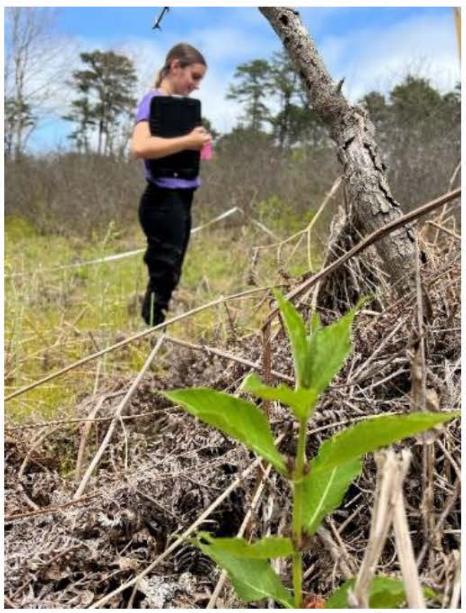
Frosted Elfin Butterfly photographed in cantonment grassland/heathland habitat, May 2023. *Jake McCumber*

- General Moths: More opportunistic moth survey and documentation has continued forward from 2019. During FY23 a continued partnership with Teá Kesting-Handly, a graduate student from UMass Boston, led to multiple UV-light moth surveys with the two primary locations situated within mitigation focal areas SGMFA (Primary) and PBMFA (West). These efforts have led to documentation of several listed species and other species of significant conservation concern. Additionally, informal diurnal photography efforts by Jake McCumber continue to document rare barrens species. Of particular management interest is documentation of many barrens specialists that are poorly represented in New England or throughout their ranges, but persisting in fire maintained habitat at Camp Edwards. The growing suite of online identification aids and digital photography are significant facilitators allowing for better documentation, in particular, of microlepidoptera. FY23 was a good year for documenting habitat specialist state-listed species including Pink Streak Moth (*Dargida rubripennis*), Collared Cycnia (*Cycnia collaris*), and Buck Moth (*Hemileuca maia*), in addition to above mentioned species.
- Acadian Hairstreak: Surveys for Acadian Hairstreak (proposed for state listing) were completed by GZA GeoEnvironmental, Inc., under contract by MAARNG NR-ITAM, on four days in mid-July at 7 survey sites, but only one Acadian Hairstreak was observed.

- **Purple Tiger Beetle (*Cicindela purpurea*)** – The Purple Tiger Beetle was documented for the first time at Camp Edwards in 2023. Several individuals were documented at five different locations. Eighteen different individuals were photographed, representing likely a third of the individuals observed. Typical observations ranged from three to six individuals at a location. Repeated observations were made within the Primary Sandplain Grassland Mitigation Focal Area, with particular focus on the interior dirt roads within and near Parcel H of Unit K. This includes both spring (April, May) and fall (September) observations, demonstrating an effective population. While not within project or mitigation areas, it is also notable that other Purple Tiger Beetle observations occurred on training roads within Pitch Pine – Scrub Oak habitat and at actively used soldier dig sites – areas used for heavy equipment training and generally kept as open sand with sparse, dry-site vegetation. This specie warrants continued

opportunistic surveys to better document their distribution within cantonment and the northern training area.

- **State- listed Plants –** The CMP does not have specific state-listed plant monitoring requirements, but does reference monitoring and reporting will be done.
  - Frost bottom species: Six frost bottom rare plant sites were surveyed for Broad Tinker's-weed (*Triosteum perfoliatum*) in 2023 with presence documented at three sites. Adder's Tongue Fern (*Ophioglossum pusillum*) was observed at one of four sites surveyed.
  - Sandplain species: A planning level survey was conducted targeting rare (e.g., listed or watchlisted) plants within sandplain grassland/heathland habitat. This effort provided an update on the presence, status, and distribution of a variety of rare plants at Camp Edwards, including the addition of two listed species for Camp Edwards. Stiff Yellow Flax (*Linum medium var. texanum*, state Threatened) was observed at two locations within the SGMFA-Primary in August of 2023. Papillose Nut-sedge (*Scleria pauciflora*, state Endangered) was found in multiple locations, including a large population at KD Range, adjacent to the PBMFA-MPMG. A Permit amendment is in process with an approved conservation plan for the species. Finally, Grass-leaved Ladies'-tresses Orchid (*Spiranthes vernalis,* state Threated) was found to be relatively numerous and widespread in sandplain grassland/heathland, including within the SGMFA-Primary.



Conducting 2023 frost bottom rare plant surveys with *Triosteum perfoliatum* in foreground. *Erin Hilley*

- **Habitat Management and Planning**
  - **Planning –** Planning effort has primarily focused on updating the Camp Edwards Integrated Wildland Fire Management Plan. This important guiding document will facilitate long-term success of the mitigation and other conservation efforts at Camp Edwards.
  - **Pine Barrens Mechanical Restoration –** A whole-tree harvest project was contracted in FY22 for winter (FY23) implementation in Training Area E-3 (Burn Unit RAW3, PBMFA-West). This action was a third phase of ongoing restoration of restoring diverse, transitional habitat. Phase one focused on restoring a large kettle hole frost bottom, which is showing effective ecological function with this rare phenomenon. Phase two was reduced in scale due to increased forestry costs and primarily thinned woodland canopy surrounding the frost bottom to improve function and provide gradual transition. Phase three continued this transition with thinning of canopy trees across an additional 49 acres. Two stands were treated with post-harvest density of 60 and 80 trees per acre, respectively. These treatments facilitate frost bottom function, provide greatly improved pine barrens habitat and structural diversity, and increase forest resilience. This is the highest priority type of restoration effort as it is maximizing habitat and structural diversity, restoring impact area type habitat in areas where habitat maintenance actually can be implemented, and significantly reducing risk from pests and other threats like wildfire.
  - **Other Habitat Maintenance/Restoration**
    - An invasive plant management project, contracted in FY22 and completed in the beginning months of FY23 (Oct-Nov) included 50 acres of low woody invasive shrubs and vines in Grassland Unit 04a and 04d. Fourteen acres was follow-up treatment to persistent and overlooked plants from the 2021 treatment (04a) and the remaining acreage followed prescribed burns carried out in the spring 2021 (04a) and spring 2022 (04d).

- An additional invasive shrub treatment was contracted and completed in FY23 that prioritized treatment of Honeysuckle (*Lonicera japonica*) and Autumn Olive (*Eleagnus umbellata*) in GLU4B (northeastern corner of SGMFA-Primary). It was successfully completed in late September, 2023. Herbicide application is a critical piece of habitat conservation and restoration and is implemented with numerous best management practices and use minimization.
- Phase one (30 acres) of a coppice treatment of tree oak regeneration in the C-14 restoration area (PBMFA-North) was contracted in FY22 for completion in October and November (FY23). These coppice treatments are critical to restoring functioning pitch pine – scrub oak natural community and similar habitats. Selective and targeted methods are used, including hand cutting all resprout stems from some stumps and sponge-wiping cuts with herbicide while other stumps had all but one stem cut and no herbicide applied. These treatments facilitate long-term habitat development when coupled with prescribed fire. They have facilitated relatively rapid colonization by rare and listed barrens flora and fauna documented in FY23, including Narrow-leaved Bush-clover (*Lespedeza angustifolia*), Frosted Elfin Butterfly, Slender Clearwing Moth, and Barrens Buckmoth.

Ongoing habitat restoration in Training Area C-14 (PBMFA-North). The area to the left (south) has been treated with prescribed fire and selective removal of tree oak sprouts. At the time of the photo (October 2022) the north side had received neither following the 2018 thinning. *Jake McCumber*

- **Prescribed Burning** – Three prescribed burns were completed within mitigation areas during FY2023 with two operations (12.5 acres) within PBMFA – South and one operation (33 acres) within SGMFA – Primary. These numbers were below annual targets due to a variety of factors that hinder wildland fire, including weather conditions and competing programmatic priorities and schedules. However, these fluctuations were planned and accounted for within mitigation planning and the actions provided quality habitat maintenance and FY24 accomplishment is well on track.

Preparing to burn pitch pine – scrub oak habitat in Pine Barrens Mitigation Focal Area – South (Training Area BA-7); November, 2022. Occasionally conducting smaller "set up" burns serves multiple functions. One of these is to treat fuels (i.e., vegetation) in more challenging conditions or locations to facilitate a larger operation in the future. Another significant benefit is providing a mosaic of fire effects for flora and fauna through variation in timing and patch size. *Erin Hilley*

Fiscal Year 2024 Planning and Implementation

Army National Guard budgets have again been substantially reduced in FY24, impacting facilities and environmental programs throughout the country. Further, under a continuing resolution federal funding has not been provided for FY24 projects and uncertainty exists as to when and how much funding may be provided. All projects submitted for funding were approved by National Guard Bureau for FY24 and plans are in place to obligate funds when they are provided. The robust and proactive structure of the master plan CMP was specifically developed to minimize or eliminate negative impacts from low funding years as extensive mitigation has been completed, as reported above, while minimal construction implementation has occurred under the Permit.

Mechanical restoration in mitigation areas is likely to be reduced for FY24 with a greater emphasis on meeting wildland fire objectives. Monitoring and research efforts will be focal for FY24 with the continued implementation of the long-term moth monitoring protocol and other annual, long-term monitoring.

- **Project Scoping, Design Minimization, and NHESP Review**
  - **MPMG Range –** Completion of the Environmental Management Commission process will hopefully be in 2024 along with approval and contracting for construction. Submission and completion of all pre-Work required information and tasks will be completed as appropriate and able prior to construction along with any adjustments to turtle protection plans or schedules. A Permit amendment is currently in process to account for the detection of Scleria pauciflora at the KD Range location for which an approved conservation plan has already been developed.
  - **Tango Range –** Final reporting was in development and preparation for submission to NHESP to seek a certificate of compliance. However, funding was provided to include Range Operations Control Area (ROCA) buildings as previously reported and addressed above. Completion is anticipated by fall 2024 with final reporting and project close-out by the end of 2024.
  - **India and Sierra Ranges –** Consistent with Tango Range, support buildings are contracted for construction within the ROCA. Project designs and plans have been approved by MassWildlife and construction is anticipated to run through 2024. Mitigation has already been applied for Tango Range. India and Sierra Ranges do not require mitigation as there is no species or habitat take associated with the ROCA modernization.
  - **Track and Field (1800 area) –** As this project is in construction it is anticipated that project close-out and final reporting will be provided to MassWildlife by the end of 2024.

Eastern Hog-nosed Snake (*Heterodon platyrhinos*) is a state-listed species that benefits from the diverse barrens mosaic at Camp Edwards, including woodland openings such as ranges. Wildlife exclusions and surveys protect these snakes in addition to box turtles and other small vertebrates. *Sean Rigney*

  - **ISBC Range –** Design finalization and project timing for ISBC Range are uncertain. Turtle protection planning and other required support (e.g., permit compliance letter) will need to be contracted, followed by submission and completion of all pre-Work required. MassWildlife will be provided project designs, turtle protection plans, and other documents as developed if the project is to move forward.

- **Species Protection**
  - **MPMG Range** – Resumption of turtle protection efforts including silt fence installation and construction support consistent with approved turtle protection plan. This will include replacing the silt fence at the soil staging site (if used), continued monitoring, and communication with Natural Heritage.
  - **Tango, India, and Sierra Ranges** – Protection measures (silt fence) are in place and monitoring will continue through the construction period. Pre-construction surveys were completed in October, 2023.
  - **Track and Field –**Compliance with turtle protection plan and reporting.

- **Species Monitoring**
  - **Eastern Box Turtles** – Ongoing in-house monitoring of box turtles found both opportunistically and during targeted surveys in 2019-2023 near future construction projects as well as those found during planning level surveys. Review of telemetry, mortality, and spring emergence data is being completed by AECOM in FY24.
  - **Bird Surveys** – Continuation of annual surveys, including cantonment and training area point count surveys and Eastern Whip-poor-will surveys.
  - **Lepidoptera (Moths and Butterflies) –** Implementation of moth monitoring plan, including vegetation surveys, UV trap sampling (if funding becomes available), and pilot larval surveys for Barrens Buckmoth, depending on resources. Formal Frosted Elfin surveys will be conducted along with supplemental larval surveys for Frosted Elfin and Slender Clearwing Moth.

The Pink Streak Moth is a state-listed obligate of Switchgrass (Panicum virgatum) within barrens and sandplain habitats. It has been documented recently during both formal light trapping surveys and more opportunistic light-sheets. *Jake McCumber*

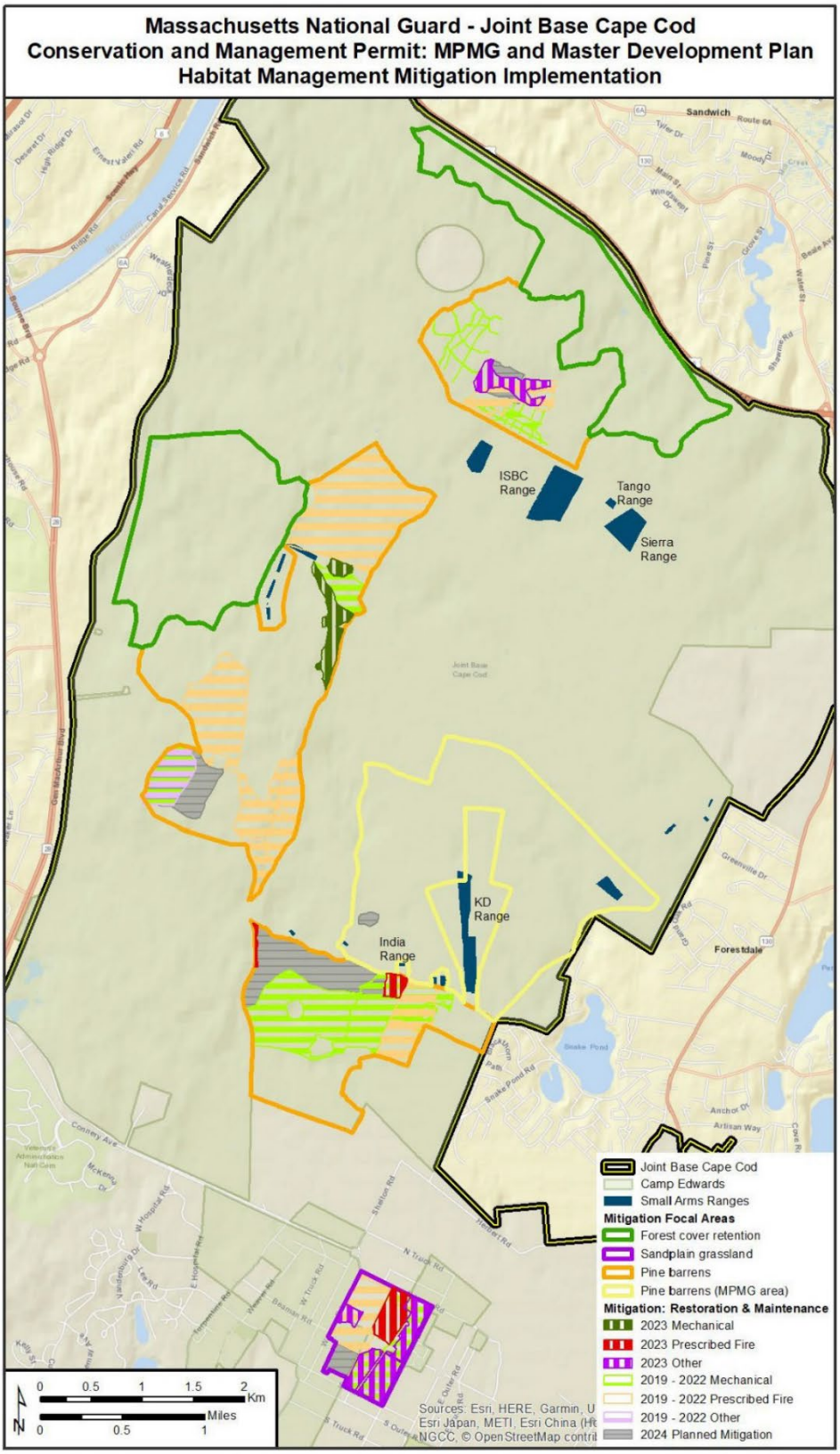
- **Habitat Management and Planning (see map below)**
  - **Prescribed Fire** – Priority prescribed burn areas for mitigation include:
    - PBMFA-West: Training Areas A-5 and BA-4 maintenance fires for pitch pine – scrub oak and pitch pine – heath habitat up to approximately 61 acres.
    - PBMFA-South: Training Areas BA-6 and BA-7 maintenance fires for pitch pine – scrub oak and pitch pine – heath habitat up to approximately 178 acres.
    - SGMFA-Primary: Approximately 90 acres are prioritized between fall and spring burn seasons. Targets include the more wooded northeastern portion of the mitigation area to facilitate transition to savannah habitat. The remainder is maintenance within open sandplain grassland along the eastern and southern portions of the MFA.
  - **Mechanical and Other Restoration** –
    - Long-term and small scale patch mowing of understory shrubs and small trees will continue in Training Area BA-6 (PBMFA South) to provide complex structural diversity in support of both training and habitat objectives. Approximately 7 acres will be mowed in FY24.
    - An 18-acre coppice treatment (phase 2) of tree oak regeneration in the C-14 restoration area (PBMFA-North) was contracted in FY23 for completion in October 2023 (FY24). These coppice treatments are critical to restoring functioning pitch pine – scrub oak natural community and similar habitats. Selective methods are used including cutting all resprout stems from some stumps and sponge-wiping cuts with herbicide while other stumps will have all but one stem cut and no

herbicide applied. These treatments facilitate long-term habitat development, coupled with prescribed fire and have facilitated colonization by rare and listed barrens flora and fauna.

- Habitat maintenance of a 5-acre sandplain patch within PBMFA – MPMG area is planned in order to maintain essential mosaic habitat including woodland openings of grassland and heathland within pine barrens to support a number of listed species. The area is known as Demo-1 and was the site of a major restoration effort in 2004. It may provide an effective expansion site for rare plants, including *Scleria pauciflora*.

- **Rare species and mitigation outreach:** while outreach for rare species is not required or discussed in the CMP, other than contractor education, public outreach on rare species is important for long-term support of conservation efforts at Camp Edwards and elsewhere, including mitigation efforts.
  - **Camp Edwards Tours** – Base-wide Camp Edwards tours remain well attended and received. Mission activities and habitat conservation are the primary topics, including extensive discussion of rare species, habitat needs, and ongoing mitigation efforts under the CMP. These tours have garnered notable interest in listed fauna and early successional habitat. FY23 tours averaged 1.5 per month from May through October.
  - **Grassland Bird Tours** – MAARNG hosted six public tours in May and June of 2023 focused on localized specialties of sandplain grassland habitat at Camp Edwards. These have long been productive outreach with the public and bird enthusiasts for both grasslands habitat conservation and military conservation.
  - **Public presentations** – MAARNG personnel gave multiple other public or wide audience outreach presentations focused on state-listed species and rare habitat management during FY23. Population trends for bird Species of Greatest Conservation Need at Camp Edwards were presented at the Cape Cod Natural History Conference along with a poster detailing Aggassiz's Clam Shrimp conservation and natural history. We hosted a MA Butterfly Club tour and discussion of Camp Edwards management, including a survey for Acadian Hairstreak Butterflies (*Satyrium acadica*), which is proposed for state-listing, and other barrens specialties. A variety of other small talks and engagements occurred through the year. All such outreach events focused on the importance and benefits of rare species conservation and habitat management with particular focus on pine barrens and sandplain grasslands.

Grassland bird tours at Camp Edwards are highly popular with bird enthusiasts and the general public. They are an exceptional outreach opportunity to engage about rare species and habitat management, including the keys to grassland management of fire, mowing, and herbicide. These tours are often people's first introduction to fire ecology, habitat management concepts, and species like the Grasshopper Sparrow. *Jake McCumber*



Camp Edwards mitigation implementation (habitat restoration and management) from 2019 through 2023, including ongoing and planned 2024 efforts. Mitigation areas from the Conservation and Management Permit are shown in bold outlines. Habitat management efforts outside mitigation areas are not shown.

APPENDIX G
RARE SPECIES REPORTED TO NATURAL HERITAGE AND ENDANGERED SPECIES PROGRAM

Appendix G - LIST OF RARE SPECIES REPORTED TO NHESP												
Quantities shown are not resulting of standardized surveys and should not be interpreted as population trends.												
			Individuals Reported									
Common/Scientific Names	**Fed Status[1]**	**State Status[2]**	**TY 2014**	**TY 2015**	**TY 2016**	**TY 2017**	**TY 2018**	**TY 2019**	**TY 2020**	**TY 2021**	**TY 2022**	**TY 2023**
BIRDS												
Grasshopper Sparrow[3] *(Ammodramus savannarum)*	-	T	26	23	16	15	16	20	34	36	29	30
Northern Harrier[4] *(Circus cyaneus)*	-	T	12	Wintering	Wintering	Wintering	Wintering	Wintering	Wintering	Wintering	Wintering	Wintering
Upland Sandpiper[5] *(Bartramia longicauda)*	-	E	2	4	9	8	7	12	6	2	1	4
Eastern Meadowlark[3,5] *(Sturnella magna)*	-	SC	1	0	8	3	2	7	14	17	9	21
Long-eared Owl[4] *(Asio otus)*	-	SC	1	0	0	0	0	0	0	0	0	0
Vesper Sparrow *(Pooecetes gramineus)*	-	T	1	0	0	0	0	0	0	0	0	0
Whip-poor-will[6] *(Antrostomus vociferous)*	-	SC	156	96	87	52	110	53	99	136	137	105
Bald Eagle[4] *(Haliaeetus leucocephalus)*	-	SC	0	3	0	0	0	0	0	0	0	0
REPTILES and AMPHIBIANS												
Eastern Box Turtle *(Terrapene carolina carolina)*	-	SC	15	13	38	42	43	58	45	83	62	96
Eastern Hog-nosed Snake *(Heterodon platirhinos)*	-	SC	0	0	2	3	8	9	1	2	6	7
PLANTS												
Adder's Tongue Fern[8] *(Ophioglossum pusillum)*	-	T	1467	256	98	247	0	25	646	N/A	225	215

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Grass-leaved Ladies' Tresses *(Spiranthes vernalis)*	-	T	0	0	0	0	0	0	0	6	0	31
Broad Tinker's Weed[8] *(Triosteum perfoliatum)*	-	E	297	N/A	113	127	0	200	6	N/A	1883	3,161
American Arborvitae[9] (*Thuja occidentalis*)	-	E	0	0	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stiff Yellow Flax (Linum texanum var. medium)	-	T	0	0	0	0	0	0	0	0	0	92
Papillose Nut-sedge (Scleria pauciflora)	-	E	0	0	0	0	0	0	0	0	0	41,081
BEETLES												
Purple Tiger Beetle (Cicindela purpurea)	-	SC	0	0	0	0	0	0	0	0	0	25
BEES												
Walsh's Anthophora[10] *(Anthophora walshii)*	-	E	0	0	0	5 (1)	0	32 (9)	4	N/A	1	9
BUTTERFLIES and MOTHS[11]												
Buck Moth (*Hemileuca maia*)	-	SC	4	13	90	95	0	4	2	74	133	23
Pine Barrens Speranza *(Speranza exonerata)*	-	SC	0	0	44	13	0	0	0	0	4	0
Sandplain Euchlaena *(Euchlaena madusaria)*	-	SC	0	0	3	7	0	0	1	0	0	0
Heath Metarranthis *(Metarranthis pilosaria)*	-	SC	0	0	1	1	0	0	0	0	0	0
Melsheimer's Sack Bearer *(Cicinnus melsheimeri)*	-	T	0	0	2	0	0	0	7	0	0	0

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BUTTERFLIES and MOTHS[11]												
Gerhard's Underwing *(Catocala herodias)*	-	SC	0	0	33	10	0	0	2	0	35	6
Pine Barrens Zale *(Zale lunifera)*	-	SC	0	0	13	8	0	0	0	0	0	0
Barrens Dagger Moth *(Acronicta albarufa)*	-	T	0	0	1	0	0	0	0	0	0	0
Sandplain Heterocampa *(Heterocampa varia)*	-	T				0	N/A	N/A	N/A	N/A	1	0
Chain-dotted Geometer *(Cingilia catenaria)*	-	SC	0	0	0	0	0	1	0	0	0	0
Drunk Apamea *(Apamea inebriata)*	-	SC	0	0	1	0	0	0	0	0	0	0
Pink Sallow *(Psectraglaea carnosa)*	-	SC	0	0	9	5	0	0	0	0	0	6
Pink Streak *(Dargida rubripennis)*	-	T	0	0	25	0	0	0	3	1	1	2
Collared Cycnia *(Cycnia collaris)*	-	T	0	0	0	1	0	11	33	200	7	4
Coastal Heathland Cutworm *(Abagrotis benjamini)*	-	SC	0	0	0	1	0	0	0	0	0	0
Woolly Gray *(Lycia ypsilon)*	-	T	0	0	0	2	0	0	0	0	0	0
Water-willow Stem Borer *(Papaipema sulphurata)*	-	T	0	0	0	1	0	0	0	0	0	0
Waxed Sallow Moth *(Chaetaglaea cerata)*	-	SC	0	0	0	2	0	0	0	0	0	0

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BUTTERFLIES and MOTHS[11]												
Frosted Elfin[12] *(Callophrys irus)*	-	SC	0	0	5	5	5	TBD	25	57	13	64
Slender Clearwing Sphinx *(Hemaris gracilis)*	-	SC	0	0	0	0	0	0	5	3	26	3
CRUSTACEANS[13]												
Agassiz's Clam Shrimp *(Eulimnadia agassizii)*	-	E	0	1	0	6	38	9	3	5	N/A	12
American Clam Shrimp *(Limnadia lenticularis)*	-	SC	0	0	0	0	0	0	0	3	N/A	0
MAMMALS												
Northern Long-Eared Bat[14, 15] *(Myotis septentionalis)*	T	E	8	22 (2)	15 (1)	2	1	3	1	TBD	N/A	0
Little Brown Bat[14, 16] *(Myotis lucifugus)*	UR	E	4	40	22	4	2	6	2	TBD	N/A	5
Tricolored Bat[14,16] (Perimyotis subflavus)	UR	E	11	11	7	3	2	3	1	TBD	N/A	3
Eastern Small-Footed Bat[14, 16] *(Myotis leibii)*[14, 16]	UR	E	0	0	0	0	0	1	1	TBD	N/A	0

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

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

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

[4] NHESP is only accepting reports of nesting raptors, rather than opportunistic observations of individuals. Reports are provided as relevant, but common wintering birds or migrants are not individually tracked or reported (e.g., Northern Harrier).

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

[6] As of TY 2016, quantities only reflect the results of annual survey routes during May, after totaling the minimum number (between two observers) heard at each site. In prior years, the number shown reflects the quantity reported to NHESP, which may include multiple survey windows and repeated counts. Due to Covid-19 concerns, 2020 routes were not run in duplicate, and the number represents the total number of individual birds heard calling throughout the routes.

[7] In most years a subset of O. pusillum sites are surveyed. In 2023, the five known extant sites were surveyed. This needs to be considered if comparing total numbers accross years. In 2018, only sites with historic records and no recent records were surveyed, and this should not be interpreted as a loss of rare plants between 2017 and 2018. The total number of 2019 numbers are likely under representative, as surveys occurred late in the season.

[8] Triosteum perfoliatum surveys, starting in 2022, are carried out using recent findings from a genetics study that suggest that the two species of Triosteum on the base, the other non-rare T. aurantiacum, are the same genetically and should be treated as the rare T. perfoliatum. Totals for years previous to 2022 consist only of Triosteum individuals that showed certain identification features now not relied on.

[9] NHESP is not interested in tracking this population, as it is likely of anthropogenic origin (pers. comm. with State Botanist, Bob Wernerehl).

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

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

[12] MAARNG staff did not perform surveys for Callophrys irus in 2019, but facilitated USFWS surveys. Results are pending, but USFWS staff found Frosted Elfins across a wider area than was previously known.

[13] Counts represent the number of sites (i.e., puddles or pools) where clam shrimp were observed during annual surveys. Annual surveys include a subset of sites that have contained clam shrimp in the past, have not contained clam shrimp in the past, and that have not been surveyed previously.

[14] Acoustic monitoring collects “call sequence” data and the true number of individuals is unknown. Numbers in the table reflect the number of survey sites with acoustic detections confirmed through manual call vetting. Numbers are reported to NHESP, but not tracked by them due to current uncertainty in using acoustic identifications.

[15] Number in parentheses is captured individuals trackable by NHESP due to species identification confirmation versus acoustic data.

[16] "UR" indicates a species is currently under review for listing on the federal Endangered Species Act.

APPENDIX H
ENVIRONMENTAL PERFORMANCE STANDARDS VIOLATIONS HISTORY

EPS VIOLATIONS HISTORY			
TRAINING YEAR	REPORTED VIOLATION	EXPLANATION OF VIOLATION	CORRECTIVE ACTION
TY 2023	None	-----	-----
TY 2022	General Performance Standard	There was unauthorized use of yellow and white smoke grenades outside of the approved non-standard training plan. White smoke grenades were not approved for use; yellow smoke grenades were used in an unapproved location. The MAARNG reported the nonconformance to the EMC on March 31, 2022.	Full-time range and civilian staff were counseled on their failure to follow established processes for consultation and approval for any non-standard training event; staff were directed that only written non-standard training plans, signed by the EMC EO and the MAARNG representative will be executed, and no verbal authorizations will be authorized. Refresher training was conducted with part-time staff to ensure compliance.
TY 2021	Range Performance EPS (EPS 19)	Additional targets were placed on the 25-meter line on Sierra Range. Transition firing was conducted on Echo Range. No consultation for approval was conducted with Camp Edwards Plans and Training, the Environmental & Readiness Center and the EMC's Environmental Officer. The MAARNG reported the nonconformance to the EMC on February 18, 2021.	Full-time Range Control staff were counseled on the importance of following established processes of consultation and approval for any non-standard training event; the Range Control maintenance manager was directed that he shall not alter or install additional targets on a range unless there is an approval in writing or the range is being prepared for an approved proof of concept for a future training event; OIC formalized non-standard training requests (exceptions to policy) in a Standard Operating Procedure; full-time Range Control staff was retrained; and those personnel involved in approving the non-standard training were given written counseling. In addition to corrective actions instituted by the MAARNG, the EMC required that the full-time Range Control staff undergo annual training on EPS 19.0 and the BMPs and OMMPs; newly assigned Range Control staff undergo training on EPS 19.0 and the BMPs and OMMP prior to being given authority for operational control of the small arms ranges; documenting the corrective actions and additional EMC requirements in Camp Edwards Operations and Training Regulation 350-2 and forwarding that to the EMC for review.
TY 2020	Training Area Fire Management EPS (EPS 11)	Three burn barrels (55-gallon drums) were found at SVLs 1 and 2. The MAARNG reported the nonconformance to the EMC on October 25, 2019.	All full-time and Mobilization Day staff are instructed to review Training Area Clearing processes and be re-briefed on guiding regulations and standards that apply to the Training Area/Reserve. Clear and obvious signage stating that open burning is prohibited has been posted at Range Control. The Camp Edwards Operations and Training Regulation

			350-2 has been updated to clearly state the requirement for clearing training areas and that open burning is prohibited on Camp Edwards.
TY 2019	General Performance Standard	Three L600 M119 whistling booby trap simulators were used; they are not on the approved munitions list and were not authorized for use. The MAARNG reported a nonconformance to the EMC on September 17, 2019.	All levels: command, units training and the ASP will be provided a list of items permanently and temporarily authorized for a particular training event. The ASP will make a change in their ammunition reservation program that will not allow unauthorized ammunition or simulators to be reserved. Camp Edwards Range Control will do a final munition check as units check in for their reserved training area or venue.
TY 2018	Rare Species EPS (EPS 3)	A road puddle containing state-listed Agassiz clam shrimp was filled by a unit training at Dig Site 1. The MAARNG forwarded a formal notice of violation to the EMC on May 16, 2018.	Camp Edwards will, after relocation of the clam shrimp and in concert with the CMP, fill the puddles, use signage to avoid infilling of relevant puddles, and educate users as to how they are supposed to coordinate with Camp Edwards before taking actions outside of their training plan while in the Training Area/Reserve.
TY 2017	None	-----	-----
TY 2016	General Performance Standard	Eight thousand paintball rounds were fired by a unit on the IMT range (Dig Site 3) without permission or prior coordination. The MAARNG forwarded a formal notice of violation to the EMC on November 9, 2015.	Unit soldiers cleaned and cleared the area of debris, discussion of the seriousness of the violation with the Unit Commander and told of actions needed for compliance when wanting to train with any unapproved munition. Camp Edwards staff conducted a Range Officer in Charge and Range Safety brief audit to validate content and effectiveness. Range Control staff will conduct assessments of units while they are training in the Training Area/Reserve to ensure activities are within established performance standards.
TY 2015	Vehicle Performance Standard EPS (EPS 17)	A pickup truck was driven into, off road, and placed in Training Area BA-7 as a temporary training aid. The MAARNG forwarded a formal notice of violation to the EMC on June 5, 2015.	Camp Edwards staff conducted a Range Officer in Charge and Range Safety brief audit to validate content and effectiveness. Range Control staff will conduct assessments of units while they are training in the Training Area/Reserve to ensure activities are within established performance standards.
TY 2014	None	-----	-----